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**THE STANDARD CYCLOPEDIA OF  
HORTICULTURE**





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I. The azalea walk.—Magnolia, South Carolina.



# THE STANDARD CYCLOPEDIA OF HORTICULTURE

A DISCUSSION, FOR THE AMATEUR, AND THE PROFESSIONAL AND COMMERCIAL GROWER, OF THE KINDS, CHARACTERISTICS AND METHODS OF CULTIVATION OF THE SPECIES OF PLANTS GROWN IN THE REGIONS OF THE UNITED STATES AND CANADA FOR ORNAMENT, FOR FANCY, FOR FRUIT AND FOR VEGETABLES; WITH KEYS TO THE NATURAL FAMILIES AND GENERA, DESCRIPTIONS OF THE HORTICULTURAL CAPABILITIES OF THE STATES AND PROVINCES AND DEPENDENT ISLANDS, AND SKETCHES OF EMINENT HORTICULTURISTS

BY  
L. H. BAILEY

*Illustrated with Colored Plates, Four Thousand Engravings in the Text,  
and Ninety-six Full-page Cuts*

IN THREE VOLUMES

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## PREFACE

**F**OURTEEN years ago the present Editor wrote the preface to Volume I of the *Cyclopedia of American Horticulture*. The purpose of that work was "to make a complete record of the status of North American horticulture as it exists at the close of the nineteenth century;" it was the effort to include "all the species which are known to be in the horticultural trade," together with outlines of "the horticultural possibilities of the various states, territories and provinces," to present biographical sketches of eminent American horticulturists not then living, and in general to discuss the cultivation and handling of horticultural crops. In the preface to Volume IV of that work the Editor expressed the hope that the *Cyclopedia* would never be revised: "If new issues are called for, mere errors should be corrected; but beyond this, the plates should be left as they are," for it was the purpose of the book that it should stand as a measure of that time. The different volumes have been separately reprinted, but about eight complete re-issues of that *Cyclopedia* have been made, with such corrections of errors as have been reported; in one restricted edition, published by Doubleday, Page & Co., the same work was bound in six volumes, together with an enlarged preface and a key to the families and genera.

The present *Cyclopedia*, although founded on the former compilation, is a new work with an enlarged scope. While the older work will no longer be published, it nevertheless stands by itself; and the two should be quoted as independent cyclopedias. The geographical boundaries are wider in the present work, due to the fact that the United States and Canada have both acquired new tropical connections and interests in recent years. It has not been the effort to cover completely the horticultural floras of Porto Rico, Hawaii, and other islands, for that would involve the tropical flora of the globe; but it is the intention to include the most outstanding species grown in a horticultural way in those islands. A fuller treatment has also been given of the plants grown in southern Florida, southern California, and the other southernmost areas of the continental United States.

The treatment in the former *Cyclopedia* was confined closely to species in "the trade,"—to those plants "sold in the United States and Canada." The present work accepts this basis in general, for the lists of nurserymen, seedsmen, and fanciers indicate very closely the plants that actually are grown, and it would manifestly be impossible as well as undesirable to include all the plants that may be found in botanic gardens, or in the grounds of specialists and amateurs who collect specimens from original sources, or those introduced for purposes of experiment or test or only for scientific study; but "the trade" is interpreted more liberally in this work, to include the offerings of

many European dealers because those dealers supply American customers, to account for species mentioned prominently in European horticultural periodicals as well as in American periodicals, and to insert such plants as are known to be subjects of exchange or to be frequently in cultivation in any region, even though their names may not be found in a commercial list. While it is intended to account for all the species in the trade, it is not intended to name the garden varieties; for the variety lists change too rapidly for discussion in cyclopedic works. The mention of varieties in the leading group-articles is more a matter of record than of recommendation.

Care has been exercised to exclude species that are evidently not now of interest to horticulturists, even though their names may be found in the literature; for the introduction of many dead entries would not only violate the purpose to make a current record, but would make the books too voluminous and would confuse the student with too many names and details. It is desired that the treatment shall be contemporaneous, and that it shall be rescued as far as desirable from the older glasshouse method of transatlantic work. The Cyclopedia aims to account for the plants horticulturally grown within its territory which are now the subjects of living interest or likely to be introduced, to discuss the best practices in the growing of the staple flower and fruit and vegetable crops, to depict the horticultural capabilities of the states and provinces, to indicate the literature of the field, and incidentally to portray briefly the lives of the former men and women who have attained to a large or a national reputation in horticultural pursuits.

The method in the Cyclopedia, in other words, turns about two purposes,—the identification of species, and the cultivation of plants. Both are essential to an understanding of horticulture. The former lends itself readily to usual cyclopedic treatment; the latter expresses itself as a manual of practice. The combination produces an irregular literary product, but it is hoped that the result is not inharmonious.

The cultural details involve special difficulties. The North American continent presents so many conditions that advice for outdoor work cannot be too specific in a work of this kind without leading to serious mistakes. What is advised by a good grower in one place may be contradicted by a good grower in another place. Even in under-glass treatment, in which conditions are largely artificial, difficulties often arise in trying to apply in America the instructions given for European practice. It is not possible for one to grow plants by a book; in this work the cultural details are not directions so much as statements of standard practice: this practice will need to be considerably modified in many cases if the best result for special conditions or objects is to be secured. In the former Cyclopedia the culture was often presented by two persons of unlike experiences for the express purpose of meeting the needs of amateurs; but readers seem to think this to be confusing and the practice has not been followed in the present work. However, special effort has been made to secure the best cultural advice for the plants requiring peculiar or particular handling, and this advice will be found in the discussion of the different crops and plants under their respective heads



and in addition many practical class-articles have been prepared for the aid of the cultivator and designer. These class-articles are mostly as follows:

Alpine Plants	Cuttings	Greenhouse	Nuts
Annals	Design, Floral	Hedges	Orchids
Ants	Diseases and Insects	Herbs	Packages
Aquatics	Drainage	Horticulture	Palms
Arboretum	Dwarfing	Hotbeds and Coldframes	Perfumery-Gardening
Arboriculture	Evaporating Fruit	House-Plants	Pergolas
Autumn-Gardening	Evergreens	Inspection	Planting
Banks	Everlastings	Irrigation	Potting
Basket Plants	Exhibitions	Kitchen-Garden	Pruning
Bedding	Ferns	Labels	Railroad-Gardening
Bees	Fertilizers	Landscape-Gardening	Rock-Gardening
Biennials	Floriculture	Layers	Seeds and Seedage
Birds	Florists' Plants	Machinery and Implements	Storage
Border	Forcing	Manure	Transplanting
Botanic Garden	Forestry	Market-Gardening	Transportation
Bouquet	Frost	Marketing	Vegetable-Gardening
Bulbs	Fruit-growing	Muckland-Gardening	Walks, Drives and Path-
Conservatory	Fungi	Mushrooms	Watering [ways]
Culinary Herbs	Grafting	Nursery	Windbreaks
Cut-Flower Industry	Grasses	Nut-Culture	Window-Gardening

There is marked growth in outdoor horticulture in North America. The largest extension in the present Cyclopedia, so far as taxonomic work is concerned, is in the description of trees and shrubs. There is widespread interest in these subjects. We are beginning to realize our native resources in woody plants, to understand how to make use of our many climates and natural conditions; and to incorporate freely into our cultivated flora many of the trees and shrubs of China and other regions, under the stimulus of the Arnold Arboretum and other agencies. The resources of the Arboretum have been placed at the command of the Cyclopedia through the careful and original work of Alfred Rehder. Similar aids have been extended from other sources, and particularly from the Foreign Seed and Plant Introduction service of the United States Department of Agriculture.

While hardy plants and outdoor gardening seem to be increasing rapidly in favor, there is a decided tendency toward the breaking-up of large fanciers' collections, in private establishments, of old-time glasshouse plants. It is now quite impossible, for example, to find in this country any large private collections of the species of begonias or of the varieties of camellias or of the show pelargoniums; orchid collections of notable extent are few. The demand of the trade is for relatively few species, and the commercial collections are mostly concerned with a few stock kinds and florists' plants, together with a small addition of annual novelties, rather than with the former long lists of many separate and interesting species and varieties. Even private places, especially private greenhouses, are devoted very largely to cut-flowers and florists' plants. It is incumbent on a cyclopedia of this kind, however, to preserve the accounts of these begonias, orchids, palms, cacti, succulents, "stove plants," and others, even though many of them may be known to very few; and the Editor hopes that the amateur will regain his ascendancy and that collections of plants because they are plants may not perish from amongst us.

There has been great extension in recent years in commercial floriculture and in the

forcing of vegetables. We now think in terms of cropping under glass. The range of species of plants involved in these industries is relatively small, but the areas are large, the business is receiving the attention of able men and women, and the glasshouse industries are making important contributions to the lives of the people. The recent growth of the commercial fruit-growing industry is also notable. Once largely restricted to narrow regions and to "fruit belts," the growing of fruits for market has now assumed the proportions of a great industry comparable with the staple agricultural productions. An effort has been made to catch something of the spirit of all these large efforts, as well as to provide information and advice for the amateur and the home gardener.

When the *Cyclopedia of American Horticulture* was made, there were few specialists in the systematic botany of cultivated plants. The Editor hopes that the publication of that *Cyclopedia* has contributed something to the acceleration of interest in this long-overlooked subject. Howbeit, the number of competent specialists, and of those intelligently interested in the subject, is now large enough to have enabled the Editor to cover many of the important groups. The cacti have been placed mostly in the hands of J. N. Rose; a number of tropical plants have been handled anew by W. E. Safford; the orchids, aroids and bromeliads by George V. Nash; euphorbiads by J. B. S. Norton; Citrus and related genera by Walter T. Swingle; Nymphæaceæ by H. S. Conard; the ferns by R. C. Benedict; most grasses by A. S. Hitchcock; special groups by Norman Taylor, chiefly among the composites, palms, and tender araliads; suggestions on cultivated forms and on cultivation have been contributed by C. P. Raffill, of the tropical department, Kew; the survey of families of plants and most of the editorial work on the general introductory key have been in the hands of K. M. Wiegand; and many small groups and special genera have found new treatment by persons who have given them careful study over a considerable period of time. The results of modern scientific studies are now beginning to be positively reflected in the identification of garden plants, and in the advice for the cultivation and handling of horticultural crops and products. With so many persons partaking, it is of course impossible to secure uniformity of taxonomic handling in the various groups, but the gain of having the contributions of specialists will abundantly offset this small technical disadvantage.

And yet, it is true that very much of the work is necessarily compiled from literature rather than constructed from a direct study of the plants themselves. There is no herbarium or other complete and authentic repository of all the species of plants sold by dealers. The best that can be done in very many cases is to accept the name appearing in a catalogue and to attach to it the most authentic or most adaptable description of a recognized botanical species of the same name; there is no telling whether the dealers' plant is properly determined or whether it represents the botanical species bearing the same name. It is impossible now to know how many wrong determinations, inaccurate



and insufficient descriptions, and faulty judgments have been perpetuated from author to author through long series of years. All these matters must be worked out in years to come, when the horticultural plants in the various groups shall have been systematically studied with care. The Editor repeats the hope expressed in the preface written fourteen years ago "that every entry in this book will be worked over and improved within the next quarter century."

Many persons aside from the leading authors have contributed to the enterprise in the most helpful spirit. The Editor's daughter has borne much of the burden of the office and editorial detail. Gardeners, fruit-growers, florists, vegetable-growers, teachers and experimenters, botanists, and the printers, have responded with good fellowship and with something like patriotic pride. Their names will be recorded in the concluding volume; and the public that uses the book will reward them with its gratitude.

Nor should the institutions that have afforded all these persons the opportunities to make their contributions be overlooked. Aside from those agencies already mentioned, the *Cyclopedia* is under special obligation for the use directly or indirectly of books and collections to Cornell University, the United States Department of Agriculture, the New York Botanical Garden, the Brooklyn Botanic Garden, the Missouri Botanical Garden, the Gray Herbarium, the Royal Botanic Gardens, Kew, the agricultural colleges and experiment stations, and others. Seed merchants, nurserymen, and other commercial establishments of standing, have been very ready with suggestions and help.

Many new illustrations have been added, representing the work of several artists. Most of the new work has been made by B. F. Williamson, New York City; F. Schuyler Mathews, Cambridge, Mass.; Miss M. E. Eaton, of the New York Botanical Garden; Mrs. M. W. Gill, Washington; C. H. L. Gebfert, Boston; and Miss Matilda Smith, of the Royal Botanic Gardens, Kew, England, whose initials will be recognized on the plates of the famous *Botanical Magazine*. By permission of Professor Sargent, much of the accurate and beautiful work of C. E. Faxon and others in *Garden and Forest*, a journal that was discontinued more than fifteen years ago and is now out of the market, has been adapted and made available for the present reader; record is made in the text of the pictures of species, at the places where they are used. Some of the work in the old government surveys of the great West has also been brought to the use of the general public.

It is not wholly with satisfaction that one puts forth a work of this magnitude. The responsibility increases with the largeness of the enterprise, for users do not readily purchase new and corrected editions of a work of this extent. Every care has been taken to present an accurate and faithful account, and this is as far as the responsibility can extend. The Editor can not expect to make another *cyclopedia* of horticulture; but he hopes that these six volumes will comprise another step in the collecting, assorting and appraising of our horticultural knowledge.

L. H. BAILEY.

## PREFACE TO SECOND EDITION

**I**N THE five years that have intervened since the Standard Cyclopedia of Horticulture was completed and published, relatively little change has occurred in the general introduction of plants new to cultivation in North America. Many species have been disseminated in an experimental way, as by the Office of Foreign Seed and Plant Introduction of the United States Department of Agriculture, and other agencies, but for the most part they have not yet become a regular part of the commerce in horticultural plants although many of them promise important results. The extensive discoveries of E. H. Wilson, exploring in China and elsewhere for the Arnold Arboretum of Harvard University, are likely to add many riches to our horticulture as they become distributed and known. The unrecognized or improperly named species long in the country are probably many, and it is the part of investigators to uncover them. The introduction of plants from many parts of the world into Florida, southern Texas, California, and other mild regions newly settled has been rapid within the past generation, and the material has not been sufficiently studied. The cultivated flora as a whole is in need of careful exploration. The more than 27,000 Latin-named species and varieties admitted in the Cyclopedia comprise in themselves an extensive flora. How many of these things are now in active cultivation, what their adaptabilities may be, what satisfaction is gained in the growing of them, are problems awaiting the attention of thoughtful students.

If to this imperfectly known flora are added the probabilities of introductions in the future to supply the vast domain of the continent, together with the wide variations and the hybridizations likely to result, the imagination scarcely runs to the limits of the subject. In the marginal regions, as along northern and southern boundaries and in the developing semi-arid parts, great experiments are still to be made in the adaptability of plants, undoubtedly calling for the introduction of species yet strange to us. Species of the native flora are now regularly collected, grown, and introduced to the public, and many of these will probably yield important variations and changes in the future.

The lists of horticultural varieties of fruits, vegetables, and flowers undergo constant changes and fluctuations. Varieties are supplanted by new and often by better ones; fashions and demands change; the legitimate desire for novelty must be met. It is fortunate that the vegetable kingdom is plastic. As these horticultural varieties are often fugitive, and as their adaptation varies so widely in different parts of the country, they are purposely not treated in this Cyclopedia, as well as because the space at the



command of the volumes precludes such extended discussion. Yet, even if the varieties come and go, they are nevertheless one of the first concerns of the horticulturist, particularly in these days when it is so necessary to meet specific requirements of markets and connoisseurs. This knowledge of varieties is to be obtained as other current information is acquired, whether in horticulture, engineering, zoölogy, or medicine,—by means of the trade periodicals, publications of commercial firms and of institutions, correspondence, discussions in societies, and other kinds of alertness.

The special mark of the horticulture of this day is its strong commercial trend. This means that the demand is good for plants and their products. Floriculture, once the exclusive domain of amateurs, has now become a staple industry and a source of national wealth. The same is true of fruit-growing and other fields, although they developed earlier. The investigations of experiment-stations have supplied a base of fact and determinable knowledge on which to build and to protect these industries. Machines and many clever devices have aided their extension. The facilities for communication, transportation, storage, and distribution have aided them as they have assisted other activities. The publication of technical and trade journals tends always to standardize the industries and to make men resourceful. The commercial movement in horticulture tends to reduce the number of species and varieties, as compared with an unorganized amateur activity.

The amateur interest in horticulture preserves the species and the miscellaneous varieties, inasmuch as the plants are grown for the human interest in them. This amateur activity is large. Probably it is larger than ever before, although it may be distanced by the commercial activities and by the market movements. In fact, to a large extent, the amateur is the market. This is true of the trade in species and varieties of iris, peonies, gladioli, and others. By every means, the amateur spirit in horticulture is to be encouraged as a resource to the people and as one of the means of providing a satisfying background to life.

The first volume of this *Cyclopedia* was published in 1914 and the sixth in 1917. Those years saw considerable activity in the introduction of plants. These introductions, numbering 89 species and Latin-named varieties, are described in the addendum to Vol. VI, pages 3565–3573. This is much less than one-half of one per cent of the total number described in the *Cyclopedia*. In 1917, the United States entered the World War, and Canada was already in. We are not to expect so great activity in plant introduction in those fateful years. It would scarcely be worth while to revise the *Cyclopedia* throughout for the purpose of entering the novelties.

Attention should be called to the Finding-List, published as a supplement to Vol. VI, beginning page 3575. This list was made for the purpose of harmonizing current trade names with the botanical names in the *Cyclopedia*. It was compiled in coöperation with the American Joint Committee on Horticultural Nomenclature, representing the national horticultural associations of the country, and it was separately published by the Committee. The Finding-List is practically a current trade index

to the Cyclopedia, and it also includes a few changes in nomenclature. The user of the Cyclopedia should understand the significance of this List.

In the present issue of the Cyclopedia, certain typographical corrections have been made. It has not been thought necessary to introduce such changes in nomenclature as have resulted from new studies of certain genera by different authors, particularly as some of the changes are of doubtful significance in horticulture.

L. H. BAILEY.



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# EXPLANATIONS

The main account of each genus, in large type and separate paragraph for each species, represents the plants probably now in cultivation or at least of major importance.

The "supplementary lists" in smaller type at the end of the articles include names of plants not known to be in the trade but which may be mentioned in horticultural literature, and also such Latin-form names of the trade as are imperfectly understood and cannot be placed under their proper species. These parts are less critical finding-lists of other or extra species.

The Cyclopedia undertakes to account for the species in cultivation within its territory to the close of the year 1912; but in practice the introductions are included to the date of the closing of the different pages.

The size-marks on the illustrations, as ( $\times \frac{1}{3}$ ), indicate the amount of reduction as compared with natural size, this scale being determined merely by measuring the flat diameter of a drawing and not representing bulk or perspective.

## AUTHORSHIP

The practice of the Cyclopedia of American Horticulture in signing the leading and most important articles with the name of the author is here retained. The original author, so far as living or as he has desired, has revised or rewritten his articles for the present work. In very many cases, another person has now revised the articles, and the name of the reviser is indicated by a dagger (†). If the revision has amounted practically to a complete rewriting of the article, the original author's name may not appear, even though some small parts or features of the original article may be retained; this is for the purpose of safeguarding the original author as well as recognizing the work of the present author: the first Cyclopedia stands as the record of its own work.

A name in parentheses, as "(G. W. Oliver)," at the close of a paragraph, indicates that the person is the author of that particular paragraph and of no other in the article. When a person is responsible for more than one paragraph in an article, his part is set off by a separate heading in such a way that it cannot be mistaken.

It is desired to secure experts and specialists for the articles; when this has not been accomplished, the task of revision has fallen to the Editor.

Effort has been made to bring the different parts of the work into as much uniformity of plan and treatment as is possible in an undertaking of this kind; references have been compared; proofs have been submitted to two or more persons in case of difficult or doubtful sub-

jects; and the advice as to cultivation has been checked by practical growers.

## NOMENCLATURE

The nomenclature follows in the main the regulations of the "Vienna code," being the principles adopted by the International Botanical Congress held in Vienna in 1905. This code was adopted by the International Horticultural Congress held at Brussels in 1910, with adaptations to horticultural practice. When no combination has yet been made under the Vienna code, the prevailing usage for the particular genus (as expressed in latest monographs) is followed. That is, there is no attempt to reduce all names to one system except so far as combinations have already been made under the international rules, both because a cyclopedia of horticulture is hardly the place in which to make original combinations (except incidentally), and because there is little likelihood that any of the formal systems will have permanency. The subject of nomenclature, and the attitude of the Editor, will be discussed under "Names and Nomenclature" in Vol. IV. Botanical names should not be changed lightly, or for the purpose of regularizing any particular scheme or plan, or to make them always conform to an arbitrary set of rules. Botanical names do not belong to botanists, to do with them as they will. The public has good rights in these names; and this is particularly true in the names of cultivated plants, for they may then have standardized commercial value. The only stability, of course, is usage; and usage can rarely be forced into hard-and-fast regulations. In this Cyclopedia, the interest is in stability of names rather than in priority of names; therefore it accepts the principle of the "nomina conservanda" of the Vienna code, so far as it retains generic names that have been established in general usage for fifty years following their publication, even though the particular names in that list may not have been adopted in every instance.

Not all the changes in names arise from the application of rules of nomenclature. Many of them are the results of taxonomic studies, which make new definitions for genera and species. In this Cyclopedia, there are marked examples of such changes in the citrus genera, in the cacti, and other groups. These changes are to be expected as a result of closer studies of the various groups, of accumulation of specimens from many regions, and the progressive modification of views as to the constitution of genera and species; they are expressions of a living botany. Such changes will be particularly demanded in horticultural plants, for most of these groups have not yet been studied with critical care.

## PRONUNCIATION

Attention is called to the fact that the names of genera and species in this work are marked to indicate the accepted pronunciation. The indications are accent marks placed over a vowel. The accent designates (1) stress, or the emphatic syllable, and (2) the length of the emphatic vowel. Following the American custom, as established by Gray and others, a grave accent (`) is employed to designate a long vowel, and an acute accent (´) a short vowel.

Thus *officinále* is pronounced offici-nay-li; *micro-cárpus* is pronounced micro-cár-pus. It should be remembered that the final *e* terminates a separate syllable, as *commù-ne*, *vulgà-re*, *gran'-de*. This final *e* takes the short sound of *i*, as in *whip*.

Ordinarily in diphthongs the mark is placed over the second letter. Thus, in *aùrea* the *au* is meant to have its customary long sound, as if written *awe*. In *eù-it* has practically the long sound of *u*, as in *Pseùdo-Quina*, *Pseùd-Acácia*. Double vowels take their customary English sounds, as *ee* and *oo*. Thus, the *oo* in *Hoòkeri* is to be pronounced as in *hook*. In most cases, the letters *oi* (from the Greek, meaning *like to*) are to be pronounced separately: if the *i* is the penultimate syllable (next to the last), it is long, as in *yuccòi-des*; if the *i* is the antepenultimate syllable (third from the end), it is short, as in *rhombòi-dea*. In *diòicus* and *monoicus*, however, the *oi* is a true diphthong, as in *moist*.

These pronunciations follow, in general, the common English method of pronouncing Latin names. However, many of the Latinized forms of substantive and personal names are so unlike Latin in general construction that the pronunciation of them may not follow the rule. As a matter of fact, biological nomenclature is a language of itself thrown into a Latin form, and it should not be a source of regret if it does not closely follow classical rules in its pronunciation of outlying or non-Latin names.

It has seemed best to make an exception to strict literary rules in the case of personal commemorative names in the genitive: we retain, so far as possible, the pronunciation of the original name. Thus, a plant named for Carey is called *Cà-reyi*, not *Carèy-i*; for Sprenger, *Spréng-eri*, not *Sprengèr-i*; for Forbes, *Forbs'-ii*, not *Forbès-ii*. It cannot be expected that uniform consistency has been attained in this matter. It is not always known how the person pronounced his name; and many personal names do not make conformable Latinized words. No arbitrary method of pronouncing personal names is likely to be satisfactory.

It may be well to add what are understood to be the long and short sounds of the vowels:

â as in <i>cane</i> .	ô as in <i>cone</i> .
á as in <i>can</i> .	ó as in <i>con</i> .
è as in <i>mete</i> .	ù as in <i>jute</i> .
é as in <i>met</i> .	ú as in <i>jut</i> .
í as in <i>pine</i> .	
î as in <i>pín</i> .	
y is often used as a vowel instead of i.	

## SPELLING

The original spelling of generic and specific names is preferred; that is, the spelling used by the person who made the name. In some cases this original orthography does not conform to the etymology of the name, particularly if the name is made from that of a person. Such a case is *Diervilla*, named for Diereville. Ideally, the name should be spelled *Dierevillea*, but Tournefort and Linnæus did not so spell it.

In accordance with the best authorities, the digraph *æ* is used in the words *cærulea*, *cærulescens*, *cæspitosa*, *cæsia*; *œ* is used in *cœlestis* and *cœlestinum*.

The type ligatures *æ* and *œ* have been dropped from Latin-made names that have come into the vernacular. Thus, as a common or English name, *Spiræa* becomes *spirea*, *Pæonia* becomes *peonia* or *peony*, *Brodiaëa* becomes *brodiaea*, *Cratægus* becomes *crategus*.

## THE KEYS

There are two groups of keys in the Cyclopedia,—the main key, in Vol. I, to leading families and genera, and the keys to the species in the different genera in all the volumes. The user of the Cyclopedia should forthwith familiarize the method of the keys. Page 79.

To facilitate the study of the plants, the species have been arranged systematically or horticulturally, under the genus, rather than alphabetically; and in large or complex genera, an alphabetical index has been supplied for rapid reference. The grouping of the species is founded preferably on horticultural rather than on botanical characters, so that the arrangement does not always express botanical relationships.

The species-keys are arranged primarily to aid the gardener in making determinations. Every effort is made sharply to contrast the species rather than to describe them. A word of explanation will facilitate the use of the keys. The species are arranged in coördinate groups of various ranks, and groups of equal rank are marked by the same letter. Thus, group *A* is coördinate with *AA* and with *AAA*, and group *B* with *BB* and *BBB*; and the *B* groups are subordinate to the *A* groups, and the *c* groups to the *B* groups, and so on. Moreover, whenever possible, the coördinate keys begin with the same catchword: thus, if *A* begins "flowers," so do *AA* and *AAA*; and this catchword is not used for keys of other rank. As an example, refer to *Abutilon*, page 177. Look first at *A*, beginning "Lvs.," then at *AA*, also beginning "Lvs." Under *AA* are the coördinate divisions *B* and *BB*, each with "Foliage" for the catchword. Under *B* there are no subdivisions, but under *BB* there are divisions *c* and *cc*, each with "Fls." for a catchword. Under *c* there are no subdivisions, but *cc* has two coördinate divisions, *D*, *DD*, each with "Blossoms" for a catchword. Again, *D* happens to have no division, but *DD* has the divisions *E* and *EE* with "Lf.-blades" as the catchword. In other words, if the plant in hand does not fall under *A*, the inquirer goes at once to *AA*. If it falls under *AA*, then he determines whether it belongs to *B* or to *BB*, and so on.



A display of a scheme would stand as follows:

- A. Leaves, etc.
    - B. Flowers, etc.
      - c. Fruits, etc.
        - d. Pods, etc.
        - dd. Pods, etc.
          - E. Seeds, etc.
          - EE. Seeds, etc.
    - cc. Fruits, etc.
  - BB. Flowers, etc.
- AA. Leaves, etc.
- B. Roots, etc.
    - c. Flowers, etc.
      - d. Margins of leaves, etc.
      - dd. Margins of leaves, etc.
    - cc. Flowers, etc.
  - BB. Roots, etc.
  - BBB. Roots, etc.
- AAA. Leaves, etc.

When the genus is large or the treatment is complicated, the key may be placed separately at the beginning rather than to be divided among the paragraphs; this allows the student to see the entire scheme or plan at once. See Acer, page 196.

## ABBREVIATIONS OF BOTANICAL TERMS AND GENERAL EXPRESSIONS

[illegible]

## BOOKS AND PERIODICALS

To aid the student in the verification of the work, and to introduce him to the literature of the various subjects, citations are made to the portraits of plants in the leading periodicals to which the American referrer is most likely to have access. These references to pictures have been verified, as far as possible, both in the MS. and in the proof. A uniform and regular form of citation is much to be desired, but is extremely difficult to secure because periodicals rarely agree in methods. It was decided to omit the year in most cases, because of the pressure for space, but the student who lacks access to the original volumes may usually ascertain the year by consulting the bibliographical notes below.

An arbitrary and brief method of citation has been chosen. At the outset it seemed best to indicate whether the cited picture is colored or not. This accounts for the two ways of citing certain publications containing both kinds of pictures, as *The Garden*, *Revue Horticole*, and *Gartenflora*. The figures given below explain the method of citation, and incidentally give some hints as to the number of volumes to date, and of the number of pages or plates in one of the latest volumes.

Standard works on the bibliography of botany are Pritzels's "Thesaurus" and Jackson's "Guide to the Literature of Botany;" also, Jackson's "Catalogue of the Library of the Royal Botanic Gardens, Kew." Rehder's "Bradley Bibliography," a guide to the literature of the woody plants of the world, is invaluable. The Catalogue of the Library of the Arnold Arboretum, Harvard University, now being printed, will afford an excellent guide to the literature of botany, particularly as it relates to woody plants.

- A.F. . . . The American Florist. Chicago. A trade paper founded August 15, 1885. The volumes end with July. Many pictures repeated in "Gng." (14:1524=vol. and page.)
- A.G. . . . American Gardening. New York. Represents 14 extinct horticultural periodicals, including The American Garden (1888-1890). (20:896=vol. and page.)
- B. . . . The Botanist. Edited by Maund. No years on title pages. Founded 1839. Eight vols., 50 colored plates in each vol. (8:400=vol. and col. plate.) Cumulative index.
- B.B. . . . Britton & Brown. An Illustrated Flora of the Northern U. S., etc. New York, 1896-98. Ed. 2 in 1913. (3:588=vol. and page of ed. 1; (ed. 2) 3:=vol. and page of ed. 2).
- B.H. . . . La Belgique Horticole. Ghent. 35 vols. (1851-1885).
- B.M. . . . Curtis' Botanical Magazine. London. Founded 1787. The oldest current periodical devoted to garden plants. The vol. for 1912 is vol. 138 of the whole work. Index to first 107 vols. by E. Tonks. London. (7690=col. plate.)
- B.R. . . . Botanical Register (1815-1847). Vols. 1-14 edited by Edwards; vols. 15-33 by Lindley. In vols. 1-23 the plates are numbered from 1-1014. In vols. 24-33 they are numbered independently in each vol. There are 688 plates in vols. 24-33. "An Appendix to the First Twenty-three Volumes" (bound separately or with the 25th vol.) contains an index to the first 23 vols. An index to vols. 24-31 may be found in vol. 31. (1198=col. plate. 33:70=vol. and col. plate.)

- B.S.D. . . Bulletin de la Société dendrologique de France Paris. Founded 1906. One vol. each year. Illustrated. (1907:198=year and page.)
- B.T. . . . Britton. North American trees. New York. 1908. All American trees illustrated.
- C.L.A. . . Country Life in America. Founded Nov. 1901. Two volumes a year. (12:75=vol. and page.)
- C.O. . . . Cogniaux. Dictionnaire Iconographique des Orchidées. Colored plates, with descriptions. (6=col. plate.)
- Em. . . . Emerson, G. B. Trees and Shrubs of Massachusetts. Boston. 2 vols. 149 plates.
- F. . . . . The Florist. London. 1840-1884. (1884:192=year and page opp. col. plate.) Editors and title pages changed many times. Known as the Florist, Florist's Journal and Florist and Pomologist. Sometimes improperly called British Florist.
- F.C. . . . Floral Cabinet Knowles & Westcott. London. 1837-1840. 3 vols., 4to.
- F.E. . . . The Florists' Exchange. New York. A trade paper, whose pictures sometimes are repeated in "A. G." Founded Dec. 8, 1888. (11:1298=vol. and page.)
- F.M. . . . Floral Magazine. London. Series I. 1861-1871. 8vo. Series II. 1872-1881, 4to. (1881:450=year and col. plate.)
- F.R. . . . Florists' Review. Chicago. A trade paper. Vol. 1, Dec. 2, 1897, to May 26, 1898. Two vols. a year (4:660=vol. and page.)
- F.S. . . . Flore des Serres. Ghent. (1845-1880.) Inconsistent in numbering, but the plate numbers are always found on the plate itself or on the page opposite. Valuable but perplexing indexes in vols. 15 and 19. 23 vols. (23:2481=vol. and col. plate.)
- F.S.R. . . Flora and Sylva. London. 1903-1905. Edited by W. Robinson. 3 vols. (2:24=vol. and page opposite colored plate. 2, p. 31=vol. and page containing black figure.)
- F.W. . . . The Floral World and Garden Guide. London. Edited by Shirley Hibberd. 1858-1880. No plates until 1868. (1875:33=year and col. plate.)
- G. . . . . Gardening, Illustrated. London. Founded March 1, 1880. Vols. begin with the March number. (10:25=vol. and page.)
- G.C. . . . The Gardeners' Chronicle. London. Series I. (1841-1873) is cited by year and page. Series II or "New Series" (1874-1886), is cited thus: II. 26:824=series, volume and page. Series III is cited thus: III. 26:416. Two vols. a year, beginning 1874. A select index is scattered through 1879 and 1880. Consult II. 12:viii (1879), and similar places in subsequent vols.
- G.F. . . . Garden and Forest. New York. 1888-1897. (10:518=vol. and page.)
- G.L. . . . Garden Life. London. Incorporates The Gardening World after May 1, 1909. Cited only from vol. 16. (16:54=vol. and page.)
- G.M. . . . Gardeners' Magazine. London. Ed. by Shirley Hibberd. Founded 1860. Cited from vol. 31 on. (42:872=vol. and page.)
- Gn. . . . . The Garden. London. Founded 1871. Two vols. a year through 1906. Since then one vol. (56:458=vol. and page opp. col. plate. 56, p. 458=vol. and page containing black figure.) An Index of the first 20 vols. was separately published. Complete Index of Colored Plates to end of 1897 in vol. 54, p. 334.
- Gng. . . . Gardening. Chicago. Founded Sept. 15, 1892. Vols. end Sept. 1. (7:384=vol. and page.)
- Gn. M. . . The Garden Magazine. Garden City, N. Y. Founded 1905. (7:543=vol. and page.)
- Gn. W. . . Gardening World. Founded 1884. Incorporated after 1909 in Garden Life. (7:118=vol. and page.)
- G.O.H. . . Guimpel, Otto & Hayne. Abbildungen der fremden in Deutschland ausdauernden Holzarten. Berlin, 1825. 144 col. plates.
- Gt. . . . . Gartenflora. Berlin. Founded 1852. (Gt. 48:1470=vol. and col. plate. Gt. 48, p. 670=vol. and page containing black figure.)
- G.W. . . . Die Gartenwelt. Founded 1896. The first year it appeared under the title "Hesdörfers Monatshefte für Blumen- und Gartenfreunde." (13:58=vol. and col. plate. 13, p. 58=vol. and page.)
- G.W.H. . . Guimpel, Willdenow and Hayne. Abbildung der deutscher Holzarten. 2 vols. Berlin 1815-20. 216 col. plates.
- G.Z. . . . Illustrierte Garten-Zeitung. Founded Oct. 1856. One col. plate in each month. (4:88=vol. and col. plate.)
- HBK. . . . Hurnboldt, Bonpland & Kunth. Nova Genera et Species, etc. Paris. 1815-25. 7 vols. Folio.
- H.E. . . . Hooker, Exotic Flora. London, 1823-7. 232 col. plates.
- H.F. . . . L' Horticulteur Français. 1st. series 1851-1859. 2nd series 1859-1872. (1853:273=1st. series, year and col. plate. II. 1860:381=2nd. series, year and col. plate.)
- H.H. . . . Hough, Handbook of Trees of the Northern States and Canada. Lowville, N. Y. 1907. All trees of the region illustrated; all parts of the trees, including bark represented by photographic reproductions.
- H.I. . . . Hooker's Icones Plantarum. London. Founded in 1837. Contains up to 1913 3,000 black plates in 30 vols. The plates with botanical descriptions in Latin.
- H.U. . . . J. Horticulteur Universel. Paris. 1839-1845. 8 vols. with col. plates. The first 6 vols. edited by C. Lemaire. Vol. 7 and 8 called Deuxième and Nouvelle série (7:28=vol. and plate.)
- H.W. . . . Hempel and Wilhelm. Bäume und Sträucher des Waldes. Wien, 1889-99. 3 vols. 60 beautiful col. plates and numerous black illustrations in the text (3:45=vol. and col. plate; 3, p. 113=vol. and page containing black figure.)
- I.H. . . . L' Illustration Horticole. Ghent. (1854-1896.) (43:72=vol. and col. plate.) The volumes were numbered continuously, but there were 6 series. Series I=1854-63. Series II=1864-9. Series III=1870-80. Series IV=1881-6. Series V=1887-93. Series VI=1894-6. The plates were numbered continuously in the first 16 vols. from 1 to 614. in vols. 17-33 they run from 1 to 619; in series V from 1 to 190; in Series VI they begin anew with each vol. Valuable indexes in vols. 10 and 20. Series V in 4to, the rest 8vo.
- I.T. . . . Icones Selectæ Horti Thenensis. Bruxelles, 1899-1909. 6 vols. with 240 plates. (6:220=vol. and black plate.)
- J. . . . . Jardin; journal bi-mensuel d'horticulture générale. Paris. Founded in 1887. (10:36=vol. and page opp. col. plate; 10, p. 345=vol. and page containing black figure.)
- J.C.T. . . Journal of the College of Science, Imperial University. Tokyo, Japan. Founded in 1886; 33 vols. up to 1913. Contains black plates and figures in the text of plants of E. Asia. (6:3=vol. and plate.)
- J.F. . . . Le Jardin Fleuriste. Ghent. 1851-1854. Edited by C. Lemaire. 4 vols. with 430 col. plates and black figures in the text. (4:421=vol. and col. plate; 4, p. 66=vol. and page containing black figure.)
- J.H. . . . Journal of Horticulture. London. Founded in 1848 as The Cottage Gardener. Series III only is cited, beginning 1880. (III. 39:504=series, vol., page.)
- J.H.F. . . Journal de la Société d'horticulture de France. Paris. Founded in 1827 as Annales et Journal de la Société roy. d'horticulture de Paris. Only series IV is cited, beginning 1900. (IV 1:209=series, vol. and page containing black figure.)



- J.H.S.** . . . *Journal of the Horticultural Society of London*. Founded in 1846. 9 vols. from 1846-55. A new series started in 1866. The earlier series is cited by the year, the new series by the volume (1846:188=year, page opposite plate; 28:394, fig. 96=vol., page opposite black plate or containing black figure, and fig. in case of several figures.)
- L.B.C.** . . . *The Botanical Cabinet*. Loddiges. 1817-33. 100 plates in each vol. Complete index in last vol. (20:2000=vol. and col. plate.)
- L.D.** . . . *Loiseleur-Deslongschamps, Herbar général de l'amateur*. Paris, 1816-27. 8 vols. with 574 col. plates. There is a second series, 1839-44 in 4 vols. with 309 plates which is very rare and not quoted.
- L.I.** . . . . *Lavallée, Arboretum Segrezianum; Icones selectae*. Paris, 1880-5. 36 black plates of trees and shrubs.
- Lind.** . . . *Lindenia*. Ghent. Founded 1885. Folio. Devoted to orchids.
- Lowe.** . . . *Beautiful Leaved Plants*. E. J. Lowe and Howard. London. 1864. (60=col. plate.)
- M.** . . . . *A. B. Freeman-Mitford. The Bamboo Garden*. London. 1896. (224=page.)
- M.D.** . . . *Mitteilungen der Deutschen dendrologischen Gesellschaft*. Bonn. Founded in 1892. (1912, p. 161=year and page containing black figure; 1910:1=year and page opp. col. plate.)
- M.D.G.** . . *Möller's Deutsche Gärtner-Zeitung*. Erfurt. Founded 1886. (1897:425=year and page.)
- Mn.** . . . . *Meehan's Monthly*. Germantown, Philadelphia. Founded 1891. (9:192=vol. and page opp. col. plate.)
- Mn.N.** . . *Meehan. The Native Flowers and Ferns of the United States*. Philadelphia. 1878-80. 4 vols. in 2 series (II. 2:3=series, vol. and plate.)
- Mx.** . . . . *Michaux. Histoire des arbres forestiers de l'Amérique septentrionale*. Paris, 1810-13. 3 vols. with 138 plates. The English translation under the title *The North American Sylva* has 156 plates. (3:4=vol. and plate.)
- N.D.** . . . *Nouveau Duhamel. Traité des arbres et arbustes*. Paris, 1801-19. 7 vols. with 488 col. plates. The first edition by Duhamel du Monceau was published in 1755 and contains only 250 black plates; the second edition was edited by several botanists and is really an entirely new work. (7:33=vol. and plate.)
- O.** . . . . *Orchis. Beilage zur Gartenflora*. (1910:88=year and col. plate. 1910, p. 88=year and page.)
- O.R.** . . . *Orchid Review*. London. Founded 1893. (18:169=vol. and plate.)
- P.G.** . . . *Popular Gardening*. Buffalo. 1885-90. (5:270=vol. and page.)
- P.M.** . . . *Paxton's Magazine of Botany*. London. 1834-49. (16:376=vol. and page opposite col. plate.) Vol. 15 has index of first 15 vols.
- R.** . . . . *Reichenbachia*. Edited by Fred. Sander. London. Founded 1886. Folio.
- R.B.** . . . *Revue de l'Horticulture Belge et Etrangère*. Ghent. Founded 1875. (23:288=vol. and page opp. col. plate.)
- R.F.G.** . . *Reichenbach. Icones Florae Germanicae et Helveticae*. Leipzig. Founded in 1834. 25 vols. with more than 3,000 col. plates issued up to 1913.
- R.H.** . . . *Revue Horticole*. Dates from 1826, but is now considered to have been founded in 1829. (1899:596=year and page opp. col. plate. 1899, p. 596=year and page opp. black figure.)
- S** . . . . . *Schneider. The Book of Choice Ferns*. London. In 3 vols. Vol. 1, 1892. Vol. 2, 1893. Vol. 3, 1894. (1:390=vol. and page.)
- S.E.B.** . . *Sowerby, English Botany*. Ed. 3. London, 1863-1902. 13 vols. with 1952 plates. The first edition was published 1790-1814 in 36 vols. Only the third edition is quoted.
- S.H.** . . . *Semaine Horticole*. Ghent. Founded 1897. (3:548=vol. and page.)
- S.I.F.** . . . *Shirasawa. Iconographie des essences forestières du Japon*. Tokyo. 1900-8. 2 vols. with 161 col. plates. (2:73=vol. and plate.)
- S.M.** . . . *Sargent. Manual of the Trees of North America*. Boston and New York, 1905. (810=page containing black figure.)
- S.O.B.** . . *Schmidt. Oesterreich's allgemeine Baumzucht*. Wien, 1792-1822. 4 vols. with 240 col. plates. (4:237=vol. and plate.)
- S.S.** . . . . *Sargent. The Silva of North America*. 13 vols. Vol. 1, 1891. Vol. 12, 1898. (12:620=vol. and plate, not colored.)
- S.T.S.** . . . *Sargent. Trees and Shrubs*. Boston and New York, 1902-13. 2 vols. 200 black plates of trees and shrubs, native and foreign. (2:147=vol. and plate.)
- S.Z.** . . . . *Siebold & Zuccarini. Flora Japonica*. Vol. 1, 1835-44. Vol. 2 partly by Miquel, 1845-70. (2:150=vol. and plate.)
- V.** . . . . . *Vick's Magazine*. Rochester, N. Y. Founded 1878. Vols. numbered continuously through the 3 series. Vols. begin with Nov. (23:250=vol. and page.)
- V.F.** . . . *Vilmorin & Bois. Fruticetum Vilmorinianum*. Paris, 1904. (205=page containing black figure.)
- V.O.** . . . *James Veitch & Sons. A Manual of Orchidaceous Plants, cultivated under glass in Great Britain*. London. 1887-94.
- W.D.B.** . . *Watson, Dendrologia Britannica*. London, 1825. 2 vols. with 172 col. plates (2:160=vol. and plate.)

## THE AUTHORS OF BOTANICAL NAMES

By common consent, the Latin name of a plant, in order to be considered by botanists, must first be regularly published by a reputable author in a reputable book or periodical. As an index to this name, the name of its author is published with it whenever an accurate account of the species is given. Thus, "*Berberis aristata*, DC." (p. 490) means that this name was made by De Candolle. This citation at once distinguishes De Candolle's *Berberis aristata* from any other *Berberis aristata*,—for example, from Sims' (p. 492). It is always possible that some other author may have given the same name to some other plant, in which case the older name must stand. In some cases, the fact that there are two plants passing under one name is indicated in the citation: "*Berberis sinensis*, Hemsl., not Poir." (p. 490, nos. 10, 11) means that Hemsley and Poirer applied the name *B. sinensis* to different plants. *B. ilicifolia*, Forst., is not the same as *B. ilicifolia*, Hort. (p. 492, nos. 27, 31); "Hort." means that the particular name is one in use amongst horticulturists,—that it is a garden name.

The citation of authorities gives a clue to the time and place of publication of the species. It is an index to the literature of the subject. It is no part of the idea merely to give credit or honor to the man who made the name. It is held by some that the authority is an integral part of the name, and should always go with it; but common usage dictates otherwise, for the authority is never pronounced with the Latin words in common speech. The authority is a matter of identification, not of language.



Following are the authors most frequently cited in this Cyclopaedia:

- ADANS. Michael Adanson, 1727–1806. France.  
 AIT. William Aiton, 1731–1793. England.  
 AIT. f. William Townsend Aiton, the son, 1766–1849. England.  
 ALL. Carlo Allioni, 1725–1804. Italy.  
 ANDERS., T. Thomas Anderson, Director of Botanic Garden in Calcutta.  
 ANDR. Henry C. Andrews, botanical artist and engraver, conducted The Botanists' Repository from 1799–1811, and illustrated books on heaths, geraniums and roses.  
 ANDR. Edward André, 1840–1911, first editor of *Illustration Horticole*, later editor-in-chief of *Revue Horticole*.  
 ANT. FRANZ Antoine, director of the royal gardens at Schönbrunn, 1815.  
 ARN. George Arnold Walker Arnott, 1799–1868. Scotland.  
 ASCHERS. Paul Ascherson, professor of botany, Berlin. 1834–1913.  
 AUBL. J. B. C. F. Aublet, 1720–1778. France.  
 AUCT., AUTH. Authors; referring to usage by various or many writers.  
 BACKH. J. Backhous, English botanist and traveler.  
 BAILL. H. Baillon, author of the great natural history of plants in French.  
 BAKER. John Gilbert Baker, formerly keeper of the Herbarium of the Royal Gardens, Kew, England.  
 BALT. Charles Baltet, frequent contributor to *Revue Horticole*.  
 BART. William P. C. Barton, 1787–1856. Pennsylvania.  
 BARTR. William Bartram, 1739–1823. American botanist.  
 BATEM. James Bateman, writer and student of orchids. England.  
 BEAUV. Ambroise Marie François Joseph Palisot de Beauvois, 1755–1820. France.  
 BECC. O. Beccari, Italian botanist and writer on E. Indian botany.  
 BECK. Lewis C. Beck, 1798–1853. New York.  
 BEISSN. L. Beissner, Inspector of the Botanic Gardens at Bonn, and Instructor at Poppelsdorf. Pub. "Handbuch der Nadelholzkunde."  
 BENTH. George Bentham, 1800–1884, one of the distinguished botanists of England; one of the authors of Bentham & Hooker's "Genera Plantarum."  
 BENTH. & HOOK. George Bentham and J. D. Hooker authors of "Genera Plantarum." England.  
 BERGER. Ernst Berger, died 1853. Germany.  
 BERNH. Johann Jacob Bernhardi, 1774–1850. Germany.  
 BERT. Carlo Guiseppe Bertero, 1789–1831. Died between Tahite and Chile.  
 BIEB. Friedrich August Marschall von Bierberstein, 1768–1826. German botanist; lived later in Russia.  
 BIGEL. Jacob Bigelow, 1787–1879. Massachusetts.  
 BLUME. Karl Ludwig Blume, born 1796 at Braunschweig, died 1862 at Leyden. Wrote much on Javan plants.  
 BOIS. Désiré Georges Jean Marie Bois, editor of *Revue Horticole*. Paris.  
 BOISS. Edmond Boissier, 1810–1886. Switzerland. Author of "Flora Orientalis" and other works.  
 BOJER. W. Bojer, 1800–1856, author of a Flora of Mauritius. Austria.  
 BONPL. Aimé Bonpland. 1773–1858. France.  
 BORKH. Moritz Balthasar Borkhausen, 1760–1806. Germany.  
 BR., N. E. N. E. Brown, Royal Botanic Gardens, Kew, England.  
 BR., R. Robert Brown, born 1773, Scotland, died 1858, London. Author of many important works.  
 BRIT. Nathaniel Lord Britton, Director of New York Botanical Garden, New York City.  
 BRONGN. Adolphe Théodore Brongniart, 1801–1876. France.  
 BUCH.-HAM. Francis Buchanan, later Lord Hamilton, wrote on Indian plants.  
 BUCKL. Samuel Botsford Buckley, 1809–1884. United States.  
 BULL. William Bull, plant merchant. London.  
 BULL. Pierre Bulliard, 1742–1793, author of the great "Herbier de la France" in 12 folio volumes, with 600 plates.  
 BUNGE. Alexander von Bunge, 1803–1890. Russia.  
 BURM. Johannes Burmann, 1706–1779, professor at Amsterdam, wrote on plants of Ceylon and Malabar.  
 BURM. f. Nickolous Laurens Burmann, 1734–1793. Son of Johannes.  
 CARR. Elie Abel Carrière, 1816–1896, distinguished French botanist and horticulturist, editor of *Revue Horticole*.  
 CASP. Robert Caspary, professor of botany at University of Königsberg. 1818–1887.  
 CASS. Alexandre Henri Gabriel Cassini, Comte de. 1781–1832. France.  
 CAV. Antonio José Cavanilles, 1745–1804. Spain.  
 CERV. Vincente Cervantes, 1759(?)–1829. Spanish botanist.  
 CHAM. Adalbert von Chamisso, poet and naturalist, 1781–1838. Germany.  
 CHAPM. Alvan Wentworth Chapman, 1809–1899, author of "Flora of the Southern United States."  
 CHOIS. Jacques Denys Choisy, 1799–1859. Switzerland.  
 CLOS. Dominique Clos, professor of botany and director of the gardens at Toulouse. Born 1821.  
 COGN. Alfred Cogniaux, French botanist.  
 COLEBR. Henry Thomas Colebrooke, 1765–1837. England.  
 COLLA. Luigi Colla, 1766–1848. France.  
 COULTER. John M. Coulter, University of Chicago.  
 CUNN. Richard Cunningham, 1793–1835. Colonial botanist in Australia.  
 CUNN., A. Allan Cunningham, born 1791, Scotland, died 1839, Sidney, Australia. Brother of Richard.  
 CURT. William Curtis, 1746–1799. England. Founder of the Botanical Magazine, now known as Curtis' Botanical Magazine.  
 CURTIS. Moses Ashley Curtis, 1808–1873. North Carolina.  
 DC. Augustin Pyramus De Candolle, 1778–1841, projector of the Prodrômus, and head of a distinguished family. Alphonse De Candolle, the son (1806–1893), and Casimir De Candolle, the grandson, are also quoted in this work.  
 DECNE. Joseph Decaisne, 1809–1882. France.  
 D. DON. See Don, D.  
 DESF. René Louiche Desfontaines, 1750–1833. France.  
 DESV. Augustin Nicaise Desvaux, 1784–1856. France.  
 DEVR. Willem Hendrik de Vriese, 1807–1862, professor of botany at Leyden. Wrote on medical plants and plants of the Dutch East Indies.  
 DICKS. James Dickson, 1738–1822, Scotch writer on flowerless plants.  
 DIELS. Ludwig Diels, professor of botany, Marburg, Germany.  
 DILL. Johann Jacob Dillenius, professor of botany in Oxford. 1687–1747.

- DIPP. Dr. L. Dippel, of Darmstadt, Germany. Dendrologist; pub. "Handbuch der Laubholzkunde."
- DON. George Don, 1798-1856. England.
- DON, D. David Don, brother of George, 1800-1841. Scotland.
- DONN. James Donn, 1758-1813, author of "Hortus Cantabrigiensis." England.
- DOUGLAS. David Douglas, 1799-1834, collector in north-western America. Scotland.
- DRUDE. Prof. O. Drude, of Dresden, Germany.
- DRY. Jonas Dryander, 1748-1810. Sweden.
- DUCHESNE. Antoine Nicolas Duchesne, 1747-1827. France.
- DUMORT. Barthélemy Charles Dumortier, 1797-1878. Belgium.
- DUNAL. Michel Felix Dunal, 1789-1856. France.
- DUNN. Stephen Troyte Dunn, Kew, England.
- DYER. W. T. Thistleton-Dyer, Director of Kew Gardens, 1885-1905, editor of the *Flora of Tropical Africa*, etc.
- EATON, A. Amos Eaton, 1776-1842, author of a "Manual of Botany for North America," 1st ed. 1817; 8th ed. 1841.
- EATON, D. C. Daniel Cady Eaton, professor at Yale College, and writer on ferns.
- EHRRH. Friedrich Ehrhart, 1742-1795. Germany.
- ELL. Stephen Elliott, 1771-1830. South Carolina.
- ELLIS. John Ellis, 1711-1776. England.
- ENDL. Stephan Ladislaus Endlicher, 1804-1849, professor at Vienna. Numerous works.
- ENGELM. George Engelmann, 1809-1884. Missouri.
- ENGLER. Prof. A. Engler, of Berlin, joint author of Engler and Prantl's "Natürlichen Pflanzenfamilien."
- ESCH. Johann Friedrich Eschschol, 1793-1831. Germany.
- FÉE. Antoine Laurent Apollinaire Fée, 1789-1874. France.
- FENZL. Edward Fenzl, professor and custodian of botanical museum at Vienna, 1808-1879.
- FERN. Merritt Lyndon Fernald, assistant professor of botany, Cambridge, Mass.
- FISCH. Friedrich Ernst Ludwig von Fischer, 1782-1854. Russia.
- FORB. John Forbes, catalogued heaths, willows, conifers, and other plants at Woburn Abbey.
- FORSK. Pehr Forskal, 1736-1768, collected in Egypt and Arabia.
- FORST. Johann Reinhold Forster, 1729-1798. Germany. (Also Georg Forster, the son.)
- FRANCH. A. Franchet, Jardin des Plantes, Paris. 1834-1900.
- FRASER. John Fraser, 1750-1811, traveled in America 1785-96. Had a son of same name.
- FROEL. Joseph Aloys Froelich, 1766-1841. Germany.
- F. v. M. Ferdinand von Mueller, royal botanist of Australia, author of many works on economic plants. See Muell.
- GAERTN. Joseph Gaertner, 1732-1791. Germany.
- GAGNEP. François Gagnepain. French botanist, writing chiefly on Asiatic plants.
- GAUD. Charles Gaudichaud-Beaupré, 1789-1864. France.
- GAWL. See Ker.
- GMEL. Samuel Gottlieb Gmelin, 1743-1774. Russia.
- GOEPP. Heinrich Robert Goeppert, 1800-1884, professor at Breslau. Wrote much on fossil botany.
- GORD. George Gordon, 1806-1879, author of the "Pine-tum," London, 1858.
- GRAEBN. Paul Graebner, professor of botany. Berlin.
- GRAY. Asa Gray, 1810-1888, Harvard University, Massachusetts. America's most noted botanist.
- GREENM. J. M. Greenman, writes from Harvard University on Mexican plants. Now at the Field Museum, Chicago.
- GRIFF. William Griffith, 1810-1845. England.
- GRISEB., GRIS. Heinrich Rudolph August Grisebach, 1814-1879. Germany.
- HARMS. Prof. Hermann Harms. Berlin.
- HASSK. Justus Karl Hasskarl, born 1811. Germany.
- HAYNE. Friedrich Gottlob Hayne, 1763-1832, professor at Berlin. Medicinal plants; trees and shrubs.
- HAW. Adrian Hardy Haworth, 1772-1833. England.
- HBK. Friedrich Alexander von Humboldt, 1796-1859. Germany. Aimé Bonpland, 1773-1858. France. Karl Sigismund Kunth, 1788-1850. Germany. Authors of a great work on plants of the New World.
- HEMSL. W. Botting Hemsley, Keeper at Kew, has written many reviews of genera of horticultural value in *The Gardeners' Chronicle* and elsewhere.
- HENFR. Arthur Henfrey, 1819-1859. English botanist.
- HENRY. Augustine Henry, collector of Chinese plants. Cambridge, England.
- HENRY, L. Prof. Louis Henry. Writer on woody plants. Paris.
- HERB. William Herbert, 1778-1847. England.
- HOCHST. Christian Friedrich Hochstetter, 1787-1860, described many African plants.
- HOFFM. Georg Franz Hoffmann, 1761-1826. Germany.
- HOOK. William Jackson Hooker, 1785-1865. England.
- HOOK. f. Joseph Dalton Hooker, the son, 1817-1911. England.
- HORT. Hortorum, literally of the gardens. Placed after names current among horticulturists, but not necessarily all horticulturists. Often used with less exactness than names of authors. Frequently indicates garden or unknown origin. Many of these plants have never been sufficiently described.
- HOST. Nicolaus Thomas Host, 1761-1834. Germany.
- JACQ. Nicolaus Joseph Jacquin, 1727-1817. Austria.
- JAUB. Hippolyte François de Jaubert. French botanist. Born 1798.
- JUSS. Antoine Laurent Jussieu, 1748-1836, the first to introduce the natural families of plants. France.
- KARSTEN. Hermann G. K. W. Karsten. German botanist, 1817-.
- KARW. Wilhelm Karwinsky von Karwin, collector in Brazil; died 1855.
- KAULF. Georg Friedrich Kaulfuss, professor at Halle; died 1830. He described the ferns collected by Chamisso.
- KER. John Bellenden Ker, 1765 (?) - 1871, botanist, wit and man of fashion. First known as John Gawler. In 1793 was compelled to leave army because of sympathy with French Revolution. His name was changed in 1804 to John Ker Bellenden, but he was known to his friends as Bellenden Ker. First editor of *Edwards' Botanical Register*.
- KER-GAWL. See Ker.
- KIRCHN. G. Kirchner, writer of the botanical part of "Arboretum Muscaviense."
- KLATT. Friedrich Wilhelm Klatt, a German botanist.
- KLOTZSCH. Johann Friedrich Klotzsch, 1805-1860, curator of Royal herbarium at Berlin, monographer of Begoniaceæ.
- KOCH. Karl Koch, 1809-1879. Germany.
- KOEHNE. Emil Koehne, professor at Berlin. Pub. "Deutsche Dendrologie."



- KOMAR. Vladimir Leontyevitch Komarov, writer on plants of eastern Asia. St. Petersburg.
- KOST. Vincenz Franz Kosteletzky. Bohemian botanist.
- KOTSCHY. Theodor Kotschy, assistant curator at Vienna, 1813-1866. Wrote on oriental plants.
- KRÄNZL. F. Kränzlin, Berlin, writes on orchids in *The Gardeners' Chronicle*.
- K. SCH. See Schumann.
- KUNTH. See HBK.
- KUNTZE. Otto Kuntze. German botanist; chiefly known as a strong advocate of priority in nomenclature. 1843-1907.
- LAG. Mariano Lagasca, 1776-1839, one of Spain's most distinguished botanists.
- LAM. Jean Baptiste Antoine Pierre Monnet Lamarck, 1744-1829, author of the Lamarckian philosophy of organic evolution. France.
- LANGS. Georg Heinrich von Langsdorf, 1774-1852, Russian consul-general in Brazil.
- LAUTH. Thomas Lauth, 1758-1826, professor of anatomy at Strassburg, wrote a 40-page monograph on *Acer* in 1781.
- LECQ. Henry Lecoq, born 1802, once professor at Clermont-Ferrand, wrote an elementary botany, a dictionary of botanical terms, a book on hybridization, etc.
- LECONTE. John Eaton LeConte, 1784-1860. Pennsylvania.
- LEDEB. Karl Friedrich von Ledebour, 1785-1851. Russia.
- LEHM. Johann Georg Christian Lehmann, 1792-1860, professor at Hamburg, wrote several monographs, and described many new plants.
- LEHM., F. C. F. C. Lehmann, German collector in South America.
- LEICHT. Max Leichtlin, horticulturist, Baden-Baden, Germany.
- LEM. Charles Lemaire, 1800-1871, works on cacti and botany of cultivated plants. Belgium.
- LEVEILLE. Augustine Abel Hector Lèveillé, professor of botany, Le Mans, France.
- L'HER. C. L. L'Héritier de Brutelle, 1746-1800. France.
- LICHTST. August Gerhard Gottfield Lichtenstein, 1780-1851. Germany.
- LIND. & ROD. L. Linden and E. Rodigas, once administrator and editor, respectively, of *L'Illustration Horticole*.
- LIND. J. Linden, 1817-1898. Belgium. For many years director of *L'Illustration Horticole*.
- LIND., L. Lucien Linden, associated with J. Linden for some years on *L'Illustration Horticole*.
- LINDL. John Lindley, 1799-1865, one of the most illustrious of English horticulturists.
- LINGELSH. Alexander Lingelsheim. Breslau, Germany.
- LINK. Heinrich Friedrich Link, 1767-1851. Germany.
- LINN. Carolus Linnæus (Carl von Linné), 1707-1778, the "Father of Botany," and author of binomial nomenclature. Sweden.
- LINN. f. Carl von Linné, the son, 1741-1783. Sweden.
- LIPSKY. Vladimir Ippolitovitch Lipsky, writer chiefly on plants from Central Asia. St. Petersburg.
- LODD. Conrad Loddiges, nurseryman near London, conducted Loddiges' Botanical Cabinet from 1817-33, 20 vols., 2,000 colored plates.
- LOES. Theodor Loesener, professor of botany, Berlin.
- LOISEL. Jean Louis Auguste Loiseleur-Deslongchamps, 1774-1849. France.
- LOUD. John Claudius Loudon, 1783-1843, an extremely prolific English writer.
- LOUR. Juan Loureiro, 1715-1796, missionary in China. Portugal.
- MAKINO. Tomitaro Makino. Tokyo, Japan.
- MARSH. Humphrey Marshall, 1722-1801. Pennsylvania.
- MART. Karl Friedrich Philipp von Martius, 1794-1868, professor at Munich, monographer of palms, founder of the great *Flora Brasiliensis*, and author of many works.
- MAST. Maxwell T. Masters, late editor of *The Gardeners' Chronicle*, wherein he has described great numbers of new plants of garden value; author of "Vegetable Teratology," etc. 1833-1907.
- MATSUM. Jinzo Matsumuro. Tokyo, Japan.
- MAXIM. Karl Johann Maximowicz, 1827-1891, one of the most illustrious Russian systematic botanists; wrote much on Asian plants.
- MEDIKUS. Friedrich Casimir Medikus, 1736-1808, director of the garden at Mannheim, wrote a book of 96 pages in German on North American plants in 1792.
- MEISN. Karl Friedrich Meisner, 1800-1874. Switzerland.
- METT. Georg Heinrich Mettenius, 1823-1866, professor at Leipzig, wrote on flowerless plants.
- MEY. Ernst Heinrich Friedrich Meyer, 1791-1851. Prussia.
- MEY., C. A. Carl Anton Meyer, 1795-1855, director botanic garden at St. Petersburg, wrote on Russian botany.
- MEZ. Dr. Karl Mez, director of the botanic garden at Königsberg; monographer of the bromeliads.
- MICHX. André Michaux, 1746-1802. France, but for ten years a resident of North America.
- MICHX. f. François André Michaux, the son, 1770-1855. France.
- MILL. Phillip Miller, 1691-1771, of Chelsea, England, author of a celebrated dictionary of gardening, which had many editions.
- MIQ. Friedrich Anton Wilhelm Miquel, 1811-1871. Holland.
- MITFORD. A. B. Freeman-Mitford, English amateur, author of "The Bamboo Garden."
- MOENCH. Konrad Moench, 1744-1805. Germany.
- MONCH. See Moench.
- MOORE. Thomas Moore, 1821-1887, curator of Chelsea Botanic Garden, author of "Index Filicum," and other well-known works.
- MOQ. Alfred Moquin-Tandon, 1804-1863. France.
- MORR. Charles Jacques Edouard Morren, of Ghent, 1833-1886.
- MOTT. S. Mottet, frequent contributor to *Revue Horticole*, translator of Nicholson's "Dictionary of Gardening."
- MUELL. ARG. Jean Mueller, of Aargau, 1828-1896, wrote for De Candolle's "Prodromus," vol. 16.
- MUELL., C. Carl Mueller, 1817-1870, who edited vols. 4-6 of Walpers' "Annals."
- MUELL., F. Ferdinand von Mueller, royal botanist at Melbourne, has written much on Australian and economic botany. 1825-1896.
- MUHL. Henry Ludwig Muhlenberg, 1756-1817. Pennsylvania.
- MURR. Johann Andreas Murray, 1740-1791. Germany.
- MURR., A. Andrew Murray, 1812-1878, author of "The Pines and Firs of Japan." London, 1863.
- NAUDIN. Charles Naudin, 1815-1899, botanist, frequent contributor to *Revue Horticole*.
- N. E. BR. N. E. Brown describes many new plants in *Gardeners' Chronicle*. See Br., N. E.



- NEES. Christian Gottfried Nees von Esenbeck, 1776-1858. Prussia.
- NICHOLS. George Nicholson, curator at Kew, author of "The Dictionary of Gardening." 1847-1908.
- NUTT. Thomas Nuttall, 1786-1859. Massachusetts.
- O'BRIEN. James O'Brien, current writer on orchids in *The Gardeners' Chronicle*.
- OLIV. Daniel Oliver, once curator at Kew, and founder of the Flora of Tropical Africa.
- ORPH. Theodor Georg Orphanides, professor of botany at Athens. Died 1886.
- ORTEGA, ORT. Casimiro Gomez Ortega, 1740-1818. Spain.
- OTTO. Friedrich Otto, 1782-1856. Germany.
- PALL. Peter Simon Pallas, 1741-1811, professor and explorer in Russia. Germany.
- PAMPAN. Renato Pampanini, writer on Chinese plants. Florence, Italy.
- PAV. See Ruiz. & Pav.
- PAX. Ferdinand Pax, professor at Breslau, Germany.
- PAXT. Joseph Paxton, 1802-1865. England.
- PERS. Christian Hendrick Persoon, 1755-1837. Germany.
- PHIL. Rudolph Amandus Philippi, 1808-1904. Santiago, Chile.
- PLANCH. Jules Emile Planchon, professor at Montpellier. France. 1833-1900.
- POHL. Johann Emmanuel Pohl, 1782-1834, professor at Vienna, wrote a large book on travels in Brazil.
- POIR. Jean Louis Marie Poiret, 1755-1834. France.
- PRAIN. Sir David Prain, Director of the Royal Botanic Gardens, Kew, since 1905.
- PRESL. Karel Boriweg Presl, 1794-1852. Bohemia.
- PURSH. Frederick T. Pursh (or Pursch), 1774-1820. Germany, but for twelve years in the United States.
- RADDI. Guiseppe Raddi, 1770-1829. Italy.
- RAF. Constantino Samuel Rafinesque-Schmaitz, 1784-1842. Professor of Natural history, Transylvania University. Lexington, Kentucky.
- R. BR. Robert Brown, born 1773, Scotland, died 1858, London. Author of many important works.
- REGEL. Eduard von Regel, 1815-1892, German, founder of *Gartenflora*; Director Botanic Garden at St. Petersburg.
- REHD. Alfred Rehder, Arnold Arboretum, Massachusetts.
- REICHB. Heinrich Gottlieb Ludwig Reichenbach, 1793-1879. Germany.
- REICHB. f. Heinrich Gustav, 1823-1889, son of the preceding. Orchids.
- RICH. John Richardson, 1787-1865. Scotland.
- RICHARD. Louis Claude Marie Richard, 1754-1821. France.
- RIDDELL. John Leonard Riddell, 1807-1865, professor of chemistry in Cincinnati and New Orleans.
- ROB. B. L. Robinson, Director Gray Herbarium of Harvard University; is editing "The Synoptical Flora of North America."
- ROD. Emile Rodigas, for some years connected with *L'Illustration Horticole*.
- RODR. J. B. Rodrigues, Brazilian botanist, writer on palms and Brazilian botany.
- ROEM. Johann Jacob Roemer, 1763-1819. Switzerland. Also M. J. Roemer.
- ROSCOE. William Roscoe, 1753-1831. England.
- ROSE. J. N. Rose, assistant curator, United States National Herbarium, Smithsonian Institution. Mexican plants.
- ROTH. Albrecht Wilhelm Roth, 1757-1834. Physician at Vegesack, near Bremen.
- ROXBG. William Roxburg, 1759-1815. India.
- ROYLE. John Forbes Royle, born 1800, at Cawnpore, died 1858 London. Professor in London. Plants of India.
- RUIZ. & PAV. Hipolito Ruiz Lopez, 1764-1815, and José Pavon, authors of a Flora of Peru and Chile. Spain.
- RUPR. Franz J. Ruprecht, 1814-1870. Russia.
- RYDB. Per Axel Rydberg. New York Botanical Garden. S. & Z. See Sieb. & Zucc.
- SABINE. Joseph Sabine, 1770-1837. England.
- SAFFORD. W. E. Safford, United States Department of Agriculture, Washington.
- SALISB. Richard Anthony Salisbury, 1761-1829. England.
- SALM-DYCK. Joseph, Prince and High Count Salm-Reifferscheidt-Dyck, born at Dyck, 1773, died 1861. Wrote on Aloe, Cactus, Mesembryanthemum.
- SARG. Charles Sprague Sargent, Director Arnold Arboretum, author of "Silva of North America."
- SAV. L. Savatier, writer on Japanese plants.
- SAVI. Gaetano Savi, died 1844. Italy.
- SCHEIDW. Michael Joseph Scheidweiler, 1799-1861, professor of botany and horticulture at Horticultural Institute of Ghent.
- SCHK. Christian Schkuhr, died 1811. Germany.
- SCHLECHT. Diedrich Franz Leonhard von Schlechtendahl, 1794-1866. Professor at Halle, wrote several memoirs in Latin and German.
- SCHNEID. Camillo Schneider, author of "Handbuch der Laubholzkunde." Vienna.
- SCHOTT. Heinrich Wilhelm Schott, 1794-1865. Wrote much on aroids with Nyman and Kotschy.
- SCHRAD. Heinrich Adolph Schrader, 1767-1836. Germany.
- SCHULT. Joseph August Schultes, 1773-1831. Germany.
- SCHUM. Christian Friedrich Schumacher, 1757-1830. Germany.
- SCHUMANN. Karl Moritz Schumann, 1851-1904, professor of botany, Berlin. Wrote much on Cactaceae.
- SCHUR. Philipp Johann Ferdinand Schur, 1785-1848. Germany.
- SCHW., SCHWEIN. Lewis David von Schweinitz, 1750-1834. Pennsylvania.
- SCHWEINF. George Schweinfurth. Germany. Born 1836.
- SCHWER. Graf Fritz von Schwerin, German authority on Acer.
- SCOP. Johann Anton Scopoli, 1723-1788. Italy.
- SEEM. Berthold Seemann, Hanover, 1825-1872. Wrote on palms, and botany of the voyage of the *Herald*.
- SIBTH. John Sibthorp, 1758-1796, author of a Flora of Greece. England.
- SIEB. & ZUCC. Philipp Franz von Siebold, 1796-1866, and Joseph Gerhard Zuccarini, 1797-1848. Germany.
- SIMS. John Sims, 1792-1838. England, for many years editor of Curtis' Botanical Magazine.
- SMALL. John Kunkel Small. New York Botanical Garden.
- SMITH. James Edward Smith, 1759-1828. England.
- SOLAND. Daniel Solander, 1736-1782. England.
- SPACH. Eduard Spach, born 1801 Strassburg, died 1879. Author of "Histoire Naturelle des Vegetaux."
- SPAETH. L. Spaeth, Berlin, nurseryman, died 1913. H. L. Spaeth, the present head of the firm.
- SPRENG. Kurt Sprengel, 1766-1833. Germany.
- STEUD. Ernst Gottlieb Steudel, 1783-1856. Germany.
- STEV. Christian Steven, 1781-1863. Russia.
- ST. HIL. Auguste de Saint Hilaire, 1779-1853. France.
- SWARTZ. Olof Swartz, 1760-1818. Sweden.

- SWEET. Robert Sweet, 1783-1835, author of many well-known works, as "Geraniaceæ," "British Flower Garden."
- SWINGLE. Walter T. Swingle, United States Department of Agriculture, Washington.
- TAUSCH. Ignaz Friedrich Tausch. Died 1848. Austria.
- TENORE. Michele Tenore, 1780-1861. Italy.
- THORE. Jean Thore, 1762-1823, physician at Dax.
- THUNB. Carl Peter Thunberg, 1743-1822, wrote "Flora Japonica" (1784). Sweden.
- TOD. Augustino Todaro, director of the botanic gardens at Palermo. 1818-1892.
- TORR. John Torrey, 1796-1873. New York.
- TRAUTV. Ernst Rudolph von Trautvetter.
- TREL. William Trelease, professor of botany, University of Illinois.
- TUCKM. Edward Tuckerman, 1817-1886. Massachusetts.
- TURCZ. Nicolaus Turczaninow. Died 1864.
- UNDERW. Prof. Lucien M. Underwood, Columbia University, New York, N. Y., has written much on ferns, etc.
- URBAN. Ignatius Urban, of the Königl. Bot. Garten, near Berlin, writer on Brazilian and West Indian plants.
- VAHL. Martin Vahl, 1749-1804. Denmark.
- VAN HOUTTE. Louis Van Houtte, 1810-1876, founder and publisher of *Flore des Serres*.
- VEITCH. John Gould Veitch, 1839-1867, and successors, horticulturists at Chelsea, England.
- VENT. Etienne Pierre Ventenat, 1757-1808. France.
- VERL. B. Verlot, contributor to *Revue Horticole*.
- VERSCH. Ambroise Verschaffelt, 1825-1886, founder and publisher of *L'Illustration Horticole* at Ghent, Belgium.
- VILL. Dominique Villars, 1745-1814. France.
- VILM. Several generations of the family of Vilmorin, Paris, seedsmen and authors of many books and memoirs on botany and horticulture. Pierre Philippe André Leveque de Vilmorin, 1746-1804. Pierre Vilmorin, 1816-1860. Henry L. de Vilmorin, died 1899.
- VOSS. A. Voss, author of botanical part of Vilmorin's *Blumengärtnerei*.
- WAHL. Georg Wahlenberg, 1781-1851. Sweden.
- WALDST. Franz Adam, Graf von Waldstein, 1759-1823. Austria.
- WALL. Nathanael Wallich, born 1786, Copenhagen, died 1854 London. Wrote on plants of India and Asia.
- WALP. Wilhelm Gerhard Walpers, 1816-1853.
- WALT. Thomas Walter, about 1740-1788, author of "Flora Caroliniana." South Carolina.
- WANG. Friedrich Adam Julius von Wangenheim, 1747-1800. Germany.
- WANGN. Walter Wangerin, monographer of *Cornaceæ*. Germany.
- WARSCZ. Joseph Warszewicz, 1812-1866.
- WATS. Sereno Watson, 1826-1892. Harvard University.
- WEB. Friedrich Weber, 1781-1823. Germany.
- WEDD. H. A. Weddell, wrote for De Candolle's "Prodromus," vol. 16, etc.
- WELW. Friedrich Welwitsch, 1806-1872.
- WENDL. Hermann Wendland, Director Royal Botanic Garden at Herrenhausen, one of the chief writers on palms.
- WIGHT. Robert Wight, writer on Indian plants. 1796-1872.
- WILLD. Karl Ludwig Willdenow, 1765-1812. Germany.
- WILSON. Ernest H. Wilson, collector of Chinese plants.
- WITH., WITHER. William Withering, 1741-1799. England.
- WITTM. Max Karl Ludwig Wittmack, editor of *Gartenflora*. Professor at Berlin.
- WOOD. Alphonso Wood, 1810-1881. Of his "Class-Book of Botany," 100,000 copies have been sold in America.
- ZABEL. Hermann Zabel, writer on woody plants, 1832-1912. Germany.
- ZUCC. Joseph Gerhard Zuccarini, 1797-1848, professor at Munich.

# The Standard Cyclopedia of Horticulture

## A SYNOPSIS OF THE PLANT KINGDOM

By KARL M. WIEGAND

Most modern botanists, as well as zoölogists, now think that organisms have descended, through the ages, from ancestors which differed in many ways and often markedly from the present organisms, but were in general of a less specialized type. It is, indeed, thought that the original life was of an exceedingly simple nature, and that during the countless ages its descendants have gradually diverged from one another much as the branches of a tree diverge from its trunk, until we have the enormous wealth of species and extreme diversity, and great complexity of structure exhibited by the plants and animals existing today. Just as through descent in the human race we have groups of individuals called families, the members of which are more closely related to each other by descent than to other individuals, so we have groups of related species and genera forming similar natural families. The attempt of the so-called systematic botanist of the present day is to interpret the evolutionary history of plants, to discover these natural families, and to represent this knowledge of history and relationship in a synopsis of the plant kingdom. Such a synopsis, therefore, attempts to show an actual "blood relationship,"—the real genealogy of the plant kingdom. Before the theory of evolution became widely accepted as a result of Darwin's labors, systems of classification were either wholly arbitrary, and planned simply for convenience in dealing with the vast number of existing organisms (e.g., the sexual system of Linnæus), or they were based on the morphological relation of the flower to a certain floral plan. Since, however, the floral plan depends largely on descent, these last-named systems often accidentally approached in many respects very closely to the natural systems based on evolution. Instead of placing the "highest" types of plants (the most recent) last in their classification, as is now done, the idealists placed them first,—hence the Ranunculaceæ, with parts separate and hypogynous, and therefore most ideal, is found first in such a classification. The fusion of parts in the Compositæ, and the union of parts in the Gamopetalæ were thought to represent a less perfect condition. Likewise, the Apetalæ, with parts lacking, were still less perfect, and therefore were placed later. The Gymnosperms were somewhat arbitrarily placed next, followed by the Monocotyledons, in which the grasses were placed last. These in turn were followed by the ferns and the lower groups. This was the system used in Bentham and Hooker's "Genera Plantarum," a great work which, notwithstanding the change in system, is still a standard authority in descriptive botany.

In the system adopted for the present synopsis, that used by Engler and Prantl in the great German work, "Die Natürlichen Pflanzenfamilien," the sequence is from the most primitive and the most ancient toward the most specialized and most modern,—from the lower algæ to the fungi, mosses, liverworts, ferns, gymnosperms, and flowering plants. Here the Monocotyledonous line culminates in the highly specialized Orchidaceæ, and the Dicotyledonous line in the equally specialized Compositæ. These two families, therefore, are now thought to represent the present culmination of nature's handiwork in the two great lines of development in flowering plants.

In the present synopsis of the Pteridophyta and Spermatophyta, the treatment of large groups, sequence of families and family limits, is, except in a few cases, that of our most recent great work edited by Engler and cited above. Among the mosses and lower plants, an abridgment of the system used in Strasburger, Noll, Schenk and Karsten's "Text-Book of Botany," and other text-books, has been used. The statistics as to genera and species are taken from Engler and Prantl, and are intended as general information, and may not in all cases conform to the limitations as worked out by the different authors in the Cyclopedia. In some cases, particularly in Cactaceæ, other authorities have been followed.

As no genera of the Thallophyta or Bryophyta are definitely treated in the body of the Cyclopedia, these two groups have been introduced into the synopsis largely as a background and as a proper perspective to the plant kingdom. Therefore, in these groups no divisions smaller than classes have been considered. In the Pteridophyta and Spermatophyta, the plan has been to include in the synopsis every family that has at least one genus represented in the body of the original Cyclopedia. A few other families of minor horticultural value have found place in the present Cyclopedia and are not included in this synopsis. Although the treatment in each case has been of necessity reduced to great brevity, it is hoped that the condensed account of important structural characteristics, size of family, range, and economic value will be of aid in forming a conception of what each family represents. To render this conception more vivid, a list of the important cultivated genera and their common names has been appended to the treatment of each family.

The number of species in the plant kingdom is not definitely known. It has been estimated that more than 120,000 species of Spermatophyta and more than 60,000 species of lower plants are described. According to the treatment in Engler and Prantl, these legions are classified in 640 families, of which 278 are of the higher plants and 362 of plants below the Spermatophyta. The number of known species, however, is being rapidly increased as research and exploration progress, so that the numbers given above are at best only approximate. The figures are also modified by disagreement as to what are species and what are varieties, some persons recognizing more or fewer species than others in a given genus or group.

The names of the natural families are mostly derived from the names of a leading genus (as *Verbenaceæ*, *Ranunculaceæ*) or from some marked characteristic of the group as a whole (e.g., *Compositæ*, composite or compound flowers, *Cruciferae*, cross-like flowers). Commonly the family name terminates in the form *aceæ*, with the accent long on the antepenultimate syllable (e.g., *Rosaceæ*, pronounced Ro-say-si-ee). The simple termination *x* is used mostly for subfamilies and tribes, but there are marked exceptions, as in *Leguminosæ*.

The illustrations accompanying this text are designed to show mainly such structural characteristics as are of importance in the separation of families. For this reason, floral diagrams have been freely introduced. These



diagrams are idealized cross-sections of the flower, and show particularly the number of parts in each floral set and their exact position, both of which are very frequently of diagnostic importance. The illustrations have been prepared by F. Schuyler Mathews under the direction of the writer. They were in part drawn from life, and in part adapted from standard texts. The most frequent sources are Baillon, "Natural History of Plants"; Engler and Prantl, "Die Natürlichen Pflanzenfamilien," Strausburger, Noll, Schenk and Karsten, "Text-Book of Botany"; Warming, "Systematic Botany."

The following is an outline of the vegetable kingdom as treated in the succeeding pages:

- Division I. Thallophyta.  
 Class I. Bacteria.  
 II. Cyanophyceæ.  
 III. Flagellata.  
 IV. Myxomycetes.  
 V. Peridineæ.  
 VI. Conjugatæ.  
 VII. Diatomæ.  
 VIII. Heterocontæ.  
 IX. Chlorophyceæ.  
 X. Characeæ.  
 XI. Phæophyceæ.  
 XII. Rhodophyceæ.  
 XIII. Phycomycetes.  
 XIV. Eumycetes.  
 XV. Lichenes.
- Division II. Bryophyta.  
 Class I. Hepaticæ.  
 II. Musci.
- Division III. Pteridophyta.  
 Class I. Filicinae.  
 Sub-class I. Eusporangiatae.  
 Order 1. Ophioglossales.  
 Family Ophioglossaceæ, page 7.  
 Order 2. Marattiales.  
 Family Marattiaceæ, 7.  
 Sub-class II. Leptosporangiatae.  
 Order 3. Filicales.  
 Family Hymenophyllaceæ, 8.  
 Cyatheaceæ, 8.  
 Polypodiaceæ, 8.  
 Ceratopteridaceæ, 8.  
 Schizæaceæ, 9.  
 Gleicheniaceæ, 9.  
 Osmundaceæ, 9.  
 Order 4. Hydropteridales.  
 Family Marsileaceæ, 9.  
 Salviniaceæ, 10.
- Class II. Equisetinæ.  
 Order 5. Equisetales.  
 Family Equisetaceæ, 10.
- Class III. Lycopodinae.  
 Order 6. Lycopodiales.  
 Family Lycopodiaceæ, 10.  
 Order 7. Selaginellales.  
 Family Selaginellaceæ, 10.
- Division IV. Spermatophyta or Siphonogamia (Phanerogamia).  
 Sub-division I. Gymnospermæ.  
 Order 8. Cycadales.  
 Family Cycadaceæ, 11.  
 Order 9. Ginkgoales.  
 Family Ginkgoaceæ, 11.  
 Order 10. Coniferales.  
 Family Taxaceæ, 11.  
 Pinaceæ, 12.  
 Order 11. Gnetales.  
 Family Gnetaceæ, 12.
- Sub-division II. Angiospermæ.  
 Class I. Monocotyledonæ.  
 Order 12. Pandanales.  
 Family Typhaceæ, 13.  
 Pandanaceæ, 13.  
 Order 13. Helobiae.  
 Family Naiadaceæ, 13.  
 Aponogetonaceæ, 13.
- Family Alismaceæ, page 13.  
 Butomaceæ, 14.  
 Hydrocharitaceæ, 14.  
 Order 14. Glumifloræ.  
 Family Gramineæ, 14.  
 Cyperaceæ, 15.  
 Order 15. Principes.  
 Family Palmaceæ, 16.  
 Order 16. Synanthæ.  
 Family Cyclanthaceæ, 17.  
 Order 17. Spathifloræ.  
 Family Araceæ, 17.  
 Lemnaceæ, 18.  
 Order 18. Farinosæ.  
 Family Bromeliaceæ, 18.  
 Commelinaceæ, 18.  
 Pontederiaceæ, 18.  
 Order 19. Lilifloræ.  
 Family Juncaceæ, 19.  
 Liliaceæ, 19.  
 Amaryllidaceæ, 20.  
 Taccaceæ, 20.  
 Dioscoriaceæ, 20.  
 Iridaceæ, 21.  
 Order 20. Scitamineæ.  
 Family Musaceæ, 21.  
 Zingiberaceæ, 21.  
 Cannaceæ, 22.  
 Marantaceæ, 22.  
 Order 21. Microspermæ.  
 Family Orchidaceæ, 22.
- Class II. Dicotyledonæ.  
 Sub-class I. Archichlamydeæ (Choripetalæ and Apetalæ).  
 Order 22. Verticillales.  
 Family Casuarinaceæ, 23.  
 Order 23. Piperales.  
 Family Saururaceæ, 23.  
 Piperaceæ, 23.  
 Chloranthaceæ, 24.  
 Order 24. Salicales.  
 Family Salicaceæ, 24.  
 Order 25. Myricales.  
 Family Myricaceæ, 24.  
 Order 26. Juglandales.  
 Family Juglandaceæ, 25.  
 Order 27. Fagales.  
 Family Betulaceæ, 25.  
 Fagaceæ, 25.  
 Order 28. Urticales.  
 Family Ulmaceæ, 25.  
 Moraceæ, 26.  
 Urticaceæ, 26.  
 Order 29. Proteales.  
 Family Proteaceæ, 27.  
 Order 30. Santalales.  
 Family Loranthaceæ, 27.  
 Santalaceæ, 27.  
 Olacaceæ, 27.  
 Order 31. Aristolochiales.  
 Family Aristolochiaceæ, 28.  
 Order 32. Polygonales.  
 Family Polygonaceæ, 28.  
 Order 33. Centropseimæ.  
 Family Chenopodiaceæ, 29.  
 Amarantaceæ, 29.  
 Nyctaginaceæ, 29.  
 Phytolaccaceæ, 30.

- Family Aizoaceæ, page 30.  
 Portulacaceæ, 30.  
 Basellaceæ, 30.  
 Caryophyllaceæ, 31.
- Order 34. Ranales.  
 Family Nymphaeaceæ, 31.  
 Trochodendraceæ, 32.  
 Ranunculaceæ, 32.  
 Lardizabalaceæ, 33.  
 Berberidaceæ, 33.  
 Menispermaceæ, 33.  
 Magnoliaceæ, 33.  
 Calycanthaceæ, 34.  
 Annonaceæ, 34.  
 Myristicaceæ, 35.  
 Monimiaceæ, 35.  
 Lauraceæ, 35.
- Order 35. Rhœadales.  
 Family Papaveraceæ, 35.  
 Fumariaceæ, 36.  
 Cruciferae, 36.  
 Capparidaceæ, 36.  
 Resedaceæ, 37.  
 Moringaceæ, 37.
- Order 36. Sarraceniales.  
 Family Sarraceniaceæ, 37.  
 Nepenthaceæ, 38.  
 Droseraceæ, 38.
- Order 37. Rosales.  
 Family Crassulaceæ, 38.  
 Cephalotaceæ, 38.  
 Saxifragaceæ, 39.  
 Pittosporaceæ, 39.  
 Cunoniaceæ, 39.  
 Bruniaceæ, 39.  
 Hamamelidaceæ, 40.  
 Platanaceæ, 40.  
 Rosaceæ, 40.  
 Leguminosæ, 41.
- Order 38. Geraniales.  
 Family Geraniaceæ, 42.  
 Oxalidaceæ, 43.  
 Tropæolaceæ, 43.  
 Linaceæ, 43.  
 Erythroxylaceæ, 44.  
 Zygophyllaceæ, 44.  
 Rutaceæ, 44.  
 Simarubaceæ, 44.  
 Burseraceæ, 45.  
 Meliaceæ, 45.  
 Malpigiaceæ, 45.  
 Tremandraceæ, 46.  
 Polygalaceæ, 46.  
 Euphorbiaceæ, 46.
- Order 39. Sapindales.  
 Family Buxaceæ, 47.  
 Empetraceæ, 47.  
 Coriariaceæ, 47.  
 Limnanthaceæ, 48.  
 Anacardiaceæ, 48.  
 Cyrillaceæ, 48.  
 Aquifoliaceæ, 48.  
 Celastraceæ, 49.  
 Stackhousiaceæ, 49.  
 Staphyleaceæ, 49.  
 Aceraceæ, 49.  
 Hippocastanaceæ, 50.  
 Sapindaceæ, 50.  
 Melianthaceæ, 50.  
 Balsaminaceæ, 50.
- Order 40. Rhamnales.  
 Family Rhamnaceæ, 51.  
 Vitaceæ, 51.
- Order 41. Malvales.  
 Family Elæocarpaceæ, 51.  
 Tiliaceæ, 52.
- Family Malvaceæ, page 52.  
 Bombacaceæ, 53.  
 Sterculiaceæ, 53.
- Order 42. Parietales.  
 Family Dilleniaceæ, 53.  
 Ochnaceæ, 53.  
 Ternstroemiaceæ, 54.  
 Guttiferae, 54.  
 Hypericaceæ, 54.  
 Tamaricaceæ, 55.  
 Fouquieriaceæ, 55.  
 Cistaceæ, 55.  
 Bixaceæ, 55.  
 Violaceæ, 56.  
 Flacourtiaceæ, 56.  
 Stachyuraceæ, 56.  
 Passifloraceæ, 56.  
 Caricaceæ, 57.  
 Loasaceæ, 57.  
 Begoniaceæ, 57.
- Order 43. Opuntiales.  
 Family Cactaceæ, 57.
- Order 44. Myrtifloræ.  
 Family Thymelæaceæ, 58.  
 Elæagnaceæ, 59.  
 Lythraceæ, 59.  
 Punicaceæ, 59.  
 Lecythidaceæ, 59.  
 Rhizophoraceæ, 59.  
 Combretaceæ, 60.  
 Myrtaceæ, 60.  
 Melastomaceæ, 60.  
 Onagraceæ, 61.  
 Hydrocaryaceæ, 61.  
 Haloragidaceæ, 61.
- Order 45. Umbellifloræ.  
 Family Araliaceæ, 62.  
 Umbelliferae, 62.  
 Cornaceæ, 63.
- Sub-class II. Metachlamydeæ or Sympetalæ.  
 Order 46. Ericales.  
 Family Clethraceæ, 63.  
 Pyrolaceæ, 63.  
 Monotropaceæ, 63.  
 Ericaceæ, 64.  
 Epacridaceæ, 64.  
 Diapensiaceæ, 64.
- Order 47. Primulales.  
 Family Myrsinaceæ, 64.  
 Primulaceæ, 64.  
 Plumbaginaceæ, 65.
- Order 48. Ebenales.  
 Family Sapotaceæ, 65.  
 Ebenaceæ, 65.  
 Styracaceæ, 66.  
 Symplocaceæ, 66.
- Order 49. Contortæ.  
 Family Oleaceæ, 66.  
 Loganiaceæ, 67.  
 Gentianaceæ, 67.  
 Apocynaceæ, 67.  
 Asclepiadaceæ, 67.
- Order 50. Tubifloræ.  
 Family Convolvulaceæ, 68.  
 Polemoniaceæ, 68.  
 Hydrophyllaceæ, 68.  
 Boraginaceæ, 69.  
 Verbenaceæ, 69.  
 Labiatae, 70.  
 Nolanaceæ, 70.  
 Solanaceæ, 70.  
 Scrophulariaceæ, 71.  
 Bignoniaceæ, 71.  
 Pedaliaceæ, 72.  
 Martyniaceæ, 72.  
 Gesneriaceæ, 72.

- Family Lentibulariaceæ, page 73.  
 Globulariaceæ, 73.  
 Acanthaceæ, 73.  
 Myoporaceæ, 74.  
 Phrymaceæ, 74.  
 Order 51. Plantaginales.  
 Family Plantaginaceæ.  
 Order 52. Rubiales.  
 Family Rubiaceæ, 74.  
 Caprifoliaceæ, 74.  
 Valerianaceæ, 75.  
 Dipsacaceæ, 75.  
 Order 53. Campanulales.  
 Family Cucurbitaceæ, 75.  
 Campanulaceæ, 76.  
 Compositæ, 76.

## DIVISION I. THALLOPHYTA

Plants characterized rather indefinitely by the absence of an archegonium around the egg, and the absence of the type of antheridium found among the higher plants. The plant body is rarely differentiated into organs simulating stem and leaves, and no true vascular tissue is found in the group. Formerly the Thallophyta were divided into the Algæ, Fungi, and Lichens; but this, though a good classification on physiological grounds, does not indicate actual relationship so well as the modern division into fifteen classes founded on structure, as follows:

### CLASS I. BACTERIA

Unicellular or filamentous organisms without green color, possibly "degenerated" from the Cyanophyceæ, with no true nucleus, the cell-wall often gelatinous: reproduction wholly asexual by division into two equal portions and subsequent separation (fission); or by asexual spores, one of which may be produced in each cell. Bacteria are probably the smallest known organisms, some being not over .00003 inch in diameter. In form, the cells are either oblong, spherical or spiral, and may be separate or united in groups or chains, and may be either motile by means of cilia or non-motile. Bacteria, while showing little structural diversity, have become highly specialized physiologically, and it is on this basis that the species are usually distinguished. Many cause disease among animals and human beings, while others cause disease among plants. Nitrifying bacteria in the soil are of vital importance to higher plants. Bacteria and fungi are the causes of decay.

### CLASS II. CYANOPHYCEÆ (Blue-green Algæ)

Unicellular or filamentous algæ of blue-green color; true nuclei wanting: cell-wall often gelatinous: reproduction wholly asexual by fission or by asexual spores borne as in the bacteria. The blue-green algæ inhabit water, damp soil, damp rocks, or damp tree trunks, where they often form filamentous or gelatinous, dark green patches. The aquatic forms prefer water containing much organic matter and hence are abundant in sewers. Certain species inhabit flower-pots in greenhouses, and brick walls.

### CLASS III. FLAGELLATA (Flagellates)

Simple unicellular aquatic organisms intermediate between the Thallophyta and Protozoa. During a portion of their life they possess no cell-wall, and often show amœboid movements. The cells contain a nucleus, pulsating vacuole, and chlorophyll; and one or more cilia are present. Some reduced forms are colorless and saprophytic. Reproduction is wholly asexual by fission and thick-walled resting spores. Found in waters of ponds and streams.

### CLASS IV. MYXOMYCETES (Slime Molds)

A very distinct and independent group, formerly often classified in the animal kingdom. The plants consist of naked masses of protoplasm called plasmodia, which contain many nuclei but no chlorophyll. These are found in forests and damp, shady places. When ready to fruit, the plasmodia move toward the light and away from the water, hence ascend grass stems, stumps and logs, where they transform into elaborately constructed sporangia. The asexual spores, each enclosed by a cell-wall, are distributed by the wind, germinate, produce a ciliated bit of naked protoplasm which swims in the soil moisture, multiply by division and at length fuse with neighboring protoplasts to form the plasmodium, which latter may be sometimes a foot in breadth. During unfavorable weather, the plasmodia are often transformed into sclerotia. *Plasmodiophora brassicæ*, which is the cause of the club-root of cabbage, is the only Myxomycete of great economic importance.

### CLASS V. PERIDINEÆ

A small group mostly inhabiting the sea, more rarely fresh water. They are unicellular, free-swimming organisms with nucleus, vacuole, chromatophores, and cilia. The cell is usually surrounded by a cellulose, sculptured, or pitted and transversely furrowed, wall. Reproduction is by cell-division and swarm-spores. Sexual reproduction has recently been discovered. The Peridineæ often form an important part of the plankton in the sea.

### CLASS VI. CONJUGATÆ

Green filamentous or unicellular fresh-water algæ: cell-wall and nuclei present: reproduction by division of the plant body, and by sexual spores, which latter result from the union of two body cells by means of a connecting tube (conjugation). Plants of the sub-group Desmidiaceæ are not filamentous, but often star-shaped, lunate, or geminate in outline. The Zygnemaceæ are filamentous with star-shaped (Zygnema), spiral (Spirogyra), or plate-like chloroplastids. The Conjugatæ are of little economic importance.

### CLASS VII. DIATOMEÆ (Diatoms)

Unicellular algæ of very peculiar and interesting habit. The wall consists of two silicious valves, one of which fits over the other like the lid of a box. These valves are frequently very beautifully sculptured. Through division, new cells and new walls are formed, which are always smaller than before, until finally as a limit a sexual spore is produced which reestablishes the size of the cell. Diatoms inhabit stagnant water, wet rocks, and the sea. They are either free-floating or pedicelled and attached. The silicious walls will resist burning. Diatoms contain little, if any, chlorophyll, and are mostly saprophytic. A large part of the oceanic plankton is composed of Diatoms.

### CLASS VIII. HETEROCONTÆ, or CONFERVÆ

A small group of green algæ, inhabiting wet soil or water, but of little, if any, economic importance. The zoöspores have unequal cilia; and the chloroplastids are yellowish green and oil-producing. Asexual resting spores also occur. Conjugating zoöspore-like gametes are found in some genera. Botrydium and Conferva are examples of this class.

### CLASS IX. CHLOROPHYCEÆ

A large and important group of fresh-water, or rarely marine, algæ. Plant body unicellular, filamentous, or even thalloid: the cells contain chloroplastids and produce starch: reproduction sometimes vegetative, but also by asexual zoöspores; sexual reproduction con-



sists of the fusion of two zoöspore-like gametes, or the fusion of one such gamete and a specialized non-motile egg. The latter condition is characteristic of the higher forms in nearly all the sub-groups of the Chlorophyceæ. The plant body in the Order Siphonales is peculiar in that it consists of a continuous tube without cross-walls. Some common genera in this class are *Volvox*, *Chlamydomonas*, *Pandorina*, *Protococcus*, *Pediastrum*, *Scenedesmus*, *Hydrodictyon* (Water-net), *Ulothrix*, *Ulva* (Sea-lettuce), *Edogonium*, *Cladophora*, *Caulerpa*, and *Vaucheria*.

#### CLASS X. CHARACEÆ (Stoneworts)

Attached plants (1 inch to 1 yard in length) of fresh or brackish water, consisting of a slender stem, which bears at each node a whorl of branches, usually again bearing whorled branchlets. The internodes consist of one immense multinucleated cell often as much as 3 inches long; which is naked or inclosed in a sheath of smaller cells. The branches are similarly constructed though the cells are correspondingly smaller. Asexual spore-reproduction is absent. Sexual reproduction is by means of an egg-cell inclosed in a jacket of spiral wall-cells, and of sperm-cells inclosed in an antheridium which has a multicellular wall. These sexual organs are borne at the nodes of the branchlets. The fertilized egg and its investment becomes a thick-walled resting structure. Many species of *Chara* and *Nitella*, the only two genera, have the power to deposit lime from solution, and thus become incrustated with that substance, hence the popular name. In this way the Characeæ have played a part in the filling up of calcareous lakes and the production of new land. They are mostly inhabitants of calcareous waters.

#### CLASS XI. PHÆOPHYCEÆ (Brown Seaweeds)

A large group of salt-water algæ, well known in all waters of the globe, but most abundant in the colder regions. Plant body attached, usually thalloid and branched, but very diverse; in some cases filamentous, in others disk-shaped or globular. The larger forms of *Laminaria* are sometimes 200 feet long. The chromatophores of the Phæophyceæ contain a brown pigment which gives to these plants a brown or yellowish color instead of green. The thallus is often very tough and cartilaginous, to resist the waves. Zoöspores are often produced. In sexual reproduction, the gametes are either similar and motile, rarely non-motile, or more often the sperm is motile while the egg is much larger and non-motile. Details of structure in respect to reproduction, however, are very great.

The thallus of various species of Phæophyceæ yields iodine and soda. Some species (e.g., *Laminaria saccharina*) yield mannite and are used in the Orient for food. The dried stalks of *L. digitata* and *L. Cloustoni* have been used in surgery. *Fucus* and other genera are used as manure.

One species, *Sargassum bacciferum*, has accumulated in great quantities in the Atlantic Ocean between the Bermuda Islands and the Spanish coast, in the so-called "Sargasso Sea."

#### CLASS XII. RHODOPHYCEÆ (Red Seaweeds)

Mostly marine algæ, a few only inhabiting fresh water, widely distributed, but most abundant in the tropics and temperate region at lower depths. The thallus is very diverse, filamentous, branched, often thalloid, attached by holdfasts, and red, violet, or purple in color, rarely green. True starch is not found. Asexual spore-reproduction is frequent. These spores are non-motile and produced in fours (tetraspores). Sexual reproduction is by dissimilar gametes, the antheridium becoming without change a single non-motile sperm-cell. The egg-cell is prolonged upward into a slender tube (trichogyne). The fertilized egg

by division gives rise to a globular mass of short filaments (cystocarp) which produce asexual spores. These spores in turn give rise to the mature plant. The cystocarp and its spores, thus following fertilization, suggest the alternation of generations found in the mosses and liverworts and all higher plants. About 300 species of Rhodophyceæ have been described.

Carraheen, or Irish moss, used in jellies and puddings, is the dried thallus of *Chondrus crispus* and *Gigartina mamillata* of northwestern Europe. Agar-agar, used in the preparation of culture media in bacteriology and mycology, is obtained from various species of this group.

#### CLASS XIII. PHYCOMYCETES

A large group of parasitic or saprophytic organisms (fungi), without chlorophyll: thallus (mycelium) of much-branched filaments (hyphæ); usually without cross-walls (non-septate), as in the algal group Siphonæ: asexual reproduction by motile or non-motile spores which are usually borne in sporangia, and by conidia which are cells abstracted from the tips of specialized hyphæ: sexual reproduction diverse, either by the conjugation of similar gametes, or by the conjugation of a specialized antheridial branch (male) and an enlarged oogonial branch (female) which contains the egg; free sperm-cells are rare. The order Oömycetes, with differentiated gametes, contains the following important fungi: *Saprolegnia* (water-mold), a whitish, aquatic mold growing on decaying plants, insects, or living fishes; *Olpidium brassicæ*, parasitic in cells at the base of the stem of young cabbage plants causing their death; *Phytophthora infestans* (potato disease); *Plasmopara viticola*, downy or false mildew of the grape; *Albugo candida*, white rust of Cruciferae; *Pythium* of *Baryanthum*, causing damping off of seedlings. Order Zygomycetes, with similar gametes, contains *Mucor mucedo*, white mold of bread, fruits, etc.; *Rhizopus nigricans*, a mold on bread, fruit, etc.; *Empusa muscæ*, parasitic on houseflies, causing their death and producing a white halo about them on the surface where they die.

#### CLASS XIV. EUMYCETES

A very large and important group of saprophytic or parasitic organisms (fungi) without chlorophyll: thallus (mycelium) composed of fine tubular threads, which are septate: sexual organs usually obscure or apparently wanting: asexual reproduction by spores or by conidia, a modified form of which is termed basidia. The conidia and basidia do not always represent homologous organs. The group is divided into Ascomycetes and Basidiomycetes. The Ascomycetes are characterized by a group of usually 8 spores inclosed in a unicellular sac (ascus), which is produced immediately after the imperfect sexual fertilization. The asci are borne in spherical bodies (perithecia) or in open cups (apothecia). The Perisporiaceæ, Discomycetes, Pyrenomycetes, and Tuberales are orders within this sub-class. Among the many important economic fungi belonging here are the following: Erysipheæ (Downy Mildews); *Aspergillus* and *Penicillium* (Fruit Mold, Blue Mold); *Morchella* (Morel), edible; *Nectria* (Currant Cane Rust and Tree Canker); *Claviceps purpurea* (Ergot), parasitic in the ovaries of grains; *Taphrina* (including *Exoascus*), causing witches' broom, leaf curl of peach, plum pockets, etc.; *Saccharomyces* (Yeast), causing fermentation in saccharine solutions. The Basidiomycetes are characterized by the production of four spores on a special hyphal tip or thread (basidium). Each spore is raised on a minute slender stalk (sterigma). These spores, in some cases, if not in all, follow immediately after a nuclear fusion, which probably represents a reduced sexual act. In this group are the Ustilaginæ (Smuts), infesting the ovaries of grains, etc.; the Uredinæ (Rusts), which infest a wide variety of cultivated and wild plants, and among which may be men-

tioned the wheat rust; the Hymenomycetes (Mushrooms, Toadstools, and Bracket Fungi), which are saprophytic or inhabit timber; and the Gasteromycetes (Puff-balls), which are saprophytic. The rusts exhibit alternation of generations to a most remarkable degree, the different generations often inhabiting different host plants and possessing a wholly different appearance, as well as a wholly different method of spore-formation. The Hymenomycetes are saprophytic, except the genus *Exobasidium* which inhabits the living foliage of various plants, the genus *Armillaria* which infests living tree-trunks, and many genera of the Polyporaceæ (Bracket Fungi) which also attack the wood of living trees. The last-mentioned fungi, including *Armillaria*, inhabit the trunks and branches of forest trees, causing their death.

#### CLASS XV. LICHENES (Lichens)

Green, gray or highly colored plants of very diverse habit and habitat, either thalloid, fruticose or crustaceous, and growing on the soil, bark of trees, rocks, or rarely on foliage: propagation by division of the thallus or by the separation of special minute powdery parts (soredia): spore-reproduction by ascospores borne in perithecia or apothecia, rarely by basidiospores. The lichen thallus is not a single organism, but is probably a symbiotic structure, comprised fundamentally of fungus hyphæ between which many unicellular green algae are distributed, usually in a definite fashion. The fungi belong to the Ascomycetes in the great majority of cases, rarely to the Basidiomycetes. The algae may belong to the Chlorophyceæ, in which case they are unicellular, or to the Cyanophyceæ, in which case they are either unicellular or in chains. Because the symbiotic structure behaves as a unit, it has been decided to continue to treat the lichens as a class by themselves, rather than to consider the algal and fungal components independently in their respective groups. Except as soil-producers, lichens are of little economic importance: *Cetraria islandica* furnishes Iceland moss; *Stictia pulmonaria* was once used in medicine; *Cladonia rangiferina* furnishes the main food of the reindeer in Lapland, and, possibly, of other arctic animals; *Roccella tinctoria* of Africa and the East Indies is the source of the chemical indicator, litmus and of the dye orchil or orseille.

#### DIVISION II. BRYOPHYTA (Mosses and Liverworts)

Small green plants of simple structure, either thalloid or differentiated into stem and leaves: true roots wanting: vascular tissue absent: alternation of generations well developed, the gamete-bearing generation dominant: female gamete (egg) inclosed in a flask-shaped multicellular archegonium: male gametes (sperm-cells) inclosed within a multicellular antheridial wall: fertilized egg producing the spore-bearing generation (sporogonium) which consists of a parasitic or semi-parasitic capsule usually borne upon a seta.

The Bryophytes are divided into two great classes, namely the Hepaticæ (Liverworts) and the Musci (Mosses). Each of these in turn is divided into several orders, which, as usual, contain one or more families. Mosses and liverworts are widely distributed over the earth, the latter seeming to prefer limestone regions.

The Hepaticæ are characterized by a spore-bearing generation consisting of a stalked or sessile simple capsule, which contains spores and elongated sterile elaters, and splits into teeth or valves at maturity. The plant body (gamete-bearing generation) consists either of a thalloid, algal-like, dichotomously branching, ribbon-like structure, or of a slender axis bearing the very thin leaves, one cell in thickness, and destitute of a midrib. The leaves are usually arranged in two lateral rows, with often a third row of small dissim-

ilar leaves on the under side, so that the shoot is strongly dorsi-ventral. The lateral leaves frequently bear at the base a curious lobe that is infolded or even flask-shaped, and probably aids in the conservation of water on the dry rocks and tree trunks which many of these plants frequent. The under side of the stem or thallus is usually provided with rhizoids that take the place of roots. The thalloid liverworts are inhabitants of damp or wet situations, some being aquatic: in the North, they are found on damp soil, wet rocks, or among damp moss. The majority of foliose liverworts inhabit similar places, only comparatively few genera and species being xerophytic. Filaments of the alga, *Nostoc*, penetrate the cavities in the thallus of *Anthoceros* and there form endophytic colonies. Vegetative reproduction is accomplished by the branching of the thallus, or by the production of special buds, called gemmæ, either on the edge of the leaf or thallus, or in special cup-like receptacles borne on the surface of the thallus.

The Hepaticæ are divided into four principal orders as follows: Order I.—**Ricciales**. Thalloid, floating or amphibious: sexual organs sunken in the thallus: capsule sessile, thin-walled, endophytic, irregularly dehiscent. Order II.—**Marchantiales**. Thalloid: archegonia and antheridia usually borne on special branches of the thallus: capsule often stalked, usually regularly dehiscent. *Marchantia* was formerly used as a remedy in diseases of the liver, hence the name liverwort. Order III.—**Anthocerotales**. Thalloid: one chloroplast in each cell: sexual organs superficial: capsule very slender, chlorophyll- and stomate-bearing, continuing to elongate by basal growth. Order IV.—**Jungermaniales**. Thalloid or foliose: capsule usually splitting to the base into four valves.

The Musci (Mosses) differ from the Hepaticæ mainly in the more elaborate capsule, which in the young state commonly contains chlorophyll, is provided with stomates, and contains a central column of sterile tissue (columella) encircled by the spore-bearing chamber. The dehiscence of the capsule is apical and transverse, and consists in the formation of a lid (operculum) which falls off exposing the mouth of the annular spore-chamber. This mouth is surrounded by a single or double row of numerous hygroscopic teeth (peristome), which, by their bending, regulate the escape of spores in wet and dry weather. No elaters are produced. The sporogonium of the moss is, therefore, not only a more independent structure from the standpoint of nutrition than is that of most liverworts, but is constructed along wholly different lines. On the summit of the capsule is usually found a delicate, diversely shaped, hood-like cap not organically connected with it and easily detached, called the calyptra. This is the enlarged upper portion of the archegonium, which, after rupture, is borne aloft on the summit of the growing sporogonium. The plant-body (gamete-bearing generation) is never thalloid; and the leaves, which are provided with a midrib, are frequently of several cells in thickness. The germination of the spore does not result at once in a moss plant, but produces a creeping filamentous branched, algal-like growth (protonema) on which at length are borne the buds that give rise to the moss-stem proper.

The Musci are subdivided as follows: Order I.—**Sphagnales** (Bog or Peat Mosses). Structure of stem and leaf peculiar, consisting of dead, tracheid-like cells without protoplasm and provided with pits or thickening bands, regularly interspersed among slender, living cells containing protoplasm and chloroplastids. Under ordinary conditions, the tracheid-like cells are filled in part with air, and hence the plant has a grayish hue. In the presence of rain or abundant soil-water, the water is drawn into the cells by capillarity until the still apparently dry plant contains a surprisingly large quantity of water, which will flow out on squeezing



in the hand. The capsule possesses no peristome, and the spore-sac is continuous over the top of the columella. Peat mosses are large, branched plants growing in extensive colonies in wet or damp situations in northern countries. They are especially abundant on the floating moors which surround certain small ponds, and by their decay play an important part in the filling in of these ponds. They continue to thrive in these "bogs" until the conditions at length become too dry. Peat mosses, therefore, form a large component of "peat," and in this way the Sphagnales have played a very interesting part in the evolution of the present surface of the earth. Because of the power to retain water, sphagnum is of economic importance to nurserymen and florists, who use this moss extensively in packing stock for shipment, in germinating seeds, and for other purposes. Some species of sphagnum are eaten in Lapland by the reindeer. Mixed with the hair of the reindeer, they are used for stuffing mattresses. Order II.—**Andreales**. A small group of rock mosses. The spore-chamber is continuous over the summit of the columella, and the capsule dehiscence by four longitudinal slits. Order III.—**Phascales**. A small group of minute terrestrial mosses with few leaves, but a persistent protonema: capsule indehiscent, at length decaying. Order IV.—**Bryales**. A large group containing the majority of the mosses: capsule dehiscing by an operculum; peristome present; spore-sac interrupted at the summit by the columella. Certain species were formerly used as astringents and diuretics. *Leskea sericea* has been used to stop the flow of blood from wounds. Species of *Hypnum* and *Fontenalis* are used in Norway and Sweden, by the peasants, to fill cracks in the walls of huts. *Hypnum triquetrum* is sometimes used in place of sphagnum for packing plants.

With the exception of sphagnum, the mosses and liverworts do not seem to be in the trade.

### DIVISION III. PTERIDOPHYTA

Eggs borne in archegonia: sperm-cells in antheridia: alternation of generations clearly evident, the spore-bearing generation dominant: true vascular tissue present; also true roots.

#### CLASS I. FILICINÆ (Ferns)

Sub-class I. *Eusporangiatæ*. Sporangial wall several cells in thickness

##### Order 1. OPHIOGLOSSALES

1. **Ophioglossaceæ** (from the genus *Ophioglossum*, *adder's tongue*, in reference to the fruiting spike). **ADDER'S-TONGUE FAMILY**. Fig. 1. Plants small or of medium size, often somewhat fleshy: leaves various, entire or often much divided, not circinate in veneration; veins forking or netted; base of leaf cap-like, enclosing the succeeding leaf: sporangia scattered, borne on the margin of the much modified fertile portion of the leaf, which is usually separated from the sterile by a stalk, globular in form; the walls several cells in thickness; annulus wanting; dehiscence by a straight horizontal or vertical fissure: prothallium subterranean, tuber-like, chlorophyllless, containing mycorrhizal fungi, saprophytic.

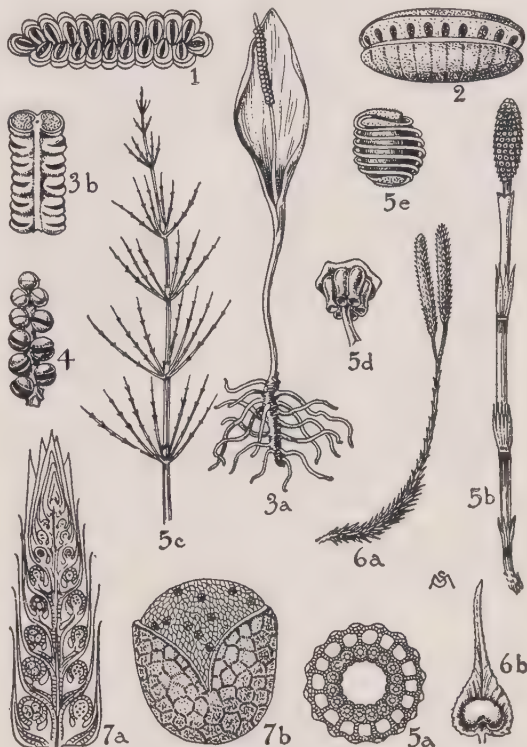
Three genera and about 50 species occur, of general distribution. Several species of *Botrychium* and one of *Ophioglossum* are found in the eastern United States. The sheathing base of the leaf, the solitary, thick-walled sporangia without an annulus, and the subterranean saprophytic prothallia are important characteristics.

Two genera are sometimes grown in North America: *Botrychium* (Moonwort Ferns, Grape Ferns) and *Ophioglossum* (Adder's Tongue).

##### Order 2. MARATTIALES

2. **Marattiaceæ** (from the genus *Marattia*, named in honor of Maratti, Italian botanist). **MARATTIA FAMILY**. Fig. 1. Stately tropical ferns with thickened, often erect, stems: leaves usually very large, from nearly entire to several times pinnate, circinate, inclosed when young by the prominent stipules: indusium present or absent: sporangia in sori on the under face of the leaf, either separate or united into a capsule-like body (synangium); the walls several cells in thickness; annulus wanting, or greatly reduced; dehiscence by clefts, pores, or, in case of the "synangia," first by valves and then by slits: prothallium a green heart-shaped thallus on the surface of the soil, sometimes branched.

Four genera and about 23 species are found in tropical regions, but extend into the south temperate



1. MARATTIACEÆ: 1. Angiopteris, sorus. 2. Marattia, synangium. OPHIOGLOSSACEÆ: 3. Ophioglossum, a, whole plant; b, dehiscent sporangia. 4. Botrychium, sporangia. EQUISETACEÆ: 5. Equisetum, a, cross-section stem; b, fruit stem; c, sterile stem; d, sporophyll and sporangia; e, spore and elater. LYCOPODIACEÆ: 6. Lycopodium, a, fruit branch; b, sporophyll and sporangium. SELAGINELLACEÆ: 7. Selaginella, a, fruit spike; b, spore showing prothallium and archegonia.

zone. The fern-like habit, the prominent stipules, the thick-walled sporangia borne in sori or synangia, the absence of a well-developed annulus, and the green thalloid emersed prothallia, are important characteristics. The family is probably very old geologically.

The thick, starchy stem of *Angiopteris* and some *Marattias* are locally used for food. The fleshy stipules of *Marattia frazinea* are eaten; the spicy leaves of some species are used to season food. The slime from the stipules of *M. Douglasii* is used medicinally by the Hawaiians.

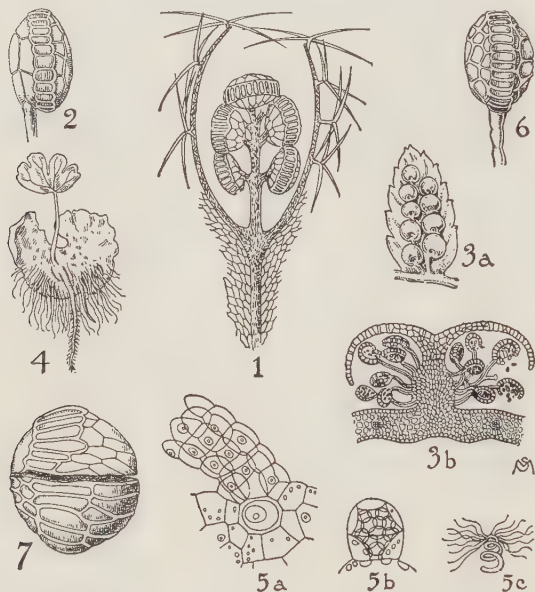
Three genera are known to American horticulture and are occasionally grown as ornamental greenhouse plants: *Angiopteris*, *Danaë*, and *Marattia*, representing less than a half-dozen cultivated species.



*Sub-class II. Leptosporangiatæ. Sporangial wall one cell in thickness*

### Order 3. FILICALES

**3. Hymenophyllaceæ** (from the genus *Hymenophyllum*, signifying *membrane-leaved*). FILMY-FERN FAMILY. Fig. 2. Very delicate ferns, small or minute in size, frequently epiphytic: leaves entire, 1-3-pinnate, or dichotomously divided, rarely thalloid or orbicular, reduced in thickness to a single layer of cells between the veins, and thus often resembling the leaves of mosses; stomates absent; ultimate or all veins dichotomous: sori marginal, raised on a slender columnar pro-



2. HYMENOPHYLLACEÆ: 1. Hymenophyllum, section of sorus. CYATHEACEÆ: 2. Alsophila, sporangium. POLYPODIACEÆ: 3. Aspidium, a, pinnule with sori; b, section of sorus. 4. Adiantum, prothallium with young fern plant. 5. Polypodium, a, archegonium; b, antheridium; c, sperm. 6. Penanema, sporangium. GLEICHENIACEÆ: 7. Gleichenia, sporangium.

jection of the veinlet: indusium cup-shaped: sporangium thin-walled; dehiscence vertical or oblique; annulus complete, horizontal: prothallium thalloid or filamentous, often much branched.

There are 2 genera and about 200 species growing upon rocks and trees in the damp, shady forests of the tropics, and in New Zealand. One species reaches central Europe and another reaches Kentucky. The family is readily distinguished by the delicate leaf, pedicelled sorus and equatorial annulus.

The Hymenophyllaceæ require a warm and very humid atmosphere, and, therefore, most species are difficult to cultivate.

Several species of Hymenophyllum and Trichomanes are in cultivation in America.

**4. Cyatheaceæ** (from the genus *Cyathea*, signifying *cup+contain*, in reference to the cup-shaped indusium). CYATHEA FAMILY. Fig. 2. Usually tree ferns with large, much-compounded, circinate leaves: sori globular, borne on the under side of the leaf: veins forking: indusium usually present, bi-valvular, cupular or unilateral: sporangia thin-walled, sessile or short-pedicelled, obovoid; annulus complete at the pedicel, oblique, dehiscence transverse: prothallium ordinary, green.

This family has 7 genera and about 300 species, of which 115 belong to *Cyathea*, 112 to *Alsophila*, and 44 to *Hemitelia*. They are distributed in the tropics of

both hemispheres. The Cyatheaceæ is closely related to the Polypodiaceæ from which it differs only in the slightly oblique annulus which passes just at one side of the insertion of the pedicel, and is therefore uninterrupted at that point.

The dense, woolly covering of the stem of many species is sometimes collected for stuffing pillows. The starchy pith of some New Zealand Cyatheaceæ was formerly used for food. In India, an intoxicating drink is prepared from the pith. Several species are important greenhouse ferns.

Five genera at least are listed in the American trade: *Alsophila*, *Cibotium* (Scythian Lamb), *Cyathea*, *Dicksonia*, *Hemitelia*.

**5. Polypodiaceæ** (from the genus *Polypodium*, signifying *many feet*, in allusion to the branched rootstock of some species). POLYPODY FAMILY. Fig. 2. Ferns of very diverse habit, rarely arborescent: leaves of normal texture, entire or pinnatifid or multisect, circinate; veins forking: sori mostly on the under side of the leaf; indusium peltate, fringed, capillary, cupular, elongated, unilateral or wanting: sporangia thin-walled, long- or short-stalked; annulus vertical, interrupted by the pedicel; dehiscence transverse: prothallium thalloid, green, growing upon the surface of the soil, mostly bisexual.

Polypodiaceæ has more than 100 genera and about 4,000 species of wide distribution; especially abundant in humid regions and in forests. The largest genera are: *Dryopteris* (or *Aspidium*), 450 species; *Polypodium*, 500 sp.; *Asplenium*, 150-200 sp.; *Elaphoglossum*, 80-100 sp.; *Adiantum*, 80 sp.; and *Pteris*, *Blechnum*, *Polystichum* and *Aspidium* about 50-70 species each. The family is most closely related to the Cyatheaceæ. The presence of sori, the thin-walled sporangium with vertical interrupted annulus and transverse dehiscence are distinctive. This comprises the larger number of ferns, and is often called the Fern Family.

Some of the most striking variants are the walking-leaf fern with undivided lanceolate leaves which take root at the apex and repeat the process several times, all the plantlets remaining for a time connected; the hart's-tongue fern with broadly lanceolate-oblong, entire frond; the epiphytic staghorn fern with erect, forked, fertile fronds and orbicular entire, sterile fronds closely imbricated over the short stem and support. In many species the fertile and sterile fronds are dimorphic. The stems of some species are slender and climbing; others long, slender and creeping; some are very stout and erect (tree ferns).

The ferns are of little economic importance except as ornamental plants. The starchy rootstocks of some species are eaten locally, as are also the young shoots. The rootstock of *Dryopteris* (*Aspidium*) *Filix-mas* is a reputed vermifuge.

About 60 species are in cultivation in America. Among these are: *Adiantum* (Maidenhair Fern); *Aspidium* (Shield F.); *Asplenium* (Spleenwort); *Camp-tosorus* (Walking-leaf F.); *Dennstædtia* (*Dicksonia*) (Fragrant F.); *Onoclea* (Sensitive F., Ostrich F.); *Pellaea* (Cliff Brake); *Phegopteris* (Beech F.); *Platyce-rium* (*Staghorn F.*); *Polypodium* (*Polypody F.*); *Polystichum* (*Holly F.*, *Christmas F.*); *Pteris* (Common Brake); *Scolopendrium* (*Hart's-tongue F.*).

**6. Ceratopteridaceæ** (*Parkeriaceæ*) (from the genus *Ceratopteris*, meaning *horn-fern*). CERATOPTERIS FAMILY. Aquatic ferns rooting in the mud: leaves of two sorts, the ones less divided with broader segments and veins more or less anastomosing; the more aerial fertile ones much divided, with narrow segments, and revolute margins which later almost completely inclose the scattered sporangia: indusium wanting: sporangia globular, thin-walled with a very diverse broad nearly complete or nearly wanting annulus; rarely the annulus wanting; dehiscence transverse: prothallia unisexual, thalloid; antheridia not superficial.

Only one genus and a few species of tropical distribution are known, the only aquatic species among the true ferns. The habit, the absence of sori, the variable annulus, and the sunken antheridia are distinctive.

This fern is sometimes cooked and eaten as greens.

One or two species are frequently grown for aquaria and aquatic gardens.

7. **Schizæaceæ** (from the genus *Schizæa*, cleft, alluding to the leaves). **CURLY-GRASS FAMILY**. Fig. 3. Ferns of very diverse habit, some extremely small, others climbing: stem mostly oblique or horizontal: leaves very diverse, usually pinnate or palmate; veins forking: sporangia thin-walled, usually scattered, at first marginal, later sometimes exceeded by the margin of the frond, often appearing spiked or paniced, sessile; no apparent indusium; annulus transverse, apical, complete; dehiscence vertical; fertile portion of the frond usually much modified: prothallium of all genera except *Schizæa* ordinary; that of the latter genus filamentous and extremely branched, resembling that of the filmy ferns.

In this family are 4 genera and about 70 species, mostly tropical, rare in the colder regions. Two species reach the eastern United States, one of which extends to Newfoundland. The solitary sporangia and transverse apical annulus are important characteristics.

The curly grass (*Schizæa pusilla*) inhabits bogs, where it may form extended mats of dry, woolly "grass" 1-3 inches high. The sterile leaves are without laminae. *Lygodium palmatum* is the "climbing fern" of eastern America. The leaf, not the stem, of this plant has unlimited growth, and twines.

Four genera are in the American trade: *Anemia*, *Lygodium*, *Mohria*, and *Schizæa*.

8. **Gleicheniaceæ** (from the genus *Gleichenia*, named in honor of W. F. Von Gleichen, 1717-1783). **GLEICHENIA FAMILY**. Fig. 2. Terrestrial ferns with peculiar foliage: leaves several times forking owing to the arrested growth of the main divisions which develop in succeeding seasons, only the ultimate branches pinnate (except in one genus); indusium none: sporangia in sori on the under side of the leaf, thin-walled, sessile, pear-shaped; annulus complete, running obliquely around the back and over the top; line of dehiscence extending vertically down the ventral side from a constricted apical place in the annulus: prothallium ordinary, green.

Two genera and about 26 species occur in tropical lands and the south temperate zone. The family is related to the *Schizæaceæ* but the habit is very different. The peculiar forking of the leaves, as well as the unusual annulus and peculiar dehiscence, are characteristic.

A few species of *Gleichenia* are in cultivation in North America.

9. **Osmundaceæ** (from the genus *Osmunda*, derived from *Osmunder*, the Saxon name of the god Thor). **OSMUNDA FAMILY**. Fig. 3. Ferns of ordinary habit, rarely aborescent: rhizome mostly vertical, thick: leaves large, circinate, 1-3-pinnate, rarely thin and stomateless; petiole somewhat sheathing at the base; fibrovascular bundle 1; veins forking; indusia wanting: sporangia scattered on the under side of the ordinary leaf, or on the margin or on both sides of modified fertile portions of the leaf, thin-walled, short-stout-pedicelled, globular; annulus imperfect, consisting of a group of cells on one side; line of dehiscence vertical, extending from this group up over the summit: prothallium ordinary, green.

There are 3 genera and 10 or 12 species of general distribution, and others in the Australian region. Three species occur in the eastern United States. The family is related to the *Gleicheniaceæ* and *Schizæaceæ*. The peculiar dehiscence, and the scattered sporangia with the annulus consisting of a group of cells, instead of a ring, are distinctive.

The family has practically no economic importance, except as ornamental plants, except that the root

masses are used as matrix on which to grow orchids and other epiphytic plants (see *Osmundine*). Some have been used in medicine, although their virtues are questionable. The family contains some of our most stately native ferns.

All three genera are in American horticulture: *Leptopteris* (leaves thin and no stomates); *Osmunda* (Royal Fern, Cinnamon Fern), *Todea* (Grape Fern).

#### Order 4. HYDROPTERIDALES

10. **Marsileaceæ** (from the genus *Marsilea*, in honor of Giovanni Marsigli, or Aloysius Marsili, Italian naturalists.) **MARSILEA FAMILY**. Fig. 3. Perennial marsh or aquatic plants with filiform and creeping rhizomes: leaves all from rootstocks, circinate; rachis without blade or with four leaflets borne together at the apex; leaflets, when present, fan-shaped, rounded at apex; veins dichotomous: sporangia of two sorts, macrosporangia bearing macrospores which give rise to egg-cells, and microsporangia bearing microspores which give rise to sperm-cells, both borne together in tiny chambers (sori) in globular capsule-like conceptacles (sporocarps) which arise from the rootstock or lower portion of the leaf, and are either stalked or sessile:



3. **SCHIZÆACEÆ**: 1. *Anemia*, sporangium. **OSMUNDACEÆ**: 2. *Osmunda*, sporangium; a, front view; b, back view. **SALVINIACEÆ**: 3. *Salvinia*, a, whole plant; b, section of sporocarps showing sporangia. **MARSILEACEÆ**: 4. *Marsilea*, a, whole plant; b, sporocarp germinating; c, sporocarp emitting gelatinous thread with sori. 5. *Pilularia*, a, cross-section of sporocarp; b, sporocarp emitting sporangia.

male and female prothallia very much reduced, remaining inclosed within the spore-wall, which in the case of the macrospores early becomes ruptured on one side to expose the archegonia.

Two genera (*Marsilea* and *Pilularia*) and about 60 species occur, of which 52 or 54 belong to *Marsilea*. The distribution is general, though mainly tropical. *Marsilea* is represented in the United States by one native and one introduced species. The family is closely related to the *Salviniaceæ*, but the peculiar habit and unusual sporocarps are distinctive.



At maturity, a gelatinous mass escapes from the sporocarp, and on this mass the sori are borne in somewhat characteristic fashion in different species. The leaflets of the clover-like leaves of *Marsilea*, in emerged forms, show sleep movement, as do those of clover. These leaflets float upon the water to the varying depths of which the petioles accommodate themselves; but the plant may grow emerged on mud, in which case the petioles are erect like clover. The leaves of *Pilularia* are filiform, pointed, and destitute of blade.

In Australia, the sporocarps of *Marsilea Nardii* and *M. Drummondii*, which contain much starch and other nutritious material, are used by the natives for food. They are ground into a powder, mixed with water and baked. Fish and *marsilea* "fruits" form almost the sole food of some tribes.

One species, *Marsilea quadrifolia*, is in cultivation in America for aquatic gardens.

11. **Salviniaceæ** (from the genus *Salvinia* in honor of A. M. Salvini, Italian scientist). **SALVINIA FAMILY.** Fig. 3. Small, floating aquatic plants, resembling large Lemnas (*Salvinia*) or foliaceous liverworts (*Azolla*): stem reduced or wanting; leaves few, orbicular or oval (*Salvinia*); or numerous, minute and imbricated (*Azolla*); sporangia and spores of two sorts as in *Marsilea*, but borne on basal columns in the single cavity of the sporocarp; at first both sorts of sporangia are present but only one kind matures so that the sporocarp becomes entirely "male" or entirely "female;" prothallium partly endosporous, only a portion of either the male or female prothallium emerging from the spore wall.

The family has 2 genera and about 15 species, of which 11 belong to *Salvinia*; generally distributed but principally tropical. Each genus is represented in the eastern United States by one native species. The family is related to the *Marsileaceæ*, but the habit, the structure of the sporocarps, and the separation of macrosporangia and microsporangia in different sporocarps are distinctive.

The "roots" of *Salvinia* represent a modified leaf. Each leaf of *Azolla* is two-lobed, one lobe floating, the other submerged. A small cavity inclosed by the upper lobe is always inhabited by a nostoc-like alga, between which and the *Azolla* there is indication of a symbiotic relationship. *Azolla* possesses true roots.

The family is of almost no economic importance.

One species of *Salvinia* and two species of *Azolla* are occasionally grown in water-gardens.

## CLASS II. EUISETINÆ

### Order 5. EUISETALES

12. **Equisetaceæ** (from the genus *Equisetum*, meaning *horse-bristle*). **HORSE-TAIL FAMILY.** Fig. 1. Plants of striking appearance, often with rhizomes and with a straight, aerial, striated axis bearing whorls of connate, scale-like leaves at the nodes: from the nodes also frequently arise slender branches of different structure which bear different but still scale-like leaves: the stem is hollow, and besides the central canal often contains numerous additional large canals imbedded in the outer tissue: spores of one kind (not microspores and macrospores): sporangia 5-9, borne on the under surface of peltate, polygonal scales which form a terminal cone; dehiscence longitudinal; spores green, provided with several hygroscopic "elaters" which aid in dissemination: prothallia green, unisexual, the female largest, branched.

A single genus and about 24 species are known, of which one section is tropical, the other of temperate distribution. Ten species are native in the eastern United States. The family is very distinct and shows no definite relationship to any existing plants. The habit, the undifferentiated spores, the peltate sporophylls, and the dioecious emergent prothallia are dis-

tinctive. The arrangement of the canals and also of the stomates along the stem are important in the distinction of species.

The stems of *E. hiemale*, rich in silica, were formerly much used for scouring and for polishing woods, and are still used to some extent. *E. arvense* and *E. sylvaticum* have been used for polishing tin vessels, hence the name "tinweed." Several species have been used in medicine, as diuretics. *E. giganteum* is employed as an astringent. *E. arvense* and *E. palustre* are bad weeds in parts of Europe.

Several species have been advertised by American dealers in native plants.

## CLASS III. LYCOPODINÆ

### Order 6. LYCOPODIALES

13. **Lycopodiaceæ** (from the genus *Lycopodium*, *wolf-foot*, from a fancied resemblance). **CLUB-MOSS FAMILY.** Fig. 1. Branched plants of moderate size, stems often erect when short, usually prostrate, pendent, or creeping: leaves very numerous, small, subulate or oblong, moss-like, often imbricated; rarely the leaves all basal (*Phylloglossum*): sporophylls either similar to the leaves, or much modified and forming terminal "cones;" sporangia and spores of one sort (not macrospores and microspores), the former reniform, borne at the base of a leaf on the upper side; dehiscence longitudinal: prothallia more or less cylindrical or amorphous, in some species green, in others colorless, saprophytic, subterranean or subcortical.

The club-moss family contains 2 genera and about 100 species, all but one of which belong to *Lycopodium*, distributed in all parts of the world except the very dry regions. The majority of the epiphytic species are tropical, but several terrestrial species extend to the arctic circle. Twelve of the species are native in the eastern United States. The family is not closely related to any other. The habit, the undifferentiated spores, and the prothallium are distinctive.

The branching of *Lycopodium* is of two types, the dichotomous, and the monopodial (a central axis from which lateral branches arise). On these types subgenera are based.

The spores of *Lycopodium* (principally of *L. clavatum*), which are produced in great quantities, are used by apothecaries for coating pills, and by metal-workers. These spores are highly inflammable and were formerly used in theaters to produce flashlights. *L. Selago* is emetic, drastic, vermifugal, and emmenagogue. *L. myrsinitis* and *L. catharticum* are purgative. Several other species have been used locally for various complaints. The creeping stems of *L. clavatum* and *L. complanatum* are often used for Christmas and church decorations.

Several species of *Lycopodium* (Club-moss, Ground Pine, Creeping Pine) are gathered or protected in America for decorative purposes or for the spores.

### Order 7. SELAGINELLALES

14. **Selaginellaceæ** (from the genus *Selaginella*, diminutive of *Selago*, ancient name of *Lycopodium*). **SELAGINELLA FAMILY.** Fig. 1. Moss-like or lycopodium-like plants, often of moderate size, usually profusely and dichotomously branched, more rarely monopodial; creeping, pendent or erect, sometimes climbing and several meters long, or minute and 1-3 cm. long; leaves moss-like, very small, usually densely placed, often imbricated, often of two sizes (the branches therefore strongly dorsiventral); ligule present, borne at the base of the leaf on the upper side; roots borne on "rhizophores" which are probably modified branches: spores of two sorts (microspores and macrospores) in separate sporangia, borne in the leaf axils: sporophylls frequently modified, forming a cone or spike: prothallia



endosporeous, the spore wall of the macrospores soon rupturing and exposing the archegonia.

The one genus, *Selaginella*, and about 500 species are widely distributed, but mostly tropical. The majority prefer damp forests, but some (e.g., *S. rupestris*) are xerophytic. Three species are native in the eastern United States. The family is related to the Lycopodiaceæ superficially, but not in the spores and in the prothallia, which are more closely allied to another family, the Isoetaceæ. The habit, the foliar ligule, the undifferentiated spores, and the endosporeous prothallia are distinctive.

The spores of *Selaginella* have been used in the same manner as those of Lycopodium, but are less easily obtainable. *S. concinna* and *S. obtusa* have been used for diarrhea and dysentery. Several Mexican species are used locally for medicine. *S. convoluta* is employed in the East Indies as an aphrodisiac. The rosette-like *S. lepidophylla* of Mexico is the best-known "resurrection plant." When dry, it rolls into a ball and becomes brown; when the air is humid, the branches spread out and the green upper surfaces are exposed.

Many species of *Selaginella* are in choice American collections, but very few are commonly in the trade. They are mostly grown for greenhouse and for table decoration under the name of "lycopodium."

## SPERMATOPHYTES or SIPHONOGAMIA (PHANEROGAMIA)

### SUB-DIVISION I. GYMNASPERMÆ

#### Order 8. CYCADALES

15. **Cycadaceæ** (from the genus *Cycas*, the Greek name of a certain palm). **CYCAS FAMILY.** Fig. 4. More or less woody plants, with thick, unbranched, columnar or tuberous stem: leaves alternate, pinnate: stamens and carpels borne in cones or in temporarily terminal clusters: scales of the staminate cone bearing very many scattered anthers on the under side: the carpels open, not forming a closed ovary, either leaf-like pinnatifid and bearing marginal ovules, or peltate with 2 or more suspended ovules; the latter very large, often 1 inch long, orthotropous, with 1 integument, becoming drupe-like.

Cycadaceæ has 9 genera and about 85 species, distributed in tropical and subtropical regions. *Zamia* is the largest genus, with 30 species. The family stands isolated among the gymnosperms. The palm-like habit, pinnate leaves, very numerous scattered stamens, and, in *Cycas*, the leaf-like carpel, are distinctive. Differences more important to the morphologist are to be found in the embryology, especially in the fertilization by motile sperm-cells. The leaves are circinate when unfolding, like those of a fern. The Cycadaceæ represent an ancient family far more numerous in past geologic ages. Many fossil species are known.

Various species of *Cycas* in the Moluccas and Japan, especially *C. revoluta*, yield a sago in the pithy part of the stem which the natives bake into bread. The Hottentots eat the pith of *Encephalartos*, making from it "Kafir bread." The seeds of *Cycas* and *Zamia* are edible. The leaves of *Cycas* are used at funerals and church festivals as "palm branches."

Several genera are in cultivation in America for greenhouse use and outdoors in the South. These are *Bowenia*; *Ceratozamia* of Mexico; *Cycas* (Sago Palm) of the far East; *Dioon* of Mexico; *Encephalartos* of South Africa; *Macrozamia* of Australia; *Stangeria* of South Africa; *Zamia* (Coontie, Comptie) of tropical America.

#### Order 9. GINKGOALES

16. **Ginkgoaceæ** (from the genus *Ginkgo*, the Japanese name). **GINKGO FAMILY.** Fig. 4. Much-branched tree

with deciduous leaves: secondary wood without true vessels; resin-tubes present: leaves alternate, fan-shaped like the pinnules of *Adiantum*; veins forking: anthers borne in pedicelled pairs on a slender axis, without bracts, the whole somewhat catkin-like: no true pistillate cone; ovules borne in pairs at the summit of branched peduncles, each ovule surrounded at the base by a fleshy ring; fruit drupaceous. Fertilization is by means of motile sperms.

A single genus of one species occurs in China and Japan. Fossil species are known. The family is distantly related to the Coniferae, but the peculiar foliage, as well as the absence of cone structure and the great reduction of sporophylls, is distinctive.

*Ginkgo biloba* (ginkgo, maidenhair tree, Kew tree), the only species, is grown as a park tree.



4. **CYCADACEÆ:** 1. *Cycas*, a, leaf; b, carpel with ovules; c, male scale with anthers. 2. *Zamia*, female cone. **GINKGOACEÆ:** 3. *Ginkgo*, a, leaf; b, ovules; c, stamen.

#### Order 10. CONIFERALES

17. **Taxaceæ** (from the genus *Taxus*, the classical name, probably from the Greek meaning *bow*, for which the wood is used). **YEW FAMILY.** Fig. 5. Much-branched trees or shrubs, with resin-tubes in the bark and no true vessels in the secondary wood: leaves alternate, needle-like or scale-like, persistent: stamens borne on the protected portion of more or less apically thickened or peltate scales (sporophylls) forming a small cone: pistillate cones wanting; ovules borne singly or two together on a fleshy or rudimentary carpel (sporophyll), inverted or straight, the outer integument forming an arillus: fruit a dry seed surrounded by the fleshy often highly colored arillus; the receptacle also often enlarged and forming a fleshy part of the fruit.

Taxaceæ has 8 genera and about 70 species widely distributed, of which 40 belong to the genus *Podocarpus*. The family is related to the Coniferae, but differs in the reduction of the pistillate cone to a single ovule, in the modification or suppression of the sporophyll, and in the aril or arillus. The closely related Ginkgoaceæ has a different staminate inflorescence. Fertilization is by means of pollen-tubes.

The timber produced by the tropical eastern species of *Podocarpus* and of *Dacrydium* (heron pine and

damion pine) is highly valued. The yew wood is hard and susceptible of a high polish. It is used in cabinet work and for bows. The seed and shoots of yew are said to be poisonous, but the arillus is harmless.

In cultivation in America are a few genera for ornamental purposes: *Cephalotaxus*, East Asia; *Podocarpus*, Chile, Japan, Australia, grown in the South; *Taxus* (Yew), Europe, Asia, North America; *Torreya* (California Nutmeg), California to Florida.

18. **Pinaceæ** (from the genus *Pinus*, the classical Latin name). **PINE FAMILY**. Fig. 5. Tree or shrub, with no true vessels in the secondary wood, but with resin-tubes: leaves linear, or needle-like, or scale-like, alternate or opposite, evergreen or deciduous: anthers and ovules both in true cones plainly subtended by scales (sporophylls); the staminate scales usually bearing 2-6, rarely more, anthers on the under side; the pistillate bearing 1-2, rarely many, ovules on the upper side, or peltate and ovule-bearing under the crown or at its base; ovules with 1 integument: fruit



5. **TAXACEÆ**: 1. *Taxus*, a, male cone; b, fruit (seed and aril). **PINACEÆ**: 2. *Tsuga*, female cone. 3. *Picea*, female cone-scale with ovules. 4. *Pseudotsuga*, female cone. 5. *Chamæcyparis*, female cone. 6. *Sequoia*, female cone. 7. *Juniperus*, a, female cones (berries); b, cross-section berry. **GNETACEÆ**: 8. *Ephedra*, a, female inflorescence; b, male inflorescence.

a dry woody cone with dry, often winged seeds between the scales; or berry-like through the union of the fleshy cone-scales.

Sub-family 1. **Cupressineæ**.—Cone-scales opposite; ovules erect: leaves opposite or whorled.

Sub-family 2. **Abietineæ**.—Cone-scales alternate; ovules inverted: leaves alternate.

There are 25 genera and about 240 species, widely distributed but most abundant in temperate regions. The largest genus is *Pinus* with 70 species. The family is related to the **Taxaceæ** and **Ginkgoaceæ**, from which it differs in the presence of true staminate and pistillate cones. It also differs from the latter in the absence of motile sperm-cells.

The **Pinaceæ**, like other **Gymnosperms**, is an old group, more abundant in former geologic ages. Many fossil species are known. The *Sequoias* of California were formerly more abundant, extending to Greenland. The young plants of many **Cupressineæ** possess foliage

quite different in appearance from the mature foliage, the leaves being longer and more spreading. These juvenile forms have been called *Retinisporas*, a name which has been applied also to all cultivated species of *Chamæcyparis*. Juniper "berries" are fleshy cones with peltate, fused scales. The leaves of *Larix*, *Pseudolarix* and *Cedrus* are deciduous. The branchlets and leaves are deciduous in *Taxodium*. The cone-scales of many **Abietineæ** are double, an outer thinner 3-toothed scale, and a thick inner scale that bears the ovules (see *Pseudotsuga*).

Among the **Pinaceæ** are some of our most valuable timber trees; e. g., cedar, arborvitæ, spruce, fir, hemlock and redwood. The resin from various pines when distilled yields spirits of turpentine and rosin; when dry-distilled, it yields tar. Venice turpentine is the resinous exudation of European larches: Canada balsam that of *Abies balsamea*. Dammar resin is from the Malayan *Agathis Dammara*. Kauri resin is the semi-fossilized resin of *Agathis australis* of Australia and New Zealand. Sandarac resin is from *Callitris quadrivalvis* of Northwest Africa. Amber is the fossilized resin of prehistoric conifers around the Baltic. Oil of savin is from the leaves and twigs of *Juniperus sabina*, and oil of cedar from *Thuja occidentalis*. Juniper berries, from *J. communis* of Europe and America, are diuretic and also used for flavoring gin. Edible seeds are produced by *Pinus Pinea* (stone pine) of the Mediterranean, *P. Cembra* of Europe and Siberia, *P. Parryana* and *P. edulis* of the southwestern United States, *Podocarpus nerifolia* of the East Indies, *Araucaria brasiliana* of Brazil, and *A. Bidwillii* of Australia. Bread is made by the Laps and Eskimos from the inner bark of *Pinus sylvestris* and *Abies alba*; also from various **Pinaceæ** by our northwestern Indians. Deodar (*Cedrus Deodara*) is sacred to the Hindoos. *Cedrus Libani* is the cedar of Lebanon. Pine bark was formerly used for tanning.

Many genera are in cultivation in America. Among these are: *Abies* (Fir, Balsam); *Araucaria* (Norfolk Island Pine, Monkey Puzzle); *Callitris* (Cypress Pine); *Cedrus* (Cedar of Lebanon, Deodar); *Chamæcyparis* (White Cedar, Yellow Cedar, Hinoki Cypress, Sawara Cypress, Retinispora, Japanese Cedar); *Cryptomeria*; *Cupressus* (Cypress, Monterey Cypress); *Juniperus* (Red Cedar, Juniper, Savin); *Larix* (Larch, Tamarack, Hackmatack); *Libocedrus* (Incense Cedar, White Cedar); *Picea* (Spruce); *Pinus* (Pine, Pannon, Soledad); *Pseudolarix* (Golden Larch); *Pseudotsuga* (Douglas Spruce, Red Fir); *Sciadopitys* (Umbrella Pine); *Sequoia* (Big Tree of California, Redwood); *Taxodium* (Bald Cypress, Deciduous Cypress); *Thuja* (Arborvitæ, White Cedar); *Thuyopsis*; *Tsuga* (Hemlock Spruce).

## Order 11. GNETALES

19. **Gnetaceæ** (from the genus *Gnetum*, derived from *Gnemon*, said to be the old Malay name of the plant). **GNETUM FAMILY**. Fig. 5. Very peculiar semi-woody plants of diverse habit: leaves large and broad, or modified, or reduced, or opposite, or whorled: no resin-tubes in the stem; secondary wood containing true vessels: true flowers present, with a 2-4-parted perianth, unisexual, rarely bisexual; stamens 2-8; pistillate perianth becoming juicy or wing-like in fruit and enclosing one naked orthotropous seed with 1 or 2 integuments.

The family consists of 3 genera and about 35-40 species, widely distributed. It is distinguished from the **Conifera** by the presence of a perianth, the absence of resin-tubes, and the presence of vessels in the secondary wood. The endosperm development, also, approaches that of the **Angiosperms**. The fertilization is by means of pollen-tubes. The three genera are very distinct: *Ephedra*, of the tropics of both hemispheres, is much branched, with slender jointed striate



equisetum-like stems, leaves scale-like at the distant nodes; Gnetum of South America, except one species, is a group of vines or shrubs with large broad leaves like those of an Angiosperm; Welwitschia of South Africa is a desert plant with a thick subterranean stem bearing two ribbon-like leaves 6 feet long, lying flat on the ground, and with a terminal cluster of cone-like flower-spikes.

It is doubtful whether any of these are regularly in the American trade.

## SUB-DIVISION II. ANGIOSPERMÆ

### CLASS I. MONOCOTYLEDONEÆ

#### Order 12. PANDANALES

**20. Typhaceæ** (from the genus *Typha*, the old Greek name). CATTAIL FAMILY. Fig. 6. Perennial marsh herbs, with creeping rootstocks, and long-linear, erect, mostly basal leaves: flowers monœcious, naked, in a dense terminal spike, which is staminate above and pistillate below, each sex subtended by one bract-like spathe; perianth 0; stamens 2-5; filaments connate, bearing long, silky hairs; carpels 1; ovary 1-celled, raised on a stipe which also bears long, silky hairs; ovule 1, suspended; style slender: fruit a nutlet; seed albuminous.

A single genus and about 12 species occur in the tropical and temperate zones. Fossil species are known. The family is closely related to the Sparganiaceæ, with which it was formerly united. These two families constitute a very distinct group of simple-flowered Monocotyledons. The habit, the flowers borne in spikes without perianth, the hairy pedicels, the absence of bracts, and the simple pistil, are together distinctive.

The starchy rootstocks are sometimes used for food. The leaves are woven into matting, and into chair-bottoms, and are used for calking barrels. The pollen has been used as a substitute for the spores of *Lycopodium*. The rootstock is used in East Asia for dysentery and urethritis, and the leaves in various localities for thatching cottages. A vain attempt has been made to utilize the silky hairs of the fruit for making velvet.

Two species of *Typha* (Cattail Flag, Reed Mace), both native, are in the American trade for water-gardens.

**21. Pandanaceæ** (from the genus *Pandanus*, derived from a Malay name). SCREW-PINE FAMILY. Fig. 6. Shrubby or arborescent plants: stems simple or branched, with prop-roots: leaves spirally arranged, densely placed, sword-shaped, often canaliculate, clasping, stiff; edges and midrib often spiny-serrate: flowers on simple or branched spadices, diœcious, naked; spathes caducous; stamens densely packed, separated or united in fascicles, scattered over the spadix, and not in definite flowers; pistillate spadix simple; ovaries numerous, coherent in bundles, or isolated, not in real flowers; stigma sessile; ovules solitary or several: fruit drupaceous, cohering in multiple fruits; seed albuminous.

There are 3 genera and about 350 species, natives of the tropics of the Old World. The family is unique. The floral structure, while much like that of *Typha*, suggests also the Palmaceæ. As in *Typha*, actual flowers cannot here be distinguished.

The fleshy pericarps of some are eaten. The strong odor of the staminate flowers is either agreeable or disagreeable, depending on the species; in the former case the flowers are used for perfumery. The leaves of *Pandanus utilis* are made into bags for shipping coffee, and the plant is now cultivated for that purpose in the West Indies.

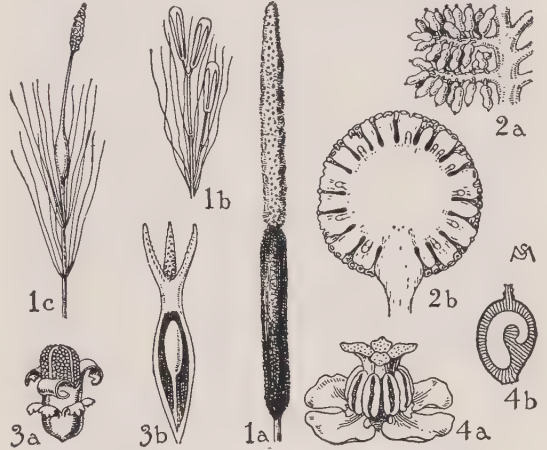
Ten to 15 species of *Pandanus* (Screw Pine, Candelabrum Tree, Chandelier Tree) are in greenhouse cultivation in America.

#### Order 13. HELOBIÆ

**22. Naiadaceæ** (from the genus *Naias*, derived from the Greek, meaning "a water nymph"). PONDWEED FAMILY. Fig. 6. Immersed aquatic herbs: leaves mostly cauline, opposite or alternate, the floating often differing from the submerged in shape and texture: flowers axillary or spicate, bisexual or unisexual; perianth of 4 herbaceous segments, or wanting; stamens 1-4, rarely more; carpels 1-9, mostly distinct, 1-celled, 1-ovuled: fruit a nutlet; endosperm none; embryo curved, rarely straight.

Naiadaceæ has 10 genera and about 100 species widely distributed, but most abundant in temperate regions. The largest genus is *Potamogeton* with 50 species. The family is a very heterogeneous one which has been divided or united in many ways by different authors. As here treated it is distinguished by the aquatic habit, greenish, often reduced perianth, few stamens, and few, separate, 1-seeded carpels. A spathe-like bract usually incloses the inflorescence.

The dried leaves of *Zostera* and *Posidonia* have been used since ancient times in Venice to pack glassware. They are now widely used for packing. Plants of *Potamogeton* and *Zostera* are employed as manure. Several species of *Potamogeton* (Pondweed) and one of *Zannichellia* are possibly in the American trade, for water-gardens.



6. TYPHACEÆ: 1. *Typha*: a, inflorescence; b, male flower; c, female flower. PANDANACEÆ: 2. *Pandanus*, a, portion male inflorescence; b, female inflorescence, vertical section. NAIADACEÆ: 3. *Naias*: a, male flower; b, female flower. 4. *Potamogeton*, a, flower; b, vertical section nutlet.

**23. Aponogetonaceæ** (from the genus *Aponogeton*, derivation obscure). APONOGETON FAMILY. Aquatic herbs with tuberous rhizomes, and basal, submerged or floating leaves; blade linear to oval, palmately parallel-veined, with transverse veinlets; the general tissue between the veins often wanting, thus producing a remarkable openwork latticed effect: flowers spicate, bisexual, regular, hypogynous; perianth of several petaloid parts; stamens usually 6, rarely more; carpels mostly 3, rarely 4-6, separate; ovules 2-6, mostly basal, anatropous: fruit pouch-like; endosperm none.

The single genus, with its 15 species occurs in Africa, Madagascar, tropical Asia and Australia. The family is related to the Naiadaceæ, with which it was formerly united, and from which it is distinguished by the petaloid perianth, several ovules, and straight embryo.

The roots are sometimes eaten by natives.

*Aponogeton distachyus* (Cape pondweed, water hawthorn) is cultivated in water-gardens.

**24. Alismaceæ** (from the genus *Alisma*, the Greek name). WATER-PLANTAIN FAMILY. Fig. 7. Herbace-



ous marsh plants with milky juice: leaves mostly basal, sheathing, with a scale in the axil; blade various, floating or erect, often sagittate, varying in size and width with the depth of the water, palmately parallel-veined with cross veinlets; flowers bisexual or unisexual, regular, hypogynous, in whorls of 3; sepals 3, more or less hyaline; petals 3, white and petaloid; stamens 6 to many, in several whorls; carpels very many, separate or rarely coherent, spirally arranged or in a whorl, 1-ovuled, rarely 2-5-ovuled; fruit dry, rarely dehiscent; seed basal, anatropous, exalbuminous; embryo curved.

The family has 10 genera and about 50 species, distributed throughout the warmer and temperate zones. The family is related to the Butomaceæ and Juncaginaceæ, which are all peculiar in having an axillary intravaginal scale. The whorled flowers, differentiated perianth, numerous carpels, and mostly solitary, basal, exalbuminous seeds are distinctive.

The acrid juice formerly led to the occasional use of these plants in medicine. The tubers and rhizomes of *Sagittaria* were eaten by the American Indians as wappato, and are cultivated in China. They are said to come into the Chinese market at San Francisco, preserved in liquid.

Two genera are in cultivation for water-gardens: *Alisma* (Water Plantain), native; and *Sagittaria* (Arrowhead), some native.

25. **Butomaceæ** (from the genus *Butomus*, signifying *ox + to cut*, in reference to the rough leaves). Fig. 7. Aquatic or marsh herbs: leaves basal, with an axillary scale, sometimes with milky juice; blade linear or oval; veins palmately parallel with cross veinlets, or nearly veinless: flowers solitary or umbelled, bisexual, regular, hypogynous; sepals 3, subherbaceous; petals 3, colored, imbricated; stamens 9 or more, whorled; carpels 6 or more, separate; ovules numerous, borne

Two genera are in cultivation for water-gardens: *Butomus* (Flowering Rush), and *Limncharis* (Water Poppy).

26. **Hydrocharitaceæ** (from the genus *Hydrocharis*, derived from the Greek meaning *water and rejoice*). FROG'S-BIT FAMILY. Fig. 7. Submerged aquatic herbs, rarely floating, the flowers usually at first inclosed by a 2-bracted spathe: leaves alternate or opposite, very diverse, cordate, linear or ribbon-like: flowers usually unisexual, regular, epigynous; perianth in 2 series, composed of 3 imbricated or valvate, calicoid parts, and 3 convolute petaloid parts, rarely of only 3 divisions; stamens in 1 to several series of 3, some often staminodia; carpels 2-15; ovary inferior, 1-celled with parietal placentæ, or imperfectly several-celled; stigmas 3-6; fruit not regularly dehiscent, submerged, somewhat fleshy; seeds many, exalbuminous.

There are 14 genera and about 40 species widely distributed. The family is related to the Alismaceæ and Naiadaceæ. The differentiation into calyx and corolla, the usually numerous stamens, the inferior, 1-celled ovary with parietal placentæ, and the exalbuminous seeds are together characteristic. The plants of this family are very diverse in appearance and often striking. Fossil species are known. The pollination of *Vallisneria* is very remarkable. (See Kerner and Oliver, "Natural History of Plants").

*Elodea canadensis*, introduced into Europe from America, has there become so abundant as to impede navigation. The plants of *Hydrocharis*, *Stratiotes*, and *Elodea* are used as fodder and as manure in Europe. The starchy rootstocks of *Ottelia* and *Boottia* are eaten in India as pot-herbs; also the tubers and fruits of *Enalua*. The fibers from the leaves of *Enalua* are used in India. *Vallisneria alternifolia* is employed in India in the preparation of sugar.

Five genera are in cultivation in America, mostly for aquaria: *Elodea* (Waterweed, Ditch-Moss, Water Thyme, Water Pest); *Hydrocharis* (Frog's-Bit); *Limnobia* (American Frog's-Bit); *Stratiotes* (Water Soldier, Water Aloe); *Vallisneria* (Eel-Grass, Tape-Grass).

#### Order 14. GLUMIFLORE

27. **Gramineæ** (from the Latin signifying *grass*). GRASS FAMILY. Fig. 8. Herbs, or sometimes almost tree-like: stems hollow or solid; leaves usually linear, in 2 ranks; composed of a sheath which is usually open down the front, a sessile blade, and a ligule at the juncture of blade and sheath: flowers bisexual or unisexual, naked, or with the perianth reduced to 1-3 tiny scales, borne in specialized spikelets composed of 3 or more 2-ranked scales, the first 2 empty (called empty glumes), the others termed flowering glumes or lemmas, and 1 scale on each secondary flower-bearing axis, called a palea or palea; stamens 2-3, exserted for wind-pollination; carpel 1; ovary 1, 1-celled, 1-ovuled; stigmas feathery, usually 2: fruit a caryopsis; seed with endosperm, and embryo with an absorbing organ.

Gramineæ is a family of 300-400 genera and perhaps 5,000 species distributed all over the earth. The largest genera are *Panicum* with 300-400 species, *Paspalum* with 160 species, and *Poa* with 100 species. The Gramineæ and Cyperaceæ form a very distinct group. The usually hollow stem, the open sheaths, the ligule, the 2-ranked leaves, and the peculiar spikelet-structure are the best characters to separate Gramineæ from Cyperaceæ. The Indian corn is one of the most modified of grasses. It is monœcious. The staminate spikelets are arranged on finger-like branches of the tassel at the summit of the plant; the pistillate spikelets are borne on the cob, which is supposed to be composed of similar finger-like portions grown together. Each spikelet is 2-flowered, but only 1 flower bears an ovary. The kernel is this ovary, and the chaff on the cob represent the glumes and paleas. The grasses are divided into 13 tribes.



7. ALISMACEÆ: 1. *Alisma*, a, inflorescence; b, flower; c, floral diagram; d, fruit. 2. *Sagittaria*, a, fruit; b, achene. BUTOMACEÆ: 3. *Butomus*, flower. HYDROCHARITACEÆ: 4. *Elodea*, female flower branch. 5. *Vallisneria*, a, habit and flower; b, female flower.

between the margins and midrib of the carpel: fruit dry, dehiscent; seed anatropous, exalbuminous; embryo straight or curved.

The family contains 4 genera and about 5 species, natives of the temperate and tropical zones of the Old World, and the tropics of the New World. The family is related to the Alismaceæ and Juncaginaceæ, from the former of which it differs principally in the numerous ovules and their peculiar position.

The roots and seeds of *Butomus* were once used as emollients. The baked roots of *Butomus* are eaten in North Asia.

The grasses are among the most useful of plants. The following, among others, are, or have been, used as medicine: Rhizome of *Agropyron repens* (quick- or quack-grass) is emollient, and aperient (several other grasses have the same properties). Root of *Arundo Donax* (reed) is diuretic and sudorific. *Phragmites communis* was formerly considered depurative and anti-syphilitic. *Calamagrostis* was used by the French peasants as a diuretic. *Perotis latifolia* is used in India for the same purpose, as are also the seeds of *Coix Lacryma-Jobi* in China. The roots of *Manisuris granularis* are used in India for intestinal troubles. The aromatic, fragrant roots of various *Andropogons* (or *Cymbopogons*) are used for medicine and for perfume in India and elsewhere, e. g., *A. Nardus* (false spikenard, citronella), *A. citratus* (lemon-grass). *A. lanier* and *A. Schœnanthus* (sweet rush, ginger-grass, geranium-grass) are used in Africa and Arabia as a stimulant, antispasmodic and diaphoretic, and for perfume.

The following are used for food: Seeds of wheat, barley, rye, oats, rice, Indian corn and millet; also seeds of *Andropogon arundinaceus* var. *vulgare* (sorghum), and var. *Durra* (durra). *Pennisetum americanum* (pearl millet) is an important food of the negro races, and *Poa abyssinica* and Eleusine are important in East Africa. Sugar is obtained from the stems of several species, most important of which are *Saccharum officinarum* (sugar-cane), and *Andropogon arundinaceus* var. *saccharatus* or *A. Sorghum* (sugar sorghum).

Many grasses are used as fodder for cattle, as, for instance, our pasture and hay grasses: *Poa pratensis* (June grass, Kentucky blue grass), *Phleum pratense* (timothy), *Festuca ovina*, etc. (fescue), *Agrostis alba* (red-top), *Dactylis glomerata* (orchard-grass), *Cynodon Dactylon* (Bermuda-grass). Some grasses are poisonous to stock, e. g., *Lolium temulentum* (darnel), and the Peruvian *Festuca quadridentata*.

Straw from cereals is used for matting, upholstery, bedding, hats and for making paper.

The bamboos yield very important building material in the East. Like the palms, the bamboos are used for almost every conceivable purpose, and are among the most useful of plants.

Several grasses, other than those above mentioned, contain a fragrant principle, e. g., roots of *Vetiveria zizanioides* (vetiver or kus-kus of India) used to perfume rooms, and to keep insects out of clothing. *Hierochloa odorata* (vanilla- or holy-grass) is used in Europe in religious ceremonies, and by the American Indians for making baskets. *Anthoxanthum odoratum* is the European sweet-grass, now introduced into America.

The most important ornamental species are *Phalaris arundinacea*, *Stipa pennata*, *Cortaderia argentea*, *Lagurus ovatus*, *Hordeum jubatum*, *Miscanthus sinensis*, *Briza*, *Arundo*, *Phragmites*, *Erianthus*, *Pennisetum*, *Thysanolaena*, and Bamboos.

In America 70-80 genera are cultivated, or are important as natural fodder plants or weeds. Among these are: *Agropyron* (Quack-Grass, Couch-G., Quick-G.); *Agrostis* (Bent-G., Red-Top, Cloud-G., Tickle-G., Fly-away-G.); *Aira* (Hair-G.); *Andropogon* (Silverbeard-G., Johnson-G., Lemon-G.); *Anthoxanthum* (Sweet Vernal-G.); *Ammophila* (Beach-G., Marram-G.); *Arundinaria* (Large Cane, Switch Cane, Scotch Cane); *Arundo* (Giant Reed); *Avena* (Oats); *Bamboo*; *Briza* (Quaking-G.); *Bromus* (Brome-G., Rescue-G.); *Calamagrostis* (Reed Bent-G., Blue-joint-G., Pony-G.); *Calamovilfa* (Purple Bent-G.); *Cenchrus* (Sand-bur, Bur-G.); *Chloris* (Finger-G.); *Cinna*; *Coix* (Job's Tears, Tear-G., Corn Beads); *Cortaderia* (Pampas-G.); *Cynodon* (Bermuda-G.); *Cynosurus* (Crested Dog's-tail, Silky-awned Dog's-tail); *Dactylis* (Cock's-foot, Orchard-G.); *Dactyloctenium* (Crowfoot-G.); *Desmazeria* (Spike-G.); *Deschampsia* (Hair-G., Hassock-G.); *Digitaria* (Crab-G., Finger-G.); *Distichlis* (Salt-G., Marsh Spike-G.); *Echinochloa* (Barnyard-G.); *Eleusine* (Crab-

G., Yard-G., Dog's-tail, Wire-G., African Millet); *Elymus* (Lyme-G., Wild Rye, Terrel-G.); *Eragrostis*; *Erianthus* (Woolly Beard-G., Plume-G., Wool-G., Ravena-G.); *Euchlœna* (Teosinte); *Festuca* (Fescue-G.); *Glyceria* or *Panicularia* (Reed Meadow-G., Manna-G.); *Cortaderia*; *Hierochloa* (Vanilla-G., Holy-G., Seneca-G., Sweet-scented-G.); *Holcus* (Meadow Soft-G.); *Hordeum* (Squirrel-tail-G., Wild Barley, Barley); *Hystrix* or



8. GRAMINEÆ: 1. a, part of a grass panicle; b, spikelet. 2. Avena, a, portion of panicle; b, spikelet; e.g., empty glume; fl.g., flowering glume or lemma; pal., palea or palea; c, ground-plan of spikelet. 3. Phleum, spikelet. 4. Phalaris, sheath and ligule.

*Asprella* (Bottle-G.); *Lolium* (Darnel, Rye-G.); *Milium* (Wild Millet-G.); *Miscanthus* (Eulalia, Himalaya Fairy-G.); *Oplismenus*; *Oryza* (Rice); *Oryzopsis* (Mountain Rice); *Panicum* (Panic-G., Old-Witch-G., Millet, Broom Corn Millet); *Pennisetum* (Pearl Millet); *Phalaris* (Canary-G., Gardener's Garters); *Phleum* (Timothy-G., Herd's-G.); *Phragmites* (Common Reed); *Phyllostachys* (Bamboo, in part); *Poa* (Blue-G., Kentucky Blue-G., Meadow-G.); *Saccharum* (Sugar-cane); *Secale* (Rye); *Setaria* (Millet, Hungarian-G., Foxtail-G., Pigeon-G.); *Spartina* (Cord-G.); *Sphenopholis*; *Stenotaphrum* (St. Augustine-G.); *Stipa* (Feathered-G., Espartago-G., Porcupine-G.); *Tripsacum* (Gama-G., Sesame-G.); *Triticum* (Wheat, Spelt).

28. **Cyperaceæ** (from the genus *Cyperus*, the ancient Greek name). **SEDGE FAMILY**. Fig. 9. Herbaceous plants with grass-like habit and solid stems; leaves alternate, in 3, rarely 2, vertical rows, linear; sheaths closed; flowers bisexual or unisexual, regular, hypogynous, borne in variously disposed spikelets, subtended and hidden by overlapping scales none of which are regularly empty as in the grasses; no true paleas; perianth reduced to bristles, scales, or 0; stamens 2-3; carpels 2-3; ovary 1-celled, 1-ovuled; style 1; stigmas 2-3; fruit an achene; seeds basal, anatropous, albuminous.

There are 65 genera and about 3,000 species, inhabiting the whole earth. More than 500 species belong to the genus *Carex*, 400 to *Cyperus*, and 200 to *Scirpus*. They are abundant in swampy regions. The family is closely related to the Gramineæ, from which it differs in the often 3-ranked leaves, solid stem, the absence of paleas and of regular empty glumes, and the presence, in most cases, of a perianth and 3 carpels. Most divergent from the ordinary is *Carex*, the flowers of which are monœcious, and the pistillate, though naked, are inclosed in a flask-shaped structure called a peri-



gynium, which probably corresponds to the modified palet of the grass spikelet. The elongated perianth forms the wool of the wool-grass or cotton-grass. The scales of the spikelet are in 2 ranks in *Cyperus* and *Dulichium*; in many ranks in the other genera.

The Cyperaceæ are of far less economic importance than the Gramineæ. The rhizomes of several species of *Carex* were formerly used as a remedy in syphilis. *Scirpus lacustris* is astringent and diuretic, but other

much-branched spadix, with or without a subtending spathe, the latter often woody; flowers unisexual, rarely bisexual, often sunk in the spadix; perianth of 6 parts in 2 series, greenish, often woody, valvate in the staminate, imbricated or convolute in the pistillate flower; stamens 6, rarely 3 or many, on or around a disk, separate or united; carpels 3, rarely fewer, separate or forming a 1-3-celled ovary; each cell 1-ovuled, but all except one seed in the ovary may abort; stigmas usually 3; fruit a berry or drupe; pericarp fleshy or fibrous; seeds albuminous.

Palmaceæ has 128 genera and about 1,000 species of tropical distribution; 10-15 species are found in the southern United States. The largest genera are *Calamus* with about 200 species, *Bactris* with 90 species and *Chamædorea* with 60 species. The family is very distinct, having no close relatives, but it evidently belongs to the spathe- and spadix-bearing group. The habit, coriaceous plicate leaves which are entire in the bud, the woody flowers and inflorescence, the 3 sepals and 3 petals, the usually 6 stamens, and the 3 carpels, each with 1 seed, are together distinctive.

Palm leaves are always entire in the bud, and if later pinnatifid or palmatifid, become so on unfolding. In this respect the palms are unique. The leaves are plicate in the bud, and, on opening, the plates of the fan expand and either remain united or, more frequently, split down along the folds. In the pinnate species the rachis between the folds elongates so that the divisions are separated, and the well-known palm leaf is produced. The splitting may be at the top of the fold, or at the bottom, depending on the genus, and is an important characteristic in classification. Some of the largest seeds in the plant kingdom belong to the Palmaceæ, as, for example, the coconut. This fruit is produced from an originally 3-celled ovary, 2 cells of which abort.

Next to the grasses, the palms are the most generally useful of all plants. It is said that probably there is not a species but that is useful in some way. Many yield textile fibers. The wood is used to build houses and the leaves to thatch the roofs. The leaves are also made into mats, baskets, hats, and the like. The fibrous bud-sheaths are used as hats, or for fiber. Some species contain starch or sugar in the trunk. The fruits of many contain sugar, protein, starch, or oil. Comparatively few are medicinal. "The palm is called King of Plants and is said to supply all the wants of an inhabitant of the tropical zone. It yields sugar, milk, solid cream, wine, vinegar, oil, cordage, cloth, cups, wood for building, thatch and other products." Coconuts, the fruit of *Cocos nucifera*, form one of the most important foods of the tropics. The date fruit (*Phoenix dactylifera* of the Sahara) is also important. *Metroxylon Rumphii*, and other species, yield sago. A fermented liquor known as palm wine, laymi or arrack, is made from the juice of *Arenca saccharifera*, *Borassus flabelliformis*, *Metroxylon Rumphii*, *Mauritia vinifera*, and others. The central bud of the cabbage palm and others is used for food. Most palm oil is from the fruit of *Elæis guineensis* of West Africa, which is now cultivated in America. It is used like olive oil, or in the North for making soap. Vegetable wax is obtained from the leaves and stems of *Ceroxylon andicolum* of Peru, also from *Copernicia cerifera* (carnauba wax). The famous 'giant double coconut is from *Lodoicea sechellarum* of the Seychelle Islands. The fruit of *Areca Catechu* of the East Indies and India yields an astringent juice which, mixed with the leaves of the betel pepper and lime, is chewed by the inhabitants of tropical Asia. Coconut fiber is important for making ship cables. The very slender stems of *Calamus*, often 300 feet or even 500 feet long (it is reported 1,200 or 1,800 feet, but not verified) and scarcely larger than a pipe-stem or a finger, are called rattan, and used for furniture. Much of the dragon's blood of the druggists



9. CYPERACEÆ; 1. *Scirpus*, a, portion of inflorescence; b, flower. 2. *Eriophorum*, spikelet. 3. *Carex*; a, inflorescence; b, vertical section perigynium. PALMACEÆ; 4. *Chamærops*, a, spathe and spadix; b, floral diagram. CYCLANTHACEÆ; 5. *Cyclanthus*, inflorescence. 6. *Carludovicia*, inflorescence.

species also possess this property. The foliage of *Eriophorum* has been used for dysentery. The spongy pith of the *Eriophorum* stem was used by German peasants for tapeworm. The tubers of *Cyperus esculentus*, now a weed in all countries, were cultivated by the Egyptians for food. The leaves of many species of Cyperaceæ have been woven into mats, chair-bottoms, and the like. The Egyptians made parchment from the pith of *Cyperus Papyrus*. The rhizomes of *Eleocharis tuberosa* are used in the manufacture of starch, in China and India. *Cyperus scariosus* and *C. pertenuis*, of India, are fragrant and used in making perfumery. Some carices are used in making rugs.

Several genera are in cultivation in America, mostly for water-gardens, table decorations, and the conservatory: *Carex* (Sedge); *Cyperus* (Umbrella Palm, Egyptian Paper Plant, Egyptian *Papyrus*, Chufa); *Dulichium*; *Eleocharis*; *Eriophorum* (Cotton-Grass, Wool-Grass); *Mapania*; *Scirpus* (Bulrush Sedge).

#### Order 15. PRINCIPES

29. **Palmaceæ** (from the Latin name *palma*). **PALM FAMILY.** Fig. 9. Woody plants of various habit, low, or arborescent, or climbing, usually unbranched, sometimes pinnate: leaves forming a crown at summit of stem except in *Calamus*, alternate, coriaceous, palmately or pinnately veined, entire or pinnatifid or palmatifid, often very large: inflorescence a simple or



is the red juice of the fruit of *Calamus Draco*. Palm-leaf fans are made from the palmately veined leaves of several species. The saw palmetto (*Sabal serrulata*) of the southern states is medicinal. The seeds of *Phytelphas macrocarpa* have a very hard endosperm known as vegetable ivory, used for carving as a substitute for ivory.

Probably 100 genera are in the trade. Except in the tropics, they are almost entirely ornamental greenhouse plants. Among these are: Areca (Betel Nut); Attalea; Bactris; Calamus; Caryota (Fish-tail Palm, Wine Palm, Toddy Palm); Ceroxylon (Wax Palm); Chamædorea; Cocos (Coco Palm, Coconut, Pindo Tree); Corypha (Talipot Palm); Dæmonorops; Elæis (Oil Palm); Erythea (Blue Palm); Geonoma; Hedyscepe (Umbrella Palm); Howea (Flat Palm, Thatch Leaf Palm, Curly Palm); Livistona; Oreodoxa (Royal Palm, Cabbage Palm); Phoenix (Date Palm); Phytelphas (Ivory Palm); Rhapsis; Rhipidophyllum (Blue Palmetto, Needle Palmetto); Sabal (Dwarf Palmetto, Blue Palm, Cabbage Palmetto); Serenæa (Saw Palmetto); Thrinax; Trachycarpus (Fortune's Palm); Washingtonia or Pritchardia (Weeping Palm).

#### Order 16. SYNANTHÆ

30. **Cyclanthaceæ** (from the generic name *Cyclanthus*, which has reference to the spiral arrangement of the flowers). CYCLANTHUS FAMILY. Fig. 9. Stemless or caulescent, palm-like, somewhat woody plants, often climbing; leaves alternate, coriaceous, cleft or parted; flowers in a dense terminal unbranched spike (spadix), with several bract-like spathes beneath; staminate flowers grouped in 4 bundles accompanying the pistillate, or both in conspicuous alternating spirals; staminate perianth reduced and fimbriate, or 0; stamens 6 to many, borne in groups; perianth of the pistillate flower 0, or of 4 fleshy parts accompanied by 4 long, twisted, exerted staminodia; carpels 4, united below, sunken in the spadix; ovary 1-celled, many-ovuled, with parietal placentæ; fruit multiple, a berry-like spike. The tissue of the spadix splits into valves, coiling up from the base to apex and thus inclosing the fruitlets which deliquesce.

This family has 5 genera and about 50 species, of which 35 belong to Carludovica. They are confined to the tropics of America, and stand intermediate between the Palmaceæ and Araceæ. The family is distinguished by the combination of palm-like foliage, numerous ovules, thick spadix, and closely associated staminate and pistillate flowers.

The flowers of *Cyclanthus bipartitus* of Brazil are vanilla-scented, cultivated, and cooked with meat as an aphrodisiac. The leaves of *Carludovica palmata* furnish the material for the panama hats.

Several species of Carludovica are in the American trade as greenhouse plants.

#### Order 17. SPATHIFLORÆ

31. **Araceæ** (from the genus *Arum*, the ancient name of these plants). ARUM FAMILY. Fig. 10. Herbs, shrubs, or trees, of the most diverse habit and appearance, often climbing, or epiphytic with aerial roots, rarely floating, usually subfleshy; juice sometimes milky; leaves ensiform or broad, parallel- or netted-veined, entire or variously cut; flowers bisexual or unisexual, rarely reduced to a single stamen and carpel, regular, hypogynous or epigynous, disposed on an unbranched fleshy axis (spadix), which is usually subtended by a special bract (spathe); perianth 0, or of 4-8 parts; stamens 1 to many; carpels 1 to several; ovary superior or inferior, 1 to several-celled, 1 to many-ovuled; style and stigmas various; fruit a berry; seeds albuminous, outer integument fleshy.

Araceæ has over 100 genera and about 900 species, widely distributed, but most abundant in the tropics.

especially as epiphytes in the deep, damp forests. The majority in the temperate regions are swamp-plants. The largest genera are Philodendron with 100 species, and Arisæma with 50 species. The family stands as the type of the spathe-bearing plants. Its close relatives are the Lemnaceæ, Palmaceæ, and Cyclanthaceæ, from which it is distinguished more by general habit and texture than by structural details.

The pollination of the Araceæ is often complicated and remarkable (see Kerner and Oliver). The transfer of the pollen is mostly accomplished by flies, which are frequently attracted by lurid color and carrion scent. The leaves of Monstera are remarkable for their peculiar perforations, while the massive petioles of other Araceæ are sometimes mottled like snakeskin. Pistia is a much-reduced floating aquatic, transitional to the Lemnaceæ. The aerial roots of the epiphytic species are frequently covered with a special water-absorbing tissue. The unfolding spathes of the Araceæ are noted for the heat evolved. The tissues are usually very mucilaginous and filled with needle-like crystals of calcium oxalate. These crystals are supposed to give the pungent flavor to Indian turnip simply by mechanically penetrating the tongue.

Many species have been used locally for medicine. *Lagenandra toxicaria* of Ceylon is extremely poisonous.



10. ARACEÆ: 1. Arisæma, spathe and spadix. 2. Arum spadix with male and female flowers. LEMNACEÆ: 3. Lemna, a, whole plant; b, male and female flowers, and spathe. BROMELIACEÆ: 4. Bromelia, flower. 5. Ananas, a, fruiting inflorescence; b, floral diagram. COMMELINACEÆ: 6. Commelina, flower. 7. Tradescantia, flower.

*Dieffenbachia Seguine* and *Arisæma triphyllum* are violent irritants when chewed, causing the mouth to swell. *Arum maculatum* of Europe was used by the ancients as an excitant. The roots of *Symplocarpus* have been used for asthma and colds. The roots of *Acorus Calamus* (sweet flag) are aromatic and used for coughs, colds, and the like. The thick rootstocks and roots of many have been used for food, e. g., *Oreontium aquaticum* of North America, *Colocasia antiquorum* of India, *Alocasia macrorrhiza* (taro) of the Pacific Islands, and *Peltandra virginica* of North America. The rhizomes of *Arisæma maculatum* and *Calla palus-*

*tris*, mixed with cereals, according to Linnæus, serve for food among the Laps and Finns. Portland arrow-root is derived from Arums. The delicately flavored, juicy fruits of *Monstera deliciosa* are eaten in Mexico. The shoots of *Xanthosoma sagittifolium*, called carai-be cabbage, are eaten as a vegetable in the Antilles. The aerial roots of aroids are used to tie bundles of sarsaparilla sent to Europe and America.

Because of their odd habit and strange appearance, as well as, in some cases, for real beauty, many Araceæ are in cultivation, mostly as conservatory plants. Many genera are in the American trade. Among these are: *Acorus* (Sweet Flag); *Alcasia*; *Amorphophallus* (Devil's Tongue, Snake Palm, Stanley's Wash-Tub); *Anthurium*; *Arisæma* (Indian Turnip, Jack-in-the-Pulpit, Dragon Root, Fringed Calla); *Arum* (Black Calla, Solomon's Lily, Lord and Ladies, Cuckoo Pint, Wake-Robin of England); *Biarum*; *Caladium*; *Calla*; *Colocasia*; *Dieffenbachia*; *Heliconia* (Hairy Arum); *Monstera* (Ceriman, Shingle Plant); *Nepenthes*; *Orontium* (Golden Club); *Peltandra* (Water Arum); *Pistia* (Water Lettuce, Tropical Duckweed); *Pothos*; *Saurum*; *Schizomatoglossis*; *Spathiphyllum*; *Symplocarpus*, or *Spathyema* (Skunk Cabbage); *Xanthosoma* (Malanga); *Zantedeschia*, or *Richardia* (Calla Lily, Lily-of-the-Nile).

32. **Lemnaceæ** (from the genus *Lemna*, an old Greek name of uncertain origin). DUCKWEED FAMILY. Fig. 10. Tiny aquatic plants floating or submerged, the plant body reduced to an oval or oblong, flat or globular thallus, which multiplies rapidly by marginal buds, and may or may not bear 1 or more roots on the under side: flowers unisexual, naked, monœcious; the staminate consisting of 1 stamen; the pistillate of 1 flask-shaped, 1-celled pistil, with several ovules; the latter orthotropous or anatropous, the micropyle transformed into a cap: fruit a several-seeded utricle.

There are 3 genera and about 25 species, distributed over the whole earth, except the arctics. The family is related to the Araceæ, from which it is supposed to have degenerated. The flowers, which rarely occur, are borne in minute pits in the edge or upper surface of the thallus, either 1 staminate and 1 pistillate, or 2 staminate and 1 pistillate together; in some genera provided with a spathe corresponding to the spathe in the Araceæ. The roots, when present, are balancing organs to resist the upsetting of the plant by the waves. *Wolffia* is the tiniest flowering plant, the whole plant sometimes in size only half the diameter of a pinhead.

By the very rapid vegetative multiplication of some species, ponds are often completely covered with a green coating, and these plants may then become of economic importance.

*Lemna* and *Spirodela* are often grown in aquaria.

#### Order 18. FARINOSÆ

33. **Bromeliaceæ** (from the genus *Bromelia*, in honor of Olaus Bromel, a Swedish botanist). PINEAPPLE FAMILY. Fig. 10. Herbs or subshrubs, mostly epiphytic: leaves usually basal, alternate, linear, trough-like, sheathing at the base, mostly stiff and spiny-serrate, usually covered in part or all over with peltate scale-like hairs or glands: flowers in spikes, racemes, panicles or heads, often in the axils of imbricated, highly colored, bracts, usually bisexual, regular, epigynous or hypogynous; perianth of 6 parts, definitely differentiated into calyx and corolla; parts free or united; stamens 6, often borne on the perianth; anthers intorse; ovary inferior or superior, 3-celled; ovules many; style 1; stigmas 3: fruit a berry or capsule, more or less surrounded by the persistent perianth; seeds albuminous.

The family has 40 genera and about 900 species, almost exclusively of tropical and subtropical America. *Tillandsia usneoides* reaches Florida and Texas.

*Tillandsia* is the largest genus with 120 species. The family is closely related to the Liliaceæ and Amaryllidaceæ. The peculiar stiff leaves, the conspicuous bracts, the herbaceous calyx, the mealy endosperm, and, in general, the epiphytic habit, are distinctive. There are few families more easily recognized than this.

The most important economic species is the pineapple (*Ananas sativus*), the fruit of which is an important article of commerce. Its unripe juice is used as a vermifuge and diuretic. Florida or Spanish moss (*Tillandsia usneoides*) is used in the preparation of a stiptic ointment. It is also used to stuff mattresses, under the name of vegetable hair. *Billbergia tinctoria* is the source of a dye. The leaves of pineapple yield a beautiful fiber. *Bromelia Pinguin* is a vermifuge employed in the West Indies.

There are several genera grown in America, all for ornamental purposes except the pineapple. Among these are: *Æchmea*; *Ananas* (Pineapple); *Billbergia*; *Bromelia* (Pinguin of Jamaica, Wild Pine); *Cryptanthus*; *Dyckia*; *Guzmania*; *Nidularium*; *Pitcairnia*; *Tillandsia* (Spanish Moss, Florida Moss, Long Moss); *Vriesia*.

34. **Commelinaceæ** (from the genus *Commelina* dedicated to J. and G. Commelin, Dutch botanists of the early 18th century). SPIDERWORT FAMILY. Fig. 10. Herbs with knotty stems, and somewhat sheathing, alternate, flat or channeled, cauline leaves: flowers usually bisexual, almost or quite regular, hypogynous; perianth of 6 parts, in 2 series, differentiated into a green calyx and colored corolla; the petals separate or united into a tube, mostly quickly disappearing, and dissolving into a viscid liquid; stamens 6, or reduced to 3, with or without staminodia; some anthers often sterile and altered; the filaments usually provided with characteristic long hairs; ovary superior, 2-3-celled, few-seeded; style 1; stigma usually capitate: fruit a capsule.

Twenty-five genera and about 300 species occur, widely distributed in the tropics and subtropics. Eleven species reach the northeastern United States. The largest genus is *Commelina*, with 88 species. The family is not closely related to any other. The general habit, the complete differentiation of the perianth into calyx and corolla, the slight irregularity of the flower, the peculiar stamen-hairs, and the transformed anthers, are together distinctive. The peculiar deliquescent character of the petals in many genera is of interest.

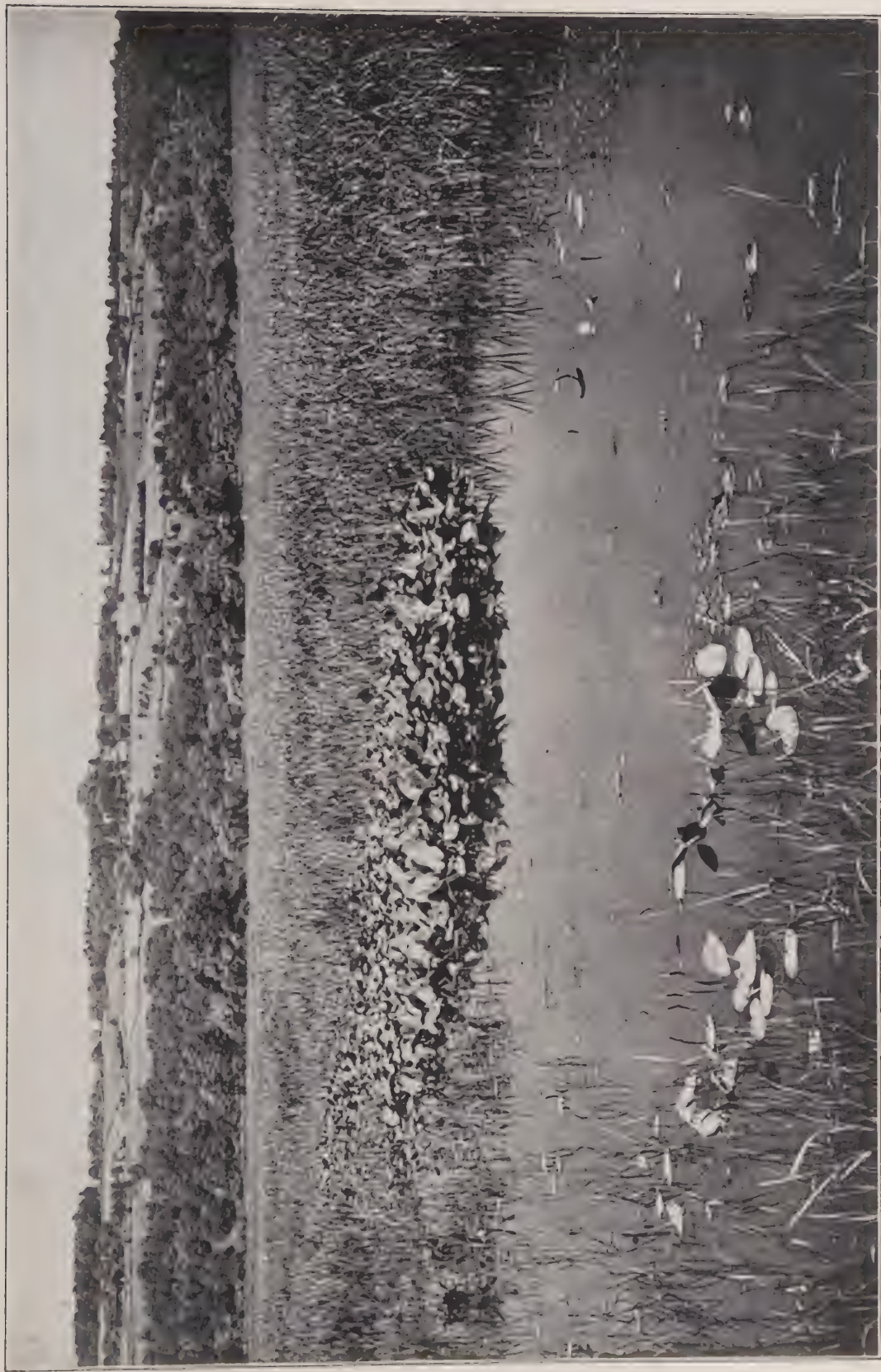
The rhizomes of several species of *Commelina* contain starch, besides the mucilage, and are eaten. The rhizome of *C. Rumphii* is an emmenagogue. The tubers of *Aneilema medicum* are used in China for coughs and lung diseases. A decoction of *Cyanotis axillaris* is used by the Indians for dropsy. The family is most important from the point of view of ornamental use.

Several genera are grown in America, all for ornament. Among these are: *Aneilema*; *Cochliostema*; *Commelina* (Day Flower); *Dichorisandra*; *Tradescantia* (Spiderwort, Wandering Jew); *Zebrina* (Wandering Jew).

35. **Pontederiaceæ** (from the genus *Pontederia*, named in honor of Ponteder, professor at Padua in the 18th century). PICKEREL-WEED FAMILY. Fig. 11. Upright or floating, fleshy, water- or swamp-plants: leaves alternate; petioles sheathing; blade cordate, oval, or orbicular, or reduced to the linear flattened petiole: flowers not bracted, bisexual, irregular, hypogynous; perianth of 6 similar parts, in 2 whorls, more or less connate, persistent; stamens 3 or 6, rarely 1, inserted unequally on the perianth-tube; anthers intorse; ovary superior, 3-celled and ovules many, or 1-celled and 1-seeded; style 1; stigmas 3: fruit a capsule, or an achene enveloped by the fleshy persistent base of the perianth; embryo as long as the endosperm.

The family contains 6 genera and about 20 species, of which 9 belong to the genus *Heteranthera*, and about 5 to *Eichhornia*. They are distributed in the swamps of





II. Vegetation areas.—Aquatic, marsh and upland floras, and the relation of farm lands.





the warmer parts of the earth, except Europe. The family is most closely related to the Liliaceæ, from which it differs in the irregular flowers, in the sympodial method of growth, in anatomical characters, and principally in the abundant mealy endosperm.

A decoction of the root of *Monochoria vaginalis* of the Far East is used for liver and stomach complaints; the root is chewed for toothache; pulverized and mixed with sugar it is used for asthma; the leaves bruised and mixed with milk are used for cholera; and the shoots are edible. *Eichhornia crassipes* is a floating fleshy plant with beautiful flowers. It has become so abundant in Florida as to interfere seriously with steam-boat navigation in the rivers. The large violet flowers of both *Eichhornia* and *Pontederia* are valued in cultivation for water-gardens.

Two genera are frequent in cultivation: *Eichhornia* (Water Hyacinth), from South America; and *Pontederia* (Pickerel-weed), native.

#### Order 19. LILIFLORÆ

36. **Juncaceæ** (from the genus *Juncus*, classical name, derived from *jungere*, to join). RUSH FAMILY. Fig. 11. Rush-like or grass-like herbs or shrubs: flowers numerous, very small, bisexual, regular, hypogynous; perianth of 6 similar, separate parts, greenish or brownish, chaffy; stamens 3 or 6 in 2 whorls; carpels 3; ovary 1-



11. PONTEDERIACEÆ: 1. *Pontederia*, floral diagram. JUNCACEÆ: 2. *Luzula*, flower. 3. *Juncus*, a, flower; b, floral diagram. LILIACEÆ: 4. *Dracena*, flower. 5. *Fritillaria*, floral diagram. AMARYLLIDACEÆ: 6. *Leucoium*; a, flower; b, floral diagram. 7. *Narcissus*, flower.

or 3-celled; ovules 3 to many; stigmas 3: fruit a capsule; seeds mostly very small, albuminous, anatropous.

**Juncaceæ** has 7 genera and about 175 species, of which 160 belong to the genus *Juncus*, widely distributed in temperate and cold regions, both north and south, but rare in the tropics. The family is closely related to the Liliaceæ, from which it differs only in the rush- or grass-like habit and scarious perianth. Fossil species are known. The leaves are sheathing and the blades are either flat, or tubular and nodulose. Distichia of the Andes is densely heath-like or moss-like.

The stems and leaves of many species are used for binding, or for weaving into mats. Light hats are made from the pith of certain species in India and China. The pith is also used for candlewicks.

In cultivation in America are 2 genera for water-gardens: *Juncus*; *Prionium*, woody. *Xanthorrhoea* is transferred to the Liliaceæ.

37. **Liliaceæ** (from the genus *Lilium*, classical Latin

name). LILY FAMILY. Fig. 11. Herbs, shrubs, or trees, usually with rootstocks or bulbs, sometimes climbing: leaves alternate, rarely with petiole and blade: flowers bisexual, rarely unisexual, regular, hypogynous, rarely epigynous, not subtended by spathes; perianth petaloid, of 6 similar parts, in 2 series, the parts separate or connate, rarely differentiated into a green calyx and colored corolla; stamens 6, rarely fewer, hypogynous, or borne upon the perianth; carpels 3, rarely more or fewer, united, rarely free; ovary usually 3-celled; ovules 1 to many in each cell; styles and stigmas 1-3: fruit a capsule or berry.

There are about 200 genera and 2,000 species, distributed in all parts of the world. The large genera are *Smilax* with 200 species, *Allium* with 250 species, *Asparagus* with 100 species, *Aloe* with 85 species and *Scilla* with 80 species. The Liliaceæ, taken in the broader sense, as is done by Bentham & Hooker, and by Engler, is an easily recognized group except in unusual cases. The regular, 6-parted perianth, 6 stamens, and 3-celled superior ovary are distinctive. The family has been divided by Engler into 11 tribes. The Liliaceæ furnishes a host of cultivated plants.

The following plants, among others, have been or are used in medicine: *Amanthium muscatolicum* of North America as a narcotic and a fly poison; various species of *Uvularia* of North America as a gargle and for rattlesnake bites; the root of *Polygonatum* sp. in Europe as a vulnerary, and the berries as an emetic and purgative; the berries of *Smilacina racemosa* of North America as a tonic; the root of *Convallaria majalis* of Europe as a purgative; the leaves of *Streptopus amplexicaulis* of North America as a gargle; the roots of *Ruscus* of Europe as a diuretic and emmenagogue; the roots of *Smilax* sp. of the tropics (the sarsaparillas of commerce) as a tonic and diuretic; the roots of *Asparagus officinalis* in Europe as an aperient, the berries as a diuretic and aphrodisiac, and the shoots as a sedative and cardiac; the roots of *Cordylone* of the southern tropics for dysentery; the flowers of *C. deflexa* as an emmenagogue; the resin from *Xanthorrhoea hastilis* (Botany Bay gum, with a fragrance like benzoin) in Australia for throat troubles; the resin of *X. australis* (grass tree gum, earth shellac, or nut pitch) for various purposes; the tubers of *Ophiopogon japonicus* (serpent's beard) in China and Japan for abdominal troubles; the bulbs of *Gagea* of Europe as an emetic; the flowers of *Hemerocallis* of Europe as a cordial; the leaves of species of *Aloe* of the Old World as a tonic, purgative, and emmenagogue (*A. Perryi* is Socotrine aloes, *A. vera* is Barbadoes aloes, and *A. spicata* is Cape aloes); the bulb of *Urginea maritima* (squills) of the Mediterranean as a diuretic, expectorant, and emetic; *Allium* sp. as a vermifuge and carminative; the bulbs of *Hyacinthus*, *Muscari*, and *Ornithogalum* of Europe as purgatives and diuretics; *Ornithogalum altissimum* of the Cape as a remedy for asthma and catarrh; *Anthericum* and *Asphodelus* as diuretics and emmenagogues; *Tulbaghia* of the Cape as a vermifuge and for phthisis; the poisonous root of *Veratrum album* (white hellebore) of Europe as a violent purge and emetic, and to exterminate vermin; *V. nigrum* (black h.) of Europe, and *V. viride* (green h.) of the United States, occasionally, for the same purpose; *Schœnocaulon officinalis* (cavaddilla or sabadilla) of Mexico for vermin and as a vermifuge; the narcotic, poisonous root and seeds of *Colchicum officinale* of Europe as a cathartic, emetic, and sedative; and *Helonias bullata* of North America as a vermifuge. The roots of *Gloriosa*, also, are poisonous. *Dracæna Draco*, the dragon tree of the Canaries and Teneriffe, famous for the extreme age and size of the trees, was superstitiously revered by the ancients. The red resinous astringent exudation of these plants was called dragon's blood.

The following have been used for food: Bulbs of *Camassia esculenta*, western United States; bulbs and

leaves of *Allium* sp. (onion, leek, eschalot or shallot, rochambole); shoots of *Polygonatum*, Europe, United States; shoots of *Asparagus officinalis*; roots of *Cordyline* sp., in South Sea Islands, and there called *ti*. The seeds of *Ruscus* are a substitute for coffee.

A few have been used for other purposes: Roots of *Yucca* for soap; fibers of New Zealand flax (*Phormium tenax*) for fabrics; and the fragrant root of *Dianella nemorosa* for incense.

For ornament, great numbers of genera and species are in cultivation.

Very many genera are in cultivation, some common, for ornamental purposes unless otherwise stated. Among these are *Agapanthus* (African Lily, Lily-of-the-Nile); *Alettris* (Colic Root), native; *Allium* (Onion, Chives, Cives, Garlic, Leek, Shallot), ornament and food; *Asphodeline* (True Asphodel, King's Spear); *Asphodelus* (Branching Asphodel); *Bessera* (Mexican Coral Drops); *Brevoortia* (Floral Fire-Cracker); *Brodiaea*; *Calochortus* (Star Tulip, Globe Flower, Mariposa Lily, Butterfly Tulip); *Camassia* (Camass); *Chionodoxa* (Glory-of-the-Snow); *Chlorogalum* (Soap Plant, Amole); *Clintonia*, native; *Colchicum* (Meadow Saffron, Autumn Crocus); *Cordyline* (*Dracæna*); *Dasyllirion*; *Dracæna* (Dragon Tree); *Erythronium* (Dog's-tooth Violet, Adder's Tongue); *Eucomis* (Royal Crown, Pineapple Flower); *Fritillaria* (Crown Imperial, Black Lily, Checkered Lily); *Funkia* (Day Lily, Plantain Lily); *Galtonia* (Giant Summer Hyacinth); *Gasteria*; *Gloriosa* (Climbing Lily); *Haworthia*; *Helonias* (Swamp Pink, Stud Pink); *Hemerocallis* (Yellow Day Lily, Lemon Lily); *Hyacinthus* (*Hyacinth*); *Kniphofia* (Red-hot-poker Plant, Torch Lily, Flame Flower); *Lachenalia* (Cape Cowslip); *Lapageria* (Chilean Bellflower); *Leucoerinum* (Sand Lily); *Lilium* (Lily, Easter Lily, Madonna Lily, Tiger Lily, Japan Lily, Turk's-cap Lily); *Littonia* (Climbing Lily); *Maianthemum* (False Lily-of-the-Valley, Two-leaved False Solomon's Seal), native; *Medeola* (Indian Cucumber Root), native; *Melanthium* (Bunch Flower); *Milla* (Mexican Star, Mexican Star of Bethlehem, Frost Flower, Floating Star); *Muscari* (Grape Hyacinth, Musk Hyacinth, Feathered Hyacinth); *Narthecium* (Bog Asphodel); *Nolina*; *Nothoscordum* (Yellow False Garlic, Streaked-leaved Garlic); *Oakesia* (Wild Oats), native; *Ornithogalum* (Star of Bethlehem); *Paradisea* (St. Bruno's Lily, St. Bernard's Lily); *Paris* (Herb Paris, Love Apple, True Love); *Phormium* (New Zealand Flax); *Polygonatum* (Solomon's Seal); *Ruscus* (Butcher's Broom); *Sansevieria* (Bow-string Hemp); *Scilla* (Squill, Wild Hyacinth, Bluebell, Harebell, Spanish Jacinth, Sea Onion, Starry Hyacinth, Cuban Lily, Hyacinth of Peru, Peruvian Jacinth); *Semele* (Climbing Butcher's Broom); *Smilacina* (False Solomon's Seal), native; *Smilax*; *Streptopus* (Twisted Stalk), native; *Tricyrtis* (Toad Lily); *Trillium* (Wake-Robin, Birthroot, Bethroot, White Wood Lily, Ground Lily), native; *Triteleia* (Spring Star-Flower); *Tulipa* (Tulip); *Urginea* (Sea Onion, Squills); *Uvularia* (Bellwort, Wild Oats), native; *Veratrum* (False Hellebore, White Hellebore, Green Hellebore, Black Hellebore, Indian Poke); *Xanthorrhoea* (Grass Tree, Grass Gum, Black Boy); *Xerophyllum* (Turkey's Beard); *Yucca* (Spanish Bayonet, Adam's Needle, Bear Grass, Silk Grass); *Zygadenus* (Fly-poison).

38. **Amaryllidaceæ** (from the genus *Amaryllis* named for a nymph celebrated by Virgil). **AMARYLLIS FAMILY**. Fig. 11. Caulescent or acaulescent herbs, bulbous- or fibrous-rooted: leaves alternate, elongated, entire: flowers bisexual, regular or irregular, epigynous, usually borne singly or in clusters from a spathe-like bract; perianth of 6 similar parts in 2 series, usually connate below into a tube and sometimes with a tubular or cup-shaped crown in the throat; stamens 6, some occasionally staminodial; anthers introrse; ovary inferior, 3-celled; ovules numerous, anatropous; style 1; stigmas 1-3: fruit a capsule, rarely a berry; seeds albuminous.

There are 71 genera and about 800 species, widely distributed but most abundant in the steppe regions of the tropics and subtropics. Five species are found in the northeastern United States. The largest genera are *Crinum* with 60 species, and *Hypoxis*, and *Hippeastrum* with 50 species each. The family is most closely related to the *Liliaceæ*; less closely to the *Iridaceæ*. The 6-parted perianth, 6 stamens with introrse anthers, and inferior 3-celled ovary, are together distinctive.

The bulbs or rootstocks of some species have been used in medicine. Those of *Narcissus Pseudo-Narcissus* and *Leucoium vernum* are vigorous emetics. Those of *Crinum zeylanicum* of the Moluccas, *Amaryllis Belladonna*, of the Cape of Good Hope, and *Buphane toxicaria* of South Africa are violent poisons. The latter is used by the Kafirs to poison their arrows. In South America the farinaceous tubers of the *Alstroemeria* are eaten. The most important plants are the *Yuccas*. From the terminal bud of these, a sugary liquid is obtained which by the Mexicans is made into a fermented drink, called pulque; when distilled this drink is called mescal. The juice of the leaves has been used for syphilis, scrofula, and cancers. The leaf-fibers yield vegetable silk or sisal hemp, and are also made into paper. Razor-strops and cork are made from the pith. The flowers are sometimes boiled and eaten.

Forty or more genera are in cultivation in America, as ornamental plants in greenhouse and garden. Among these are: *Agave* (Century Plant, Sisal Hemp, Pulque Plant); *Alstroemeria*; *Amaryllis* (*Belladonna Lily*); *Beschorneria*; *Bomarea*; *Bravoa* (Mexican Twin Flower); *Cooperia* (Evening Star, Giant Fairy Lily); *Crinum* (St. John's Lily, Florida Swamp Lily); *Eucharis* (*Amazon Lily*, Star of Bethlehem); *Eurycles* (Brisbane Lily); *Furcraea*; *Galanthus* (Snowdrop); *Griffinia* (Blue *Amaryllis*); *Hæmanthus* (Blood Lily); *Hippeastrum* (*Amaryllis*, Lily-of-the-Palace, Barbadoes Lily); *Hy-menocallis* (Spider Lily, Sea Daffodil); *Hypoxis* (Star Grass), native; *Leucoium* (Snowflake); *Lycoris* (Golden Spider Lily); *Narcissus* (*Narcissus*, Jonquil, Daffodil, Pheasant's Eye); *Nerine* (Guernsey Lily); *Pancratium* (Spider Lily, Spirit Lily); *Polianthes* (Tuberose); *Sprekelia* (*Jacobean Lily*); *Tecophilæa* (Chilean Crocus); *Vallota* (Scarborough Lily); *Zephyranthes* (*Zephyr Flower*, Fairy Lily, *Atamasco Lily*).

39. **Taccaceæ** (from the genus *Tacca*, from the Malay name). **TACCA FAMILY**. Fig. 12. Herbaceous plants: leaves large, entire, or commonly pinnatifid or bipinnatifid, all basal: flowers saucer- or urn-shaped, bisexual, regular, epigynous; perianth of 6 nearly separate similar parts in 2 series; stamens 6, borne on the base of the perianth; filaments queerly broadened and cucullate; ovary inferior, 1-celled, or incompletely 3-celled; ovules numerous; placenta parietal; style umbrella-like, the terminal disk variously lobed, and bearing the peculiar stigmatic pores beneath: fruit a capsule or berry; seed albuminous.

**Taccaceæ** has 2 genera and 10 species, inhabitants of the tropics of both hemispheres, mostly of the Malay archipelago. A very distinct family of doubtful relationship, even suggesting several Dicotyledonous families, but probably close to the *Dioscoreaceæ* and *Amaryllidaceæ*. The acaulescent habit, the epigynous bisexual flowers, the six queer stamens, and the 1-celled, many-ovuled ovary, are together distinctive.

Several species of *Tacca*, e. g., *T. pinnatifida*, possess tubers from which a starchy meal, called arrowroot, is made in the East. Straw hats are made from the stems of *Tacca* by the Tahitians.

*Tacca pinnatifida* and *T. cristata* are cultivated sparingly in America.

40. **Dioscoreaceæ** (from the genus *Dioscorea*, named in honor of Dioscorides). **YAM FAMILY**. Fig. 12. Climbing or twining herbs or shrubs: leaves alternate, mostly arrowhead-shaped: flowers bisexual or unisex-



ual, regular, small, and inconspicuous; perianth of 6 similar parts, in 2 series; stamens usually 6, or the 3 inner staminodia; ovary inferior, 3-celled, rarely 1-celled; placentæ axile or parietal; ovules 2 in each cell, superposed, anatropous; stigmas 3, or each 2-parted; fruit a capsule or berry; seed albuminous.

Nine genera and about 170 species, of which 150 belong to the genus *Dioscorea*, are distributed very generally in the tropics and in the subtropics, and extend sparingly into the north temperate zone. They are most abundant in South America and the West Indies. One species reaches north to southern New England. The family is related to the Amaryllidaceæ and Liliaceæ. The climbing habit, peculiar leaves, definite stamens, inferior 3-celled ovary, and 2 albuminous seeds are distinctive. Most Dioscoreaceæ spring from a tuberous base, which is sometimes very large and conspicuous. Odd tubers are borne in the leaf-axils of species of *Dioscorea* and *Rajania*.

The tuberous root of *Dioscorea Batatas* yields the yams of eastern commerce, a very important article of food in the Far East. Those of several other species, including our own native *D. villosa*, are also cultivated in various parts of the tropics. The leaves of some species are used in intermittent fevers. The tubers of *Tamus communis* were formerly employed as a purgative, and were also applied to bruises, hence the name "beaten woman's herb." The shoots are eaten like asparagus.

Two genera are in cultivation in the United States, mostly in the South: *Dioscorea* (Yam, Chinese Potato, Cinnamon Vine, Air Potato); *Testudinaria* (Hottentot's Bread, Tortoise Plant, Elephant's Foot), rarely grown.

41. **Iridaceæ** (from the genus *Iris*, the rainbow). **IRIS FAMILY.** Fig. 12. Herbs or sub-shrubs with fibrous roots or often tuberous rootstocks (corms); leaves mostly basal, equitant, linear; flowers usually showy, bisexual, regular or irregular, epigynous, each with 2 spathe-like bracts; perianth of 6 petaloid parts in 2 series, usually unlike, generally connate into a tube; stamens 3, the inner whorl wanting, separate or connate; anthers extrorse; ovary inferior, 3-celled, rarely 1-celled; ovules few to many, anatropous; style 1; stigmas 3; fruit a capsule; seeds albuminous.

The iris family has 57 genera and about 1,000 species of wide distribution. The two main centers are the Cape of Good Hope and subtropical America. The family is not plainly related to any other, perhaps most closely to the Amaryllidaceæ. The ensiform equitant leaves, the 6-parted showy perianth, the 3 extrorse stamens, and the inferior 3-celled ovary, are together characteristic.

The rootstocks of many Iridaceæ are purgative and diuretic, e. g., *Iris florentina*, *I. germanica*, *I. pallida*, and *I. versicolor*. The rootstock of *I. florentina* is fragrant and used for sachet perfume and tooth-powder (orris root). *I. Pseudacorus* and *I. versicolor* have been used for dropsy and diarrhea. *I. fetidissima* was an ancient remedy for scrofula and hysteria. The stigmas of *Crocus sativus* have been renowned since earliest times as an emmenagogue; they are deep orange in color, and used also in dyeing and as a condiment. Iris-green of the painters was prepared by treating violet iris flowers with lime. The seeds of *I. Pseudacorus* have been used as a substitute for coffee. The rootstocks of *Homeria collina* of South Africa are very poisonous. The family contains many well-known ornamental plants.

In America, many genera are in cultivation, all for ornamental purposes. Among these are: *Belamcanda* (Blackberry Lily, Leopard Flower); *Crocus*; *Freesia*; *Gladiolus*; *Hermoadactylus* (Snake's-head Iris); *Iris* (*Fleur-de-lis*, *Iris*, *Cladwin*); *Ixia*; *Moræa* (Wedding Iris); *Schizostylis* (Crimson Flag); *Sisyrinchium* (Blue-eyed Grass, Satin Flower, Rush Lily); *Sparaxis* (Wand Flower); *Tigridia* (Tiger Flower, Shell Flower); *Trionia* (Blazing Star).

## Order 20. SCITAMINEÆ

42. **Musaceæ** (from the genus *Musa*, the Arabic name). **BANANA FAMILY.** Fig. 12. Large, semi-ligneous herbs, the stout stem enveloped at base by the sheathing petioles, unbranched; leaves alternate, entire, convolute, pinnately parallel-veined; flowers bisexual, or unisexual, irregular, epigynous, borne in the axil of a bract in spikes with subtending spathes; nectaries ovarian; perianth of 6 parts, in 2 series, the parts unequal in size and shape, separate or variously united; stamens 6, 5 fertile and 1 staminodium; ovary inferior, 3-celled; ovules solitary and basal, or numerous and axile, anatropous; style 1; stigmas usually 3; fruit



12. **TACCACEÆ:** 1. *Tacca*, flower. **DIOSCOREACEÆ:** 2. *Dioscorea*, leaf and fruit. **IRIDACEÆ:** 3. *Crocus*, a, vertical section whole plant; b, floral diagram. 4. *Sisyrinchium*, flower. **MUSACEÆ:** 5. *Musa*; a, flower, st., stamen; b, floral diagram. **ZINGIBERACEÆ:** 6. *Zingiber*, a, flower; st., stamen; b, floral diagram.

fleshy and pulpy or drupaceous, indehiscent, dehiscent or separating into fruitlets; seeds with perisperm; embryo straight.

Six genera and about 60 species occur, 30 of which belong to the genus *Heliconia* and 20 to *Musa*, of general tropical distribution. Fossil species are known. The family is related to the Marantaceæ, Zingiberaceæ and Cannaceæ; with the last it is often united. These families all have irregular flowers of the same type, and inferior ovaries; but the Musaceæ differ in their slightly differentiated calyx and corolla, in the 5 fertile stamens, and in the absence of aromatic principles.

The banana (*Musa paradisiaca*, *M. sapientum*, etc.) is the most important economic plant, the fruit of which is widely used for food. The pith of the stem, top of the floral spike, and also the shoots, are eaten as vegetables. The fibers from the petioles of *Musa textilis* are made into thread and fabrics. The leaves are used to thatch huts. The traveler's tree (*Ravenala madagascariensis*) holds sufficient water at the leaf bases to serve for drink. The water is obtained by boring the sheath. The seeds of this tree are eaten.

Four genera are in cultivation in the South and in conservatories, for ornament; and one also, *Musa*, for the fruit: *Heliconia* (Balisier, Wild Plantain); *Musa* (Banana, Plantain Tree, Chumpá, Adam's Fig); *Ravenala* (Traveler's Tree); *Strelitzia* (Bird of Paradise Flower).

43. **Zingiberaceæ** (from the genus *Zingiber*, the Indian

name). GINGER FAMILY. Fig. 12. Herbs with creeping or tuberous rhizomes, rarely with fibrous roots; leaves basal or cauline, alternate, sheathing; blade with ligule at top of petiole, linear or elliptic, the pinnately parallel veins strongly ascending; flowers bisexual, irregular, epigynous; perianth of 6 parts, in 2 series, differentiated into a tubular 3-toothed or spatheform somewhat herbaceous calyx, and a tubular unequally 3-lobed corolla; 1 stamen only is fertile, opposite this is a large petaloid staminodium, and there are sometimes other smaller ones; ovary inferior, 3-celled, rarely 1-celled; ovules many in each cell; style 1; stigma usually 1: fruit a capsule; seed with large perisperm, small endosperm, and straight embryo.

There are 24 genera and about 270 species, distributed in the tropical regions of the eastern hemisphere. Only 2 genera are in America. The largest genera are *Amomum*, with 50 species, and *Alpinia*, with 40 species. The family is related to the Musaceæ, Marantaceæ and Cannaceæ, but differs in the ligule, the aromatic oil, the sharp differentiation of the perianth, the single stamen, and the large single staminodium.

To the spicy aromatic flavor of the rhizomes and fruits the family owes its useful qualities. Ginger is from the rhizomes of *Zingiber officinale*, cultivated from India. Cardamon fruits are from *Elettaria Cardamomum* of farther India. Curcuma or turmeric is from the rhizomes of *Curcuma longa*, cultivated from south-east Asia. This is used in medicine, and for flavoring pickles. In it is a yellow dye. The seeds of *Amomum Melegueta* of west Africa are the grains of para-

dise of commerce. Galangal, used in perfumery, is the rootstock of *Alpinia Galanga* of the East Indies.

Several genera are in cultivation in America, mostly grown for ornamental purposes in greenhouses and principally in the South. Among these are: *Alpinia* (Shell Flower); *Amomum*; *Curcuma* (*Curcuma*, Turmeric); *Elettaria* (commercial Cardamon seeds); *Hedychium* (Butterfly Lily, Ginger Lily, Garland Lily); *Kæmpferia*; *Zingiber* (Ginger).

44. **Cannaceæ** (from the genus *Canna*, the origin of the name not clear). CANNA FAMILY. Fig. 13. Similar to the Marantaceæ in all but the following structural details: no joint nor ligule at summit of petiole; ovules many in each cell of the ovary; embryo straight.

This family contains a single genus and 25-50 species of tropical and subtropical America.

The starchy rhizome of *C. edulis* is grown and eaten in the West Indies and Australia. The arrowroot starch of the English and French is derived from *C. coccinea* of the West Indies and South America. The cannas are popular ornamental garden plants.

45. **Marantaceæ** (from the genus *Maranta*, named for Maranti, a Venetian botanist and physician of the 16th century). ARROWROOT FAMILY. Fig. 13. Herbs with rhizomes: leaves mostly basal, with an articulation at the summit of the petiole; blade linear to oval, pinnately parallel-veined; inflorescence usually surrounded by spathe-like bracts; flowers bisexual, irregular, epigynous; perianth of 6 parts, plainly differentiated into calyx and corolla, the latter somewhat irregular; one stamen of the inner set fertile, petaloid, with lateral anther, the two others of the inner whorl transformed into enlarged staminodia; usually 1 or 2 of the outer whorl also present as petaloid staminodia; ovary inferior, 3-celled, rarely 1-2-celled; ovule 1 in each cell; style flat and twisted or lobed; fruit a capsule or berry; seeds with perisperm, and aril; embryo curved.

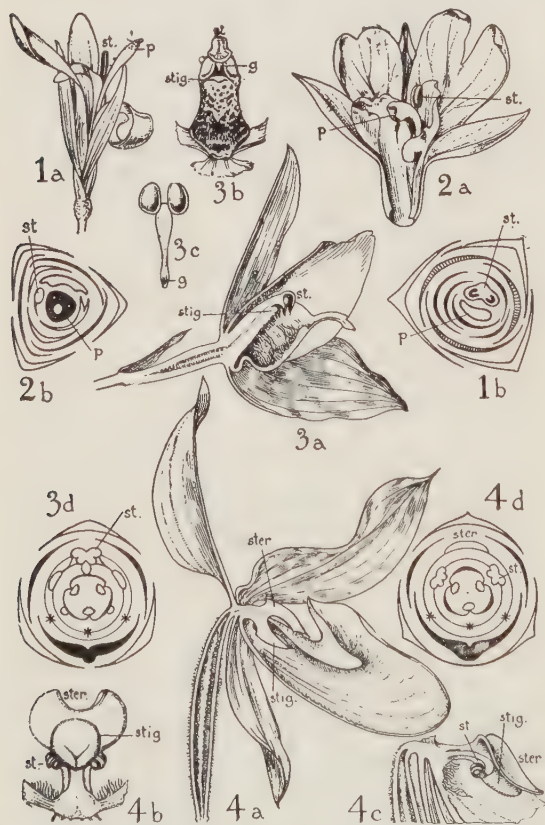
Marantaceæ has 12 genera and about 160 species, of damp situations in the tropics, mostly American. The largest genus is *Calathea* with 60 species. The family is related to the Cannaceæ, Zingiberaceæ, and Musaceæ. The joint at the summit of the petiole, the type of stamen-irregularity, the 1-seeded cells of the ovary, and the curved embryo are distinctive.

The rhizome of *Maranta arundinacea* is cultivated in tropical America, and furnishes the maranta arrowroot of commerce; rhizomes of some other species are eaten. Many species are ornamental, mostly for conservatory.

Five or 6 genera are in cultivation in America, as *Calathea* (Rattlesnake Plant); *Maranta*; *Phrynium*; *Stromanthe*; *Thalia*.

#### Order 21. MICROSPERMÆ

46. **Orchidaceæ** (from the genus *Orchis*, an ancient name of these plants). ORCHID FAMILY. Fig. 13. Herbaceous plants of very diverse habit and structure; terrestrial, epiphytic or saprophytic, sometimes climbing; the terrestrial with fibrous roots or with thickened tuber-like roots, the epiphytic often with the base of the leaf and adjoining stem swollen, forming a pseudobulb; the saprophytic without chlorophyll; the epiphytic often with aerial hanging roots are provided with a water-absorbing layer (velamen): leaves alternate, succulent, coriaceous or membranous, linear to oval: flowers bisexual, rarely unisexual, irregular, epigynous; perianth of 6 parts, in 2 series, usually all petaloid; one petal larger, forming the lip (labellum); stamens originally 6, but all except 1 or 2 wanting, or reduced to staminodia, united with the pistil; pollen-grains compound, granular, or aggregated into masses (pollinia) which are either free in the anther or attached by a stalk to a viscid apical or stigmatic gland; carpels 3; ovary inferior, 1- or 3-celled; ovules very numerous; style united with the stamens to form the column; stigma in the front of the column, or on a projecting lobe; fruit a capsule; seeds very minute.



13. **CANNACEÆ**: 1. *Canna*, a, flower; b, floral diagram. **MARANTACEÆ**: 2. *Maranta*, a, flower, pistil removed; b, floral diagram. **ORCHIDACEÆ**: 3. *Lycaste*, a, flower; b, column, front view; c, pollinia and gland; d, floral diagram. 4. *Cypripedium*, a, flower; b, column, under side; c, column, side view; d, floral diagram. (st., fertile stamen; ster., sterile stamen; stig., stigma; g., gland; p., pistil).



This is an important family of more than 400 genera and between 6,000 and 10,000 species. Orchids are very widely distributed, except in the arctics, but are most numerous in the tropics. Those of temperate regions are mainly terrestrial; those in the tropics commonly epiphytic. The large genera are *Epidendrum*, 500 species; *Habenaria*, *Dendrobium*, *Bulbophyllum*, and *Oncidium*, 200–600 species each; *Masdevallia*, *Odontoglossum*, and *Maxillaria*, each 100 or more species.

From the standpoint of the intricate and very special mechanisms evolved in order to insure cross-pollination, the orchids are the most wonderful of our insect-pollinated plants. For a detailed account see Darwin's "Fertilization of Orchids," or Kerner and Oliver's "Natural History of Plants." In general, the insect visiting the showy flower for the honey comes in contact with the sticky gland above the stigma, thereby pulling it out, along with the attached pollen masses. While the insect is going to another flower, the pollen masses dry and bend down until they are in position to strike the viscid stigma, which tears away and retains some of the pollen. The method of pollination in *Cypripedium* is fundamentally different. Some orchids (e.g., *Catasetum*) possess a sensitive explosive mechanism that forcibly ejects the pollen mass, often to the distance of 2 or 3 feet. The minute seeds of the orchids are well adapted to be disseminated by the wind and find lodgment in the crevices of the bark of trees and on other supports.

Orchids are divided into large groups as follows:

Group I. *Diandra*. The two lateral stamens of the inner whorl fertile; the dorsal of the outer whorl staminodial or fruitful, the others absent. *Cypripedium*, *Selenipedium*, *Paphiopedilum*, and others.

Group II. *Monandra*. The dorsal stamen of the outer whorl fruitful, all the others wanting. By far the majority of the species belong here. Subgroup I. Pollinia connected by caudicles with a gland at base of anther near stigma. Subgroup 2. Pollen without caudicles or with these attached to a gland at apex of anther.

The family is very distinct and easily distinguished. Its only near relatives are the *Burmanniaceæ*. The peculiar structure of the stamens and pistil, together with the minute exalbuminous seeds are distinctive.

The *Orchidaceæ* is perhaps the most important family from the standpoint of ornamental gardening. To grow these singular, fantastic, showy, and often sweet-scented flowers has in recent years become almost a craze. It is estimated that, whereas Linnaeus knew but a dozen exotic orchids, at the present day more than 2,500 are known to English horticulturists. Plants in the family useful for other purposes are few. The most important is vanilla, derived from the capsule of *Vanilla planifolia* of Mexico, and now widely cultivated in the tropics. Faham (*Angræcum fragrans* of Bourbon) has a fragrant, bitter-almond-like taste; the leaves are used for indigestion and tuberculosis, and are known as Bourbon tea. Salep is derived from the roots of various terrestrial orchids of the Mediterranean region. The roots of helleborine (*Epipactis latifolia*) are used for rheumatism. The root of *Spiranthes diuretica* of Chile is renowned as a diuretic. The flowers of *Habenaria conopsea* are used for dysentery. *Spiranthes autumnalis* and *Habenaria bifolia* are said to be aphrodisiac. The roots of *Cypripedium parviflorum* var. *pubescens* are frequently used in America as a substitute for valerian.

## CLASS II. DICOTYLEDONEÆ

### Sub-class 1. *Archichlamydeæ* (*Choripetalæ* and *Apetalæ*)

#### Order 22. VERTICILLALES

47. *Casuarinaceæ* (from the genus *Casuarina*, derived from the resemblance of the branches to the feathers of the bird cassowary). **CASUARINA FAMILY.**

Fig. 14. Shrubs, or much-branched trees, with the habit of the horse-tail (*Equisetum*) or *Ephedra*: branches whorled, jointed, striate; leaves replaced by striate, many-toothed sheaths; flowers monœcious or diœcious, the staminate in spikes, the pistillate in heads; perianth of the staminate flower of 2, rarely 1, bract-like parts; stamen 1; perianth of the pistillate flower 0; ovary 1-celled, rarely 2-celled, 2–4-ovuled; stigmas 2; fruit



14. **CASUARINACEÆ:** 1. *Casuarina*, a, portion of male inflorescence; b, diagram of whorl of flowers; c, female flower; d, female flower, cross-section. **SAURURACEÆ:** 2. *Saururus*, a, flower; b, floral diagram. **PIPERACEÆ:** 3. *Piper*, a, inflorescence in fruit; b, portion of spike with flowers; c, female flower, vertical section. **CHLORANTHACEÆ:** 4. *Chloranthus*, a, flower, vertical section; b, floral diagram.

dry, often samaroid, inclosed by the woody valve-like bracts; seeds 2, or 3–4, orthotropous, ascending.

A single genus containing about 20 species occurs in Australia and the neighboring islands, extending to Madagascar and to southeast Asia. The family is very distinct and its relationships are in doubt. It is placed here in the system because of the simple flowers. The peculiar habit, reduced staminate flowers, and peculiar fruit are characteristic.

The wood of *Casuarina equisetifolia* is very hard, and called ironwood. It is used in ship-building, and by the Indians for war-clubs; the powdered bark is used to dress wounds, or for diarrhea. A brown dye is obtained from the same plant.

A few species of *Casuarina* (Beefwood, She Oak) are cultivated in the South for timber and ornament.

#### Order 23. PIPERALES

48. *Saururaceæ* (from the genus *Saururus*, meaning lizard's tail, in allusion to the long slender spike). **LIZARD'S-TAIL FAMILY.** Fig. 14. Herbs: leaves alternate, large and broad; flowers bisexual, regular, in a long, dense spike; perianth 0; stamens 6 or fewer, hypogynous or united with the pistil; carpels 3–4, separate, or united in to a 3–4-celled ovary; ovules 2 to several, parietal; stigmas as many as the carpels; fruit of follicles, or a lobed berry.

Three genera and about 4 species are found in temperate or subtropical Asia and North America. The family is related to the *Piperaceæ*, with which it is frequently united. From that family it differs in having several carpels in each flower and several parietal ovules for each carpel.

*Saururus cernuus* (lizard's tail), a native herb, is in the trade as a garden plant for wet soil.

49. *Piperaceæ* (from the genus *Piper*, an ancient name of pepper). **PEPPER FAMILY.** Fig. 14. Herbs, shrubs, or rarely trees: leaves alternate, rarely opposite or whorled; flowers in dense spikes, bisexual, or unisexual, regular; perianth 0; stamens 1–10; ovary

1-celled; ovule 1, basal; stigmas 1-4, rarely more, sessile; fruit a dry or fleshy berry.

There are 9 genera and about 1,025 species, confined to the tropics. The largest genera are *Piper* with 600 species and *Peperomia* with 400 species. The family is related to the Saururaceae, with which it is often united; otherwise it stands alone as a distinct type, the systematic position of which is uncertain. The spicate inflorescence, naked flowers, and 1-celled, 1-seeded ovary are distinctive.

The unripe fruit of *Piper nigrum* (Java, etc.) yields black pepper. The ripe fruit of the same plant yields white pepper. Long pepper is the whole spike of *P. longum* of India. The drug cubebs is obtained from *P. Cubeba*. Betel consists of the leaves of *P. Bette*, which in India are mixed with the areca nut and masticated (p. 16). From an extraction of the roots of *P. methysticum* (ava, or kava-kava), mixed with the milk of coconuts, an intoxicating drink is made in the Pacific Islands. Some species of *Peperomia* are eaten as salads; others chewed as betel.

Some genera are in cultivation in America as greenhouse foliage plants: *Peperomia*, 10 or more species; *Piper* (Pepper, Black Pepper, Japanese Pepper).

50. **Chloranthaceae** (from the genus *Chloranthus*, signifying green flowers). **CHLORANTHUS FAMILY**. Fig. 14. Herbs, shrubs or trees: leaves opposite; flowers bisexual or unisexual, regular, very small, subtended by bracts, and mostly borne in spikes; perianth 0; stamens in the bisexual flowers 1-3, united with each other and with the ovary; in the staminate inflorescence inserted on a common axis and forming a spike; carpels 1, with 1 pendent ovule; stigma sessile; fruit drupeaceous.

Three genera and about 35 species occur, in tropical America, East Asia, and the islands of the Pacific Ocean. The family is related to the Piperaceae and Saururaceae. The opposite leaves, the few stamens, which are often unilaterally united with the 1-celled ovary, and the suspended ovule, are peculiar.

The roots of *Chloranthus officinalis* have a camphor-like odor, and are used in the East as a febrifuge.

One species of *Chloranthus* is grown in greenhouses for foliage and berries.

#### Order 24. SALICALES

51. **Salicaceae** (from the genus *Salix*, the classical Latin name). **WILLOW FAMILY**. Fig 15. Shrubs or crees, creeping in the arctics: leaves alternate, simple; flowers dioecious, both sexes in catkins, 1 flower to each scale; perianth 0; disk present, cup-shaped or finger-like; stamens 2-many, separate or united; ovary often pedicelled, 1-celled; placentae 2, parietal; ovules numerous; stigmas 2, often each 2-lobed; fruit a capsule; seeds with a basal tuft of long hairs.

Salicaceae has 2 genera and about 180 species, of which 160 belong to the genus *Salix*; inhabitants of the north temperate and arctic zones, a few in the tropics and in South Africa. The family is not definitely related to any other family, though possibly to the Tamaricaceae. The flowers of both sexes in catkins, the glandular disk, and the dehiscent many-seeded capsule with comose seeds, are distinctive.

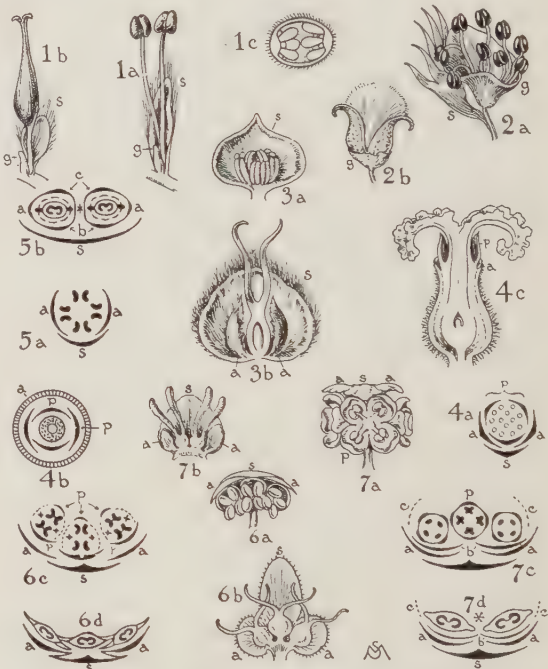
The bark of many species has been used for intermittent fevers and for tanning leather. A yellow dye occurs in the bark of *Populus alba* and *P. tremula*, also in *Salix alba*, *S. daphnoides*, and others. The resinous buds of *P. balsamifera*, or tacamahac, furnish American balm of Gilead. The staminate catkins of *S. aegyptiaca* are odoriferous and are used in the East in medicinal waters, as a cordial, and as a sudorific. Willow and poplar wood is soft and light. The twigs of several species of *Salix* are universally used in basket-making.

The two genera are in cultivation in America, as

ornamental plants and for shelter-belts and basket-work and sometimes for timber: *Populus* (Poplar, Aspen, Tacamahac, Balm of Gilead [not the original], Cottonwood, Abele); and *Salix* (Willow, Osier).

#### Order 25. MYRICALES

52. **Myricaceae** (from the genus *Myrica*, the ancient name of the Tamarisk). **SWEET GALE FAMILY**. Fig. 15. Shrubs or trees: leaves alternate, usually simple, resinous: flowers monœcious or diœcious, in catkins or spikes, single for each bract; perianth 0; stamens 4-6, or 16, in the axil of the bract (scale); ovary 1-celled, 1-ovuled; stigmas 2: fruit a drupe, usually slightly horned by union with the bracteoles; seed solitary, orthotropous, basal.



15. SALICACEAE: 1. *Salix*, a, male flower; b, female flower; c, cross-section ovary. 2. *Populus*, a, male flower; b, dehiscent fruit. MYRICACEAE: 3. *Myrica*, a, male flower; b, female flower. JUGLANDACEAE: 4. *Juglans*, a, diagram male flower; b, diagram female flower; c, vertical section female flower. BETULACEAE: 5. *Corylus*, a, diagram male flower; b, diagram female flowers. 6. *Betula*, a, male flowers; b, female flowers; c, diagram male flowers; d, diagram female flowers. 7. *Alnus*, a, male flowers; b, female flowers; c, diagram male flowers; d, diagram female flowers. (s, scale; a, b, and c, bracteoles of the first, second and third orders; p, perianth; g, gland.)

One genus with about 35 species is generally distributed over the more temperate parts of the earth. The Myricaceae are related to the other amentiferous families, e.g., Juglandaceae, Fagaceae and Betulaceae. The indehiscent, 1-seeded fruit, basal seeds, two carpels, absence of perianth, and simple leaves are characteristic of the family.

*Myrica Gale* and other species are used for tanning leather. *M. Gale* has also been used in the preparation of beer. The wax from the drupelets of *M. cerifera* and *M. carolinensis* is used for making candles. The fruit of *M. sapida* and *M. Nagi* is edible. *M. (Comptonia) asplenifolia* has been used as a tonic. A volatile oil is obtained from the fruits of *M. Gale*. The root of *M. cerifera* is emetic and purgative.

*M. Nagi* is cultivated in California for the edible fruit. *M. asplenifolia*, native in the United States, is grown for ornament. Other species are sometimes planted.



## Order 26. JUGLANDALES

53. **Juglandaceæ** (from the genus *Juglans*, a contraction of the Latin *Jovis glans*, the nut of Jupiter). WALNUT FAMILY. Fig. 15. Trees or shrubs, often resinous: leaves alternate, exstipulate, pinnately compound: flowers monœcious, small; the staminate in drooping catkins with single perianth of 4 parts, or rarely 0, one flower for each bract; the pistillate 2-3 together, with perianth of 4 parts adherent to the ovary as are also the bract and bracteole; ovary inferior, 1-celled; ovule 1, basal, orthotropous; stigmas usually 2- or 4-branched: fruit a nut with a fleshy exocarp, or bursting irregularly, or 4-valved, or winged.

In this family are 6 genera and about 35 species of the north temperate zone. The largest genus is *Carya* with 10 species. The family is related to other Amentifera, e.g., Myricaceæ, Fagaceæ, and Betulaceæ. The indehiscent, 1-seeded fruit, basal seeds, 2 carpels, perianth and pinnate leaves are distinctive. Fossil species are known.

The wood of English walnut is highly valued, but that of *Juglans nigra* (black walnut) is one of the most valuable of woods. Hickory wood is prized for its hardness and toughness. The fruits of the English walnut (*J. regia*), butternut (*J. cinerea*), and of species of *Carya* (hickory) are among the most important food-nuts. The leaves and bark of *Carya* and *Juglans* are purgative. Green dyes are obtained from *Carya tomentosa*, and yellow from *C. ovata*, *C. sulcata*, and *C. glabra*. Walnut oil and hickory oil are in the trade.

The cultivated genera in America are *Carya* or *Hicoria* (Hickory, Pecan, Bitternut, Pignut, Mockernut, Shellbark, Kingnut), native and hardy; *Juglans* (Walnut, Butternut, English Walnut), ornamental, fruit, and timber; *Platycarya*, ornamental; *Pterocarya*, ornamental.

## Order 27. FAGALES

54. **Betulaceæ** (from the genus *Betula*, the ancient Latin name of the birch). BIRCH FAMILY. Fig. 15. Trees or shrubs: leaves alternate, simple, mostly pinnately parallel-veined: flowers monœcious, regular, much reduced; the staminate in slender catkins; the pistillate in short spikes, rarely in flexuous catkins or geminate; 3 flowers, rarely by reduction 2 or 1 flower behind each bract; perianth of the staminate flower single, 2-4-lobed or 0; stamens 2-10; perianth of the pistillate flower absent in *Betula* and *Alnus*, in other genera an epigynous crown of several tiny scales; ovary inferior, originally 2-celled and each cell 1-ovuled, but only one cell and 1 seed maturing; stigmas 2: fruit an indehiscent nutlet, often winged; either separating from the bract and bracteoles (*Alnus*, *Betula*), or falling with them, in which case these organs form a protective involucre (*Corylus*), or a winged or bladderly organ concerned in seed-dissemination (*Carpinus*, *Ostrya*); seeds anatropous, exalbuminous.

Six genera and about 75 species inhabit the extra-tropical northern hemisphere; many are arctic, some of which are creeping. Fossil species are known. The family is related to the Fagaceæ and other amentiferous families. The pistillate flowers in spikes, the presence of a perianth in one or the other sex, the cymose group of flowers for each bract, the 2 carpels, and the single integument of the seed are characteristic.

The wood of *Alnus* and *Betula* is prized by wagon-makers, cabinet-makers and turners; charcoal for gunpowder is made from this wood. The twigs of *Betula* are made into brooms. The bark of *Betula papyrifera* strips off in thin plates and is used for making canoes and for writing-paper. The very thin bark-layers of *B. Bhojpatra* of India also furnish writing-paper. Vinegar and beer are made from the sugary sap of *Betula*, which is also considered an efficient antiscorbutic. The bark

of *Alnus* and *Betula* is used in tanning Russia leather, and other kinds. Hazelnuts are the fruit of *Corylus*; filberts of *Corylus Avellana*. Oil of *Betula* has a flavor like wintergreen. The wood of *Ostrya* is very hard and prized for beetles. The wood of all the Betulaceæ is good for firewood.

Several genera are in cultivation in America for ornament or for the fruit (*Corylus*) such as: *Alnus* (Alder); *Betula* (Birch); *Carpinus* (Hornbeam Tree, Blue Beech, Water Beech); *Corylus* (Hazel, Filbert, Cobnut); and *Ostrya* (Hop Hornbeam, Ironwood, Leverwood).

55. **Fagaceæ** (from the genus *Fagus*, the classical name, in allusion to the esculent nuts). BEECH FAMILY. Fig. 16. Trees or shrubs: leaves simple, alternate: flowers monœcious; the staminate in slender catkins, one flower with each bract and a perianth of 4-6 parts; the pistillate solitary or in groups of 3, epigynous, the perianth reduced; ovary mostly 3- or 6-celled; ovules 2 in each cell, suspended, all but one in the ovary aborting; integuments 2; stigmas 3: fruit a 1-seeded nut, which singly, or in a group of 2-3, is surrounded by a special involucre.

The family has 5 genera and about 600 species, all natives of the subtropical and temperate northern hemisphere, except the antarctic genus, *Nothofagus*. The largest genera are *Quercus* with 200 species, and *Pasania* with 100 species. The family is related to the Betulaceæ and other amentiferous families; but the staminate flowers alone in catkins, the indehiscent 1-seeded fruit, the 3 carpels, and the special involucre are distinctive. There has been much debate as to the morphology of the involucre,—whether it is composed of the bracteoles of the little dichasium, or represents sterile scales of the condensed catkin, or is a wholly new outgrowth of the subfloral axis. The latter is a recent view of Engler. This involucre becomes the bur in beech and chestnut, and the cup in the oak.

The wood of white oak, red oak and many other species is very valuable, as is also that of beech and chestnut. The bark of *Quercus Suber* of Spain yields bottle-cork. The bark of *Q. velutina* of America is called quercitron, and is used to dye yellow. The kermes insect, which furnishes a crimson dye, lives on *Q. coccifera* of the Mediterranean. The stings of gall insects produce the commercial oak-galls from which tannic and gallic acid are obtained, and from which ink was made. Official creosote is distilled from the tar of species of *Fagus*. The nut-like fruits of *Castanea*, *Fagus*, *Quercus Ilex*, *Q. Robur*, and *Q. Ægilops* are eaten. The cups of *Q. Ægilops* are sold for dyeing black and for tanning. The bark from many species of this family is used for tannin.

In America several genera are cultivated for ornament, food, and timber: *Castanea inc.* (Chestnut, Chinquapin); *Castanopsis Fagus* (Beech); *Nothofagus*, little known; *Quercus* (Oak, Black Jack).

## Order 28. URTICALES

56. **Ulmaceæ** (from the genus *Ulmus*, the classical name). ELM FAMILY. Fig. 16. Trees or shrubs without milky juice: leaves alternate, usually oblique: flowers bisexual or unisexual, regular, small; perianth simple; parts 4-5, rarely 3-7; stamens of the same number opposite the sepals, rarely twice as many, not elastically incurved; ovary superior, 1-celled, 1-ovuled; the ovule suspended, anatropous; stigmas usually 2: fruit nut-like, drupaceous, or winged.

Thirteen genera and about 140 species are generally distributed in all but the polar regions. The largest genus is *Celtis*, with 60 species. The family is closely related to the Urticaceæ and Moraceæ. Its non-elastic stamens, and suspended anatropous seeds are important distinguishing characters.

The seeds of some species of *Celtis* are edible. The wood is used to make wind instruments, and the like.

Elm wood is of use in the crafts. The mucilaginous bark of slippery elm (*Ulmus fulva*) is used for poultices and coughs. The fragrant wood of *Planera Abelicea* of Crete is false sandalwood.

There are several genera in cultivation in America. Among these are: Aphananthe, ornamental; Celtis (Nettle Tree, Hackberry, Sugarberry), hardy, ornamental; Planera (Water Elm), ornamental; Ulmus (Elm), ornamental, and for timber; Zelkova, ornamental.

57. **Moraceæ** (from the genus *Morus*, the classical name). MULBERRY FAMILY. Fig. 16. Herbs, shrubs, or trees, sometimes climbing: juice milky: leaves alternate: flowers dioecious or monoecious, regular, small, mostly in heads or spikes, or lining the hollow pyriform fleshy axis of the inflorescence (*Ficus*); perianth single, of 4, rarely 2-6, imbricated parts, more or less united and fleshy in the pistillate flower; stamens of the same number and opposite the sepals, usually inflexed in the bud and elastic; ovary superior, sessile or stipitate, 1-celled, 1-ovuled; the ovule suspended, amphitropous, rarely

tropics. The leaves of *Morus indica* are eaten in India; those of *M. rubra* in America. *M. serrata* is cultivated for fodder. The fig is the fleshy receptacle of the inflorescence of *Ficus Carica*. For the structure and pollination of this remarkable plant see Kerner and Oliver's "Natural History of Plants." The leaves of *Morus* are diuretic and anthelmintic. The juice of *Antiaris toxicaria* is used by the Javanese to poison arrows. Hops are used in medicine, also to flavor beer. Hashish, bhang or Cannabis indica is obtained from *Cannabis sativa*, and is much used in the East as a narcotic to chew and smoke like opium. The fibers of *C. sativa* are hemp. The bark of *Broussonetia* furnishes clothing to the South Sea Islanders. The wood of *Maclura aurantiaca* is flexible; the yellow juice of the fruit of this plant was used by the Indians to paint their faces. *Cudrania javanensis* yields a dye. The milky juice of *Ficus elastica* and other species yield commercial rubber. *F. indica* is a banyan tree of India. *F. religiosa* is the sacred fig. The leaves of various species of mulberry are used to feed silkworms. Shellac is obtained from a small hemipterous insect which lives on *F. laccifera* and *F. religiosa* in India.

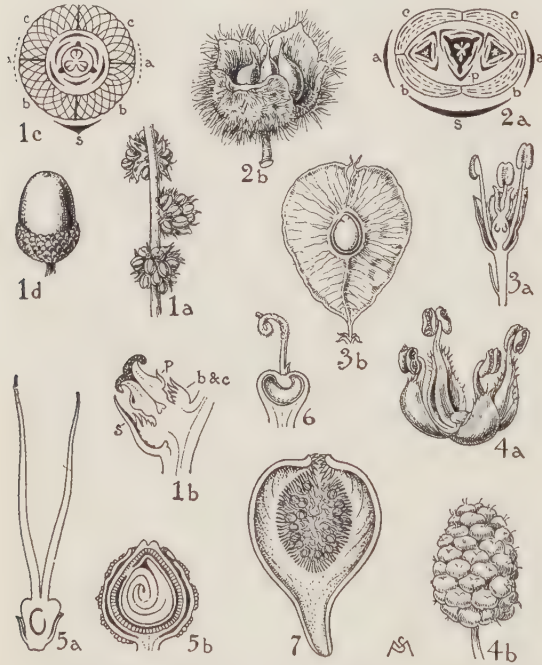
Several genera are in cultivation in America, the majority in the far South. Among these are: Artocarpus (Bread Fruit, Jack Fruit), cultivated in the West Indies and in botanical gardens; Brosimum (Bread Nut), tropical; Broussonetia (Paper Mulberry), ornamental, semi-hardy; Cannabis (Hemp), grown for fiber or ornament; Cudrania, grown for hedges; Ficus (Fig, India Rubber Plant, Banyan Tree, Creeping Fig, Peepul Tree), grown in warm regions and in the greenhouses; Humulus (Hops), grown for the fruit; Maclura (Osage Orange), for hedges; Morus (Mulberry), for fruit, and leaves for silkworms.

58. **Urticaceæ** (from the genus *Urtica*, the classical Latin name of the plant, signifying to burn). NETTLE FAMILY. Fig. 17. Herbs, shrubs or trees, rarely climbing: leaves alternate or opposite: flowers unisexual, regular; perianth single, rarely 0, usually green, consisting of 4-5, rarely 2-3, separate or united parts, imbricated or valvate; stamens as many, and opposite the segments, inflexed and uncoiling elastically; ovary sessile, or pedicelled, or rarely united with the perianth, 1-celled, 1-ovuled; style 1; stigma feathery: fruit an achene or drupe; seeds basal, orthotropous; embryo straight.

The 41 genera and about 475 species are mainly tropical, a few in North America and fewer in Europe. The largest genus is *Pilea*, with 100 species. The family is very closely related to the Moraceæ and Ulmaceæ, with which it was formerly united. The apetalous anemophilous flowers, with elastic stamens opposite the sepals, and the 1-celled ovary, with a single basal, orthotropous seed, are distinctive. Many of the Urticaceæ are covered with stinging hairs containing formic acid. The common nettles are examples. Cystoliths are common in the leaves.

*Parietaria diffusa* and *P. erecta* contain niter, and have been used as diuretics. Nettles were used by doctors to flog patients in order to produce a counter irritation of the skin, a practice called "urtication." Other species have been used locally as medicine. *Laportea stimularis* has been used as a fish-poison. The bast fibers of many species are useful; e.g., *Urtica dioica*, *U. cannabina*, *Laportea canadensis*, and especially the China grass or ramie (*Bahmeria nivea*). The fibers of this latter have long been used in the Netherlands. The young foliage of many Urticaceæ is used as spinach. The tuberous root of *Pouzolzia tuberosa* is eaten.

The following are in cultivation in America; three of them are ornamental: Pellionia, a greenhouse creeper; Pilea (Artillery Plant), a garden and greenhouse plant; and Urera, a greenhouse shrub. The other genus, Urtica (Nettle), is grown for fiber, and Boehmeria occurs occasionally in cultivation.



16. **FAGACEÆ**: 1. *Quercus*, a, male flowers; b, female flower; c, diagram female flower; d, fruit. 2. *Castanea*, a, diagram female flower; b, involucre and 3 fruits. **ULMACEÆ**: 3. *Ulmus*, a, flower; b, fruit. **MORACEÆ**: 4. *Morus*, a, male flower; b, fruit. 5. *Humulus*, a, female flower; b, vertical section fruit. 6. *Cudrania*, pistil. 7. *Ficus*, vertical section female inflorescence (for explanation of letters see Fig. 15).

basal; stigmas 1-2: fruit an achene or drupe enveloped by the fleshy perianth, or on a fleshy gynophore, or composed of achenes in a fleshy hollow common receptacle.

Moraceæ contains 55 genera and about 950 species, mostly of tropical distribution, 6 species of which are native in the eastern United States. The largest genus is *Ficus* with 600 species. The family is frequently united with the Urticaceæ and differs from that family only in the presence of milky juice, in the two stigmas, and in the usually suspended seed. From the Ulmaceæ it differs in the inflexed elastic stamens.

The fruit of the black mulberry (*Morus nigra*) has been eaten since earliest times. Those of *M. rubra* (red mulberry), and *M. alba* are also used for food. The bread fruit (*Artocarpus incisa*) of the South Sea Islands is now cultivated for food everywhere in the



## Order 29. PROTEALES

**59. Proteaceæ** (from the genus *Protea*, from *Proteus*, a self-transforming sea-god, in allusion to the great diversity of the genus). **PROTEA FAMILY.** Fig. 17. Shrubs or trees, rarely herbs: leaves alternate; flowers bisexual, rarely unisexual, regular or irregular; perianth of one series, parts 4, separate or variously united, or labiate, valvate; stamens 4, opposite the perianth parts, hypogynous or inserted on the perianth; hypogynous stalk (gynophore) usually developed, often bearing a ring of scales, or swellings, or a cup; carpel 1; ovary superior, 1-celled; ovules 1 to several; style slender; stigma slender or enlarged: fruit unsymmetrical, capsular, drupaceous, or nut-like, or a samara or follicle; seeds sometimes winged.

There are 49 genera and about 1,000 species, mostly Australian, but many also in South Africa, and a few in South America. The largest genera are *Grevillea*, with 160 species; and *Hakea*, with 100 species. The family is perhaps distantly related to the *Loranthaceæ*, *Santalaceæ*, and *Urticaceæ*, but the relationship is little understood. The 4 valvate sepals, 4 stamens, and the unsymmetrical, 1-celled ovary, raised on an appendaged gynophore are distinctive. The small flowers are usually aggregated in heads or spikes surrounded by bracts. The *Proteaceæ*, for the most part, inhabit countries in which a very dry windy season alternates with a rainy season, and many of them are white-hairy.

*Grevillea robusta*, *Knightia excelsa*, *Embothrium coccineum*, *Leucospermum conocarpum* (redwood), and *Protea grandiflora* (wagen-boom) are useful for timber. The wood of the last species is used for wagon-wheels. The seeds of several species are eaten. A bitter principle is found in *Leucadendron argenteum* of Africa; a gum resin in *Grevillea robusta* of Australia. A golden dye is obtained from the Australian *Persoonia saccata*. *Gevuina avellana* (Chilean hazelnut) furnishes an edible fruit, as does also *Brabeium stellatifolium* (wild chestnut of South Africa), and *Macadamia ternifolia* (Queensland nut). *Banksia* and *Protea* furnish important bee-plants.

The genera in cultivation in America are mostly the following: *Banksia*; *Gevuina* (Chilean Nut, Chile Hazel), grown in California; *Grevillea* (Silk Oak), in greenhouse and California; *Leucadendron* (Silver Tree of the Cape), grown in California; *Macadamia* (Australian Nut), in southern California; *Protea*, in southern California; *Telopea* (Waratah, Warratau), in California.

## Order 30. SANTALALES

**60. Loranthaceæ** (from the genus *Loranthus*, meaning *thong flower*, significance not clear). **MISTLETOE FAMILY.** Fig. 17. Herbs or subshrubs, parasites or half-parasites, with or without chlorophyll, rarely rooted in the earth: leaves usually opposite, rarely alternate, thick and green, or reduced to scales: flowers bisexual or unisexual, usually regular; receptacle of the pistillate flower cup-shaped, united with the ovary; perianth undifferentiated, usually in 2 series of 2 or 3 parts each, of which the outer may be calyx and the inner corolla; stamens as many as the parts of the perianth and opposite them, free, or united with the perianth; ovary 1-celled, inferior; ovule 1, orthotropous; stigma 1, often sessile: fruit a 1-seeded berry.

The 21 genera and about 600 species are mostly inhabitants of tropical countries, but extend into the temperate zone. One species reaches Newfoundland. *Loranthus*, the largest genus, contains 200 species, and *Phoradendron* contains 80 species. The family is related to the *Santalaceæ* and *Proteaceæ*. The habit, the cup-shaped receptacle, the position and number of the stamens, and the 1-celled, 1-seeded fruit are distinctive. The fruits are often very viscid and easily become fastened to the branches of trees where they

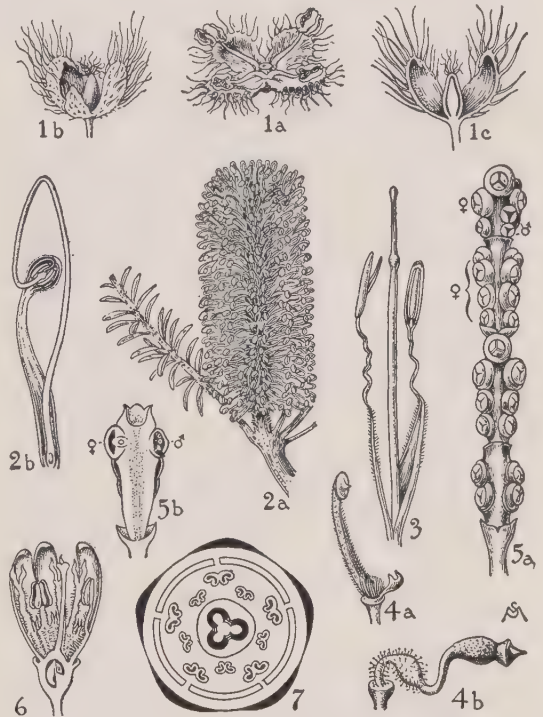
germinate and grow. The inflorescence is often much reduced and inconspicuous.

The viscid substance of the fruit is called birdlime, and is used for catching small birds. Various species have been used locally as medicine. The mistletoe (*Viscum album*) of Europe was worshipped by the Gauls. When gathered from the oak it was considered sacred by the Druids.

*Phoradendron flavescens* (American mistletoe) is gathered and sold in the market.

**61. Santalaceæ** (from the genus *Santalum*, the Latin name for sandalwood). **SANDALWOOD FAMILY.** A family closely related to the *Loranthaceæ*, from which it differs only in the more numerous ovules and the general habit. The *Santalaceæ* are commonly independent plants or root parasites, while the *Loranthaceæ* are usually aerial parasites.

The *Santalaceæ* consists of 26 genera and about 250 species, in the temperate and tropical regions.



**17. URTICACEÆ:** 1. *Urtica*, a, male flower; b, female flower; c, female flower, vertical section. **PROTEACEÆ:** 2. *Banksia*, a, inflorescence; b, flower. 3. *Protea*, flower. 4. a and b, pistils of *Proteaceæ*. **LORANTHACEÆ:** 5. *Phoradendron*, a, inflorescence; b, vertical section inflorescence. **OLACACEÆ:** 6. *Liriosma*, flower. 7. *Liriosma*, floral diagram.

The aromatic and sweet-scented wood of the tree, *Santalum album*, has been used medicinally, and is used in perfumery and cabinet-making. Other species of *Santalum*, also of *Fusanus*, *Acanthosyris*, *Colpoen*, and *Exocarpus* are also used in cabinet work. The sweet flesh of the fruit of some species, the thickened pedicels or oily seeds of others, are edible.

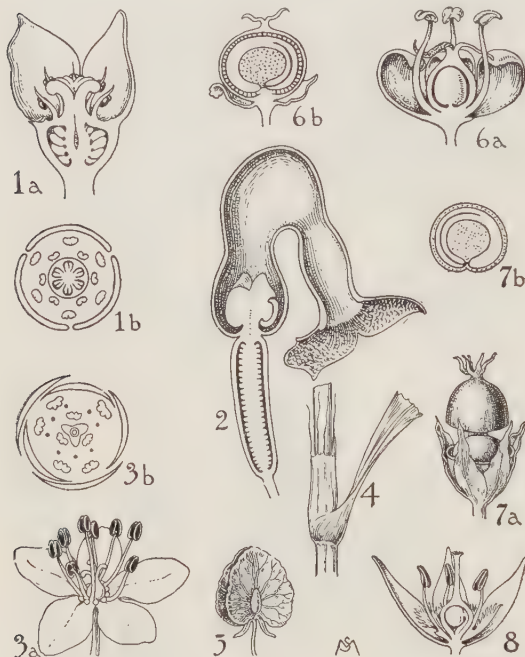
Queer tendril-like brushes on the fruits of the reduced aerial genus *Myzodendron* of South America serve as flying organs and later twine about the support.

*Buckleya* of the southeastern United States is sometimes cultivated; also *Pyrularia*.

**62. Olacaceæ** (from the genus *Olar*, signifying a furrow, application unknown). **OLAX FAMILY.** Fig. 17. Trees or shrubs, sometimes twining or climbing, with alternate, entire leaves: flowers mostly bisexual, regular; perianth single, the divisions (sepals?) 4-5, rarely 6,

valvate; stamens 4-10, often adnate to the perianth or connate; disk present, diverse; carpels 3, rarely 2-5; ovary superior, 1-celled, rarely falsely 3-5-celled; ovule 1; style 1; fruit usually a drupe inclosed in the accrescent and persistent perianth; seed albuminous.

Olacaceæ has 25 genera and about 140 species of tropical distribution, two of which reach southern Florida. *Olax* is the largest genus. The Olacaceæ are related to the Loranthaceæ and Santalaceæ.



18. ARISTOLOCHIACEÆ: 1. *Asarum*, a, flower; b, floral diagram. 2. *Aristolochia*, flower. POLYGONACEÆ: 3. *Fagopyrum*, a, flower; b, floral diagram. 4. *Polygonum*, sheathing stipule. 5. *Rumex*, fruiting calyx. CHENOPODIACEÆ: 6. *Chenopodium*, a, flower; b, fruit. AMARANTACEÆ: 7. *Amarantus*, a, fruit; b, vertical section seed. 8. *Achyranthes*, flower.

The family is of little economic importance. Some species are valuable for their hard timber. The drupes of *Ximenia* are eaten in Senegal. *Olax zeylanica* has a fetid wood, used locally for fevers.

One species, *Ximenia americana* (hog plum) is native in Florida and the tropics, and is of moderate value for the fruit.

#### Order 31. ARISTOLOCHIALES

63. **Aristolochiaceæ** (from the genus *Aristolochia*, in reference to its supposed medicinal properties in connection with child-birth). BIRTHWORT or DUTCHMAN'S PIPE FAMILY. Fig. 18. Herbs or woody plants, the latter mostly twining; leaves alternate, usually broad and entire; flowers bisexual, epigynous, regular or irregular; perianth of one series, the parts mostly 3, connate, often petaloid, very diverse, sometimes regular with the parts nearly separate, sometimes with a long tube which is swollen below, abruptly curved above, and with an abruptly spreading entire border; stamens 6-36, separate and inserted on the ovary, or united with the style; ovary inferior, rarely superior, 4- or 6-, rarely 5-, celled; ovules many; style 1; stigmas 4 or 6; fruit a capsule.

Five genera and about 210 species are known, 180 species of which belong to *Aristolochia*. They are distributed in the warm parts of the earth, but are most numerous in South America. Seven or 8 species are native in northeastern North America. The family is

not definitely related to any other, but is placed provisionally near the Polygonaceæ, not however because related to that family, but because equally simple in structure. Three scale-like organs between the perianth and stamens in *Asarum* are probably true petals. The flowers of most *Aristolochiaceæ* are lurid in color and pollinated by flies. Many are carrion-scented and afford an additional attraction for these insects. The perianth in *Aristolochia* assumes remarkable shapes, some of which have led to the name "Dutchman's pipe."

The rootstock of *Asarum canadense* (Canada snake-root or wild ginger) is aromatically peppery, and used to flavor wines, the breath, and the like. *Aristolochia reticulata*, of Arkansas, and *Aristolochia Serpentaria*, of the eastern United States, furnish the serpentaria of medicine, used as a tonic and as a febrifuge. The latter plant is Virginia snakeroot. The common name arises from the reputed efficacy of these plants and other species of the family as remedies for snake-bites.

The genera in cultivation in America are: *Aristolochia* (Birthwort, Virginia Snakeroot, Dutchman's Pipe, Pelican Flower, Goose Flower), hardy or greenhouse twiners; *Asarum* (Wild Ginger, Canada Snakeroot), low hardy border herbs.

#### Order 32. POLYGONALES

64. **Polygonaceæ** (from the genus *Polygonum*, derived from the Greek meaning *many knees* in reference to the swollen joints of some species). BUCKWHEAT FAMILY. Fig. 18. Herbs, shrubs, or trees, sometimes twining; stem often knotty; leaves alternate, rarely opposite, simple, usually with a sheathing stipular growth (ochrea) at the base; flowers bisexual or unisexual, regular; perianth apparently of one set, though sometimes in 2 whorls, the parts usually 3, 5, or 6, distinct or connate at base, the inner set sometimes much enlarged and modified with hooks, spines, wings, or tubercles; stamens 1-15, usually 6, 8, or 9, usually opposite the perianth parts, mostly separate and hypogynous; ovary superior or nearly so, compressed or 3-angled, of 2-4-carpels, but 1-celled or falsely 3-celled; ovule solitary; styles and stigmas 2-4; fruit a flat, angled, or winged achene; seeds usually not inverted (orthotropous).

Thirty genera and about 700 species occur, mostly in the north temperate zone of both continents. The largest genera are *Polygonum*, 150 species; *Coccoloba*, 125 species; *Eriogonum*, 120 species; and *Rumex* with 100 species. The family is not closely related to any other, but is usually placed near the Chenopodiaceæ because of its simple floral structure and for want of a better place. The stipular sheaths or, when absent, the involucre heads (*Eriogonum*), and 1-celled fruit with a single orthotropous seed, are distinctive.

The foliage of the Polygonaceæ contains an acid, for which reason it is frequently eaten as salads or pot-herbs. Among plants used for this purpose are several species of *Rumex*, petioles of *Rheum Rhaponticum*, and *Oxyria*. The seeds of buckwheat (*Fagopyrum esculentum*) contain much starch and are made into flour. In medicine, rhubarb (*Rheum officinale*), employed as a purge and tonic, has been in use since earliest times, and its origin is lost in antiquity, though probably it is a native of China. Yellow dock (*Rumex crispus*) is a tonic. Smartweed (*Polygonum Hydropiper*) has an acrid juice that will produce a blister. A blue dye is obtained from *P. tinctorium* of China. The roots of *Calligonum Pallasia* are used in Siberia to stay hunger; and the fruits to quench thirst. The astringent drug, bistorta, is from *P. Bistorta*. The leaves of *P. orientale* are smoked like tobacco in China.

Several genera are in cultivation in America for ornament and food. Among these are: *Antigonon* (Mountain Rose, San Miguelito), very showy climbers; *Coccoloba* (Sea Grape, Shore Grape, Pigeon Plum),



trees both of greenhouse and the South, used for timber and edible fruit; *Eriogonum*, garden plants; *Fagopyrum* (Buckwheat), grain; *Muehlenbeckia* (cultivated as *Coccoloba* or Tapeworm Plant), greenhouse; *Polygonum* (Smartweed, Jointweed, Knotweed, Prince's Feather, Kiss-me-over-the-garden-gate, Lady's Thumb, Mountain Fleece, Secalinal), hardy ornamental herbs; *Rheum* (Rhubarb, Pie-plant, Wine Plant), food, medicine, and ornament; *Rumex* (Dock, Sorrel, Sheep Sorrel, Canaigre, Rais Colorado, Herb Patience, Spinage Dock, Curly Dock), ornamental plants, food-plants and weeds.

### Order 33. CENTROSPERMÆ

65. **Chenopodiaceæ** (from the genus *Chenopodium*, which means *goose foot*, from the shape of the leaves). **GOOSEFOOT FAMILY.** Fig. 18. Herbs, shrubs, or rarely small trees, often very fleshy with reduced branching and foliage, and very diverse and remarkable in form: leaves alternate, rarely opposite, often fleshy or reduced to scales: flowers bisexual or unisexual, regular, very small; perianth of one series, the parts 1-5, separate or united, greenish, imbricated, persistent; stamens as many as the perianth parts, or fewer, opposite them, hypogynous or borne on the perianth, often connate; hypogynous disk usually present; ovary superior, 1-celled, 1-ovuled; style and stigmas 1-4; fruit dry, rarely fleshy, usually indehiscent, inclosed in the very diverse perianth which is often hard, or fleshy, or thorny, or hooked; embryo coiled.

This family contains 73 genera and about 550 species, distributed all over the world, but principally confined to saline or alkaline habitats. A few have become weeds in good garden soil. The family is closely related to the *Amarantaceæ*, *Phytolaccaceæ*, *Caryophyllaceæ* and *Portulacaceæ*, all of which have an annular embryo. The fleshy habit, absence of scarious bracts, 1-celled, 1-seeded ovary, and coiled embryo are distinctive. A remarkable family of littoral plants, often with water-storing tissue, spines, queer fruits, and the like.

The most important economic species is the beet (*Beta vulgaris*), the enlarged root of which is used for food and for sugar, the foliage as a pot-herb. Species of *Chenopodium*, *Atriplex*, *Spinacia* and others are eaten as greens. Of these spinach is the most famous. The young shoots of *Salicornia* (glasswort, marsh samphire) are eaten as a pot-herb and are pickled. These shoots are also used for making glass and soaps because of the soda contained. The seeds of *Chenopodium Quinoa* are made into flour in Peru. The foliage of *Chenopodium Botrys* and *Chenopodium ambrosioides* is fragrant-scented. The seeds of *Chenopodium anthelminticum* (wormseed) are a well-known vermifuge. *Chenopodium mexicanum* yields saponin. *Atriplex hortensis* (orach) of Europe and Asia, yields an indigo dye, and the leaves are edible. Soda is obtained by burning many species. *Salsola Kali* var. *tenuifolia* (Russian thistle) is a bad weed.

Several genera are in cultivation in America, largely for food, but some for ornament. Among these are: *Atriplex* (Orach, Sea Purslane), food and ornament; *Beta* (Beet, Mangel-wurzel, Mangel, Chard, Swiss Chard, Spinach Beet), food and ornament; *Chenopodium* (Good King Henry, Mercury, Markery, Feather Geranium, Jerusalem Oak, Wormseed, Mexican Tea), ornament, food, medicine; *Cycloloma* (Cyclone Plant), ornament; *Kochia* (Mock Cypress), ornament; *Spinacia* (Spinach, Spinage), food.

66. **Amarantaceæ** (from the genus *Amarantus*, derived from the Greek, signifying *unfading*; the bracts are scarious and unchanging). **AMARANTH FAMILY.** Fig. 18. Herbs, shrubs, or rarely trees: leaves opposite or alternate, rarely fleshy: flowers bisexual or unisexual, small, regular, usually surrounded by scarious bracts; perianth simple, in one series of 5, rarely 1, 2, 3, or 4,

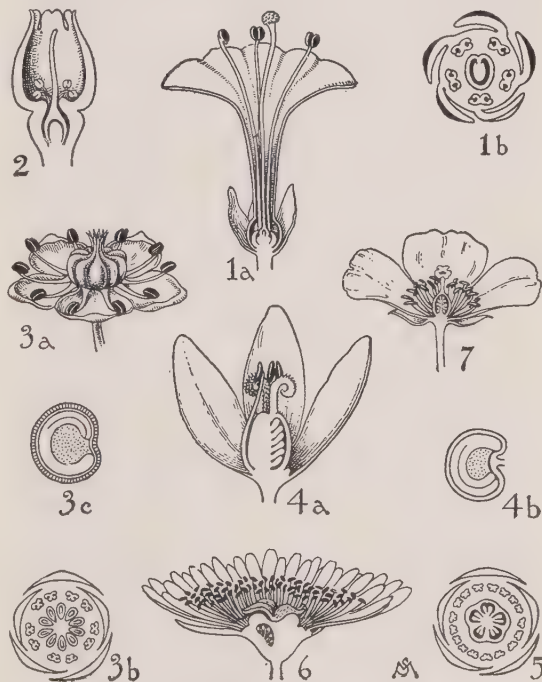
separate or united parts; stamens opposite the perianth parts, of the same number or fewer, rarely more numerous, hypogynous or perigynous, separate or united, the stamen-tube often with fringed appendages at the top; hypogynous disk usually present; ovary superior, free or slightly united with the perianth, 1-celled, 1 to many-seeded; style 0, or 1, or several; stigmas various: fruit a berry, an achene, or dehiscent by a lid; usually surrounded by the perianth; embryo coiled.

The 40 genera and about 450 species are distributed everywhere except in the arctics; most abundant within the tropics. The family is very closely related to the *Chenopodiaceæ* and *Phytolaccaceæ*, also to the *Caryophyllaceæ* and *Portulacaceæ*. The single perianth, scarious persistent bracts, and 1-seeded fruit are distinctive.

Many species of *Amarantus* are eaten as greens. *Gomphrena arborescens* is a tonic. Many *Amarantaceæ* are weeds in cultivated grounds. Some are important ornamental plants. The garden forms of *Celosia cristata* are remarkable for their fasciated inflorescence.

In cultivation in America are: *Amarantus* (Love-lies-bleeding, Prince's Feather, Joseph's Coat), garden annuals; *Bosea*, ornamental; *Celosia* (Cockscomb), garden annuals; *Gomphrena* (Globe Amaranth, Bachelor's Button), garden annual; *Iresine* or *Achyranthes*, bedding plants; *Telanthera* (*Alternanthera*), bedding plants; *Trichinium* or *Ptilotus*, greenhouse.

67. **Nyctaginaceæ** (from the generic name *Nyctago*, a synonym of *Mirabilis*, meaning *night*, in reference to the crepuscular or nocturnal flowering of the Four-O'clock). **FOUR-O'CLOCK FAMILY.** Fig. 19. Herbs, shrubs, or trees: leaves usually opposite, entire; flowers bisexual, rarely unisexual, surrounded by an involucre of separate or united bracts which incloses 1 or several flowers; corolla absent; perianth parts united, very diverse in consistency, form and color, often petaloid,



19. NYCTAGINACEÆ: 1. *Mirabilis*, a, flower; b, floral diagram, 2. *Neea*, flower. PHYTOLACCACEÆ: 3. *Phytolacca*, a, flower; b, floral diagram; c, vertical section of seed. AIZOACEÆ: 4. *Mollugo*, a, flower; b, vertical section of seed. 5. *Aizoon*, floral diagram. 6. *Mesembryanthemum*, flower. PORTULACACEÆ: 7. *Calandrinia*, flower.

valvate or plicate, persistent after flowering, and often woody or leathery, enveloping the fruit; stamens 1-30, united at the base, unequal, hypogynous; ovary of 1 carpel, 1-celled, 1-ovuled; style 1; stigma 1: fruit an achene.

The family has 18 genera and about 150 species, principally natives of America from Colorado to Chile. A few are scattered in other parts of the world. The largest genus is *Pisonia* with 40 species; *Neea* has 30 species. The family is related to the *Phytolaccaceæ*. The floral bracts, absence of corolla, persistent perianth enveloping the very thin-walled fruit, and the 1-seeded, 1-celled ovary, are distinctive.

The roots of *Borhavia* and of *Mirabilis Jalapa* are purgative, and are sold as a substitute for jalap. The foliage of several species of *Borhavia* is used as vegetables. The natives of the Hawaiian Islands catch birds with the very sticky fruits of the native species. The leaves of *Neea theifera* are used as tea in Brazil, also as a black dye.

In America 3 genera are in common cultivation: *Abronia*, garden annuals; *Bougainvillea*, greenhouse shrubs; *Mirabilis* (Four-o'clock, Marvel of Peru).

68. **Phytolaccaceæ** (from the genus *Phytolacca*, derived from the Greek meaning *plant* and *lac*, in reference to the red juice of the fruit). **POKEWEED FAMILY.** Fig. 19. Herbs, shrubs, or trees: leaves mostly alternate, simple: flowers bisexual, rarely unisexual, regular; perianth of one series, divisions 4-5, separate, persistent, not modified in fruit; stamens of the same number as the parts of the perianth and alternate with them, or more numerous, often connate at base, hypogynous; disk obscure or annular; ovary usually superior, rarely inferior; carpels 1 to many, free, or united into a several-celled ovary; ovules 1 for each carpel; styles as many as the carpels: fruit a berry, utricle, nut, or samara; embryo curved.

The pokeweed family contains 22 genera and about 100 species, mostly of tropical and subtropical America and South Africa. One species reaches the eastern United States. All the genera are small. The family is related to the *Aizoaceæ*; also to the *Caryophyllaceæ*, *Chenopodiaceæ*, *Nyctaginaceæ*, and other families with curved embryos. The several 1-seeded carpels and non-acrescent perianth are usually distinctive.

The red juice of the fruit of *Phytolacca decandra* was used by the American Indians for staining baskets, and the like. The roots of this plant are medicinal (emetic, cathartic), and the young shoots are eaten.

A few genera are in cultivation in America. Among these are *Phytolacca* (Pokeberry, Pokeweed, Scoke, Garget, Pigeonberry, Inkberry), native, hardy, rarely cultivated as a pot-herb; and *Rivina* (Rough Plant), ornamental garden and greenhouse plants.

69. **Aizoaceæ** (from the genus *Aizoon*, derived from the Greek meaning *always alive*, in reference to the persistence of life in desert habitats). **CARPET-WEED or ICE-PLANT FAMILY.** Fig. 19. Erect or prostrate, often fleshy herbs or sub-shrubs, either the stem or the leaves, or both, curiously modified to reduce surface and store water; rarely ordinary herbaceous plants: leaves opposite, alternate or whorled, simple and mostly entire; flowers bisexual, regular, hypogynous or epigynous; perianth of one set of 4-5 separate or united parts; stamens 5, alternating with the perianth parts, or by the splitting up of each becoming very numerous, in which case many of the outer are changed into long, showy, petaloid staminodia, the whole then somewhat resembling the head of an aster; ovary 2-20-celled, superior or inferior; placenta axilal, basal, or parietal; ovules mostly numerous; stigmas 2-20: fruit capsular or nut-like; embryo curved or annular.

Eighteen genera and about 500 species are known, of which 300 belong to the genus *Mesembryanthemum*; mostly inhabitants of the desert or, at least, dry portions of tropical and south-tropical regions. The large

genus, *Mesembryanthemum*, is almost exclusively South African, but reaches the Mediterranean. One species of *Aizoaceæ* (*Sesuvium*) is native in the eastern United States. The family is related through some genera to the *Phytolaccaceæ*; through others to the *Caryophyllaceæ* and *Portulacaceæ*. The annular embryo places the *Aizoaceæ* in this group. The apetalous, often falsely polypetalous, flowers, with several-celled ovary, and curved embryo, are characteristic.

The fruits of *Mesembryanthemum edule* (Hottentot fig) are edible. The leaves of *Mesembryanthemum* are used as a vegetable on the borders of the African desert. *Tetragonia expansa* (New Zealand spinach) is cultivated as a pot-herb. *Mesembryanthemum crystallinum* (ice-plant) of the Mediterranean region, with leaves covered with peculiar vesicular hairs filled with a viscid liquid, which sparkles in the sunlight like frost, is cultivated as a curiosity. Other species are cultivated for their strange appearance.

Many species of *Mesembryanthemum* (Fig. Mari-gold, and Ice-plant) are more or less cultivated in America; also one species of *Tetragonia* (New Zealand Spinach, New Zealand Ice-plant).

70. **Portulacaceæ** (from the genus *Portulaca*, an old Latin name of unknown origin). **PURSLANE FAMILY.** Fig. 19. Herbaceous or suffruticose: leaves often fleshy, sometimes connate: flowers bisexual, usually regular; sepals 2; petals 4-5, rarely more, sometimes connate at the base, fugaceous; stamens in 1 or 2 whorls, hypogynous (except in *Portulaca*), equal in number to the petals and opposite them, or double the number and alternating with them, or fewer, or, by multiplication, very many; ovary 1-celled, with a free-central or basal placenta; ovules 2 to many; style 2-3-parted: fruit a capsule, opening by a valve or lid, rarely indehiscent; embryo curved or annular.

Most of the 17 genera and about 150 species are inhabitants of the warmer, dry or arid regions, for which their fleshy structure and frequently prostrate or caespitose habit are an adaptation. They are most abundant in South America and the Cape of Good Hope; also common in western North America. The *Portulacaceæ* are most closely related to the *Caryophyllaceæ* and *Aizoaceæ*. The 2 sepals, 1-celled ovary with central placenta, several styles, and curved or coiled embryo are distinctive. In the common purslane and a few other species, the capsule opens by a terminal lid, which, separating along a transverse line, falls off and thus allows the seeds to escape. In *Portulaca* the ovary is partly inferior.

Most of the *Portulacaceæ* are mucilaginous; some are slightly bitter and have been used as a mild tonic. The herbage of *Portulaca oleracea* is eaten as a salad or as greens, and is also said to be sedative and an antidote for scurvy. Several species of *Calandrinia*, *Talinum* and *Claytonia*, are used as pot-herbs. The roots of *Claytonia tuberosa* of Siberia are edible, as are also the roots of the western *Lewisia*.

About one-third of the genera are in cultivation in America. *Portulaca grandiflora* (Rose Moss) is ornamental; *P. oleracea* (Purslane or Pusley) is a pot-herb; the *Montias* are also pot-herbs. *Lewisia*, *Talinum*, *Spraguea* and *Claytonia* are mostly ornamental.

71. **Basellaceæ** (from the genus *Basella*, the Malabar name of the plant). **BASELLA FAMILY.** Fig. 20. Climbing, perennial herbs, rarely slightly woody: leaves alternate, broad, often fleshy: flowers bisexual, regular, 2 bracteolate; sepals 2; petals 5, separate or connate, imbricated, persistent; stamens 5, opposite the petals and attached to their base; ovary superior, 1-celled; ovule 1, basal, curved; style and stigma 1-3: fruit indehiscent, inclosed in the corolla; embryo spiral.

There are 5 genera and about 15 species, all except one species being confined to tropical America, mostly in the Andes. *Boussingaultia*, the largest genus, contains 10 species. The family is related to the *Cheno-*



podaceæ with which it has been united; also to the Polygonaceæ and Portulacaceæ. The twining stem, and the two sets of floral envelopes, together with the 1-celled ovary and single seed, are distinctive.

*Basella alba* (red and white spinach) is eaten as a pot-herb. The starchy root of *Ullucus tuberosus* is eaten in Peru. It is used as a substitute for the potato, which it resembles.

The genera apparently in cultivation in America are: Anredera; *Basella* (Malabar Nightshade), grown as ornamental greenhouse plants, or eaten as spinach; and *Boussingaultia* (Madeira Vine, Mignonette Vine), ornamental garden or greenhouse plants.

72. **Caryophyllaceæ** (from the genus *Caryophyllus*, an old botanical name for the clove pink [*Dianthus*], the application of the name obscure). PINK FAMILY. Fig. 20. Herbs, rarely suffrutescent, with opposite entire leaves; flowers bisexual, rarely unisexual, regular; sepals 5, separate or united; petals 5, rarely wanting; stamens twice as many as the petals, rarely fewer, hypogynous or perigynous; carpels 3-5; ovary superior, 1-celled with a free-central or basal placenta; ovules 1 to many; styles 3-5; fruit a capsule, rarely a berry, opening by valves or indehiscent; seed albuminous; embryo strongly curved or coiled.

The pink family consists of 70 genera and from 1,200-1,500 species, distributed over all parts of the earth, though most abundant in the temperate and sub-

night-flying moths. The bracts at the base of the flower in *Dianthus* are distinctive. The petals of chickweed are curiously 2-parted, simulating 10 petals.

The Caryophyllaceæ are of little economic importance. Some were formerly used in medicine, but have fallen into disrepute. The roots of *Saponaria officinalis* contain a saponaceous substance, saponin, and have been used for washing, whence the common name "soapwort." Saponin is a powerful local irritant, and, if applied strong, is said to kill either muscular or nervous tissue. *Spergula arvensis* has been used as a fodder plant. Many members of the family are well-known ornamental plants, of which the most famous is *Dianthus Caryophyllus*, the carnation pink.

Perhaps 20 genera (including Illecebraceæ) are grown, mostly for ornament. Among these are: *Arenaria* (Sandwort); *Cerastium* (Mouse-ear Chickweed); *Dianthus* (Carnation, Clove Pink, China Pink, Plum Pink, Sweet William, Picotee, Grenadine); *Gypsophila* (Baby's Breath); *Lychnis* (Ragged Robin, Maltese Cross, Dusty Miller); *Paronychia* (Whitlow-wort); *Sagina* (Pearl-wort); *Saponaria* (Bouncing Bet, Soapwort, Cow Herb); *Silene* (Catchfly, Campion, Wild Pink); *Spergula* (Spurry); *Stellaria* (Chickweed, Starwort); *Tunica*.

#### Order 34. RANALES

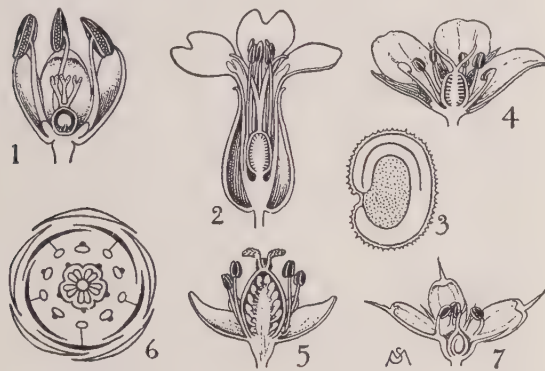
73. **Nymphæaceæ** (from the genus *Nymphæa*, a name intended for the white water-lilies; dedicated by the Greeks to the water nymphs). WATER-LILY FAMILY. Fig. 21. Aquatic herbs; leaves alternate; flowers usually bisexual, regular, the organs, in part at least, spirally arranged; sepals mostly 4, rarely 3, 5, 6, or 12; petals 3-many, usually very numerous, hypogynous, or more or less epigynous, often a distinct transition to the stamens; stamens very numerous (rarely 6), inserted with the petals; carpels rarely 3-4, usually many, rarely distinct, usually cohering in a whorl or sunken in the enlarged receptacle; stigmas radially arranged on a sessile disk (as in poppy) or single; fruit indehiscent or irregularly dehiscent, usually fleshy; seeds several.

*Nymphæaceæ* has 8 genera and about 60 species, distributed in all parts of the world, but more especially in tropical South America. The family is closely related to the other families with spiral structure of the flower, as the Ranunculaceæ, Magnoliaceæ and Dilleniaceæ. There is also a relation to *Podophyllum* of the Berberidaceæ, and to the *Papaveraceæ*. The habit, spiral arrangement of floral parts, when present, the numerous stamens, the usually coherent carpels, and the type of fruit, are characteristic.

The leaves of *Nelumbo* are raised on long petioles, those of *Nymphæa* usually float, those of *Brasenia* are covered with a thick layer of slime, those of *Victoria regia* are 5-8 feet in diameter and floating. The receptacle of *Nelumbo* in fruit is like an inverted top with the ripe 1-seeded carpels loosely rattling in small cavities on the flat surface. The *Nymphæaceæ* in stem-structure and character of the embryo shows a transition to the monocotyledons.

Because of their unique appearance among plants, some species were venerated by the ancients. The lotus of the Egyptians, represented on their monuments and statues of their gods 5,000 years ago, was *Nymphæa cærulea* or *N. Lotus*, though *Nelumbo nucifera* has long passed under that name. (See article on *Nymphæa*.) The rootstocks of the *Nymphæaceæ* contain abundant starch, mucilage and sugar, which render them nutritive. The seeds are edible and the negroes of the Nile used them as millet. The Egyptians still eat the seeds and rootstocks. The seeds and rootstocks of *Euryale ferox* are cultivated and eaten in China.

In the American trade a few genera appear. *Cabomba* (Fish-Grass), with dissected submerged leaves and



20. **BASSELLACEÆ**: 1. *Boussingaultia*, flower calyx removed. **CARYOPHYLLACEÆ**: 2. *Silene*, flower. 3. *Agrostemma* (*Lychnis*), seed. 4. *Arenaria*, flower. 5. *Sagina*, flower. 6. *Spergula*, floral diagram. 7. *Paronychia*, flower.

arctic zone. Many have become weeds in cultivated ground and are now very widely dispersed. The Caryophyllaceæ are related to the Chenopodiaceæ, Amarantaceæ, Phytolaccaceæ, Portulacaceæ, Nyctaginaceæ and Aizoaceæ, all of which have a coiled, curved or annular embryo. Of these, the Phytolaccaceæ probably represent more nearly the ancestral type. By most recent authors (see Pax) the Illecebraceæ (*Paronychia*, *Anychia*, *Scleranthus* and *Herniaria*) are included in the Caryophyllaceæ. The curved embryo, the 1-celled ovary with several styles and central placenta, the 10 stamens, the 5 separate petals and the opposite entire leaves are together distinctive.

The family is very naturally divided into two distinct tribes: **Tribe I. Silenoideæ**.—Sepals united forming a tubular calyx; stamens hypogynous. This includes *Silene*, *Lychnis*, *Dianthus*, *Tunica*, *Saponaria* and *Gypsophila*.

**Tribe II. Alsinoideæ**.—Sepals separate; stamens mostly perigynous. Includes *Spergula*, *Cerastium*, *Stellaria*, *Arenaria*, *Sagina*, *Paronychia*, *Anychia*, *Herniaria* and *Scleranthus*.

In the Silenoideæ, the long-clawed petals often have a scale at the top, the five together forming a tiny crown. Some species of *Silene* and *Lychnis* flower only at night or in cloudy weather, and are pollinated by

white flowers, is grown in aquaria; *Brasenia* (Water Shield) is grown in aquatic gardens, as are also various species of *Nuphar* (Yellow Water-Lily, Spatterdock, Cow Lily); *Nymphaea* (White Pond-Lily); *Nelumbo* (Indian Lotus, so-called Egyptian Lotus, and Water Chinquapin); *Victoria regia*; and the similar *Euryale ferox*. The white water-lilies have latterly been called *Castalia*, but the name *Nymphaea* as applied to them has good historical standing and is retained in this work; *Nuphar* is still held for the yellow pond-lilies.

74. **Trochodendraceæ** (from the genus *Trochodendron*, from the Greek *wheel*, plus *tree*). **TROCHODENDRON FAMILY.** Trees or shrubs: leaves alternate or opposite, with oil-glands: flowers bisexual or unisexual,

many, or 0, often in the form of honeyglands; stamens usually very numerous, hypogynous; carpels 1 to many, usually separate: fruit an achene or follicle, rarely a capsule or a berry; seeds with endosperm.

The 27 genera and about 680 species are distributed mainly in the north temperate and subarctic regions. *Clematis*, *Anemone* and *Delphinium* cross the equator southward. The largest genus is *Ranunculus*. The family is related to the *Magnoliaceæ*, *Annonaceæ*, *Dilleniaceæ*, *Nymphaeaceæ*, and other families with acyclic flowers and numerous carpels. The spiral floral structure, the numerous hypogynous stamens, and the usually separate carpels are the most distinctive characteristics. The *Ranunculaceæ* is probably a very old family, and by some authors is thought to represent more closely than others the stock from which the dicotyledons have sprung.

The floral structure is very interesting and very variable. The petals, when not wanting, are rarely normal. In one series a transition is shown from the staminode-like nectary of *Coptis* to the petal-like nectary of *Ranunculus*; in another series the nectar-bearing petals are spurred or variously irregular, as in *Aconitum*, *Delphinium* and *Aquilegia*. In the last two genera, the flowers also have become extremely irregular. The fruits show an equally great diversity. From the primitive follicular type, they have become modified into achenes with a suspended or erect ovule, into a berry, or, in *Nigella*, even into a several-celled capsule by the fusion of the carpels. The wind-pollinated *Thalictrum* shows great reduction and modification on that account. The stalked carpels of *Coptis* simulate an umbel of separate fruits. Finally the foliage of several species of *Ranunculus* has become very much dissected on account of the aquatic habit, and the plants, therefore, simulate a *Myriophyllum*.

The *Ranunculaceæ* is divided by Prantl into three tribes as follows:

**Tribe I.** Fruit follicular, carpels fleshy, outer seed-coat long, e.g. *Pæonia* and *Hydrastis*.

**Tribe II.** Fruit usually follicular, carpels rarely fleshy, outer seed-coat not longer than the inner, e.g., *Caltha*, *Helleborus*, *Coptis*, *Actæa*, *Aquilegia*, *Delphinium*, etc.

**Tribe III.** Fruit an achene, e.g., *Anemone*, *Clematis*, *Ranunculus*, *Thalictrum*, etc.

The family contains many plants useful to mankind. Many are cultivated for their ornamental flowers. The seeds, leaves and roots contain a bitter acid principle which is very irritating and in many cases poisonous. Because of this, many species of *Anemone*, *Clematis*, and so on, have been used to produce blisters, and beggars are said to have made use of *C. Vitalba* to produce artificial sores and thus excite pity. The roots of *Coptis* (gold-thread) are bright yellow, and have been used both as bitters and for the dye-stuffs contained. *Hydrastis* (golden seal) is a well-known tonic and stomach corrective. *Aconite* is a powerful narcotic drug much used to allay fever. Slow cooking usually dissipates the poisonous properties of the *Ranunculaceæ*, thus enabling the vegetative portion in many cases to be eaten as greens. *Ranunculus Thora* and *R. sceleratus* were named by the Romans "sardonian" because they are said to excite convulsive sardonic laughter.

Two dozen or more genera are in cultivation in America, almost entirely for ornamental purposes. Among these are: *Aconitum* (Aconite, Monkshood, Wolfsbane); *Actæa* (Baneberry, Red and White Cowhose); *Adonis* (Pheasant's Eye, Adonis); *Anemone* (Anemone, Windflower, Patens, Pasque Flower); *Aquilegia* (Columbine); *Caltha* (Marsh Marigold, American Cowslip); *Clematis* (Virgin's Bower); *Coptis* (Gold-thread); *Delphinium* (Larkspur); *Eranthis* (Winter Aconite); *Helleborus* (Christmas Rose); *Hydrastis* (Golden Seal, Orange Root); *Nigella* (Love-in-a-Mist, Devil-in-a-Bush, Fennel Flower); *Pæonia* (Peony, Piney);



21. **NYMPHÆACEÆ:** 1. *Nelumbium*, fruit. 2. *Nymphaea*, flower. 3. *Nuphar*, fruit. **RANUNCULACEÆ:** 4. *Ranunculus*, a, flower; b, fruit. 5. *Aquilegia*, fruit. 6. *Clematis*, fruit. 7. Petals of various genera, a, *Coptis*; b, *Eranthis*; c, *Ranunculus*; d, *Aquilegia*; e, *Aconitum*.

regular, hypogynous or perigynous; sepals and petals wanting; stamens numerous, spirally arranged; carpels separate, sometimes half immersed in the receptacle, 2 to many in one whorl; ovules 1 to many: fruit a follicle, or indehiscent.

Only 3 genera and 6 species are known, all of Eastern Asia. The family is closely related to the *Magnoliaceæ*, in which it has been included by many authors. It has the same spiral structure of the flower, and separate carpels, but the perianth is wanting.

*Trochodendron* is one of the very few angiosperms in which the secondary wood is made up entirely of tracheids with bordered pits, without true vessels, as in the *Coniferæ*.

The family is of little economic value. The wood of some species is used locally. In America, *Cercidiphyllum japonicum* and *Euptelea polyandra* are in cultivation as hardy, ornamental woody plants.

75. **Ranunculaceæ** (from the genus *Ranunculus*, from the Latin signifying a little frog, because many of these plants are aquatic or marsh plants). **BUTTERCUP FAMILY.** Fig. 21. Herbs or shrubs of diverse habit: flowers bisexual rarely unisexual, spirally constructed except often the perianth, regular or irregular; sepals 3 to many, usually 5, separate, often petaloid; petals 3 to



*Ranunculus* (Buttercup, Crowfoot); *Thalictrum* (Meadow Rue); *Trautvetteria* (False Bugbane); *Trollius* (Globe Flower); *Xanthorrhiza* (Shrub Yellow Root).

A considerable industry has recently sprung into existence in which *Hydrastis* is grown for the medicinal value of the roots.

76. **Lardizabalaceæ** (from the genus *Lardizabala*, named in honor of a Spanish naturalist, Lardizabala y Uribe). **LARDIZABALA FAMILY.** Mostly twining plants with palmately compound leaves; flowers polygamous or unisexual, rudiments of the other sex organs present, regular, hypogynous; sepals 6; petaloid, in two whorls, petals none; stamens 6, hypogynous; usually with nectaries between stamens and petals; carpels 3, rarely 6-9 or numerous, separate; ovules many rarely one, parietal; fruiting carpels baccate, indehiscent or dehiscent.

This family has 8 genera and 18 species, inhabitants of the Himalayas, China, Japan, and Chile. The family is related to the Berberidaceæ, with which it was formerly united, and to the Menispermaceæ, from both of which it is distinguished by the several-seeded fruit and by other characters.

The fruits of most species are edible. The stems of *Boquila* and *Lardizabala* are used as cordage.

*Lardizabala*, *Stauntonia*, *Akebia* and *Sargentodoxa* are in the American trade.

77. **Berberidaceæ** (from the genus *Berberis*, derived from Berberys which is the Arabic name of the fruit). **BARBERRY FAMILY.** Fig. 22. Herbs or shrubs with large, compound leaves, or small and simple, or spine-like leaves; flowers bisexual, regular, hypogynous; sepals 3-9 in 1-3 series; petals 4-9 or more, in several whorls, often changed to nectaries; stamens as many as the petals and opposite them, rarely twice as many; anthers peculiar, opening by valves which roll upward; ovary 1-celled with several ovules; style almost 0; stigma mostly peltate; fruit a berry or capsule.

The family Berberidaceæ has 8 genera and about 200 species, distributed through north temperate Europe, Asia and America. *Berberis* extends along the Andes to the Straits of Magellan. Fossil species in the Tertiary are known. The family is related to the Ranunculaceæ, Papaveraceæ and Fumariaceæ. There is also an evident relation to the Magnoliaceæ and Annonaceæ. The cyclic flowers, definite stamens opposite the petals, the solitary carpel, and usually the dehiscence of the anthers are distinctive. In *Podophyllum*, the anthers open longitudinally in the ordinary way, and the stamens are twice the number of the petals. The stamens of *Berberis* are irritable, flying toward the stigma when touched, and then scattering the pollen.

The fruit of the common barberry (*Berberis vulgaris*) contains oxalic acid and is used as a preserve; the yellow inner bark and stems are astringent and yield the yellow "berberine," which is also a purgative. This yellow color formerly induced doctors to administer *Berberis* for jaundice. The fruits of the mahonias of California are also eaten as a preserve. The wood of the Indian and South American species of *Berberis* is used as a dye. The root of *Podophyllum* (mandrake or May apple) is purgative and poisonous; the ripe fruit of this plant is fleshy and edible. Many other species have been used for medicine in various parts of the world. *Berberis vulgaris* is the famous host-plant of the æcidial stage of the wheat rust.

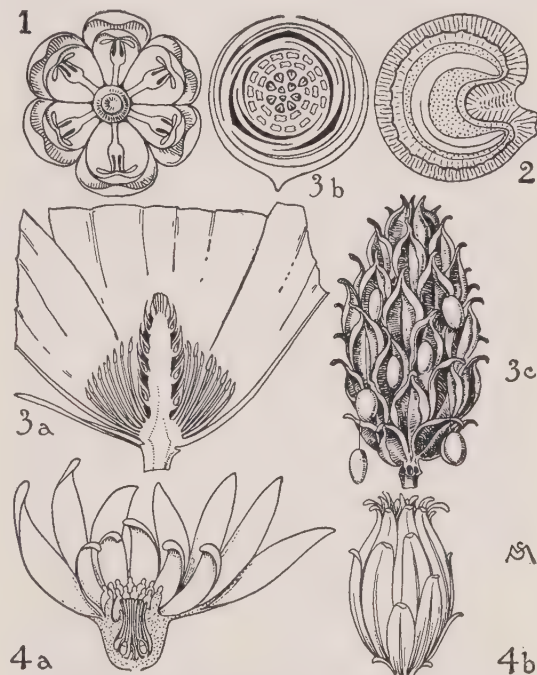
The genera that are in the American trade are mostly grown as unusual herbaceous plants in gardens and are not widely known. Many species of the shrubby and spiny *Berberis*, and also of *Mahonia*, are grown for ornamental purposes. *Akebia*, a well-known woody twiner with palmate leaves and curious purple flowers, is now placed in the Lardizabalaceæ.

78. **Menispermaceæ** (from the genus *Menispermum*, derived from the Greek meaning moonseed). **MOON-**

**SEED FAMILY.** Fig. 22. Woody climbers; leaves alternate; flowers dicecious, regular; sepals usually 6, in 2 series; petals 6, in 2 series; stamens 6, hypogynous, opposite the petals, sometimes monadelphous; carpels usually 3, rarely more, separate, 1-ovuled, much curved in fruit; seed half-inverted; embryo usually curved; fruit compound of sessile or stipitate drupelets.

There are 56 genera and 150 species, distributed mostly in the tropical and subtropical portions of both hemispheres. None are found in Europe. Three species are native in the northeastern United States. The Menispermaceæ are related to the Berberidaceæ, the Annonaceæ and the Magnoliaceæ. The numerical plan of 3, the 2 whorls of sepals and petals, the curved seed, the drupelets, and the absence of oil-glands, are distinctive. Cross-sections of the twining stems often present peculiar patterns due to the unequal growth of the cambium.

Several species are used in medicine. *Jateorhiza palmatus* of tropical Africa has a turnip-shaped root which was much used as a tonic. The roots of species of *Cissampelos* are administered in Brazil in cases of snake-bites. The bark of several species yields a yellow dye. *Anamirta Cocculus* of tropical Asia has extremely poisonous fruits (fish-berries or cocculus) used to intoxicate and poison fish which are thus obtained in abundance, but are sometimes dangerous to eat. The narcotic principle, picrotoxine, is almost as poisonous as strychnine. In England, beer is said sometimes to



22. **BERBERIDACEÆ:** 1. *Berberis*, flower. **MENISPERMACEÆ:** 2. *Menispermum*, fruit. **MAGNOLIACEÆ:** 3. *Magnolia*; a, flower; b, floral diagram; c, fruit. **CALYCANTHACEÆ:** 4. *Calycanthus*; a, flower; b, fruit.

be adulterated with the fruit (called cocculus indicus) of this plant.

Few genera are in cultivation in America for ornamental purposes, mostly in the southern states, and especially Florida: *Cissampelos* (Velvet Leaf or Pareira Brava), tonic and diuretic, in Florida; *Menispermum* (Moonseed Vine, from the curved fruit), hardy, native; *Cocculus carolinus* of the southeastern United States, semi-hardy; *C. triloba*, E. Asia, hardy.

79. **Magnoliaceæ** (from the genus *Magnolia*, which was dedicated to P. Magnol, a professor of Botany at

Montpellier in the 17th century.) **MAGNOLIA FAMILY.** Fig. 22. Woody plants with alternate, entire or lobed leaves, and usually large stipules, each pair of which forms a hood over the young growth above, the outer pair of stipules serving as bud-scales, and each pair leaving a scar which completely encircles the stem: flowers usually bisexual, regular, hypogynous, the parts spirally arranged except sometimes the sepals and petals; sepals 3; petals 6 to many, separate; stamens very numerous; carpels usually many and usually separate; ovary 1-celled, 1- to several-seeded, arranged spirally or in a whorl (*Illicium*) at the top of the receptacle: fruit a follicle, or samara, or indehiscent and fleshy.

Ten genera and about 80 species are distributed principally in the subtropical and temperate portions of Asia and America, but are absent in Africa, Europe and the arctic regions. The Magnoliaceae are most closely related to the Annonaceae and Calycanthaceae. The peculiar stipules, the spiral structure of the hypogynous flower, and the separate carpels are distinctive. In *Magnolia*, the outer seed-coat is fleshy and red; when ripe the seeds fall out but remain suspended by the uncoiled spiral vessels of the raphe and funiculus.

The wood is generally valuable for timber, while all parts, such as leaves and bark, contain a bitter resin, which in some species is fragrantly aromatic. *Michelia Champaca* is cultivated in tropical Asia for its sweet flowers which are carried about as a perfumery. Its aromatic and acrid bark and buds are used in rheumatism. The bark of *Talauma elegans* is used in Java as a stomachic. The seeds of *Magnolia Yulan* have been used from prehistoric times in China as a febrifuge. It is said that the aromatic bark of the tulip tree is a substitute for cascarilla and quinine. *Drimys Winteri* has long been used as a stimulant in Central and South America, and, by importation, in Europe. The fruit of *Illicium verum*, a Chinese shrub, is very pleasantly aromatic, resembling anise, from which, and its remarkable star-like whorled carpels, it is called "star anise." It is much used as a condiment in oriental countries. The bark of *Illicium anisatum* (*I. religiosum*) was formerly burned as incense in the temples of Japan. For a long period the name *Illicium anisatum* was thought to apply to the star anise, but this mistake was rectified in the B.M. 7005. *Liriodendron Tulipifera* furnishes the valuable "whitewood" or "yellow poplar" of commerce. The wood of various species of *Magnolia* is used in cabinet-work.

Several genera are in cultivation in America, all except *Illicium* as ornamental trees and shrubs. Among these are: *Illicium* (Star Anise); *Liriodendron* (Tulip Tree); *Magnolia* (*Magnolia*, White Bay, Beam Tree, Cucumber Tree); and *Schizandra*, a procumbent warty shrub.

**80. Calycanthaceae** (from the genus *Calycanthus*, derived from the Greek, which means a *cup* and *flower*, referring to the peculiar receptacle). **CALYCANTHUS FAMILY.** Fig. 22. Shrubs with opposite leaves and aromatic bark: flowers bisexual, regular, perigynous, spirally constructed; parts of the perianth numerous, petaloid, not clearly differentiated into calyx and corolla; stamens 10-30 (5 in *Meratia*); carpels numerous, separate, inserted on the inner face of the hollow receptacle, each 1-2-ovuled, in fruit forming 1-seeded achenes, which are completely inclosed by the fleshy receptacle; seeds, exalbuminous; cotyledons spirally rolled.

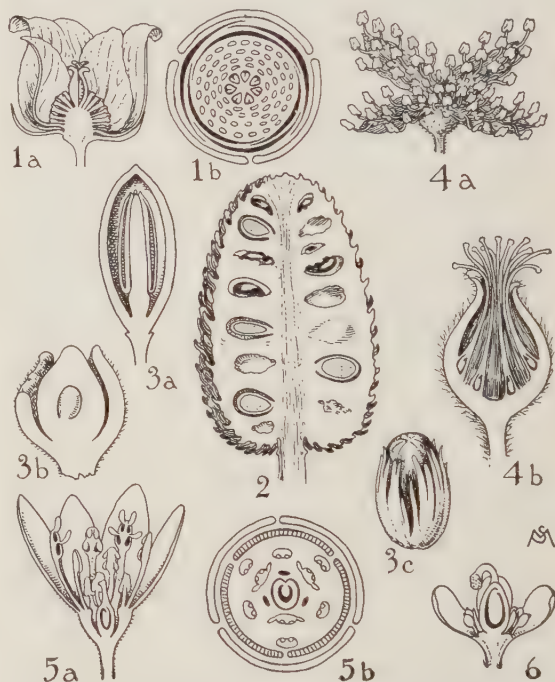
*Calycanthus*, with 4-6 species, is confined to the southern United States and California; *Meratia* has two species in China and Japan. The family is related to the Magnoliaceae and the Annonaceae in the spiral structure of the flowers, but differs in the exalbuminous seed, the perigynous flowers and the opposite leaves. By some authors the family has been placed near the Rosaceae because of the perigynous flowers, but the spiral arrangement is not that of this latter family. The aromatic bark, the magnolia-like flowers, and the peculiar rose-like fruits are distinctive.

The bark of *Calycanthus floridus* is used in America as a tonic under the name Carolina allspice.

All the species are in cultivation in the northern United States as ornamental shrubs.

**81. Annonaceae** (from the genus *Annona*, which is from Menona, its Banda name). **CUSTARD-APPLE FAMILY.** Fig. 23. Trees or shrubs, with simple and entire alternate leaves: flowers usually bisexual, regular, hypogynous; sepals 3; petals usually 6, commonly valvate, rarely imbricated; stamens spirally arranged; numerous; carpels usually numerous and separate (united in *Monodora*), 1- to several-ovuled: fruit berry-like, rarely capsular, often constricted between the seeds.

From 500-600 species in 46 genera are found mostly in the tropical regions of Asia, Africa and America, the majority occurring in the Old World. Only



23. ANNONACEAE: 1. *Asimina*; a, flower; b, floral diagram. 2. *Annona*, fruit. MYRISTICACEAE: 3. *Myristica*; a, male flower; b, female flower; c, seed with arillus. MONIMIACEAE: 4. *Monimia*; a, male flower; b, female flower. LAURACEAE: 5. *Cinnamomum*; a, flower; b, floral diagram. 6. *Benzoin*, female flower.

the genus *Asimina* is extra-tropical in Atlantic North America and in Australia. The family is most closely related to the Magnoliaceae; but also to the Myristicaceae, Menispermaceae, Calycanthaceae and Dilleniaceae. The plan of 3 in calyx and corolla, the numerous spiral stamens, the usually separate carpels, the berry-like fruit and ruminant endosperm are distinctive. There is great structural diversity in the family.

The Annonaceae is rich in useful plants. The Malaysians use the bark of several species for rheumatic pains, and the fruit of others as a stomachic. With the flowers of *Uvaria* they prepare an ointment to ward off fevers. European women in India formerly used the scented flowers of this plant in hair-oil. Many species of *Annona* and *Asimina* produce edible fruit, as for example, the sweet-sop (*Annona squamosa*), the sour-sop (*Annona muricata*), the custard-apple (*Annona reticulata*), and the northern papaw (*Asimina triloba*).

A few genera are in cultivation in America, mostly in Florida and southern California: *Annona*, cultivated



for the fruit; Asimina, ornamental, in the North; Artabotrys, climbing, ornamental, sweet-scented, used for perfume; Duguetia, cultivated for the fruit in Florida.

82. **Myristicaceæ** (from the genus *Myristica*, meaning an *anointing medium*, in reference to the fragrant fruit). NUTMEG FAMILY. Fig. 23. Trees or shrubs: leaves alternate, coriaceous, entire: flowers dioecious, regular, small; perianth of one series, the 3 parts connate, 3-lobed; stamens 3-18, monadelphous; carpel 1, superior; ovary 1-celled; ovule 1; stigma sessile, entire or lobed: fruit a fleshy capsule; seed with a fleshy, lacinate aril.

The family contains 1 genus and about 80 species, of tropical distribution, principally in tropical Asia. The family is most closely related to the Annonaceæ. The dioecious flowers with only one set of floral envelopes, and that consisting of 3 parts, the monadelphous stamens, the 1-celled, 1-ovuled ovary and the aril are distinctive.

All parts of Myristicaceæ contain a fragrant oil, which, however, is most abundant in the fruit. The seeds of *Myristica fragrans*, of the Moluccas, furnish the well-known nutmeg, used as a condiment. The aril of the same fruit is mace. The fruits of other species are also sparingly used as condiments.

*Myristica fragrans* is cultivated and naturalized in the West Indies.

83. **Monimiaceæ** (from the genus *Monimia*, named for the wife of Myrthidates). MONIMIA FAMILY. Fig. 23. Trees or shrubs with aromatic glands: leaves opposite or whorled, rarely alternate: flowers usually bisexual, regular, perigynous, the more or less cup-shaped receptacle conspicuous, variously formed; perianth of 1 or 2 whorls, inconspicuous; stamens numerous, rarely few, scattered over the inner face of the receptacle; anthers often opening by uplifting valves; carpels numerous, all separate, also scattered over the receptacular cup; ovaries 1-ovuled; style and stigma 1 for each carpel: fruit an achene or drupe, borne on the receptacle and sessile or pedicelled, or immersed in the fleshy often urn-shaped receptacle which becomes part of an aggregate accessory fruit and frequently completely incloses the achenes.

Contained in this family are 31 genera and about 150 species, of tropical and subtropical distribution, principally of the South Sea Islands and Australia; some, however, reach South America, Africa, and other countries. The largest genus is *Siparuna*, containing 60 species. The family is related to the Calycanthaceæ, as is plainly evident in the fruit. The usually enlarged receptacle, the peculiar fruit, and the 1-seeded carpels are distinctive.

The Monimiaceæ have stimulating properties. *Peumus* leaves are used to promote digestion, like tea and coffee. The fruits of this plant are edible, as are also those of *Laurelia sempervirens*. The wood of *Atherosperma moschatum* is much sought for ship-building; the bark is a substitute for tea.

*Peumus* (Chilean Boldo) is advertised in California; valuable for its timber, edible fruits, and ornamental qualities.

84. **Lauraceæ** (from the genus *Laurus*, the old Latin name). LAUREL FAMILY. Fig. 23. Trees or shrubs with fetid or aromatic bark: leaves alternate, rarely otherwise, simple, punctate: flowers bisexual or unisexual, regular; parts of the perianth similar, usually 6, in 2 whorls; stamens in 3-4 whorls of 3 each, perigynous or epigynous, some often staminodial and glandular; anthers opening by uplifting valves; ovary superior or very rarely inferior, 1-celled, 1-ovuled; style 1; stigma 2-3-lobed: fruit a berry, drupe, or dry, often seated on a thickened pedicel or inclosed in a hollow receptacle.

The 39 genera and about 900 species inhabit mostly tropical regions, but extend into the temperate regions. Six species are found in the northeastern United States. The largest genera are *Ocotea* with 200 species,

and *Litsea* with 100 species. The family is related to the Monimiaceæ, and stands between that family and the Thymelæaceæ. The undifferentiated perianth, numerous stamens with uplifting valves, and 1-celled, 1-seeded ovary are distinctive.

The Lauraceæ are useful on account of the aromatic oil. The leaves of laurel (*Laurus nobilis*) are used for flavoring and for packing figs. Cinnamon is from the bark of *Cinnamomum zeylanicum*. *Cinnamomum Cassia* yields cassia cinnamon. The bark of the root of *Sassafras varifolium* is the sassafras of commerce. Camphor is obtained by distillation from *Cinnamomum Camphora*. The fruit of *Persea gratissima* is the avocado of South America, eaten by both men and animals. Many fragrant woods are obtained from this family, as, for example: anise wood (*Ocotea cymbarum*), bebeeru wood, greenheart (*Nectandra Rodieri*), or clove-cassia pepper wood (*Dicypellium caryophyllatum*) so named because of the pungency of the dust, Madeira mahogany (*Persea indica*), fetid till (*Ocotea fetens*), sweetwood (*Nectandra exaltata*), and stinkwood (*Ocotea bullata*).

Among the genera in cultivation in this country are: Benzoin (Spice Bush, Benjamin Bush, Wild Allspice, Fever Bush), native, ornamental; *Cinnamomum* or Camphora (Camphor Tree), introduced in Florida and California; *Cinnamomum* (Cinnamon, Cassia Buds), cultivated under glass; *Laurus* (Sweet Bay), ornamental, conservatory; *Persea* (Red Bay, Bull Bay, Avocado), greenhouse and South; Sassafras, native ornamental; and Umbellularia (California Laurel), ornamental, in the South and California.

#### Order 35. RHCEADALES

85. **Papaveraceæ** (from the genus *Papaver*, derivation obscure). POPPY FAMILY. Fig. 24. Annual or perennial herbs, or rarely shrubs, with yellow (*Chelidonium*), white (*Papaver*), or red (*Sanguinaria*), or rarely watery (*Eschscholtzia*) juice: leaves usually alternate, often crenately toothed or lobed or divided: flowers bisexual, regular; sepals 2, rarely 3; petals 4, rarely 6 or more, rarely wanting; stamens numerous in many whorls, hypogynous; carpels 1 to many, connate into a 1-celled ovary, with the parietal placentæ as many as the stigmas; ovules 1 to many; styles as many as the carpels, usually wanting; stigmas distinct, or in a radiate disk, or lobed: fruit capsular or silique; seed albuminous.

The 23 genera and about 80 species are widely distributed in the north temperate zone, but are especially numerous in central and eastern Asia, the Mediterranean region and western North America. One species of poppy is found in the south temperate region in South Africa and Australia. The family is closely related to the Fumariaceæ (which see), with which it is united by many European authors. It is also related to Capparidaceæ and Crucifereæ. There is, on the other hand, an affinity with the Berberidaceæ. The milky juice, numerical plan of 2 or 3 in the perianth, numerous stamens, and 1-celled ovary with parietal placentæ are characteristic.

In *Papaver*, an orbicular disk crowns the ovary on the top of which radiate the numerous stigmatic lines. The capsules open by means of small valves between the placentæ and underneath the disk. The capsule of *Chelidonium* is like a mustard fruit (silique), in being long and slender and the lateral walls springing upward as valves, leaving the placentæ exposed.

Many of the Papaveraceæ are cultivated as ornamental plants. Some poppies are bad weeds in cultivated ground in Europe. *Papaver somniferum*, a native of Asia, furnishes the opium of commerce, which is obtained by incisions made in the capsules. Poppy oil is derived in France from the seeds of *Papaver somniferum*. *Sanguinaria* root is used in medicine as a sedative.

A score of genera are in cultivation in America, all as garden plants. Some of these are: *Bocconia* (Plume Poppy of eastern Asia); *Chelidonium* (Celandine), a weed from Europe; *Dendromecon*, shrubby; *Eschscholtzia* (California Poppy); *Mecynopsis* (Welsh Poppy of western Europe); *Papaver* (Poppy); *Platystemon* (Cream Cups); *Platystigma*; *Sanguinaria* (Bloodroot), native; *Stylophorum* (Celandine Poppy), native.

86. **Fumariaceæ** (from the genus *Fumaria*, which is from the Latin *fumus*, smoke, presumably referring to the nitrous odor of the roots when pulled from the ground). **FUMITORY FAMILY**. Fig. 24. Herbaceous plants with alternate, dissected leaves: flowers bisexual, regular or irregular, hypogynous; sepals 2; petals 4, free or connate, in 2 unlike pairs, outer pair larger, either one or both petals of which are spurred or gibbous, the two inner crested and united over the anthers and stamens; anthers 6, borne on 2 filaments; carpels 2, united; ovary 1-celled, 1- to many-seeded: fruit a silique, vesicular or indehiscent, or transversely jointed; seeds albuminous.

There are 5 genera and 130 species, mostly from the north temperate regions. The family is closely related to the *Papaveraceæ* with which it is often united. The

87. **Cruciferæ** (from the Latin signifying *cross-bearers*, in reference to the cross-like appearance produced by the four petals). **MUSTARD FAMILY**. Fig. 24. Herbs, rarely shrubby: leaves usually alternate, simple, often varying from entire to palmate or pinnatifid within the same genus: flowers bisexual, regular; sepals 4; petals 4, rarely wanting; stamens 6, 4 long and 2 shorter (tetradynamous), rarely fewer, very rarely more, hypogynous; carpels 2, united, ovary superior, 2-, rarely 1-, celled with 2 parietal placentæ at the edges of the septum: fruit a silique (long), or a silicle (short), rarely indehiscent; seeds exalbuminous; the embryo variously curved and folded.

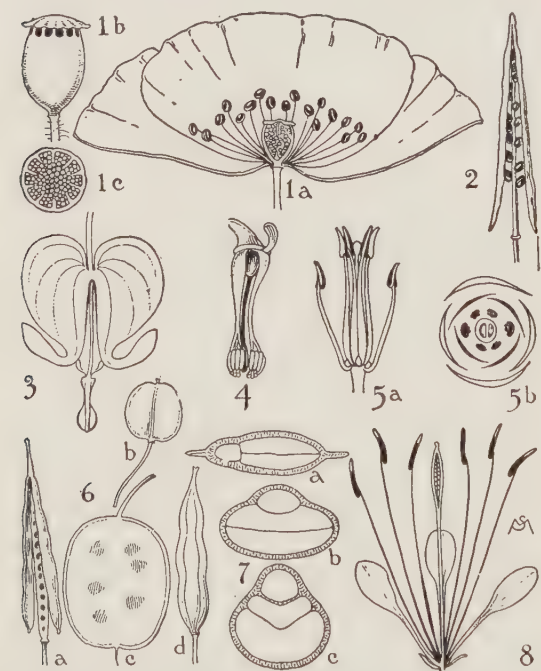
In the family are 208 genera and 1,600 species, distributed throughout the cold and temperate parts of both hemispheres, but especially abundant around the Mediterranean Sea; a few are tropical. The *Cruciferæ* are closely related to the *Capparidaceæ*, *Papaveraceæ*, and *Fumariaceæ*. The 4 sepals, 4 petals, 6 stamens (4 long and 2 short), and the peculiar fruit are distinctive.

The 6 stamens probably represent a reduction from 2 sets of 4 each. In *Lepidium* and other genera, there may be only 2 stamens. The septum of the fruit remains upon the plant when the seeds and valves fall. The siliques are often flattened, either perpendicular or parallel to the partition (in different genera). The embryos in the seed are folded so that the hypocotyl (radicle) and cotyledons lie side by side. Distinct patterns are thus produced which are so constant as to be of great value in the classification within the family. Three principal types are recognized: cotyledons accumbent, when the edges of the cotyledons are applied to the hypocotyl; incumbent, when the back of one cotyledon is applied to the hypocotyl; and conduplicate, when the cotyledons themselves are also folded and enwrap the hypocotyl. In *Leavenworthia*, alone, the embryo is straight.

The flower of *Cruciferæ* is of little value in classification within the family; the important characters are in connection with the fruit and seeds.

Many have become well-known weeds as, for example, charlock (*Brassica arvensis*), shepherd's purse (*Capsella Bursa-pastoris*), pepper grass (*Lepidium*), spring mustard (*Barbarea*), wild radish (*Raphanus Raphanistrum*). Many others are among the well-known old-fashioned ornamental plants of the garden, e.g., rocket (*Hesperis matronalis*), stock or gilliflower (*Matthiola*), wallflower (*Cheiranthus*), honesty (*Lunaria*) with large orbicular flat pods, candytuft (*Iberis*), sweet alyssum (*Alyssum*). Others are used as food, of which *Brassica oleracea*, a very variable species, is the most important, furnishing cabbage, cauliflower, kohlrabi and kale. *Brassica campestris* furnishes the various forms of rutabaga. *Brassica alba* furnishes white mustard, and *Brassica nigra*, black mustard. *Radicula Nasturtium-aquaticum* is water-cress; *Radicula Armoracia* is horse-radish. The rootstocks of *Dentaria* are eaten in America under the name "crinkle root." *Raphanus sativus* is the garden radish; *Lepidium sativum* is garden cress. The various organs of most *Cruciferæ* contain an oily substance which is very pungent to the taste and which gives the peculiar flavor to the various cresses. This oil is abundant in the seeds from which it is extracted (oil of mustard). The foliage of the various maritime *Cruciferæ* have been found a useful article of diet in counteracting scurvy, for which reason the arctic *Cochlearia* is called "scurvy-grass." The leaves of the woad of western Europe (*Isatis tinctoria*) yield a blue dye. *Anastatica Hierochuntica* is the original "rose of Jericho," the branches of which close and open when alternately dried and wetted. (See article on Resurrection Plants.)

88. **Capparidaceæ** (from the genus *Capparis*, the Greek name, from the Arabic *kapar*, capers). **CAPER FAMILY**. Fig. 24. Herbs or rarely shrubs: flowers bisex-



24. **PAPAVERACEÆ**: 1. *Papaver*; a, flower; b and c, fruit. 2. *Chelidonium*, fruit. **FUMARIACEÆ**: 3. *Dicentra*, flower. 4. *Fumaria* flower 1, corolla removed. **CRUCIFERÆ**: 5. Flower; a, perianth removed; b, floral diagram. 6. Fruit; a, *Brassica*; b, *Lepidium*; c, *Lunaria*; d, *Raphanus*. 7. Cross-section seeds of *Cruciferæ*, showing types of embryos; a, accumbent; b, incumbent; c, conduplicate. **CAPPARIDACEÆ**: 8. *Cleome*, flower.

bleeding-heart-like flower, the plan of 2, the 6 anthers on 2 filaments, the 1-celled ovary, and the absence of milky juice are distinctive.

*Fumaria officinalis* and some species of *Corydalis* have been used as medicine, but the family is of little economic importance, except for the few ornamental species.

Following are the genera best known in cultivation: *Adlumia* (Allegheny Vine, Climbing Fumitory), a graceful native garden climber; *Corydalis*, with 1-spurred corolla; *Dicentra* (Bleeding Heart, Squirrel Corn, Dutchman's Breeches), with 2-spurred corolla; and *Fumaria* (Fumitory), with 1-spurred corolla.



ual, more or less irregular; sepals 3-8, usually 4; petals 4-8, rarely 0, hypogynous or perigynous; disk ring-like or scale-like or tubular at the base of the petals; stamens 6, rarely 4 or many; carpels 2 or more; ovary 1- to several-celled, usually raised on an outgrowth (gynophore) of the pedicel-like axis, which may become much elongated in fruit; ovules numerous; style 1 or 0; stigmas 1 to several: fruit a capsule, silique, berry or drupe; embryo usually coiled.

Thirty-four genera and about 350 species occur, mostly of tropical and subtropical distribution. They extend to Australia, the African deserts and into the western and eastern United States. The family is very closely related to the Cruciferae and certain forms are difficult to distinguish from that family. The non-tetradynamous stamens, and commonly 1-celled ovary are distinctive. The gynophore is often very long, slender and conspicuous, and sometimes (Gynandropsis) carries up the stamens along with the pistil. The detailed variation in the flower is very intricate.

Several genera are cultivated as ornamental plants. The acrid oil in the fruit is stimulating, as in the Cruciferae, and for this reason several genera have been used in medicine (Cleome, Polanisia, Capparis, etc). *Capparis spinosa* of the Mediterranean region furnishes the capers of commerce, which are flower-buds preserved in salt and vinegar.

As garden plants, a few genera are in the American trade: Cleome (Bee or Spider Plant), ornamental; Gynandropsis, ornamental; Capparis (Caper Plant), shrubby, grown in this country for ornament as well as for food; and Crataeva, shrubby, grown in southern California.

89. **Resedaceae** (from the genus *Reseda* which is from the Latin, *to calm*, in allusion to supposed quieting properties). MIGNONETTE FAMILY. Herbs or shrubs: leaves usually alternate: flowers mostly bisexual, more or less irregular; calyx persistent, 4-8-parted, irregular; petals 0-8, alternating with the sepals; stamens 3-40, inserted within an irregular fleshy disk; carpels 2-6, free, or united into a 1-celled ovary which is often imperfectly closed at the top; placentae 2-6, parietal; ovules many; styles or sessile stigmas 3-6: fruit usually a dehiscent capsule, rarely a berry, or composed of separate follicles; seeds reniform, without endosperm; embryo curved.

About 45 species and 6 genera occur, mainly distributed about the Mediterranean Sea. This family is allied to the Cruciferae and Capparidaceae, from which it differs principally in general character. The extra-staminal disk, the numerous stamens, the 1-celled ovary or ovaries with parietal placentae, and the usually gaping summit of the ovary are distinctive.

*Reseda luteola* (Dyer's weed) yields a yellow dye which was formerly much used. *R. odorata* (mignonette), a plant cultivated since early times, and whose origin was long considered unknown, although probably Egyptian, is extensively cultivated for the fragrance of its flowers.

90. **Moringaceae** (from the genus *Moringa*, derived from the Malabar name of the plant). MORINGA FAMILY. Trees, with 2-3-pinnate alternate leaves: flowers bisexual, irregular, perigynous; sepals 5, imbricated; petals 5, imbricated, unequal, lower reflexed; stamens 8-10, separate or united at the base, alternate ones shorter or reduced to staminodia; sub-ovarian disk present, lining the cup; ovary borne on a gynophore, 1-celled; placentae 3; ovules numerous; style 1: fruit a silique-like capsule.

There is but one genus, containing 3 species, natives of northeastern Africa and India. The family is distinct, not related closely to any other, perhaps distantly related to the Bignoniaceae, the Capparidaceae, the Violaceae, or the Leguminosae. Provisionally placed by Engler and Prantl between the Poppy group of families and the Rose group.

*Moringa arabica* of Arabia (ben-nut) yields a useful oil which does not become rancid. The root of one species is used in intermittent fevers. A tragacanth-like gum exudes from the bark of *M. oleifera*.

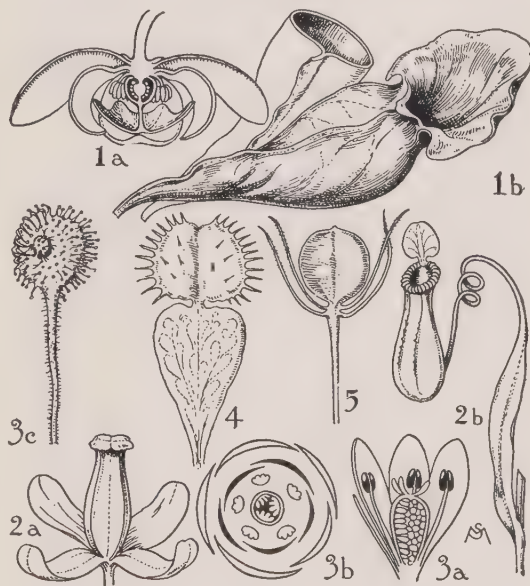
*M. oleifera* (horse-radish tree) is grown sparingly in the southern United States. The fruits and the roots are edible.

#### Order 36. SARRACENIALES

91. **Sarraceniaceae** (from the genus *Sarracenia*, in honor of Dr. Sarracin, an early physician of Quebec, who sent the northern species to Europe). PITCHER-PLANT FAMILY. Fig. 25. Perennial herbs inhabiting bogs: leaves all basal, tubular: scapes 1-flowered; flowers bisexual, regular; sepals 4-5, imbricated; petals 5, hypogynous, or 0; stamens many but not apparently either cyclic or spiral; ovary superior, 3-5, rarely 6-, celled; ovules numerous; style 1; stigmas 1-5: fruit a capsule.

The Sarraceniaceae has 3 genera and 8 species, of which 6 belong to the genus *Sarracenia*; all American. *Heliamphora* is in British Guiana, *Darlingtonia* in California, and *Sarracenia* in Atlantic North America from Newfoundland to Florida. The family is most closely related to the Droseraceae and Nepenthaceae, but also to the Papaveraceae and Nymphaeaceae.

The Sarraceniaceae are far-famed as insectivorous plants. The pitchers are partly filled with a liquid containing a digestive enzyme. Small insects which fall into the liquid, or are attracted by a sugary secretion, and are unable to escape because of various devices, are at length digested and absorbed. Like the sun-



25. SARRACENIACEAE: 1. *Sarracenia*; a, flower; b, leaves. NEPENTHACEAE: 2. *Nepenthes*; a, female flower; b, leaf. DROSERACEAE: 3. *Drosera*; a, flower; b, floral diagram; c, leaf. 4. *Dionaea*, leaf. 5. *Aldrovanda*, leaf.

dews, these plants can inhabit soils poor in nitrates. The remarkable umbrella-shaped style, and fiddle-shaped petals of *Sarracenia* are part of a very interesting mechanism for cross-pollination.

The family is of little economic importance. The rhizome of *Sarracenia purpurea* was used in Canada as a specific against smallpox, but did not prove of value. *Darlingtonia californica* and species of *Sarracenia* are in the trade because of their peculiar habits and structure, and their botanical interest. They are grown mainly in the greenhouse.

92. **Nepenthaceæ** (from the genus *Nepenthes*, derived from the Greek signifying a *magic potion*, probably in reference to the pitchers). **NEPENTHES FAMILY.** Fig. 25. Slightly woody or herbaceous plants: leaves alternate, consisting of a winged basal portion, a slender stalk-like intermediate portion, and a terminal urn-shaped pitcher with a rolling fluted border and a lid, the pitcher containing a watery fluid: flowers diœcious, paniculate, regular; perianth of 4 parts, possibly 2 sepals and 2 petals, imbricated; stamens 4-16, monadelphous; ovary superior, 3-4-celled; ovules numerous in each cell; stigma sessile, discoid: fruit a capsule.

A single genus with about 40 species occurs in the East Indies, Madagascar, the Seychelle Islands, and New Caledonia. Borneo has the greatest number of species. The family is related to the Sarraceniaceæ and Droseraceæ, although formerly considered related to the Aristolochiaceæ. The habit, the undifferentiated perianth, the monadelphous stamens, and the 3-4-celled ovary, are distinctive. A remarkable family of insectivorous plants. Along with the water secreted in the cavity of the pitcher is a pepsin-like substance, by the aid of which insects are digested, the dissolved material being later absorbed. The slender part of the leaf in some species coils and serves as a tendril by means of which the plant climbs.



26. **CRASSULACEÆ:** 1. *Sedum*, flower. **SAXIFRAGACEÆ:** 2. *Saxifraga*, flower. 3. *Ribes*, a, floral diagram; b, flower. 4. *Parnassia*, a, floral diagram; b, flower. **CEPHALOTACEÆ:** 5. *Cephalotus*, leaves.

In American greenhouses, many kinds of *Nepenthes* (Pitcher Plants), some of hybrid origin, are cultivated because of their curious habit.

93. **Droseraceæ** (from the genus *Drosera*, derived from the Greek, meaning *dewy*). **SUNDEW FAMILY.** Fig. 25. Very glandular herbs or sub-shrubs with alternate leaves: flowers bisexual, regular, hypogynous, rarely perigynous; sepals 4-5, imbricated; petals 5, imbricated; stamens in 1 or more whorls of 5; carpels 2-5; ovary superior, 1-3-celled: fruit a capsule with numerous seeds.

The 6 genera and about 100 species, 90 species of which belong to the genus *Drosera*, are widely scattered over the earth. The family is related in floral structure to the Cistaceæ and Violaceæ, and to the Saxifragaceæ.

The Droseraceæ are noted as insectivorous plants. *Drosera* has a rosette of small basal leaves covered with sensitive motile tentacles that secrete a terminal drop of clear sticky fluid, the so-called dew, in which small insects are caught as on sticky fly-paper. A digestive substance is then secreted and the organic matter absorbed. The leaves of *Dionæa* (the famous Venus' fly-trap of Carolina) have a conduplicate ter-

minal lobe which closes violently when a fly alights upon the upper (inner) surface. A marginal fringe prevents the escape of the insect; and it is in time digested. *Aldrovanda* of South Europe has tiny traps similar to those of *Dionæa*, but the whole plant is aquatic, and resembles *Utricularia*.

*Drosophyllum* and *Roridula* are said to be used in Portugal and the Cape for the practical capture of flies in the house. The leaves of some *Droseras* yield a purple dye. The liquids known as *aqua-auri* and *rosoglio* (Italian) contain *Drosera rotundifolia* as an essential ingredient.

*Drosera* and *Dionæa* are in the American trade, mostly grown as greenhouse curiosities.

#### Order 37. ROSALES

94. **Crassulaceæ** (from the genus *Crassula*, diminutive of *crassus*, meaning thick). **ORPINE FAMILY.** Fig. 26. Herbs or sub-shrubs: leaves mostly alternate, commonly fleshy: flowers mostly bisexual, regular; sepals 5, rarely 3-30, imbricated; petals as many, rarely connate; stamens as many or twice as many as the petals, epipetalous or hypogynous, rarely perigynous, separate; carpels as many as the petals, separate with a scale at the base of each; ovules numerous, rarely few or one: fruit a group of follicles, rarely the carpels somewhat united and ovary half-inferior.

Thirteen genera and about 500 species inhabit the drier parts of the earth, but principally South Africa and South Europe. The genus *Sedum* contains 140 species, and *Crassula* 120 species. This is a very definite family, but closely related to the Saxifragaceæ, from which it differs in the regular numerical plan, almost constantly separate ovaries, and predominantly fleshy habit.

The Crassulaceæ are well adapted to a dry climate. The fleshy leaves are provided with water-storage tissue and a thick cuticle, and are often odd in shape and appearance. These leaves lose water very slowly when separated from the plant, and will often remain fresh for weeks. When pinned to the wall, the leaf of *Bryophyllum* sends forth plantlets from the margin, and the stem of live-forever may grow and flower, so efficient is the protection against loss of water afforded by the cuticle. These plants, likewise, will grow for weeks or months in the collector's press.

The herbage contains much tannin and sometimes acid. A refreshing drink has been made from *Sempervivum tectorum* (houseleek). The fleshy leaves of the Crassulaceæ are cooling to wounds and burns. *Sedum Telephium* was formerly cultivated as a pot-herb. Other species have been used for nearly similar purposes.

Several genera are in cultivation in America. Of these, *Sempervivum* is the well-known Houseleek or Old-hen-and-chickens; *Cotyledon* is somewhat similar in growth; *Sedum acre* is Moss Stonecrop; and *Sedum triphyllum* (*S. Telephium*) is Live-forever, or Orpine.

95. **Cephalotaceæ** (from the genus *Cephalotus*, derived from the Greek meaning *headed*, said to refer to the capitate hairs at the base of the flower). **CEPHALOTUS FAMILY.** Fig. 26. Perennial scapose herbs: leaves of 2 kinds in a basal rosette, one lanceolate and ordinary, the other a petioled pitcher with winged sides, fluted mouth and a lid: flowers bisexual, regular, perigynous; perianth of 6 parts, apparently in one series, valvate; stamens 12, in 2 whorls; carpels 6, separate, arranged around the woody apex of the axis; 1-2 basal ovules in each: fruit dry, somewhat inflated.

The family consists of but 1 genus and 1 species (*Cephalotus follicularis*), found in the swamps of King George's Sound, West Australia. This family is related to the Saxifragaceæ, and was formerly united with that family, but differs in the peculiar habit, the wholly separate carpels arranged around the apex of the axis,



and the basal seeds; related also to the Crassulaceæ, but lacks the hypogynous scales and has basal seeds.

This remarkable little insectivorous plant is cultivated in greenhouses as a curiosity.

96. **Saxifragaceæ** (from the genus *Saxifraga*, derived from the Latin signifying to *break rocks*, in allusion to the habit of growing in the clefts of rocks). **SAXIFRAGE FAMILY.** Fig. 26. Herbs, shrubs, or small trees: leaves alternate, rarely opposite; flowers bisexual, usually regular, hypogynous or perigynous, rarely epigynous; sepals 4-5, rarely more or fewer; petals usually of the same number, valvate or imbricated, inserted with the stamens at the edge of a receptacular nectariferous disk; stamens of the same number as the petals and alternate with them, or twice as many and the outer opposite the petals; carpels 2, rarely 5, partly united, rarely separate, superior or half inferior; ovules numerous; styles and stigmas as many as the carpels: fruit a capsule or berry.

There are about 70 genera and some 700 species, widely distributed but more abundant in temperate regions. Many reach the arctic. Some are fossil. *Saxifraga* is the largest genus, with 200 species in the north temperate, arctic and Andean regions. *Ribes* has 50 species. The family is closely related to the Rosaceæ, differing in the more abundant endosperm and constantly few carpels and few stamens; related also to the Crassulaceæ, which has a regular numerical plan and hypogynous scales; and to the Cunoniaceæ and Hamamelidaceæ.

The ovaries of *Ribes*, *Philadelphus*, *Chrysosplenium*, *Deutzia*, *Hydrangea*, and some *Saxifragas*, and a few other genera are almost wholly inferior. *Parnassia* has staminodia in clusters at the base of each petal. The fruit of *Ribes* is a berry. Some *Heucheras* have irregular flowers; also some *Saxifragas*, some *Hydrangeas* and *Tolmieas*. The peripheral flowers of *Hydrangea* often have enlarged corollas and are sterile. Water-glands in the axils of the foliar teeth of some *Saxifragas* secrete a deposit of lime.

The rough leaves of *Deutzia scabra* are used in Japan to polish wood. The fruits of several species of *Ribes* are edible; *R. vulgare* yields the red currant; *R. Grossularia*, the English gooseberry, and also native gooseberries; *R. nigrum*, the black currant. Otherwise the family is of economic importance only for its ornamental species, which are numerous and largely hardy.

Many genera are in cultivation in this country. Among these the following well-known names may be noted: *Deutzia*; *Decumaria*, climbing shrub; Golden Saxifrage (*Chrysosplenium*); *Astilbe*; *Hydrangea*; Mock-orange or *Syringa* (*Philadelphus*); Currants and Gooseberries (*Ribes*); False Mitrewort or False Bishop's-cap or Foam-flower (*Tiarella*); Grass of Parnassus (*Parnassia*); Mitrewort or Bishop's-cap (*Mitella*); Alum Root or Coral Bells (*Heuchera*); Saxifrage and Strawberry Geranium (*Saxifraga*).

97. **Pittosporaceæ** (from the genus *Pittosporum*, the name referring to the viscid coating of the seeds). **PITTIOSPORUM FAMILY.** Trees or shrubs, often climbing: leaves alternate, mostly leathery: flowers bisexual, regular; sepals or divisions of the calyx 5, imbricated; petals 5, imbricated in the bud; claws often connivent or coherent; stamens 5, alternating with the petals, hypogynous, no disk at the base; carpels 2, rarely 3-5; ovary 1- to several-celled; placentæ parietal or axial; style 1; stigmas 1 to several: fruit a capsule or berry; seeds numerous or few, immersed in a pulp or viscid juice.

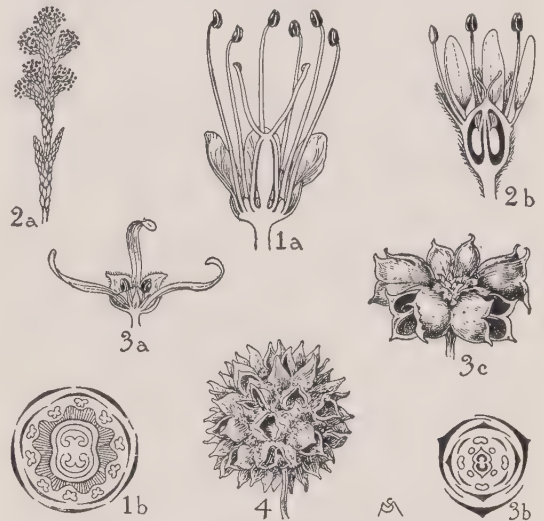
All the 9 genera and about 90 species are natives of Australia, except the genus *Pittosporum*, which, however, is of the Old World. The largest genus is *Pittosporum* containing 70 species. The relationship of the family is doubtful. Though in the past supposed by different authors to be related to the Celastraceæ,

*Polygalaceæ*, *Caryophyllaceæ*, *Rutaceæ*, *Saxifragaceæ*, *Ericaceæ*, and so on, it is, according to Pax, most closely related to the *Saxifragaceæ*.

The *Pittosporaceæ* all contain resinous aromatic bitter material in organized resin-canals or chambers. These give the fruit a disagreeable flavor. In spite of this disagreeable taste, it is said (Lemaout and Decaine) that, "The natives of Australia, who to appease their hunger are reduced to filling their stomachs with clay mixed with organic detritus, eagerly devour the fleshy fruits of this family."

Most of the genera are in cultivation: *Bellardiera*; *Bursaria*, a spiny shrub; *Hymenosporum*, a shrub with yellow flowers; *Pittosporum* (*Pittosporum*, *Karo*, *Tawhiwhi*, *Tarata*, *Tobira*), evergreen, fragrant shrubs; *Sollya* (Australian Bluebell Creeper).

98. **Cunoniaceæ** (from the genus *Cunonia*, named after John Christian Cuno, an Amsterdam botanist of the 18th century). **CUNONIA FAMILY.** Fig. 27. Trees or shrubs: leaves opposite or whorled, simple, ternate or pinnate: flowers small, densely crowded, usually bisexual, hypogynous; sepals 4-5, rarely 6, usually valvate; petals 4-5, small, usually wanting; stamens twice as many as the sepals, rarely just as many or more nu-



27. **CUNONIACEÆ:** 1. *Cunonia*, a, flower; b, floral diagram. **BRUNIACEÆ:** 2. *Brunia*, a, flower branch; b, flower. **HAMAMELIDACEÆ:** 3. *Hamamelis*, a, flower; b, floral diagram; c, fruit. 4. *Liquidambar*, fruit.

merous, exserted, attached near the edge of an intrastaminal disk; ovary mostly 2-celled, superior; ovules numerous, rarely few; styles 1-2; stigmas 2: fruit usually a capsule, rarely a drupe or nut.

Nineteen genera and 120 species are known, 70 species of which belong to *Weinmannia*; all of South America or the Australian region, except one in South Africa.

The family is closely related to the *Saxifragaceæ*, with which it was formerly united, but because of the uniform floral structure and the position of the leaves, as well as the geographical distribution, it is now treated as distinct.

The wood of some species is useful; otherwise the *Cunoniaceæ* are of little economic importance. *Acrophyllum venosum*, an Australian evergreen shrub, is cultivated in greenhouses.

99. **Bruniaceæ** (from the genus *Brunia*, named in honor of Cornelius Brun, a traveler in the East). **BRUNIA FAMILY.** Fig. 27. Heath-like shrubs: leaves alternate: flowers bisexual, regular, epigynous; sepals 4-5, imbricated; petals 4-5, imbricated; stamens 4-5,

alternating with the petals, free or united with the petals, or with each other, rarely an intrastaminal disk present; ovary inferior, 1-3-celled; ovules 1-2 in each cell; fruit dry, indehiscent, or capsular.

Twelve genera and about 50 species occur, all natives of South Africa. The family is related to various families of the Saxifrage group, as, for instance, the Hamamelidaceæ, but is distinct because of its heath-like habit. The flowers are mostly in dense heads.

The family is of no economic importance. One species of *Audouinia* (*A. capitata*) is said to be sometimes in cultivation as *Diosma capitata*.

100. **Hamamelidaceæ** (from the genus *Hamamelis*, an ancient Greek name applied to some tree). WITCH-HAZEL FAMILY. Fig. 27. Trees or shrubs: leaves simple, alternate: flowers unisexual or bisexual, hypogynous, perigynous or epigynous; sepals 4-5; petals 4-5, or 0; stamens 4-5, rarely more; sub-ovarian disk rare; ovary 2-celled; ovules 1 or several in each cell: fruit a woody, 2-valved capsule, with a separating inner layer of different texture; seeds often winged.

Twenty genera and 50 species are known, widely distributed in subtropical or warm temperate regions of both hemispheres. It is an ancient family more abundant in former ages, related to the Saxifragaceæ, and by some considered related to the Cornaceæ or Araliaceæ. Many fossil species are known. The peculiar fruit is distinctive.

In some genera, as in *Hamamelis*, the seeds are forcibly expelled when the fruit opens, often to a distance of 10 feet or more, much as wet apple seeds may be shot from between the thumb and finger.

The family is of little economic importance. Extract of the bark of *Hamamelis* is used as a liniment (witch-hazel). The twigs are supposed to have supernormal properties, especially in the detection of water in the earth. They are frequently used in rural districts in the attempt to detect underground springs. *Liquidambar styraciflua* (sweet gum), of the southern United States, yields a balsam. The oriental balsam, *Styrax*, is obtained from the eastern *L. orientalis*. This was formerly used in medicine.

Perhaps half the genera are in cultivation, all for ornamental purposes. Of these, *Fothergilla*, *Corylopsis*, *Hamamelis*, and *Liquidambar* are the best known. Most of the species are hardy.

101. **Platanaceæ** (from the genus *Platanus*, the ancient name of the tree, signifying *broad*). PLANE-TREE FAMILY. Fig. 28. Trees with alternate, broad, palmately veined leaves: flowers in dense heads, monoecious, regular, perigynous; sepals usually 3-8, separate, thick, often with bracts at the base; petals of the same number, glabrous; stamens of like number alternating with the petals; connective peltate at the top; extra staminodia often present; carpels several, distinct, 1-seeded: fruit a caryopsis, angled from pressure, and truncate at top, surrounded by long hairs at the base; seed orthotropous.

A single genus and about 6 species are distributed in southern Europe, southern Asia, and in North America. The family is related to the Saxifragaceæ and Hamamelidaceæ. The polypetalous perigynous flower, with as many stamens as petals, the separate carpels, and especially the peculiar inflorescence and leaf, are distinctive. Fossil species are known.

The wood of *Platanus* is similar to maple and of value, but the most important use is for ornament. Two species of *Platanus* (Plane-Tree, Buttonwood, Button Ball, Oriental Plane, Sycamore) are in cultivation in America.

102. **Rosaceæ** (from the genus *Rosa*, the ancient name of the rose). ROSE FAMILY. Fig. 28. Herbs, shrubs, or trees, often thorny, sometimes climbing: leaves alternate, rarely opposite: flowers bisexual, rarely unisexual, usually regular, perigynous; calyx of 4-5 imbricated or valvate sepals; corolla of as many imbricated petals,

or 0; stamens 5 to many, in whorls of 5, borne on the cup of the receptacle at some distance from the carpels; cup lined with a glandular disk; carpels 1 to many, separate and superior or united and inferior; ovaries 1 to several-ovuled; styles as many as the carpels: fruit a follicle, achene, drupe, pome, or hip; seeds usually exalbuminous.

There are about 90 genera and 1,500 species, widely distributed in all parts of the world, most abundant, perhaps, in the temperate regions. The largest genera are *Rubus*, 180-200 species; *Potentilla*, 200 species; and *Rosa*, 100 species. The family is related to the Saxifragaceæ and the Leguminosæ, also to the Calycanthaceæ. The perigynous flower with cup lined by the glandular disk, the numerous cyclic stamens, and



28. **PLATANACEÆ**: 1. *Platanus*, a, flower; b, floral diagram. **ROSACEÆ**: 2. *Fragaria*, a, flower; b, fruit. 3. *Geum*, fruit. 4. *Rosa*, a, floral diagram; b, fruit. 5. *Spiraea*, fruit. 6. *Prunus*, a, flower; b, fruit. 7. *Pyrus*, a, flower; b, fruit. **LEGUMINOSÆ**: 8. *Pisum*, a, flower; b, flower, petals removed; c, fruit. 9. *Desmodium*, fruit. 10. *Cassia*, flower. 11. *Acacia*, flower.

the separate, usually cyclic, carpels, are distinctive. The Ranunculaceæ is similar, but acyclic and hypogynous.

The family is divided into 6 very distinct sub-families, some of which, by certain authors, are considered of family rank, as follows: I. Fruit follicular, e.g., *Spiræa*, *Physocarpus*, *Aruncus*, *Sorbaria*, and so on. II. Ovary compound, inferior: fruit fleshy, e.g., *Pyrus*, *Cratægus*, *Cotoneaster*, *Cydonia*, *Amelanchier*, *Mespilus*, and the like. III. Fruit of achenes or separate drupelets, e.g., *Rubus*, *Fragaria*, *Potentilla*, *Geum*, *Cercocarpus*, *Ulmaria*, *Alchemilla*, *Agrimonia*, *Sanguisorba*, and *Rosa*. IV. Carpels connate, and adnate to the hollow, but dry, receptacle, e.g., *Neurada* and *Griellum*. V. Carpel 1, superior: fruit a drupe: style terminal, e.g., *Prunus*. VI. Same as the last, but



style basal and flowers often irregular, e.g., *Chrysobalanus*.

The fruitlets of *Rubus* have a fleshy ovarian wall and are drupelets. The strawberry has a fleshy receptacle with dry achenes scattered upon it. The rose fruit consists of a hollow, fleshy receptacle bearing achenes on its inner face; that of *Pyrus* is similar, but the receptacle and carpels have grown together into one structure. The peach, cherry, and plum are each the product of one superior carpel.

The following plants are cultivated for their fruits: apple, pear, quince, cherry, plum, apricot, peach, almond, raspberry, blackberry, strawberry, and medlar. These fruits are eaten fresh, preserved in sugar, or fermented into vinegar or cider. Rose fruits are also preserved, and the fruits of mountain ash are used for making a spirituous drink. The petals of *Rosa damascena* and *R. gallica* are macerated with oil of sesame to form attar of roses. The petals themselves yield oil of rose, from which rose-water is made. Many species have been used in medicine; e.g., rose, the seeds of which are vermifugal. Quince seeds contain mucilage and are emollient. The conserve of rose is astringent. Agrimony is nephritic, and is also used for pulmonary catarrh and angina. Alchemilla is astringent and vulnerary. The root of *Fragaria* is diuretic and astringent. Flowers of *Hagenia abyssinica* are a famous remedy for tapeworm. Flowers of *Ulmaria* are used to give a bouquet to wine; also as a sudorific and cordial. The bark of *Prunus serotina* (wild cherry bark) is tonic and pectoral. The bark of *Quillaja Saponaria* (soap-bark tree) of Chile, is a stimulant, diuretic and irritant, contains saponin, and is used for washing delicate fabrics. Gummy exudations from the bark of cherry are sometimes used in medicine. *Sanguisorba* has been used for forage, and as a condiment. The seeds of many species of *Prunus* and others yield oil in quantity.

Fifty or sixty genera are cultivated in America. Among these are: Agrimonia (Agrimony); Alchemilla (Lady's Mantle); Amelanchier (Shadbush, Juneberry, Service-berry); Aronia (Choke-berry); Aruncus; Cercocarpus; Chrysobalanus (Cocoa Plum); Comarum (Marsh Cinquefoil); Cotoneaster; Cratægus (Hawthorn, Scarlet Thorn, Washington Thorn); Eriobotrya (Loquat, Japan Plum); Exochorda (Pearl Bush); Fragaria (Strawberry); Geum (Avens); Gillenia or Portercanthus (American Ipecac, Bowman's Root); Holidiscus or Schizonotus; Kerria (Globe-flower, Japanese Rose); Margyricarpus (Pearl Fruit); Mespilus (Medlar, Mespil); Neviusia (Snow Wreath); Photinia (Toyon, Tollon); Physocarpus (Ninebark); Potentilla (Cinquefoil, Five-finger, Silver-weed); Pyracantha; Pyrus (Pear, Apple, Crab); Quillaja (Soap-bark Tree); Raphiolepis (Indian Hawthorn); Rosa (Rose, Eglantine, Sweetbrier); Rubus (Bramble, Blackberry, Raspberry, Cloud-berry, Baked-apple Berry, Yellow Berry, Salmonberry, Wineberry, Blackcap, Thimbleberry, Dewberry); Sanguisorba (Burret); Sorbaria; Sorbus, (Mountain Ash, Rowan Tree, Dogberry, Service Tree, White Beam-tree); Spiræa (Queen of the Meadows, Meadowsweet, Hardhack, Steeple-bush, Bridal Wreath); Ulmaria (Meadowsweet, Queen-of-the-Prairie, Queen-of-the-Meadows); Waldsteinia (Barren Strawberry, Yellow Strawberry).

103. **Leguminosæ** (from *legume*, the name of the type of fruit characteristic of this family). **PEA FAMILY.** Fig. 28. Herbs, shrubs, or trees, often twining: leaves alternate, compound, rarely simple: flowers regular or irregular, usually bisexual, hypogynous or perigynous, fundamentally polypetalous; sepals 5, more or less connate, often unequal; petals 5, rarely fewer, nearly equal, or unequal, or more commonly papilionaceous (i. e., 1 dorsal standard, 2 lateral cleaver-shaped wings, and 2 ventral, more or less connate, petals forming the keel); stamens 10 or very numerous, rarely 5, included or exserted, often inserted around a glandular disk, mona-

delphous, 9 united and 1 separate, or all separate; carpel 1, rarely 2–15, superior; ovary 1-celled, inequilateral; the single parietal placenta ventral but turned dorsally; ovules 1 to many: fruit a legume, or, by reduction, indehiscent, or follicular, or fleshy, often jointed between the seeds, and sometimes filled with pulp; seeds exalbuminous.

Leguminosæ contains 429 genera and about 7,000 species, distributed over the whole earth, but most abundant in the tropics. This family and the Orchidaceæ are, next to the Compositæ, the largest families of flowering plants. The large genera which contain 100 or more species are: Astragalus, 1,200 species; Acacia, 450 sp.; Cassia, 380 sp.; Mimosa, 300 sp.; Crotonaria, 250 sp.; Indigofera, 250 sp.; Trifolium, 250 sp.; Bauhinia, 150 sp.; Aspalanthus, 150 sp.; Oxytropis, 150 sp.; Desmodium, 150 sp.; Inga, 140 sp.; Tepirosia, 120 sp.; Vicia, 120 sp.; Pithecolobium, 110 sp.; Lupinus, 100 sp.; Psoralea, 100 sp.; Dalea, 100 sp.; Lathyrus, 100 sp.; Rhynchosia, 100 sp.; and Phaseolus, 100 sp. Taken in the broad sense, the family is a very natural one, the nearest relatives being the Chrysobalanus section of the Rosaceæ. The most constant distinguishing character is the leguminous type of fruit. When this occasionally varies, the papilionaceous corolla, or the general Mimosa type of flower, is distinctive. Except in the fruit, the family is very diverse, and the following sub-families have often been treated as distinct families.

Sub-family I. **Mimosæ.**—Flowers regular; corolla valvate; stamens 5–10, or very numerous, exserted: e.g., Pithecolobium, Albizzia, Mimosa, and Acacia.

Sub-family II. **Cæsalpinæ.**—Flowers irregular, not papilionaceous; stamens 10 or fewer, not conspicuously exserted; corolla imbricated: e.g., Copaiba, Tamarindus, Cercis, Bauhinia, Cassia, Gleditsia, Gymnocladus, Cæsalpinia, and the like.

Sub-family III. **Papilionatæ.**—Corolla papilionaceous, imbricated; stamens 5–10, included: e.g., Pisum, Lathyrus, Robinia, Vicia, Phaseolus, and so forth.

The leaves of many Leguminosæ are motile. *Mimosa pudica*, *Cassia nichilans*, and others, are sensitive to touch, the leaflets, and often the leaves, quickly drooping when disturbed. A great number show sleep movement, the leaflets drooping at nightfall. The motile organ is the pulvinus at the base of the leaflet or leaf. The lateral leaflets of *Desmodium gyrans* are rhythmically and spontaneously motile. The pollination of the papilionaceous flowers is complicated and interesting. (See Kerner and Oliver's "Natural History of Plants.") The legumes of *Desmodium* separate into 1-seeded joints which are covered with hooked hairs, and, therefore, bur-like. The roots of the Leguminosæ commonly bear tubercles containing nitrogen-fixing organisms, the product of which is used by the plant.

The economic plants are almost innumerable. The following are the most important:

Plants used for food: *Detarium senegalense* of Senegambia, edible drupe; *Castanospermum australe* (Australian chestnut), *Dolichos Lablab* (black bean), *Phaseolus vulgaris* (bean), *Cicer arietinum* (chick pea), *Pisum sativum* (pea), *Ervum Lens* (lentil) and *Lupinus* spp., all have edible seeds; *Apios tuberosa*, *Psoralea hypogæa*, and *P. esculenta*, edible tubers; *Arachis hypogæa* (peanut), and *Voandzeia subterranea*, subterranean seeds; *Lathyrus tuberosa*, sugary tubers, much used before potatoes were known; and *Cytisus scoparius*, buds used as capers.

Plants used as forage: *Ceratonia Siliqua* (St. John's bread), *Onobrychis sativa* (sainfoin), *Vicia sativa* (vetch), *Medicago sativa* (alfalfa), *Medicago lupulina* (medick), *Trifolium* species (clover), *Glycine hispida* (soy bean), *Vigna Catjang* (cowpea), *Lotus corniculatus*, *Lupinus* spp., *Anihyllis Vulneraria*, *Hedysarum coronarium*, *Ornithopus sativus*, *Pisum sativum*, *Ulex europæus*.

Plants used for medicine: *Acacia Senegal* (gum acacia); *A. Catechu* (catechu), astringent, tonic; *Swartzia tomentosa*, sudorific; *Copaiba Langdorfii* (balsam of Copaiba), of Brazil, for catarrh; *Cassia* sps., Orient, India, etc., leaves purgative; *Tamarindus indica* (tamarind), pulpy pods used; *Sophora tomentosa*, India, seeds arrest choleric vomiting; *Toluifera Balsamum* (balsam of Tolu), South America, bronchial; *Andira* sps., tropical America, emetic, purge, narcotic, vermifuge; *Pterocarpus Draco* (dragon's blood), West Indies, astringent; *P. Marsupium* (gum kino); *Butea frondosa* (eastern kino), Asia; *Mucuna pruriens* (cow-itch or cowage), India, stinging hairs on pod, anthelmintic; *Astragalus gummifer* (gum tragacanth), of the Orient; *Colutea arborescens* (bladder senna), purgative, emetic; *Glycyrrhiza glabra*, (licorice), Europe, emollient; *Genista tinctoria*, purgative; *Cytisus scoparius*, diuretic; *Trigonella Fœnum-græcum* (fenugreek), Old World, food, condiment, horse-remedy, and so on; *Anagris fetida* (stinking wood), purgative and poisonous; *Physostigma venosum* (calabar bean), sedative, contracts the pupil, poisonous; *Astragalus* sps., and *Crotalaria* sps. are loco-weeds, and poisonous to cattle; arrow-poisons are furnished by *Erythrophœum*, *Azafia*, and *Pithecolobium*. Fifteen genera furnish fish-poison.

Dye-stuffs: *Cæsalpinia echinata* yields braziline; *Sophora japonica* yields yellow dye; *Indigofera tinctoria* yields indigo; *Genista tinctoria*, yields a dye; *Hæmatoxylon campechianum* yields logwood and hæmatoxylin. *Pterocarpus santalinum* yields red sandalwood, a brown dye.

Other purposes: Copal varnish from *Hymenæa* sps., *Trachylobium* sps., and *Copaiba* sps. Many species are valuable timber trees. A snuff-perfume is obtained from seeds of *Coumarouna* (tonka bean). Rosewood is from *Dalbergia nigra*, and other species. African rosewood is from *Pterocarpus erinaceus*. Red seeds of *Abrus precatorius* (jequirity) are used for necklaces, as are also those of *Adenanthera Pavonina* (Circassian seeds). Branches of *Cytisus scoparius* (broom) are used for basket-work. *Ulex europæus* (furze) is used as firewood in France. Many species furnish fibers for spinning. Oil is obtained from seeds of peanut and others. Many are ornamental.

About 150 genera are cultivated in America, or are important to American agriculture. Many of the species are among our most valuable ornamental and food-plants. Some of these genera are: *Abrus* (Crab's-eye Vine, Weather Plant); *Acacia* (Wattle, Kangaroo Thorn, Weeping Myall, Australian Blackwood, Mulga, Popinac, Opopanax, Cassie, Huisache, Espino, Cavan, Gum Arabic Tree); *Adenanthera* (Red Sandalwood); *Albizia*; *Alhagi* (Camel's Thorn); *Amphicarpæa* (Hog Peanut); *Amorpha* (Lead Plant, Bastard Indigo); *Anthyllis* (Kidney Vetch, Sand Clover, Woundwort, Jupiter's Beard); *Apios* (Groundnut, Wild Bean); *Arachis* (Peanut, Goober); *Astragalus* (Milk Vetch); *Baptisia* (Wild Indigo); *Bauhinia* (Mountain Ebony); *Cæsalpinia* (Brasilieto, Barbadoes Pride, Barbadoes Flowerfence, Dwarf Poinciana); *Canavalia* (Jack Bean, Chickasaw Lima); *Caragana* (Pea Tree); *Cassia* (Wild Senna, Partridge Pea, Pudding Pipe Tree); *Centrosema* (Butterfly Pea); *Cercis* (Judas Tree, Red Bud); *Chorizema*; *Cicer* (Chick Pea); *Cladrastis* (Yellow-wood); *Chianthus* (Glory Pea, Glory Vine, Parrot's Bill); *Cliatoria* (Butterfly Pea); *Colutea* (Bladder Senna); *Coronilla* (Crown Vetch, Scorpion Senna); *Crotalaria* (Rattle-Box); *Cytisus* (Broom, Genista); *Desmodium* (Tick Trefoil, Telegraph Plant); *Dolichos* (Hyacinth Bean, Taukok, Black Bean), the species still much confused; *Erythrina* (Coral Tree); *Galega* (Goat's Rue); *Genista* (Dyer's Greenwood); *Gleditsia* (Honey Locust, Sweet Locust, Three-thorned Acacia); *Glycine* (Soy Bean); *Glycyrrhiza* (Licorice); *Gymnocladus* (Kentucky Coffee Tree); *Halimodendron* (Salt Tree);

*Hedysarum* (French Honeysuckle); *Hosackia*; *Indigofera* (Indigo); *Kennedya*; *Laburnum* (Golden Chain, Bean Tree, Scotch Laburnum); *Lathyrus* (Sweet Pea, Tangier Scarlet P., Pride of California, Everlasting P., Two-flowered P., Flat P., Perennial P., Lord Anson's P., Marsh P., Sea P., Beach P., Prairie Vetchling, Black P., Black Bitter Vetch, Spring Bitter Vetch); *Lens* (Lentil); *Lespedeza* (Bush Clover, Japan Clover, Hoop-koop); *Leucana* (White Popinac); *Lotus* (Bird's-foot Trefoil, Babies' Slippers, Winged Pea); *Lupinus* (Lupine, Sundial, Deer Cabbage); *Milletia* (Ironwood); *Medicago* (Alfalfa, Lucerne, Black or Hop Medick, Nonesuch, Snails, Tree Alfalfa, Moon Trefoil); *Melilotus* (Sweet Clover); *Mimosa* (Sensitive Plant, Humble Plant); *Mucuna* (Cowitch, Cowage, Velvet Bean, Banana Bean); *Onobrychis* (Sainfoin, Holy Clover); *Ononis* (Rest-Harrow, Goat Root); *Parkinsonia* (Jerusalem Thorn); *Parocheus* (Shamrock Pea, Blue Oxalis); *Petalostemon* (Prairie Clover); *Phaseolus* (Bean, Caracol, Snail-flower, Corkscrew Flower, Scarlet-runner, Dutch Caseknife B., Metcalfe B., Moth B., Gram, Silva B., Civet B., Lima B., Kidney B., Bush B.); *Piscidia* (Fish-poison Tree, Jamaica Dogwood); *Pisum* (Garden Pea, Field P.); *Pithecolobium*; *Prosopis* (Mesquite, Screw Bean, Tornillo); *Poinciana* (Royal Poinciana, Peacock Flower, Flomboyant); *Psoralea* (Scurfy Pea, Pomme Blanche); *Pueraria* (Kudzu Vine); *Robinia* (Locust, False Acacia, Black Locust, Rose Acacia, Clammy Locust); *Schrankia* (Sensitive Brier); *Sophora* (Japan Pagoda Tree); *Spartium* (Spanish Broom); *Sutherlandia* (Bladder Senna); *Swainsona* (Winter Sweet Pea); *Tamarindus* (Tamarind); *Templetonia* (Coral Bush); *Tephrosia* (Goat's Rue, Catgut, Wild Sweet Pea, Hoary P.); *Thermopsis*; *Trifolium* (Clover, Alsike, Cowgrass); *Trigonella* (Fenugreek); *Ulex* (Gorse Whin, Furze); *Vicia* (Vetch, Tare, Broad Bean, Windsor B., English Dwarf B.); *Vigna* (Cowpea, Black Pea, China Bean); *Wistaria* (Chinese Wistaria, Kidney-bean Tree).

#### Order 38. GERANIALES

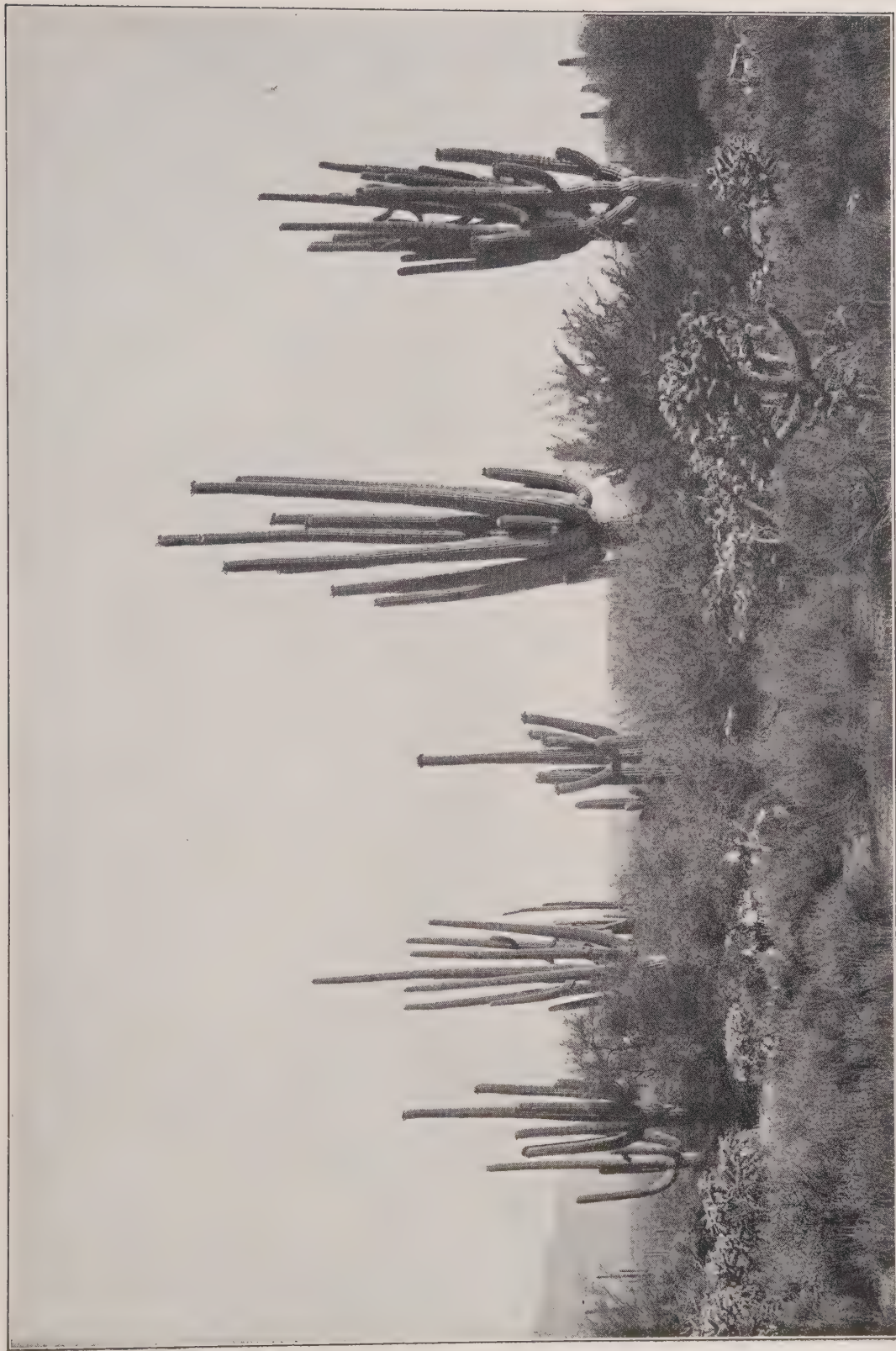
104. **Geraniaceæ** (from the genus *Geranium*, Crane's-bill, from *geranos*, a crane, in allusion to the cranelike beak of the fruit). GERANIUM FAMILY. Fig. 29. Herbs and shrubs, sometimes fleshy: leaves opposite or alternate, very diverse: flowers bisexual, regular or slightly irregular; sepals 5, imbricated, persistent; petals 5, rarely fewer, imbricated or convolute; stamens usually 10, rarely more, hypogynous or perigynous, the outer set opposite the petals, some frequently antherless, somewhat monadelphous below, often glandular at the base; carpels 5; ovary 5-celled, rarely 2-3-celled, 5-lobed, prolonged into a beak terminatd by the 5 styles; ovules 1 to many in each cell: fruit rarely a capsule, more commonly splitting into 5 beaked sections; seeds with endosperm, straight or curved.

The family has 10 genera and 360 species, widely distributed over the whole globe. The largest genera are *Pelargonium* (South Africa) with 175 species, and *Geranium* with 160 species. Some fossil fruits of Geraniaceæ are known. The Geraniaceæ are related to the Oxalidaceæ, Tropæolaceæ and Balsaminaceæ; also to the Linaceæ and Rutaceæ. The 5 sepals and petals, the 10 stamens, the 5 carpels, and the more or less beaked or lobed fruit with its peculiar dehiscence, are together distinctive.

The flower of *Pelargonium* is slightly irregular, with a dorsal receptacular spur at the base of the calyx. The fruits of all but 40 Geraniaceæ dehisce elastically, throwing the seeds to a distance. The 5 carpels split away at base, coil up violently, and remain attached to the summit of a column which projects from the receptacle. This method of dehiscence, when present, is characteristic of the Geraniaceæ.

The Geraniaceæ are astringent; several contain resin, and others contain free acids. Several species of





III. Desert vegetation.—The giant cactus (*Carnegiea gigantea*); also bushes of *Opuntia fulgida*, and in the foreground the low fine growths of *Bigelovia nana* Twigg.





*Geranium* have been used as remedies for wounds, others for dysentery, and the like; some have been used as stimulants. *Erodium moschatum* is valued because of a very strong odor of musk. The resinous stems of *Monsonia* (South Africa) burn readily, and have been used for torches. The most important economic genus is *Pelargonium*, cultivated for ornament. The foliage of some *Pelargoniums* is glandular and very fragrant ("rose geraniums"). Some species of *Geranium* also are ornamental. The awn-like beak of *Erodium* fruits have been used as hygrometers.

Few genera are in cultivation in America as ornamental plants: *Erodium* (Stork's-bill); *Geranium*, (Crane's-bill); *Pelargonium* (so-called "Geraniums"). Several cultivated genera, formerly included in the *Geraniaceae*, are now placed in separate families, which see, e.g., *Impatiens* (Balsaminaceae), *Tropaeolum* (Tropaeolaceae), *Oxalis* and *Averrhoa* (Oxalidaceae).

105. *Oxalidaceae* (from the genus *Oxalis*, signifying acid, from the sour taste of the foliage). *OXALIS* FAMILY. Herbs, rarely shrubby: leaves usually compound: flowers bisexual, regular; sepals 5, persistent, imbricated; petals 5, convolute or imbricated, rarely united at the base; stamens 10 in 2 whorls, the outer set opposite the petals, filaments coherent below, those of the outer set shorter, one or both sets with external glandular appendages at the base, hypogynous; ovary superior, 5-celled, with a persistent central column (as in *Geraniaceae*); styles separate: fruit an ordinary capsule with each cell dorsally dehiscent, or a berry.

The *Oxalis* family contains 7 genera and about 230 species, of which 220 belong to the genus *Oxalis*. They are mostly of tropical and subtropical distribution. *Oxalis* occurs chiefly in South Africa and South America. The *Oxalidaceae* were formerly united with the *Geraniaceae*, but differ in the fruit, which is a dehiscent capsule or a berry and does not break up into separate carpels.

The species of *Oxalis* are often bulbous or tuberous, or the roots are enlarged as water-storage tissue. The leaflets usually have a sensitive cushion at the base (pulvinus) and show sleep-movements. The flowers of many are dimorphic or trimorphic, i.e., have stamens or styles of 2 or 3 lengths in the same species. The seeds are forcibly ejected through the dorsal suture of the capsule by the elastic separation of the outer layer of the testa.

*Oxalis* contains much oxalic acid, which may be extracted for economic purposes. It is somewhat sedative, and the sour taste has made some species useful as salads. The starchy roots of some South American species are used for cattle-fodder. The fruits of *Averrhoa* are used in the tropics as a substitute for gooseberries, which they resemble in flavor.

Two genera are grown in America: *Averrhoa* (Carambola), 1 species grown for shade and fruit; and *Oxalis*.

106. *Tropaeolaceae* (from the genus *Tropaeolum*, from *tropaion*, a trophy; the leaves are shield-like, and the flowers resemble a helmet). *NASTURTIIUM* FAMILY. Fig. 29. Diffuse or climbing succulent herbs with alternate, peltate or lobed leaves: flowers bisexual, irregular, spurred; sepals 5, imbricated; petals 5, imbricated, the upper two differing in shape from the lower three; stamens 8, separate, somewhat perigynous; ovary superior, 3-celled, 3-lobed, each cell 1-seeded; style 1; stigmas 3: fruit splitting into 1-seeded, indehiscent nutlets or drupelets.

A single genus of about 35 species is found in the mountainous regions from Mexico to Chile. The family was formerly included in the *Geraniaceae*, but is distinguished by its separate stamens, its indehiscent fruitlets, and a very peculiar method of embryo development, in which the suspensor divides into three parts, one part growing into the placenta, another out into the ovarian cavity, and the third producing the embryo on its apex. The spur of the flower is an outgrowth of

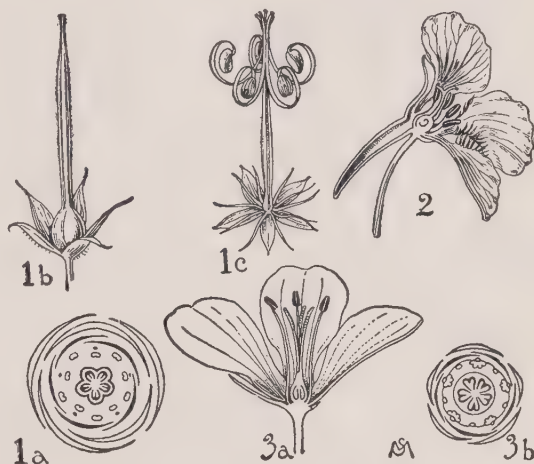
the obliquely cup-shaped receptacle at the base of the calyx, as in *Pelargonium*.

The herbage of *Tropaeolum* has an acrid taste like cress, and is often used for salad, hence the common name "nasturtium" or "Indian cress."

In America, several species are grown for their showy flowers. *Tropaeolum majus* is the most widely known species. *T. peregrinum* is the "canary-bird flower."

107. *Linaceae* (from the genus *Linum*, the Latin name for flax, from the old Celtic *lin*, a thread). *FLAX* FAMILY. Fig. 29. Woody or herbaceous plants: leaves alternate or opposite, rarely whorled, simple, entire: flowers bisexual, regular; calyx of 5, persistent, imbricated sepals, rarely 4-parted, with 3-fid lobes; petals 5, rarely 4, convolute, clawed, the claw sometimes crested; stamens 5, alternate with the petals, with sometimes 5 additional staminodia, or 10, 15, or 20, hypogynous, usually united at the often glandular base; ovary 5-, rarely 3- or 4-, celled or falsely 10-celled by the intrusion of the midrib; ovules few; styles as many as the cells of the ovary: fruit a capsule or drupe.

There are 9 genera and about 120 species, of which 90 species belong to *Linum*. The *Linaceae* are related to



29. GERANIACEAE: 1. *Geranium*, a, floral diagram; b, fruit; c, fruit dehiscing. TROPEOLACEAE: 2. *Tropaeolum*, flower. LINACEAE: 3. *Linum*, a, flower; b, floral diagram.

the *Geraniaceae* and *Oxalidaceae*, but also show a relation to the *Silenes* in the *Caryophyllaceae*. The many-stamened genera suggest the *Ternstroemiaceae*. The family is most easily recognized by the simple, regular pattern of the flower, and the numerical plan of 5 (or 4) which is carried through all the floral parts. For this reason, the flax was taken by the older botanists as a pattern flower.

*Linum catharticum* (Europe) was formerly used as a purgative. A fixed oil is extracted from the seeds of the common flax (*Linum usitatissimum*), which is used in medicine as an emollient. The most extensive use of this oil is in painting, its value being due to the property of drying into a hard, waterproof coating. Flaxseed meal, from which the oil has been expressed, is used for fodder and for poulticing. The seed-coats of flax become very mucilaginous when soaked, on which account flaxseed has also been used as an emollient in the treatment of coughs and colds. The cortical bast-fibers of the flax have been used since earliest times in textile industries. As the basis of linen cloth, flax is one of the most useful of cultivated plants. Flax was probably Asiatic in its origin. Many species of *Linum* are ornamental, but are little grown.

Two genera are cultivated in America: *Linum*, with species of annual garden plants; and *Reinwardtia*, with species of conservatory sub-shrubs from India.

108. **Erythroxylaceæ** (from the genus *Erythroxylon*, the name signifying *red wood*; the wood of some species being red). **Coca FAMILY**. Fig. 30. Shrubs and small trees: leaves alternate: flowers bisexual, regular, inconspicuous; sepals 5, persistent, imbricated or valvate; petals 5, convolute or imbricated, with appendages on the inner face, or with projecting callosities; stamens 10, in 2 whorls, more or less connate into a tube, and externally glandular; ovary 3-4-celled, usually but 1 cell developing in fruit; 1-2 ovules in each cell; styles 3-4: fruit drupaceous, 1-2-seeded.

Two genera and about 90 species are known; all tropical, and reaching their greatest development in



30. **ERYTHROXYLACEÆ**: 1. *Erythroxylon*, a, flower of *E. pulchrum*; b, flower, perianth removed, of *E. Coca*. **ZYGOPHYLLACEÆ**: 2. *Zygophyllum*, a, flower; b, floral diagram. **RUTACEÆ**: 3. *Ruta*, a, flower; b, floral diagram; c, leaf.

tropical South America, but extending northward to Mexico and southward in the Old World to Natal. The family is closely related to the *Linacææ* with which it was formerly united, but differs in the more prominent stamen-tube, the appendages on the petals, and the drupaceous non-capsular fruit.

The only important economic plant is the coca plant (*Erythroxylon Coca*), a shrub famous as the source of cocaine. Its origin is unknown, but it was early used by the Peruvians as a stimulant. Coca is now grown to a limited extent in southern Florida and southern California, as well as in most tropical countries.

109. **Zygophyllaceæ** (from the genus *Zygophyllum*, derived from the Greek signifying a *yoke* and *leaf*; the leaflets are in pairs). **CALTROP FAMILY**. Fig. 30. Herbs, shrubs, or trees: leaves opposite, rarely alternate, mostly pinnately compound: flowers bisexual, regular, rarely irregular; sepals 4-5, persistent, imbricated or rarely valvate; petals 4-5, rarely 0, imbricated, rarely valvate; disk present, diverse, rarely wanting; stamens usually 8 or 10, hypogynous, the outer opposite the petals, usually scaled at the base of the filaments; ovary superior, 4-5-celled, rarely falsely many-celled; ovules 2 to several in each cell; style and stigma 1: fruit a capsule or separating into fruitlets.

Twenty-one genera and about 150 species occur as natives of the warmer parts of the world, especially the drier desert regions. They are especially abundant in North Africa and the Mediterranean region. This family is very closely related to the *Rutaceæ*, from which it differs in the absence of glandular dots and oil, and in the presence of stipules. The fruits are usually more or less lobed and sometimes winged or covered with prickles.

The hard, faintly aromatic wood (*lignumvitæ*) of *Guaiacum officinale* is used for cabinet work and for pulleys. The wood of this plant yields a resin used as a diaphoretic and purge. The flower-buds of one species of *Zygophyllum* are used in place of capers.

The Arabs use *Z. simplex* to remove freckles. The fetid smell of this plant is so strong that even camels are said to reject it. Soda is obtained from species of *Nitraria*, which inhabit alkaline soil.

*Guaiacum officinale* is sometimes grown in southern Florida and southern California for ornament. *Zygophyllum* may be in cultivation.

110. **Rutaceæ** (from the genus *Ruta*, the ancient name). **RUE FAMILY**. Fig. 30. Herbs, shrubs, trees: leaves usually alternate, simple or variously cut or compound, usually with pellucid dots: flowers bisexual, usually regular; sepals 4-5, often coherent, imbricated; petals 4-5, imbricated or valvate, usually separate; stamens 8-10, rarely 15, inserted at the base of a thick disk, usually distinct; ovary superior, 2-5-lobed, 2-5-celled; each cell 1 to many-ovuled, raised on a prolongation of the receptacle, a glandular disk at its base; styles usually connate: fruit a capsule opening by valves, or fleshy and indehiscent, or separating into fruitlets, rarely winged.

*Rutaceæ* contains over 100 genera and about 900 species, mostly of tropical countries but extending into temperate parts of Europe and America. *Fagara*, with more than 130 species, is the largest genus. The *Rutaceæ* are related to many of the *Geranium* group, especially to *Simarubaceæ*, *Zygophyllaceæ*, and *Meliaceæ*. The transparent dots in the leaves, the numerical plan, and especially the lobed ovary raised on the disk or stalk, are together distinctive. The disk is often much developed and very diversely constructed. The outer stamens are usually opposite the petals, not alternate with them as might be expected. In some cases the carpels are entirely free below and united only by the styles or stigmas. The seeds, except in the berry fruits, are only 1 or 2. The great development of oil-glands containing a fragrant oil is one of the most characteristic features of the family. These glands are produced on all parts of the plant, even on the floral parts and surface of the fruits. The orange and lemon are examples of *Rutaceæ* with berry fruits, and they are widely cultivated and perplexingly variable.

The volatile oil of the *Rutaceæ* has been used to some extent for medicine and also for perfumery. Extract of rue has been used as a vermifuge. The Romans used rue as a condiment. Some species of rue are so pungent as to produce a poisoning of the skin similar to that produced by poison ivy. The volatile oil is so copious in *Dictamnus* as to ignite readily. Several species of *Barosma* (buchu) are tonic and diuretic. The genus *Citrus* is the most useful. It includes the orange, the bitter orange, the citron, the lemon, the lime, the grape-fruit, the kid-glove orange or tangerine, and the bergamot from the rind of which bergamot oil is manufactured, used in perfumery. The bark of the prickly shrub, *Zanthoxylum*, is sometimes used as a tonic. The seeds of some species of *Zanthoxylum* are used to poison fish.

In cultivation in America or worthy of trial are 20 to 30 genera, used mostly for ornament and fruit. Among these are: *Adenandra* (Breath of Heaven); *Ægle* (Bael Fruit, Bengal Quince); *Atalantia*; *Balsamocitrus* (African Bael-Fruit); *Calodendron* (Cape Chestnut); *Casimiroa* (White Sapota); *Citrus* (Orange, Lemon); *Dictamnus* (Dittany, Gas Plant, Burning Bush); *Fagara* (Prickly Ash); *Feronia* (Wood Apple); *Murraya* (Orange Jessamine, Satinwood); *Phellodendron* (Chinese Cork Tree); *Poncirus* (Trifoliate Orange); *Ptelea* (Hop Tree); *Ruta* (Rue); *Triphasia* (Bergamot Lime, Lime Berry); *Zanthoxylum* (Prickly Ash, Chinese or Japanese Pepperwood, Toothache Tree).

111. **Simarubaceæ** (from the genus *Simaruba*, which is the Caribbean name of *Simaruba officinalis*). **QUASIA FAMILY**. Fig. 31. Shrubs or trees: leaves alternate or rarely opposite, pinnate, rarely simple, dotless: flowers unisexual, regular; sepals 3-5, more or less connate, imbricated or valvate; petals 3-5, rarely 0, free or connate, variously arranged in the bud; disk prominent, very diverse, rarely 0; stamens usually twice the petals, filaments naked or with a scale; carpels 2-5, free, or



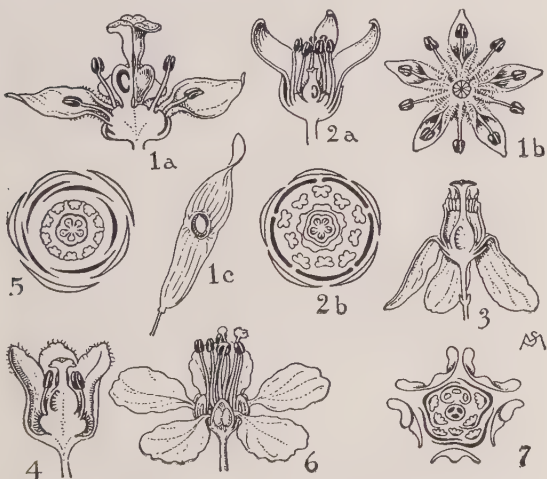
connate at the base or by the styles, or completely united into a 2-5-celled, superior ovary; each cell 1-, rarely several-, ovuled; carpels in fruit drupe-like, rarely forming a berry or samaras.

About 28 genera and 140 species are generally distributed in the tropics, but extend into the temperate regions. The center of distribution is in tropical America. Some fossil species are known. The family is closely related to the Rutaceæ, but differs in the absence of foliage-glands and in the presence of scales on the filaments. It is also closely related to the Zygophyllaceæ.

Most of the Simarubaceæ contain a bitter principle, also, sometimes, a resinous matter and an oil which is of value as a tonic. *Quassia amara* of tropical America furnishes the quassia wood, famous as a bitter tonic. *Picrasma excelsa*, of Jamaica, also furnishes quassia of equal quality. Branches of quassia and the pulverized bitter wood of species of *Simaruba* are used in tropical America to drive away insects. The seeds of *Simaruba Cedron* are used for the same purpose. Various species are used for snake-bites. The leaves and sap of species of *Picramnia* furnish a beautiful violet dye.

Very few are in cultivation in America: *Picrasma*, a semi-hardy shrub; and *Ailanthus* (Tree of Heaven), a well-known tree.

112. **Burseraceæ** (from the genus *Bursera*, named in memory of Joachim Burser, a botanist in Naples). BURSERIA FAMILY. Fig. 31. Trees or shrubs, often very large, with usually alternate compound leaves: flowers bisexual, regular, usually small and very numerous; sepals 3-5, more or less connate, imbricated or often valvate; petals 3-5, usually separate, imbricated or val-



31. SIMARUBACEÆ: 1. *Ailanthus*, a, flower, section; b, flower, looking in; c, fruit. BURSERACEÆ: 2. *Bursera*, a, flower; b, floral diagram. MELIACEÆ: 3. *Swietenia*, flower. 4. *Cedrela*, flower. 5. *Melia*, floral diagram. MALPIGHIACEÆ: 6. *Camarea*, flower. 7. *Malpighia*, floral diagram.

vate; stamens usually twice as many as the petals, hypogynous, sometimes unequal, separate, the outer opposite the petals; disk present, annular or cup-shaped, rarely 0, sometimes adnate to the calyx; ovary superior, 2-5-celled; ovules usually 2 in each cell; style 1 or 0; fruit drupe-like with 2-5 stones or with a bony endocarp or a capsule with the epicarp opening and exposing the connate bony pits; seeds exalbuminous.

The 16 genera and about 270 species are widely distributed in tropical regions. One species of *Bursera* reaches Florida. The family is related to the Rutaceæ and Simarubaceæ, from which it differs in the presence of resin-chambers in the bark. It is also very closely related to the Anacardiaceæ.

The family is very rich in resin and, therefore, is of considerable economic importance. These resins are frequently aromatic or fragrant; hence many have been used as incense. The resin myrrh is obtained from species of *Commiphora* of Arabia and Africa. Mecca balsam is from the same genus. *Olibanum incense* is derived from trees of the genus *Boswellia*, of India. Frankincense is either this *olibanum* or the resin from *Boswellia Carteri*. A substitute for dammar and copal has been obtained from the *Burseraceæ*.

Few species of the *Burseraceæ* are in cultivation in America: *Bursera Simaruba*, as an ornamental greenhouse tree; and *Garuga pinnata*, which is grown in Florida and California for the gooseberry-like fruit.

113. **Meliaceæ** (from the genus *Melia*, the Greek name of the somewhat similar manna-ash). MAHOGANY FAMILY. Fig. 31. Trees or shrubs: leaves usually alternate, pinnate or rarely simple; flowers bisexual, rarely unisexual, paniced; sepals 4-5, usually partly connate, imbricated; petals 4-5, rarely 3-8, separate, or connate or adnate to the stamens; stamens 8-10, rarely 5, or numerous, hypogynous, filaments usually connate into a tube which is entire or lacerate, rarely free; disk present; ovary superior, 2-5-celled, rarely 1- or many-celled, each cell 2-, rarely several-, ovuled; style and stigma 1: fruit a drupe, berry, or capsule.

There are 42 genera and about 600 species, all confined to the tropics. They enter the United States only in southern Florida. Some fossil species are known. The family is related to the Rutaceæ, but lacks the resin and oil-glands. It is closely related to all of the disk-bearing families, but is distinguished by the peculiar stamen-tube with teeth and fringe.

There is the greatest diversity in the arrangement of the anthers on the staminal tube and the dentation or fringing of the latter. Very commonly there are 2 stipule-like teeth just below the anthers. The seeds are sometimes winged (in mahogany). The leaves are rarely transparent-dotted (*Flindersia*).

*Melia Azedarach*, an Asiatic tree, is bitter, and has been used in medicine as a purgative and vermifuge. Other species of *Meliaceæ* are purgative and emetic, or are used for heartburn, and the like. Some have the odor of garlic. The bark of the Asiatic *Walsura piscidia* is used to stupefy fish. The pulp of the fruit of *Aglaia edulis* is said to be delicious. The bitter bark of mahogany has been used in place of quinine. The most celebrated member of the family is *Swietenia Mahogani* of the West Indies and Peru, which furnishes the mahogany timber of commerce. The wood of the West Indian *Cedrela odorata* is fragrant, and is the so-called cigar-box cedar, from which these boxes are made. The sawdust of the South African sneezewood (*Pteroxylon obliquum*) causes sneezing, hence the popular name.

Five or more genera are in cultivation in America, all confined to southern California and southern Florida, except *Melia*, which is common throughout the southern states, and *Cedrela sinensis*, hardy in Mass. Among these are *Cedrela* (West Indian Cedar); *Melia* (Pride of India, China-berry Tree, Texas Umbrella Tree); *Pteroxylon* (Sneezewood); *Swietenia* (Mahogany).

114. **Malpighiaceæ** (from the genus *Malpighia*, in honor of Marcello Malpighi, once professor of medicine at Pisa). MALPIGHIA FAMILY. Fig. 31. Trees or shrubs, most often climbing: leaves usually opposite, often with petiolar glands and jointed petioles: flowers commonly bisexual, usually obliquely irregular; sepals 5, mostly separate, some or all with large glands; petals 5, fringed or toothed, slender-clawed; stamens 10, in part staminodial, rarely fewer, the outer opposite the petals, hypogynous or nearly so, usually connate below; anthers very diverse and odd; ovary superior, 2-3-celled and lobed, rarely 5-celled, the cells 1-ovuled; styles 2-3, rarely connate: fruit commonly separating into 2-3 nut-like portions which are entire, or pectinately winged, or naked, rarely a single nut or drupe; seeds

exalbuminous; embryo variously curved or spiral, rarely straight.

This family has 55 genera and about 650 species, generally distributed in the tropics, but reaching to Texas and California in North America, and Port Natal in Africa. They are most abundant in the tropical forests of South America. The family is closely related to the Zygophyllaceæ, Sapindaceæ, and Erythroxylaceæ, as shown by the lobed and winged fruit, or clawed petals. The glandular calyx, clawed petals, the outer stamens opposite the petals, peculiar anthers, queer fruit, and curved embryo are together distinctive.

The family is of little economic importance. Various coloring matters and astringent tannins are contained in the bark, for which reason some of the Malpighiaceæ have been used for dysentery and intermittent fever. Some are used as a remedy for snake-bites. The fruits of certain Malpighiaceæ are sour, juicy and refreshing.

Few species are in cultivation in North America, all in California, Florida or the West Indies. *Galphimia* and *Stigmaphyllon* are ornamental; *Malpighia glabra* is the Barbadoes cherry, cultivated in the West Indies for the cherry-like fruit.

**115. Tremandraceæ** (from the genus *Tremandra*, which is from the Latin *tremble* and the Greek *male*, probably in allusion to the anthers). **TREMANDRA FAMILY.** Fig. 32. Shrubs or sub-shrubs, with opposite, whorled or alternate leaves: flowers bisexual, regular; sepals 4-5, rarely 3, valvate; petals of the same number as the sepals and alternating with them, colored, entire, separate induplicate-valvate; stamens 8 or 10, rarely 6, hypogynous, in 1 or 2 whorls; anthers opening by a transverse terminal valve, or more or less prolonged into a beak with terminal pores; ovary superior, 2-celled; style 1; stigma 1: fruit a capsule; seeds 1 or 2 in each cavity.

In this family are 3 genera and about 23 species, of which 20 belong to the genus *Tetratheca*. All are native of south and west Australia. The family is very similar to the Polygalaceæ, and separated from that



32. TREMANDRACEÆ: 1. *Platytheca*, floral diagram. POLYGALACEÆ: 2. *Polygala*, a, flower; b, flower, vertical section; c, floral diagram. EUPHORBIACEÆ: 3. *Euphorbia*, a, involucre and flowers; b, involucre, vertical section; c, floral diagram. 4. *Croton*, a, flower; b, floral diagram, male flower; c, floral diagram, female flower.

family only by the regular flowers. *Platytheca* is remarkable in having the four anther cells all in one plane.

Two genera are in the American trade, both tender heath-like plants: *Platytheca*, and *Tetratheca*.

**116. Polygalaceæ** (from the genus *Polygala*, an old Greek name applied later to this genus by botanists because of the supposed stimulative action of the plant on the lactation of cattle). **MILKWORT FAMILY.** Fig. 32.

Herbs, shrubs, or small trees, sometimes climbing or twining; leaves mostly alternate: flowers bisexual, irregular; sepals 5, imbricated, separate or somewhat coherent, the 2 inner largest and often winged or petaloid; petals rarely 5, commonly 3, at least the 2 upper, and sometimes all more or less coherent with each other and with the stamen-tube, inner petal concave and often with a fringed crest (keel); stamens 8, rarely fewer, in 2 whorls, hypogynous, usually adherent to the keel petal and coherent into a tube which is slit down and open behind; anthers usually opening by terminal pores or slits; ovary superior usually 2-celled; ovule usually 1 in each cell; style 1, dilated above; stigmas 1-4: fruit usually a capsule, rarely a drupe or samara; seeds pendulous, albuminous.

Polygalaceæ has 10 genera and about 500 species, 450 of which belong to the genus *Polygala*; widely distributed over the earth, but absent in New Zealand, Polynesia, arctic North America and arctic Asia. The family is not closely related to any other. The peculiar perianth and stamens, and the 2-celled ovary, are together very distinctive. The floral parts, though simulating those of the Leguminosæ, are not homologous.

A bitter principle gives the Polygalaceæ tonic and astringent properties. Some species are emetic. The root of *Polygala Senega* (North America), so-called "Senega or Seneca snakeroot," is used as an emetic and cathartic, but more especially as an expectorant. This and many other species of *Polygala* are reputed antidotes for snake-bites, hence the name "snakeroot."

Only the genus *Polygala* is in cultivation in N. America, of which 9 or 10 species are grown for ornamental purposes. Some are shrubs and 1 is an evergreen trailer.

**117. Euphorbiaceæ** (from the genus *Euphorbia*, named in honor of Euphorbus, physician to King Juba). **SPURGE FAMILY.** Fig. 32. Herbs, shrubs or trees, of greatly varying habit, sometimes fleshy and cactus-like, often with milky juice: leaves mostly alternate: flowers monœcious or dicecious, regular or irregular; both calyx and corolla present, or the latter absent, or both absent, or both much reduced, valvate or imbricated; the parts free, rarely united; intrastaminal disk usually present in the staminate flowers, often changed to glands; stamens as many as the sepals, or twice as many, or reduced to 1, separate or monadelphous; hypogynous disk in the pistillate flowers annular or cup-shaped or in the form of glands; ovary superior, usually 3-celled, rarely 1-, 2-, or 4-celled; style and stigma various; ovules 1-2 in each cavity, side by side, suspended, anatropous; micropyle external, covered with a caruncle: fruit splitting into three portions, leaving a central column, rarely indehiscent and berry-like, or drupaceous; seeds albuminous.

The 208 genera and about 4,000 species are widely distributed, mainly in the tropics, but extend into temperate regions. The largest genera are *Euphorbia* with about 700 species, *Croton* with 500-600 species, and *Phyllanthus* with 400 species. The family is related to the Geraniales, as shown by the fruit. The only constant characters of this great polymorphic family are the collateral anatropous ovules with micropyle external, the caruncle, the usually persistent axis of the fruit, and the albuminous seeds. In *Euphorbia*, some sessile staminate flowers and a pedicelled pistillate flower are inclosed in a common involucre which bears various horn-like, or gland-like, or petaloid appendages. The variation in the inflorescence and floral structure throughout the family is very intricate.

The family is of great economic importance. Only the most important plants can be mentioned here. The following are used in medicine: The juice of *Euphorbia Esula*, *E. Cyparissias*, *E. Lathyris*, *E. helioscopia*, and others, is purgative, as is also that of *Mercurialis*. *Croton Tiglium* yields the purgative croton oil. *Ricinus communis* yields castor oil. *Jatropha Curcas* (physic nut) is purgative. *Euphorbia Hyberna*, *Jatropha*



*officinalis*, *Croton*, and *Stillingia sylvatica* (queen's root) are used for syphilis. *Euphorbia corollata* and *E. Ipecacuanha* are emetic. *E. thymifolia* is used as a vermifuge in India. *Croton Eluteria* yields cascarilla bark, a tonic. The hairs of the capsule of *Mallotus philippinensis* are in the trade as kamala. The juice of *E. cotinifolia* is used by the Caribbeans to poison arrows; that of *Excoecaria Agallocha* (blinding tree) is so acrid as to blind the eye into which it may chance to fall. The juice of *E. balsamifera*, of the Canaries, is cooked and eaten as jelly. The seeds of *Aleurites triloba* are called "almonds," and eaten; as are also those of *Conceveiba guyanensis*. The fruit of *E. disticha* is edible. *E. Emblica* has fleshy, sweet fruit. The most useful as food are the tuberous roots of the sweet manioc (*Manihot palmata* var. *Aipi*), eaten cooked or raw; and of the bitter manioc (*M. utilissima*), which is poisonous when raw, but when cooked is very widely used for food in the tropics. This root is the source of cassava bread, and tapioca. Phosphorescent juice is obtained from *E. phosphorea* of Brazil. The fruit of *Hura crepitans* (sand-box) opens with a report like a pistol. It is cooked in oil to prevent dehiscence, and used as a sand-box. India rubber is obtained from the juice of *Hevea guyanensis*, and other species. *Omphalea triandra* yields a blackening juice used as ink. Soap is made from the seminal oil of *Jatropha Curcas*. Oil from the seeds of *Aleurites cordata* (Japanese oil tree) is used for lighting. Turnsole (*Crotophora tinctoria*), of the Mediterranean, yields a dye used to color Dutch cheese. Other Euphorbiaceæ yield dyes. *Sapium sebiferum* (Chinese tallow tree) yields a fat used for burning, and other purposes.

Twenty to 30 genera are in cultivation in N. America for various purposes. Among these are: *Acalypha*, ornamental; *Aleurites* (Candlenut, Candleberry Tree), California; *Codiaeum* (Croton), ornamental; *Euphorbia* (Spurge, Snow-on-the-Mountain, Scarlet Plume, Poinsettia, Mexican Fire Plant, Hypocrite Plant, Painted Leaf, Fire-on-the-Mountain, Crown of Thorns, Medusa's Head, Caper Spurge, Mole Plant), greenhouse, garden, ornamental; *Hevea* (South American Rubber Tree), botanical gardens and Florida; *Jatropha* (French Physic Nut), South; *Manihot* (Ceara Rubber Tree, Cassava, Manioc Plant), South, food and ornamental; *Pedilanthus* (Bird Cactus, Jew Bush), greenhouse; *Phyllanthus* (Snow-bush, Emblie Myrobolan, Otaheite Gooseberry), greenhouse, garden; *Putranjiva* (Indian Amulet Plant), South; *Ricinus* (Castor-Oil Plant, Palma Christi), garden, ornamental; *Stillingia* (Queen's Root, Queen's Delight); *Sapium* (Tallow Tree), South.

#### Order 39. SAPINDALES

118. **Buxaceæ** (from the genus *Buxus*, the ancient name of the box). **BUXUS FAMILY.** Herbs, shrubs or trees: leaves opposite or alternate: flowers monœcious, inconspicuous; hypogynous disk wanting; corolla absent; calyx 4-parted, or in the pistillate flower 4-12-parted or 0, imbricated; stamens 4, opposite the lobes of the calyx, or numerous; ovary superior, 3-celled, rarely 2-4-celled; ovules 2, collateral, rarely 1, suspended, micropyle turned toward the axis; styles 2-3: fruit capsular and opening elastically, or fleshy; seeds with endosperm, with or without a caruncle.

About 6 genera and 30 species inhabit the tropics and subtropics. One species is native in the southeastern United States. The largest genus is *Buxus* with 19 species. Fossil species are known. The family is related to the Euphorbiaceæ, with which it is united by some authors, and to the Celastraceæ and Empetraceæ. The absence of milky juice, the calycoid perianth, the 3-celled ovary with collateral suspended albuminous seeds, and the axially directed micropyle are together characteristic.

The wood of the box (*Buxus sempervirens*) of Europe is close-grained and homogeneous; used for engraving and for the manufacture of musical instruments. A decoction of the wood was formerly used in medicine for fevers. Its leaves and seeds are purgative. Oil from the seeds of *Simmondsia* is used as a hair-tonic.

Four or more genera are in cultivation in America. These are: *Buxus* (Box) ornamental; *Pachysandra*



33. EMPETRACEÆ: 1. *Empetrum*, a, flower; b, floral diagram. CORIARIAEÆ: 2. *Coriaria*, a, flower; b, floral diagram. ANACARDIAEÆ: 3. *Rhus*, a, flower; b, floral diagram. 4. *Anacardium*, fruit. CYRILLACEÆ: 5. *Cyrilla*, flower.

(Mountain Spurge), garden, ornamental; *Sarcococca*, greenhouse, ornamental; and *Simmondsia*, California, for oil.

119. **Empetraceæ** (from the genus *Empetrum*, an ancient name signifying upon a rock). **CROWBERRY FAMILY.** Fig. 33. Small ericoid shrubs: leaves alternate, deeply furrowed beneath: flowers polygamous or dioecious, small, regular, hypogynous; disk wanting; sepals 2-3, imbricated; petals 2-3, or 0; stamens of the same number as the petals and alternate with them; ovary superior, 2-9-celled, each cell 1-ovuled; style-branches 2-9, often fringed or toothed: fruit drupaceous; seed ascending, anatropous, albuminous; micropyle turned toward the outside.

In the north temperate and arctic regions, and in the Andes, are found 3 genera and about 5 species. The family is related to the Buxaceæ, and more distantly to the Euphorbiaceæ and Celastraceæ. The habit, the reduced or absent corolla, the few stamens, the 1-seeded ovary, the external micropyle, and the absence of the disk and aril are together distinctive.

The acid berries of *Empetrum* are eaten in north Europe and Kamtschatka, and also used to prepare a drink. The fruit of *Corema album* has been used as a fever remedy. An acid drink is prepared from it in Portugal.

In North America, 2 genera are in cultivation: *Ceratiola*, not hardy; and *Empetrum* (Crowberry), grown in rock-gardens.

120. **Coriariaceæ** (from the genus *Coriaria*, derived from the Latin meaning a hide, used for tanning). **CORIARIA FAMILY.** Fig. 33. Shrubs with opposite or whorled, entire leaves: flowers bisexual, or unisexual, regular; sepals 5, imbricated; petals 5, smaller, but enlarging in fruit, fleshy, keeled within and pressed between the carpels; stamens 10, hypogynous; carpels 5-10, superior, separate: fruitlets indehiscent, 1-seeded, dry.

This family consists of a single genus containing 8 species, widely distributed in warm-temperate zones. *Coriariaceæ* is not closely related to any other family;

perhaps most closely to the Empetraceæ. Some authors place it near the Sapindaceæ or Phytolaccaceæ, or Rutaceæ. It represents an ancient group. Fossil species are known.

*Coriaria myrtifolia* (myrtle-leaved sumach) of the West Mediterranean region, contains much tannin and is used by curriers; its leaves and fruits are poisonous. The fruit of *C. ruscifolia* of New Zealand contains a vinous juice, which is drunk as a beverage, but its seeds are poisonous. *C. ruscifolia* also yields a black color used by shoemakers.

Two species are grown for ornamental purposes in eastern North America. They are semi-hardy.

121. **Limnanthaceæ** (from the genus *Limnanthus*, the name signifying marsh flower). **LIMNANTHUS FAMILY.** Herbs with alternate leaves: flowers bisexual, regular; sepals 3 or 5, valvate; petals 3 or 5, convolute, separate; stamens twice as many as the petals, the outer opposite the petals, often glandular at base; ovary superior, 3- or 5-lobed, 3- or 5-celled; ovules 1 in each cell, ascending, micropyle directed downward and outward; stigmas 3 or 5: fruit dry, separating into segments.

This is a small family of 2 genera and 5 species, all of North America. The family was formerly united with the Geraniaceæ, to which the floral structure bears a superficial resemblance. It is also related to the Anacardiaceæ and Sapindaceæ. It may be said to possess the general floral structure and lobed ovary of the Geraniaceæ, but the seed position of the two families last named.

*Limnanthus Douglasii*, of California, is grown for ornamental purposes.

122. **Anacardiaceæ** (from the genus *Anacardium*, the name meaning heart-like, in reference to the shape of the nut). **CASHEW FAMILY.** Fig. 33. Trees or shrubs with resinous bark, and alternate, simple or compound leaves: flowers bisexual or unisexual, regular, small, and numerous, epigynous, perigynous or hypogynous; sepals 3-5; petals 3-5, mostly imbricated, or 0; stamens 5 or 10, rarely many, inserted with the petals at the edge or base of an annular, intra-staminal disk; ovary 1-, rarely 2-6-, celled, with 1 ovule in each cell; styles 1-6: fruit a drupe or nut, rarely dehiscent; seeds usually exalbuminous.

There are 58 genera and about 400 species, most abundant in the tropical zone of both hemispheres, but represented by the genus *Rhus* as far north as Europe and the United States. *Rhus* is the largest genus, containing 120 species. The family is related to the Sapindaceæ, but contains resin, and has an intra-staminal disk. It is also related to the Burseraceæ and Simarubaceæ.

The disk in some genera becomes elongated into a stalk on which the ovary is raised. The drupe is sometimes edible (*Mangifera*). In *Anacardium*, the nut-like fruit is situated on top of a fleshy edible receptacle. Sometimes the nut is surrounded by the edible receptacle. In *Cotinus*, the pedicles become plumose and the whole much-branched inflorescence breaks off, and blows about, distributing the seeds. In *Swin-tonia*, the calyx or the corolla becomes enlarged and persistent and serves as a parachute in seed-dissemination. *Rhus Toxicodendron* (poison ivy) and *R. Vernix* (poison sumach, poison elder, poison dogwood) contain in all their parts an oily, extremely irritating substance, which often produces a very painful vesicular eruption that may last for several days.

The Anacardiaceæ is a family of considerable economic importance. Because of the resinous juice, it yields medicinal substances and varnishes. It also yields important edible fruits. *Pistacia vera* of Syria furnishes the pistachio nut; *Pistacia Terebinthus* of the Mediterranean yields Cyprus turpentine, formerly medicinal. The leaves of *Rhus Coriaria* of the Mediterranean are used for tanning fine leather. *Rhus succedanea* of Japan yields vegetable wax, which coats the seed

within the capsule. *Melanorrhœa usitata* yields a celebrated black varnish of Burmah. *Mangifera indica* of the East Indies is the mango tree, the fruit of which is large, juicy, sugary-acid and agreeable. *Anacardium occidentale* of tropical America is the cashew. This plant yields edible nuts and an edible receptacle. From it vinegar is made, also a peppery oil used as a condiment; and the trunk yields a valuable acacia-like gum. The seeds of *Semecarpus* (marking-nut tree) give an indelible black dye used in marking linen. *Spondias purpurea* is the so-called Spanish plum of the West Indies. The fruit of *Spondias dulcis* of the Pacific Islands is also frequently eaten. Other species furnish the hog plum of the West Indies. The mastic, a fragrant gum-resin of the pharmacist, is obtained from *Pistacia Lentiscus* of the Orient.

Eight to 12 genera are in cultivation in N. America, but with the exception of *Rhus* and *Cotinus*, mostly in the southern states, especially in southern Florida and southern California. Among these are: *Anacardium* (Cashew Tree); *Cotinus* (Smoke-bush); *Cyrtocarpa*, fruit edible; *Mangifera* (Mango); *Pistacia* (Pistachio Nut); *Rhus* (Sumach, Poison Ivy, Poison Oak, Poison Elder, Poison Dogwood), 15 species; *Schinus* (California Pepper Tree, Peruvian Mastic); *Semecarpus* (Marking-nut Tree).

123. **Cyrillaceæ** (from the genus *Cyrilla*, named in honor of Dominico Cyrillo, a professor of medicine at Naples). **CYRILLA FAMILY.** Fig. 33. Shrubs with alternate, entire leaves: flowers bisexual, regular, small; sepals 5, often enlarged in fruit, imbricated; petals 5, imbricated, slightly connate at base or separate; stamens 5 or 10, hypogynous, the inner sometimes wanting, filaments dilated; ovary superior, 2-4-celled; ovules 1, rarely, 2-4 in each cell; style short; stigmas 2: fruit a fleshy or dry capsule, or nearly dry drupe with wings; seeds albuminous.

The 3 genera and only 5 species are all American, ranging from Virginia to Brazil. The relationship of the Cyrillaceæ is doubtfully understood. It is probably closely related to the Aquifoliaceæ, although some have placed it with the Ericaceæ. The small polypetalous flowers, the few stamens, the several-celled, few-seeded ovary, the dry fruit and the non-arillate seeds are important characteristics.

*Cyrilla racemiflora* (leatherwood, black ti-ti) of the southeastern United States is occasionally cultivated for ornamental purposes.

124. **Aquifoliaceæ** (from *Aquifolium*, Tournefort's name for the genus *Ilex*, application obscure). **HOLLY FAMILY.** Fig. 34. Trees or shrubs, with alternate or opposite, simple, often evergreen leaves: flowers bisexual, rarely unisexual, very small, axillary, solitary or fascicled, rarely cymose; sepals 3-6, more or less connate; petals 4-5, nearly separate, imbricated; stamens 4-5, alternating with the petals, and sometimes adhering to them, hypogynous disk wanting; ovary superior, 3 to many-celled, each cell 1-2-ovuled; stigma subsessile, lobed: fruit berry-like; seeds albuminous.

Three genera are known and about 280 species, of which 275 belong to the genus *Ilex*. These are widely distributed, but rare in Europe, the center of distribution being in Central and South America. Ten species are found wild in the northeastern United States. The Aquifoliaceæ are related to the Celastraceæ and the Anacardiaceæ, from which they are distinguished by the absence of the hypogynous disk and by the general appearance.

*Ilex Aquifolium* of Europe is used there for hedges and for indoor decoration. *I. opaca* is used for indoor decoration in this country. The leaves of both are thick, glossy, evergreen and spiny-toothed. *I. paraguariensis* furnishes maté, which is the tea of South America. It was early cultivated by the Jesuits (1609-1768), and is even yet one of the most important cultivated plants of South America. Other species of *Ilex*



have been used in various parts of the world for medicine because of their astringent qualities and bitter principle.

Many species of *Ilex* (Holly, Dahoon, Cassena, Yaupon, Winterberry, Black Alder), and one of *Nemopanthes* (Mountain Holly) are grown as cultivated plants in America, all for ornamental purposes.

125. **Celastraceæ** (from the genus *Celastrus*, an ancient Greek name). STAFF-TREE FAMILY. Fig. 34. Shrubs or trees, often climbing; leaves alternate or rarely opposite, simple, not lobed; flowers bisexual or unisexual, small and greenish, regular; sepals 4-5, imbricated; petals 4-5, imbricated; stamens 4-5, alternate with the petals, rarely 10; disk present, lining the bottom of the calyx, sometimes adnate to the ovary; ovary superior, 2-celled, buried in the disk, or distinct and disk small; 1-2 ovules in each cell; style 1, short; stigmas 2-5-lobed; fruit a drupe, or samara, or a capsule; seeds albuminous, usually with a pulpy aril.

Thirty-eight genera and about 375 species are distributed in all parts of the world except the arctic zone. They are especially numerous in the tropics. *Euonymus*, *Maytenus*, and *Celastrus* are the largest genera. The Celastraceæ are in some respects related to the Cyrillaceæ, in others to the Aquifoliaceæ and Rhamnaceæ. The small greenish flowers, the stamens alternating with the petals, the ovary sunken in the disk, and the aril are in general distinctive. There are exceptions to all these characters.

The capsule of *Celastrus* and *Euonymus* frequently remains on the plant through late fall and early winter. It splits into from 3-5 valves, which become reflexed and expose the aril of the seeds. The contrast in color between aril and pericarp is often very striking and ornamental. The Celastraceæ are mostly pollinated by ants and flies which run over the disk for the honey.

The Celastraceæ are of but slight economic importance. Some have been used for their emetic and purgative properties. *Catha edulis* of East Africa has been long cultivated by the Arabs under the name *khat*; the leaves produce an agreeable excitement and it is considered a very valuable remedy for plague. The drupes of an *Elæodendron* are said to be eaten in South Africa. The wood of some Celastraceæ is much valued for carving.

In North America 6 or more genera of Celastraceæ are grown for ornamental purposes; *Elæodendron* in warm-houses and in southern parts; *Euonymus*, hardy North; *Gymnosporia* and *Maytenus* grown in southern regions; *Pachistima*, hardy; and *Celastrus*, a hardy vine.

126. **Stackhousiaceæ** (from the genus *Stackhousia*, named in honor of John Stackhouse, a British botanist). STACKHOUSIA FAMILY. Fig. 34. Herbs with rather thick, alternate leaves; flowers bisexual, regular, in spikes, racemes or fascicles; sepals 5, imbricated; petals 5, more or less, perigynous, long-clawed, the claws separate below, connate above; disk thin, clothing the inside of the cup-shaped receptacle; stamens 5, perigynous, alternating with the petals, often unequal; ovary superior, 2-5-lobed, 2-5-celled, each cell 1-ovuled; styles 2-5, free or connate; fruit of 2-5 separate, globose, angular, reticulated or winged, indehiscent portions which separate from a central persistent column; seeds albuminous.

This is a very small family of 2 genera and 14 species; natives of Australia and adjacent islands. It is probably related to the Celastraceæ more closely than to any other family.

One species of *Stackhousia* is grown for ornamental purposes in California.

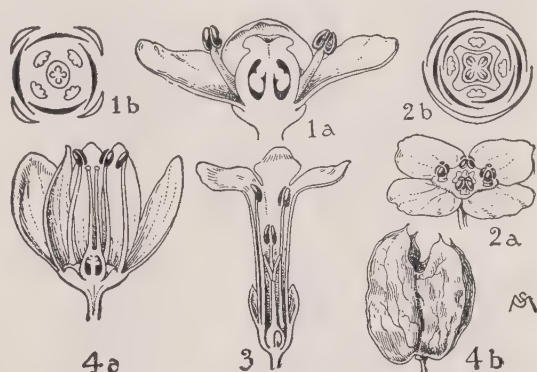
127. **Staphyleaceæ** (from the genus *Staphylea*, derived from the Greek meaning *a cluster*, probably in reference to the flower-cluster). BLADDERNUT FAMILY. Fig. 34. Trees or shrubs; leaves opposite or alternate, pinnately compound, stipulate; flowers bisexual, regular; sepals 5, imbricated; petals 5, imbricated; stamens 5, alternating with the petals, inserted outside the large, cup-shaped disk; ovary usually 3-celled; styles 3, sepa-

rate or connate; fruit a capsule, often deeply lobed, sometimes indehiscent and berry-like; seeds usually many in each cell, albuminous, sometimes with an aril.

This family contains 5 or 6 genera and about 22 species, in the north temperate zone, extending rarely to northern South America and to the Malay region. Fossil species are known. The family is closely related to the Sapindaceæ, in which it was formerly included, and from which it is separated by the abundant endosperm, the intra-staminal disk, the more numerous seeds, the straight embryo, and various anatomical differences. The fruits of the bladdernut are an inch long, membranous and bladderly; the seeds become loosened and the fruit then is interesting to children as rattle-boxes.

The family is of little economic importance. Three genera are cultivated in North America for ornamental purposes. These are: *Euscaphis*, *Staphylea* (Bladdernut), and *Turpinia*.

128. **Aceraceæ** (from the genus *Acer*, the classical name of the maples, from the Celtic meaning *hard*).



34. AQUIFOLIACEÆ: 1. *Ilex*, a, flower; b, floral diagram. CELASTRACEÆ: 2. *Euonymus*, a, flower; b, floral diagram. STACKHOUSIACEÆ: 3. *Stackhousia*, flower. STAPHYLEACEÆ: 4. *Staphylea*, a, flower; b, fruit.

MAPLE FAMILY. Fig. 35. Trees or shrubs; leaves opposite, exstipulate, simple or compound; flowers mostly unisexual, often bisexual ones intermixed, regular; sepals 4-5, separate or somewhat connate, imbricated; petals 4-5, or 0, imbricated; disk either extra-staminal or intrastaminal, usually flat, and sometimes lobed or divided; stamens 4-10, mostly 8, separate, inserted at the edge of the disk; ovary superior 2-celled, 2-lobed, much flattened contrary to the partition; style 1; stigmas 2: fruit splitting into two portions, each a samara; seeds 2 in each cell, exalbuminous.

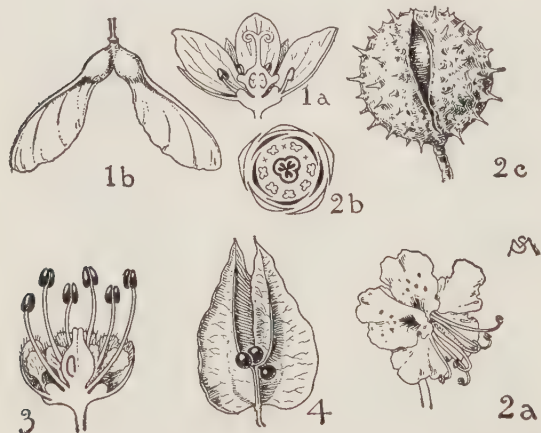
There are 2 genera and about 110 species; all but 1 belong to the genus *Acer*. They are mostly natives of mountainous or upland countries of the northern hemisphere. Some fossil species have been discovered. The Aceraceæ are closely related to the Sapindaceæ, with which they were formerly united, and from which they differ in the opposite, usually palmate leaves, the peculiar fruit, and regular flowers. In position, the disk shows a transition between the Sapindaceæ and other families. The family is easily recognized by the opposite, exstipulate leaves, and peculiar fruit.

The wood of *Acer saccharum* (sugar maple, hard maple) is of great value for timber. Bird's-eye maple and curly maple are forms of this species in which the growth of the cambium is irregular. The manufacture of sugar from the sap of the sugar maple is an important industry in the northern states in early spring. The sycamore of England is *Acer pseudo-platanus*; that of America is a species of *Platanus*. The juice of *Acer platanoides* (Norway maple), and probably of others, is milky.

Forty or more species of *Acer* (maple) are in cultivation in N. America for ornamental purposes. *Acer Negundo* (box elder) is exceptional in having compound leaves.

**129. Hippocastanaceæ** (from the genus *Hippocastanum*, the old generic name of the genus *Æsculus*, derived from the Greek meaning horse and chestnut). HORSE-CHESTNUT FAMILY. Fig. 35. Trees or shrubs: leaves opposite, exstipulate, palmately 3-9-foliolate: flowers, some bisexual, some staminate, irregular; sepals 5, separate or connate, imbricated; petals 4-5, unequal, clawed; stamens 5-8, separate; disk present, extra-staminal, often inequilateral; ovary 3-celled; ovules 2 in each cell; style and stigma 1; fruit usually 1-celled and 1-seeded, capsular, 3-valved; seeds very large, exalbuminous.

There are 2 genera and 22 species of general distribution in the north temperate zone. The family is closely related to the Sapindaceæ, with which it is often united, and from which it differs only in its larger flowers, palmately compound leaves and large seeds. The Hippocastanaceæ, Sapindaceæ, Melianthaceæ,



35. ACERACEÆ: 1. *Acer*, a, flower; b, fruit. HIPPOCASTANACEÆ: 2. *Æsculus*, a, flower; b, floral diagram; c, fruit. SAPINDACEÆ: 3. *Sapindus*, flower. 4. *Koeleruteria*, vertical section fruit.

and some Aceraceæ are almost the only plants with extra-staminal disks.

The horse-chestnut (*Æsculus Hippocastanum*) is a well-known shade tree, said to have been introduced into Europe by Clusius in 1575. The seeds, rich in starch, have been used for fodder. They have also been used to form the principal part of a certain kind of snuff, and the oil contained has been used to a slight extent in medicine. The roots of *Æsculus* contain saponin and have been used, like soapberry, for washing.

Several species of *Æsculus* are in cultivation in N. America. *Æ. glabra* and *Æ. octandra*, natives of the central United States, are called buckeyes.

**130. Sapindaceæ** (from the genus *Sapindus*, a contraction of the Latin *sapo-indicus*, Indian soap). SOAP-BERRY FAMILY. Fig. 35. Trees or shrubs, rarely herbs, often climbing: leaves usually alternate, mostly compound, sometimes ternately, sometimes pinnately decompound; flowers unisexual or polygamous, regular or irregular (i.e. obliquely unsymmetrical), small; sepals 4-5, imbricated or rarely valvate; petals 4-5, small or wanting, usually with scales or hairs at the base inside; disk well developed, situated between the petals and the stamens (extrastaminal); stamens usually 10 in 2 whorls, more or less united at the base; ovary superior, mostly 3-celled and deeply 3-lobed; ovules typically 1 in each cell; style 1; fruit very diverse, a firm or bladdery capsule, a berry, nut, or winged fruit; seeds without endosperm.

The 118 genera and about 1,000 species are of trop-

ical distribution. Only one species reaches northward as far as Kansas. The family is closely related to the Staphyleaceæ, Hippocastanaceæ, and Aceraceæ, which see for differences; and more distantly to the Celastraceæ. The small flowers, usually appendaged petals, 10 stamens, extra-staminal disk, and 3-celled, few-seeded fruit are usually distinctive.

The climbing Sapindaceæ often have very peculiar stems in which many separate cambium rings have taken part. This renders the cross-section very peculiar, making it appear sometimes as a bundle of woody ropes tied together, with bark between them.

The Sapindaceæ are of considerable economic importance. The fruits of many are used locally for food, sometimes the flesh of the fruit, sometimes the aril being of importance. The seeds of *Sapindus* and other genera are often roasted and eaten as food. Oil is obtained from the seeds of others. Some are used locally for medicine. The seeds and other parts of many species are very poisonous, the fruits of species of *Sapindus* being used to poison fish. The juice of *Paullinia pinnata* (cururu) is used by savages in Guiana to poison their arrows. The Lechcheuquana bee collects honey from *Serjania lethalis* which, when eaten even in small quantities, produces raving madness or even death. The bark and berries of many species (e.g., the soap tree, *Sapindus*) contain saponin which reacts like soap, on which account they are used for washing. Yellow and black dyes, used as cosmetics, are obtained from certain species. The very hard wood of certain Sapindaceæ is much prized for timber. The hard, spherical, black seeds of *Sapindus Saponaria* are strung as beads.

There are 15 or more genera of true Sapindaceæ grown in America. *Koeleruteria* (Varnish Tree) is hardy and ornamental. *Cardiospermum* (Balloon Vine) is a tender annual with queer fruit. *Xanthoceras* is a hardy ornamental tree. *Paullinia* is a greenhouse climbing shrub. The following are grown only in the southern states or California: *Greyia*; *Melicocca* (Spanish Lime); *Blighia* (Akee Tree); *Dodonaea*; *Ungnadia* (Mexican or Spanish Buckeye); *Sapindus* (Soapberry).

The following cultivated genera are now referred to other families: *Melanthus* (Melianthaceæ); *Æsculus* (Hippocastanaceæ); *Acer* (Aceraceæ); *Ptæroxylon* (Meliaceæ); *Staphylea* (Staphyleaceæ); *Euscaphis* (Staphyleaceæ); *Turpinia* (Staphyleaceæ).

**131. Melianthaceæ** (from the genus *Melanthus*, derived from the Greek meaning honey and flower). MELANTHUS FAMILY. Shrubs or trees: leaves alternate, entire or pinnate; flowers bisexual, irregular, soon inverted; sepals 5, imbricated; petals 4-5; stamens 4-5, or 10, free or slightly connate at the base, alternating with the petals; disk present, extrastaminal, crescent-shaped, or annular with 10 projections; carpels 4-5; ovary 4-5-celled; ovules 1 to many in each cell; style 1; stigma 4-5-lobed: fruit a capsule; seeds albuminous, sometimes arillate.

All the 3 genera and 17 species are natives of Africa. The Melianthaceæ were formerly united with the Sapindaceæ, with which they agree in the extra-staminal disk, but they differ in the vertically bisymmetrical, not obliquely bisymmetrical, flowers, and more abundant endosperm.

In southern California, species of *Melanthus* are grown for ornament.

**132. Balsaminaceæ** (from *Balsamina*, the old name of the genus *Impatiens*, probably derived from *balassan*, the Arabic name of these plants). BALSAM FAMILY. Fig. 36. Herbs, very rarely epiphytic: leaves various: flowers bisexual, irregular, spurred, nodding; sepals 3-5, irregular, imbricated often petaloid, the posterior very large and sack-like, and gradually prolonged backward into a honey-spur; petals 5, alternate with the sepals, separate, or united so as to appear as 3, lower petals much the larger; stamens 5, hypogynous, closely



covering the ovary like a hood; anthers coherent; ovary superior, 5-celled; ovules 3 to many in each cell; stigmas sessile: fruit a 5-valved capsule, the valves of which coil up elastically and forcibly distribute the seeds, or sometimes a 5-celled drupe-like structure.

Contained in this family are 2 genera and about 220 species, of which all but 1 belong to the genus *Impatiens*; widely distributed, but most abundant in the tropics of the Old World, wanting in South America. The family is closely related to the Geraniaceæ, with which it was formerly united, but is distinguished by the 5 peculiar hypogynous stamens. The honey-spur in this family is an outgrowth of the sepals, and not of the receptacle as in *Pelargonium* and *Tropæolum*. There are extra-floral nectaries on the foliage of some species, which attract protective ants.

The sap of several species of *Impatiens* has been used as a dye to color red or yellow: that of *I. biflora* (North America) staining yellow; that of *I. Balsamina* (India) staining red, and used to color the skin and fingernails. The tubers of *I. tinctoria* of Abyssinia are used for dyeing the feet and hands red or black. Some species have been used as medicine. Many are ornamental.

There are several species of *Impatiens* in the North American trade: *I. aurea* and *I. biflora* are the east American touch-me-nots or jewel-weeds; *I. Balsamina* is the garden balsam; the other species are greenhouse plants.

#### Order 40. RHAMNALES

133. **Rhamnaceæ** from the genus *Rhamnus*, the old Greek name). BUCKTHORN FAMILY. Fig. 36. Trees or shrubs, rarely herbs, sometimes spiny or climbing: leaves simple, mostly alternate: flowers bisexual or unisexual, regular, perigynous, small, greenish, mostly axillary; sepals 5, rarely 4, valvate; petals 5, or 4, alternate with the sepals; stamens of the same number as the petals and opposite them; an intrastaminal disk lining the cup-shaped receptacle; ovary 2-4-celled, superior or inferior; cells 1-, rarely 2-, ovuled; styles 2-4, more or less connate: fruit drupaceous, or winged, or capsular.

Rhamnaceæ has 46 genera and about 550 species very generally distributed over the earth. *Rhamnus* is the largest genus (70 species), and the most widely distributed. The family is represented by 6 native species in northeastern North America. It is most closely related to the Vitaceæ and Celastraceæ, differing from the former in the simple entire leaves and strongly perigynous flowers, and from the latter in the stamens being opposite the petals.

The family is not of great economic importance. The berries and bark of *Rhamnus cathartica* (buckthorn) contain a bitter principle which is purgative. The fruits of some species of *Rhamnus* yield yellow or green dyes of some importance. *R. dahurica* and *R. tinctoria* give Chinese green. The bark of *R. cathartica* and *R. Frangula* (Europe) is used to dye yellow. *R. Purshiana* (California) is the cascara sagrada of medicine, a strong purgative. The fruits of *Zizyphus* *Lotus* are pulpy and agreeable, and were much prized by the ancients. The fruits of several species of *Zizyphus* are eaten in various parts of the Old World. The spiny branches of *Paliurus Spina-Christi* or *Zizyphus Spina-Christi* are thought to have been those from which the crown of thorns was made.

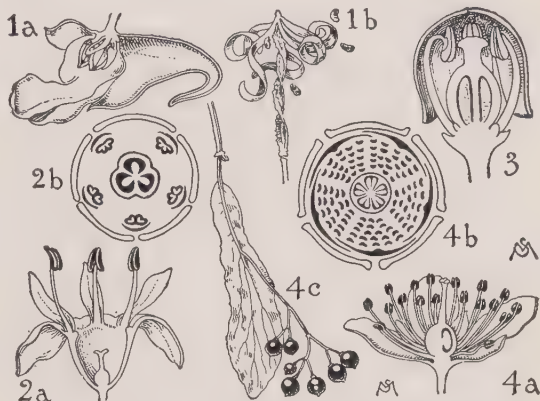
Nine or more genera are in cultivation in N. America for ornamental purposes. These are: *Ceanothus* (New Jersey Tea); *Berchemia* (Supple Jack); *Gouania*; *Hovenia*; *Paliurus*; *Pomaderris*; *Reynosia*; *Rhamnus* (Buckthorn); *Zizyphus* (Jujube).

134. **Vitaceæ** (from the genus *Vitis*, the classical name). GRAPE FAMILY. Fig. 36. Mostly climbing shrubs with tendrils, seldom upright shrubs or small trees: leaves alternate or opposite, very diverse: flowers bisexual, or unisexual, small, numerous, regular; sepals 4-5,

rarely 3-7, minute or obsolete; petals 4-5, rarely 3-7, valvate, separate (gamopetalous in *Leea*); stamens 4-5, rarely 3-7, opposite the petals, somewhat perigynous; disk evident; annular or of separate lobes; ovary superior, 2-, rarely 3-6-, celled, with 2, or rarely 1, ovule in each cell; style 1 or 0; stigma capitate or peltate: fruit a berry; seeds albuminous.

The 11 genera and about 450 species are mostly of tropical and subtropical distribution. Fourteen species reach the northeastern United States. The largest genus is *Cissus* with 250 species. Some fossil forms are known. The Vitaceæ are closely related to the Rhamnaceæ. The climbing habit, the few stamens opposite the petals, the 2-carpelled berry, and the capitate stigma are distinctive.

The petals in *Vitis* remain connate at the tip as in the bud, but separate from each other at the base, and fall off as a cap. The tendrils of the Vitaceæ are borne at the nodes and opposite the leaves. There has been much discussion as to whether the tendrils are apical or



36 BALSAMINACEÆ: 1. *Impatiens*, a, flower; b, fruit. RHAMNACEÆ: 2. *Rhamnus*, a, flower; b, floral diagram. VITACEÆ: 3. *Vitis*, flower. TILIACEÆ: 4. *Tilia*, a, flower; b, floral diagram; c, fruit.

lateral, i.e., whether the plant is sympodial or monopodial. The tips of the tendrils are in some species expanded into disk-like holdfasts. The species of *Cissus* are mainly desert plants. They are often cactus-like, with fleshy, angled, jointed, or terete stems; or have tubers or tuberous bases.

The most important economic plant in the family is the grape (*Vitis*), which has been cultivated since early times. *V. vinifera* is the wine grape of Europe and southern California, and has given rise to our greenhouse grapes; not hardy. *V. Labrusca* is one of the parents of most of our hardy grapes. *V. vulpina* and *V. cordifolia* are frost or fox grapes. Several species of *Vitis* are grown for ornamental purposes only. Raisins are the dried fruit of certain species of *Vitis*, mostly *V. vinifera*. Virginia creeper or woodbine (*Parthenocissus* [*Ampelopsis*] *quinquefolia*) and Boston ivy or Japanese ivy (*P. tricuspidata*) are ornamental.

A few genera are in cultivation in America: *Ampelopsis*; *Parthenocissus* or *Psedera*; *Cissus* (Kangaroo Vine); and *Vitis*.

#### Order 41. MALVALES

135. **Elæocarpaceæ** (from the genus *Elæocarpus*, derived from the Greek meaning *olive-fruit*). ELÆOCARPUS FAMILY. Trees or shrubs, with entire alternate or opposite leaves without slime-cells: flowers usually bisexual, regular, hypogynous; involucre 0; sepals 4-5, separate or connate, valvate; petals 4-5, or 0, separate, rarely connate, usually valvate, often incised; stamens many; anthers opening by terminal pores; hypogynous.

nous intra-staminal disk present; ovary superior, 2- to many-celled, rarely 1-celled; ovules many in each cell; style 1; stigmas 1 to several; fruit capsular or drupaceous.

Seven genera and about 120 species are distributed in the tropics of both hemispheres. *Elaeocarpus* contains 60 species and *Sloanea* 44 species. The family is closely related to the Tiliaceæ, with which it is often united and from which it is distinguished by anatomical characteristics, and usually also by the often hairy and firm, or incised, petals, or by the absence of petals.

A vegetable ivory used in carving is obtained from the large stone of the drupe of *Elaeocarpus sphaericus* of India. Those of *E. tuberculatus* (India and Java) are worn as amulets. The seeds of *Sloanea dentata* of Guiana are eaten like chestnuts. The bark of *Crinodendron Patagua* of Chile is used for tanning. The wood of *Aristotelia Maqui* of Chile is variously used. Its leaves are medicinal and its berries are edible.

Two genera are cultivated in North America: *Aristotelia*, California; *Elaeocarpus*, not hardy.

**136. Tiliaceæ** (from the genus *Tilia*, the ancient Latin name of the Linden). LINDEN or BASSWOOD FAMILY. Fig. 36. Trees, shrubs, or herbs: leaves mostly alternate, entire or variously lobed: flowers bisexual, regular; sepals 5, rarely 3 or 4, free or connate, usually valvate; petals as many as the sepals, convolute or imbricated, or valvate, rarely wanting or modified; stamens 10 or more, hypogynous, usually very numerous, filaments separate, or connate only at the base, or in 5-10 fascicles, some may be staminodia; anthers 4-celled, opening by slits or pores; ovary superior, 2-10-celled; ovules 1 to several in each cell; style 1; stigma rayed: fruit a capsule, or indehiscent and nut-like, or a drupe, rarely a berry, or separating into drupelets; seeds usually albuminous.

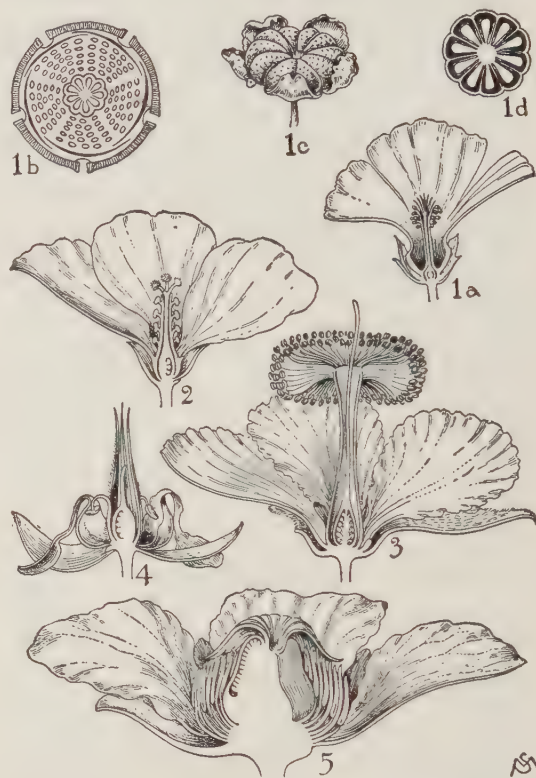
Most of the 35 genera and 270 species are tropical. The most important extra-tropical genus is *Tilia* (linden, basswood), which is widely distributed. Fossil species are known. The Tiliaceæ are related to the Malvaceæ and Sterculiaceæ, from which they are distinguished by the nearly distinct stamens, and 4-celled anthers. The stamens are sometimes borne, along with the ovary, on a long stipe-like projection of the receptacle, sometimes cover the whole surface of a discoid receptacle, and sometimes are enveloped by the petals.

The Tiliaceæ, like the Malvaceæ, are mucilaginous. For this reason, many have been used more or less in medicine. The genus *Tilia* and other arborescent genera furnish very valuable timber; that of *Grewia asiatica* is flexible and used for bow-making. In the tropics the foliage of *Corchorus olitorius* is used as a pot-herb. The fruits of species of *Grewia* are used in India as a sherbet because of their agreeable juice. Some members of the family yield cordage. The beautiful seeds of many species are made into necklaces by the Indians.

In North America 6 or more genera are in cultivation. They are all warmhouse plants, or are grown in southern California, except the *Tilias* (Basswood, Lime, Linden), of which many species are grown in America. The *Tilias* furnish some of our best-known hardy, ornamental trees. Other genera are: *Entelea*, *Luehea*, *Grewia* (with some half-hardy species), and *Sparmannia*.

**137. Malvaceæ** (from the genus *Mallow*, altered from the Greek, in allusion to the mucilaginous emollient qualities). MALLOW FAMILY. Fig. 37. Herbs, shrubs or trees, with alternate, simple, usually palmately veined leaves: flowers bisexual, regular; sepals 5, often united, valvate, frequently bracteolate at the base; petals 5, convolute, often adnate to the stamens; stamens very numerous, hypogynous, the filaments united into a tube (monadelphous), anthers 1-celled, pollen spiny; ovary superior, 2 to many-celled, rarely 1-celled; ovules in each cell 1 to many; styles and stigmas usually as many as the carpels: fruit a capsule or separating into drupelets, very rarely fleshy.

The Mallows include 39 genera and from 800 to 900 species, distributed over the whole earth, except in the arctic zone, but most abundant in tropical America. The Malvaceæ are closely related to the



37. MALVACEÆ: 1. *Malva*, a, flower; b, floral diagram; c, fruit; d, cross-section fruit. 2. *Hibiscus*, flower. BOMBACEÆ: 3. *Adansonia*, flower. STERCULIACEÆ: 4. *Theobroma*, flower. DILLENIACEÆ: 5. *Dillenia*, flower.

Sterculiaceæ and Tiliaceæ. From the former they are distinguished by their 1-celled anthers and rough pollen, and from the latter by their monadelphous stamens as well as the 1-celled anthers. The hollyhock-like flower is characteristic.

The foliage, stems, and seeds of most Malvaceæ contain abundant mucilage for which, in some countries, they have been used as medicine. Pungent and poisonous properties are apparently wanting. *Althæa officinalis* (marsh mallow of Europe), *Malva sylvestris* and *M. rotundifolia*, both of Europe, have been used as emollients. *Hibiscus Sabdariffa* and *H. digitatus* (white and red ketmies of tropical Africa) have acid juice and are used in the preparation of refreshing drinks. The capsule of *H. (Abelmoschus) esculentus* (okra or gumbo) of the tropics is eaten in soup, or cooked and seasoned. The seeds of *H. Abelmoschus* of India, now widely cultivated in the tropics, are used for perfumery. *H. Rosa-sinensis* (Chinese hibiscus or shoeblack plant) contains a coloring matter in the flower with which the Chinese blacken shoes and eyebrows. *Althæa cannabina* of southern Europe has fibers which may be used in place of hemp. The fibers of *Urena lobata*, *Abutilon indicum*, *Sida*, *Hibiscus cannabinus*, *H. tiliaceus*, and others, are also used. The most useful genus is *Gossypium* (cotton) of Egypt, India, and tropical America, the abundant, long, woolly hairs on the seeds of which furnish the cotton of commerce. Cotton seed yields an oil which is used for fuel, cattle-food, soap, artificial butter, and many other purposes. Several mallows are weedy plants.



Many of the genera in cultivation in N. America are among the most important old-fashioned cultivated garden plants. Among these are: *Abutilon* (Indian Mallow, Velvet Leaf); *Althæa* (Marsh Mallow, Hollyhock); *Callirhoë* (Poppy Mallow); *Gossypium* (Cotton); *Hibiscus* (Bladder Ketmia, Roselle, Jamaica Sorrel, Okra, Gumbo, Rose of Sharon, Mountain Mahoe, Shoeblack Plant); *Malope*; *Malvastrum*; *Pavonia*; *Sida*; *Sphæralcea*.

138. **Bombacaceæ** (from the genus *Bombax*, from the Latin meaning *silk* or *cotton*). **BOMBAX FAMILY.** Fig. 37. Trees: leaves mostly alternate, entire or digitate, often with slime-cells and stellate hairs: flowers bisexual, regular or slightly irregular; involucre often present; sepals 5, separate or connate, valvate; petals 5, twisted in the bud; stamens 5 to many, separate or monadelphous; anther cells 1-2 or more; pollen smooth; staminodia often present; ovary superior, 2-5-celled; ovules 2 to many; style 1; stigmas 1-5: fruit dry or fleshy, dehiscent or indehiscent.

There are 20 genera and about 100 species, of tropical distribution, mostly in America. The family is closely related to the *Malvaceæ* and often united with that family. It is distinguished most easily by the smooth pollen and the often several-celled anthers.

Many *Bombacaceæ* are very large trees. The trunk of the baobab tree, or monkey's bread tree (*Adansonia digitata*) of tropical Africa is often 100 feet in circumference. The wool produced in the fruit is of little value. The fruit of *Durio zibethinus* contains a cream-like substance and is eaten. The seeds of the green fruit of *Matisia cordata* of the Andes is edible. The sour cucumber tree or cream of tartar tree is *Adansonia Gregorii*. The fruit contains tartaric acid.

Five or 6 genera are in cultivation in this country in the South and in greenhouses: *Adansonia* (Boabab Tree, Monkey's Bread); *Bombax* (Silk Cotton Tree); *Chorisia* (Floss-silk Tree); *Eriodendron*; *Pachira*.

139. **Sterculiaceæ** (from the genus *Sterculia*, derivation obscure). **STERCULIA FAMILY.** Fig. 37. Trees, shrubs, or herbs, sometimes vines: leaves alternate, simple or digitate: flowers bisexual or unisexual, usually regular; sepals 3-5, somewhat united, valvate; petals wanting or reduced; stamens very remarkable and wonderfully diverse, in 2 whorls, those opposite the sepals reduced to staminodia or wanting, the 1 to many others united into a tube, the anthers frequently alternating with sterile teeth, or variously arranged on the back of the tube; ovary superior, 4-5-celled; ovules several; styles 4-5, distinct or connate: fruit dry, rarely fleshy, or splitting into separate berries.

The 48 genera and about 750 species are almost entirely confined to the tropics. The family is related to the *Malvaceæ* in the monadelphous stamens, but differs in the 2-celled anthers; also related to the *Bombacaceæ* and *Tiliaceæ*. The valvate sepals, reduced petals, 4-5-celled ovary, and especially the peculiar stamens, are distinctive.

The *Sterculiaceæ*, like the *Malvaceæ*, contain abundant mucilage. They also contain a bitter principle which renders them emetic and stimulant. The seeds of *Theobroma Cacao*, native of central and northern South America, furnishes cocoa, chocolate, and cocoa-butter. *Cola acuminata* of Africa furnishes the cola nut, now very popular as an ingredient in a mildly stimulating drink. It is said to form the main constituent of the drink called "coco-cola."

There are about 12 genera in cultivation in America, all either in tropical agriculture or in greenhouse culture: *Rulingia*, *Reevesia*, and *Pterospermum* in southern California; *Sterculia* (Japanese Varnish Tree, Chinese Parasol Tree, Flame Tree), *Fremontia* and *Guazuma* in the South; *Theobroma* and *Cola* in the West Indies; *Abroma*, *Dombeya*, and *Mahernia* (Honey Bell) mostly in the greenhouse. All are grown for ornamental purposes except *Theobroma* and *Cola*.

## Order 42. PARIETALES

140. **Dilleniaceæ** (from the genus *Dillenia*, in honor of John James Dillenius, a professor of botany at Oxford). **DILLENIA FAMILY.** Fig. 37. Trees or shrubs, often climbing: leaves alternate, very rarely opposite: flowers bisexual, regular, hypogynous; sepals 5, rarely more or fewer, imbricated, persistent; petals 5 or fewer, imbricated, deciduous; stamens numerous, often very numerous, free or united in groups, anthers opening by slits or pores; carpels several, usually distinct, but often united; ovules numerous: fruit a follicle, or a berry or a capsule, or inclosed in a fleshy calyx, which simulates a berry; seed albuminous, usually with an aril.

Nearly all the 11 genera and about 200 species are tropical, distributed chiefly in Australia, India, and tropical America, rarely in Africa. Of these *Dillenia*, *Hibbertia* and *Tetracera* are the largest genera. The family is related to the *Ranunculaceæ* and *Magnoliaceæ* on the one hand, and to the *Theaceæ* on the other. Its closest affinity is with the latter family. The woody habit, polypetalous flowers, very numerous stamens, usually separate carpels, albuminous seeds with arils, and straight embryo, are characteristic.

The *Dilleniaceæ* are astringent, for which reason some are used medicinally; the fruits of some are eaten because acid, others are used as tonics. Davilla of Brazil has been used for wounds; *Curatella* for ulcers; *Tetracera aspera* of Guiana as a sudorific and diuretic, also for syphilis, intermittent fevers and scurvy. The astringent bark of a species of *Dillenia* is said to have been used in Asia for ulcerated sores. The acid and inedible fruit of *Dillenia speciosa* serves to season dishes; and a syrup of the juice of the unripe fruit allays coughs, assists expectoration and is said to cure angina; the bark is also used for tanning. Many species of *Dillenia* furnish timber in the Indo region. The rough, silicious leaves of many of the tribe *Tetracera*, especially *Curatella americana*, have been used in Brazil to polish wood in place of sandpaper. Some of the climbing species furnish drinking-water by incisions in the stem.

The flowers of many species are very beautiful, but few forms are in cultivation. In this country the only one apparently is *Dillenia indica*, a large magnolia-like tree with flowers 9 inches in diameter, grown in southern California and in Florida.

By recent authors (Gilg, in Engler and Prantl), *Actinidia*, a genus of vines from eastern Asia, has been placed in this family, although formerly included in the *Theaceæ*. A few species of *Actinidia* are in the American trade.

141. **Ochnaceæ** (from the genus *Ochna*, which is from *ochne*, the Greek name of a wild pear tree; the



38. **OCHNACEÆ:** 1. *Ochna*, fruit. **TERNSTROMIACEÆ:** 2. *Gordonia*, flower. 3. *Thea*, floral diagram.

resemblance is probably in the foliage). **OCHNA FAMILY.** Fig. 38. Shrubs or trees, with alternate, simple or pinnate, coriaceous leaves: flowers bisexual, regular; sepals 4-5, imbricated, rarely 10; petals 5, rarely 3-4, or 10, usually convolute; stamens 1-3 times the number of the petals, sometimes with 1-3 series of staminodia, hypogynous, separate; anthers usually opening by terminal pores; an hypogynous stipe usually present (gynophore); ovary 4-5-celled, often deeply lobed; ovules 1 to many in each cell; style and stigmas 1-5:

fruit coriaceous and indehiscent, or fleshy, or a capsule, or composed of the 1-seeded drupe-like lobes of the ovary which are whorled on the enlarged fleshy receptacle (Ochna).

The family has 17 genera and 100 or more species, distributed in the tropical regions of both hemispheres, most abundant perhaps in Brazil, but also abundant in Africa. The family is not closely related to any other but seems to stand between the Ranunculaceae group and the Hypericaceae group of families. The many sepals, petals and stamens, the gynophore, and usually the lobed ovary, are distinctive.

The wood of some species of Ochnaceae has been used locally for timber, and, because of the pronounced astringent properties of some species, they have been used locally for fly-bites, ulcers, and so on.

*Ochna multiflora*, of Upper Guiana, is cultivated in America. This is grown occasionally in greenhouses because of the peculiar fruit, for an account of which see the article on Ochna.

142. **Ternstroemiaceae** (or **Theaceae**) (from the genus *Ternstroemia*, in honor of Ternstroem, a Swedish naturalist and traveler who died in 1745). **TEA FAMILY**. Fig. 38. Large or small trees, with alternate, entire, leathery leaves: flowers solitary or scattered, usually bisexual, regular; sepals 5-7, imbricated, persistent; petals 5, rarely 4 or more, nearly or quite separate; stamens very many, rarely 15 or fewer, usually hypogynous, separate or united at the base, or in 5 fascicles, usually adnate to the corolla below; ovary superior, 2-10-celled; ovules 1 to many in each cavity; styles as many as the cells of

(transferred to the Stachyuraceae). The very numerous stamens, the type of ovary and the curved embryo are distinctive. The numerous stamens have probably been produced by the splitting up of one set of 5, as in the Hypericaceae.

Various glucosides and alkaloids are found in the foliage, on account of which *Gordonia* has been used for tanning leather, and other species have been used in medicine. The most important species is *Thea chinensis* (tea). The bitter taste of tea is largely due to a glucoside, and the stimulating properties to an alkaloid, theine.

Exclusive of *Actinidia* and *Stachyurus*, 8 or 10 genera are in cultivation in N. America. *Stuartia* and *Gordonia* (Loblolly Bay) are hardy. *Visnea*, *Ternstroemia* and *Cleyera* are grown in Florida. *Eurya* and *Schima* are Camellia-like warmhouse shrubs. *Camellia* (*Thea*) is a famous genus of old-fashioned greenhouse shrubs.

143. **Guttiferae** (from the Latin signifying *drop-bearing*, in allusion to the resinous exudation). **GARCINIA FAMILY**. Fig. 39. Trees or shrubs, with opposite or whorled, rarely alternate leaves: flowers regular, usually some bisexual and others unisexual on the same plant, rarely all bisexual; styles usually united and stigmas sometimes shield-shaped,—otherwise as in the Hypericaceae, to which family it is closely related, and with which the Guttiferae is united by many authors.

Thirty-five genera and about 370 species inhabit the tropical regions of both hemispheres. *Clusia* (America), with 80 species, and *Garcinia* (Old World), with 150 species, are the largest genera. Many species are tropical trees of majestic size and handsome form, useful for timber. The *Clusias* are mostly epiphytic shrubs with aerial roots and evergreen leaves.

The Guttiferae yield a yellow or greenish resinous juice when incisions are made. Gamboge is an intensely yellow resinous pigment extracted from *Garcinia Morella* (Ceylon). It is also a powerful purgative. The blackish bitter juice of *Clusia rosea* (West Indies) is also a purgative. The juice of species of *Clusia* (West Indies) may be used as a varnish. The resin of *C. flava* (hog-gum) is a wound remedy. Wounded swine smear themselves with the gum by rubbing against the plant, hence the name. The pulpy fruit of *Garcinia Mangostana* ("mangosteen" of the Moluccas), and *Mammea americana* (West Indies) are delicious to many people.

There are 3 or 4 genera in cultivation in warm America: *Garcinia* including the Mangosteen, cultivated in the West Indies, and the Gamboge Tree cultivated in the West Indies and Florida; *Calophyllum*, cultivated in southern Florida and southern California; *Mammea americana* (Mammee Apple or St. Domingo Apricot), cultivated in southern Florida and southern California.

144. **Hypericaceae** (from the genus *Hypericum*, an ancient Greek name of unknown origin). **ST. JOHN'S-WORT FAMILY**. Fig. 39. Herbaceous or woody plants: leaves opposite or whorled, often pellucid punctate or black-punctate; flowers bisexual, regular, cymose; sepals 4-5, more or less connate, the outer smaller, rarely 4, with the 2 outer much larger; petals as many as the sepals, sessile or clawed; claw naked or with a honey-furrow or -pit; stamens many, hypogynous, usually in 3-5 bundles the members of which are often more or less united, rarely monadelphous; ovary superior 3-5, rarely 1-, celled; placentae usually parietal; ovules numerous; styles 1-5, usually 3-5; fruit a capsule, rarely fleshy.

About 8 genera and 260 species are known, of which 200 are in the genus *Hypericum*, of the tropical and temperate regions throughout the world, but especially abundant in the north temperate zone. The family is very closely related to the Guttiferae, with which it is united by Engler and Prantl under the latter name; also related to the Ternstroemiaceae (Theaceae). The fascicles of stamens probably represent individual stamens, each of which has become divided into many.



39. **HYPERICACEAE**: 1. *Hypericum*, species, a, flower; b, flower, petals removed; c, fruit. 2. *Visnea*, floral diagram. **GUTTIFERAE**: 3. *Garcinia*, a, flower; b, flower, perianth removed. **TAMARICACEAE**: 4. *Tamarix*, a, flower; b, flower, perianth removed; c, floral diagram.

the ovary, or united into one: fruit a capsule or indehiscent, dry or drupaceous; embryo more or less curved.

In this family are 16 genera and 174 species of tropical and subtropical distribution. *Stuartia* reaches Virginia and Kentucky, and *Gordonia* reaches Virginia. This family is related to the Hypericaceae and Guttiferae, also to the Dilleniaceae. From it are now usually excluded several genera which were formerly included. Of importance to us in this connection are *Actinidia* (transferred to the Dilleniaceae), and *Stachyurus*



The opposite pellucid-dotted leaves, fascicled stamens, and 3-5-celled ovary with separate styles are characteristic.

The balsamic exudations from the bark and wood, especially of the shrubby species, were formerly used to some extent in medicine as an astringent.

The genera in cultivation in America for ornamental purposes are: *Ascyrum* (St. Andrew's Cross, St. Peter's-wort), and *Hypericum* (St. John's-wort). Some of the species are herbaceous and some are shrubby. Some of the *Hypericums* are very showy.

145. **Tamaricaceæ** (from the genus *Tamarix*, said to have been named from the river Tamaris, now Tambro, on the border of the Pyrenees). **TAMARISK FAMILY.** Fig. 39. Shrubs or small trees, with alternate, mostly needle-like or scale-like, ericoid leaves: flowers bisexual, regular; sepals 4-5; petals 5, imbricated, withering and drying persistent; stamens equal to and alternate with the petals or double the number, inserted on a more or less evident disk; ovary superior, 1-celled, with 3-4 parietal placentæ, or placenta basal; ovules 2 to many; styles 3-4, or stigmas sessile; seeds densely bearded at distal end, rarely winged: fruit a capsule, sometimes becoming falsely and incompletely several-celled.

The 5 genera and about 90-100 species are mainly distributed in the Mediterranean region and in central Asia. The family is related to the Frankeniaceæ and Elatinaceæ; possibly also to the Salicaceæ. The ericoid habit, withering-persistent petals, definite stamens, 1-celled ovary and bearded seeds are distinctive. By means of small leaves, sunken stomata, water-storing tissue, and other contrivances, the Tamaricaceæ are adapted for life in the dry saline regions in which they live. Foliage-glands excrete an excess of absorbed mineral matter, and this very hygroscopic excretion accumulates on the surface of the plant.

The Tamaricaceæ contain much tannin, resin and oils, which render them bitter and astringent. The bark of *Myricaria germanica* has been used for jaundice; the galls of some species are used because astringent. *Tamarix mannifera*, "which grows on Mount Sinai and elsewhere in Arabia, secretes, as the result of the puncture of a cynips, a saccharine matter, supposed by some to be the manna which fed the Hebrews in the desert." (See also *Fracinus Ornus*.)

None of the genera in cultivation in N. America is very hardy: *Tamarix* (Tamarisk); *Myricaria*, all grown for the queer, fluffy foliage, and small, abundant flowers.

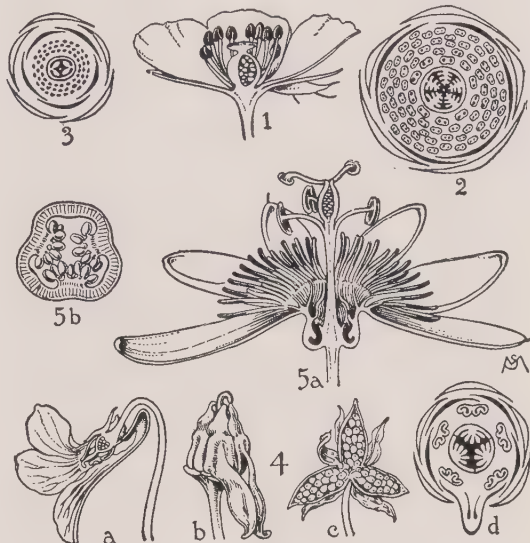
146. **Fouquieriaceæ** (from the genus *Fouquieria*, named in honor of Pierre E. Fouquier, professor of medicine at Paris). **CANDLEWOOD FAMILY.** Similar to the Tamaricaceæ and formerly united with that family, but differing in the gamopetalous corolla, the ligule-bearing, hairy stamens, partially united styles, median ovules instead of basal, and leaves without crystal glands or epidermal glands.

The single genus and about 4 species are natives of Mexico and the southwestern United States.

*F. splendens* is the ocotilla, coach-whip cactus, vine cactus, or Jacob's staff of the Southwest, a spiny cactus-like shrub used by the Mexicans to make impenetrable hedges. A useful wax is obtained from the cortex of this species. The cortex is also used medicinally. This species is in cultivation in the larger rockeries of California.

147. **Cistaceæ** (from the genus *Cistus*, derived from the Greek, meaning a *box* or *capsule*, on account of the shape of the capsule). **ROCK-ROSE FAMILY.** Fig. 40. Herbs or shrubs: leaves mostly opposite: flowers bisexual, regular; sepals 3 or more, in  $\frac{2}{3}$  phyllotaxy; petals 5, rarely 3 or 0, quickly falling; convolutions of corolla and calyx in opposite directions; stamens numerous, hypogynous; ovary superior, 1-celled, with 3-10 parietal placentæ, or falsely 5-10-celled by ingrowing partitions; ovules 2 to many, orthotropous; style 1; stigmas 1-3: fruit a capsule.

In North America and around the Mediterranean Sea, 4 genera and about 70 species are distributed; also a few species in eastern Asia and in South America. The family is most closely related to the Violaceæ and the Bixaceæ, and more distantly to the Hypericaceæ. The quickly falling convolute petals, many



40. **CISTACEÆ:** 1. *Helianthemum*, flower. 2. *Cistus*, floral diagram. **BIXACEÆ:** 3. *Bixa*, floral diagram. **VIOLACEÆ:** 4. *Viola*, a, flower; b, flower, perianth removed; c, fruit; d, floral diagram. **PASSIFLORACEÆ:** 5. a, flower; b, cross-section of ovary.

hypogynous stamens, 1-celled, many-seeded ovary, parietal placentæ and copious endosperm are distinctive features.

In the dry region about the Mediterranean, the shrubby forms, especially *Cistus ladaniferus* and *C. monspeliensis* take part in forming extensive "maquis," or impenetrable evergreen thickets, where they alone form great stretches of vegetation. The Cistaceæ prefer dry, sunny, sandy or alkaline soil. In America, *Hudsonia* forms carpets on the sand-dunes which are often strikingly beautiful when in flower. The family includes also *Lechea* (pinweed), and *Helianthemum* (rock-rose).

In North America several species of *Cistus*, all shrubs, and of *Helianthemum*, are grown for ornamental purposes, although they have no marked importance in this country.

148. **Bixaceæ** (from the genus *Bixa*, a name of South American origin). **BIXA FAMILY.** Fig. 40. Trees or shrubs: leaves alternate, simple or compound: flowers unisexual or bisexual, regular; sepals 4-5, imbricated; petals 4-5, large and colored, imbricated and twisted in the bud; stamens numerous; anthers opening by slits, or rarely by pores (*Bixa*), hypogynous; carpels 1 to several, united; ovary 1-celled, with 1 to several parietal placentæ, or falsely 3-celled; seeds many, with endosperm: fruit fleshy or dry, indehiscent or valvular, in *Bixa* large and bristly-prickly all over.

All the 4 genera and 19 species (excluding the Flacourtiaceæ and other small families often here included) are tropical, from Mexico to Brazil and in Africa, Madagascar and Australia. *Bixa* is now widely distributed through the tropics. The Bixaceæ are related to the Violaceæ and Cistaceæ, as well as to the Tiliaceæ. The numerous stamens, compound but 1-celled ovary with many placentæ are all important distinguishing characters.

*Bixa Orellana* furnishes the coloring matter known as "anatto," extracted from the pulp around the seeds,

which is much used to give butte, a rich yellow color and is also used in dyeing silks. The Caribbeans formerly tattooed themselves with this dye in order, it is said, to prevent mosquito-bites. The wood is very soft and serves only for tinder; the roots are aromatic and have been used to color and flavor soups. *Maximiliana* *Gossypium* furnishes a substitute for gum tragacanth in farther India.

*Bixa Oreilana* is in cultivation in the West Indies, where it is grown for the fruit. Several other genera in the American trade, which were formerly included in the Bixaceæ, are now placed by Warburg in the Flacourtiaceæ.

149. **Violaceæ** (from the genus *Viola*, the ancient Latin name). VIOLET FAMILY. Fig. 40. Herbs, shrubs or small trees, rarely climbing; leaves usually alternate; flowers bisexual, regular or irregular; sepals 5, separate or nearly so; petals 5, 1 often spurred; stamens 5, hypogynous or slightly perigynous, closely connivent around the style, similar or dissimilar (2 spurred); ovary 1-celled; placenta 2-5, usually 3, parietal; ovules many; style 1: fruit a firm capsule with placenta on the middle of the valves, rarely a berry and indehiscent.

Violaceæ has 15 genera and about 300 species, of which about 200 belong to the genus *Viola*. These genera are grouped in three tribes: the Violeæ, with irregular flowers, found chiefly in Europe, Siberia and North America, although the woody species are mainly natives of tropical America; the Paypayroleæ and Rinoreæ, with regular flowers, are principally found in South America, Africa and Australia. The family is closely related to the Cistaceæ. The tendency to irregular flowers, the peculiar stamens, the 1-celled ovary with usually 3 parietal placenta, and the anatropous ovules, are distinctive.

In the genus *Viola* and some other genera, a finger-like curved nectar-secreting horn projects backward from the connective of each of the two lower anthers into the spur of the lower petal. In many species of *Viola*, almost all the seeds are produced by small apetalous cleistogamous flowers on short pedicels near the ground in midsummer, after the normal flowering period is over. These are very fertile, and quite diverse in structure, and, therefore, useful in classification. Cleistogamous flowers are also produced in the genus *Hybanthus*. The capsules of most Violaceæ open elastically when ripe, the valves springing back and at the same time folding on the midrib so that the seeds are forcibly ejected as one would shoot a wet apple seed from between the fingers.

The Violaceæ have been used to a certain extent in medicine, their virtues being due to an alkaloid having emetic and laxative properties. *Hybanthus ipecacuanha* ("white ipecacuanha" of commerce) furnishes a substitute for ipecac. Various species of *Viola* and other genera have been used in many countries for skin diseases, as emetics, laxatives, and the like. Several species are ornamental.

Three genera are in the American trade: *Cornistylis* or *Calyptrion*, a species of greenhouse woody climbers; *Hybanthus* or *Solea*, of the garden; and *Viola* (Common Pansy, Horned Pansy, Sweet English Violets, Wild Violets).

150. **Flacourtiaceæ** (from the genus *Flacourtia*, named in honor of E. de Flacourt, a governor of Madagascar). FLACOURTIA FAMILY. Trees or shrubs, rarely climbing; leaves usually alternate and in 2 ranks; flowers bisexual, rarely unisexual, regular; sepals 2-6, commonly 4-5, imbricated, rarely otherwise; petals 0, or equal to the sepals, or many, imbricated or convolute; stamens numerous, hypogynous or perigynous; receptacle enlarged and variously modified, often surmounted by a diversely formed disk; ovary superior or nearly so, 1-celled; placenta parietal; ovules numerous; styles and stigmas 1 to several: fruit dry or fleshy, dehiscent or indehiscent.

There are 70 genera and more than 500 species of tropical distribution. The family is related to the Violaceæ, Passifloraceæ, and other families with similar parietal placentation, but is most closely related to the Bixaceæ with which it has often been united, and from which it differs mainly in the absence of slime-cells. In general, the peculiar ovary, the numerous stamens, the regular flower, and the enlarged receptacle are characteristic.

The sour fruit of several species is eaten, or preserved, in the tropics. The seeds of *Pangium edule* are roasted and used for baking. The leaves of *Casearia esculenta* are eaten in India. The wood is little used. The bark of *Neumannia theiformis* is used like ipecac in Madagascar. Chaulmugra oil is obtained probably from *Gynocardia odorata* of farther India. A peculiar resin is secured from species of *Lætia* of Cuba. Coccois oil, used in perfumery, is obtained from the Polynesian genus *Myroxylon*. The fixed oil of species of *Pangium* is used in cooking.

Probably 5 or 6 genera are in cultivation in the warmer parts of North America: *Aberia* (Kei Apple); *Azara*; *Carriera*; *Flacourtia* (Rambutan, Governor's Plum); *Idesia*, hardy in Mass.; *Oncoba*; *Xylosma*.

151. **Stachyuraceæ** (from the genus *Stachyurus*, signifying *spike-tail*, in reference to the form of inflorescence). STACHYURUS FAMILY. Shrubs or small trees with alternate leaves; flowers bisexual or polygamous, regular; sepals 4, imbricated; petals 4, imbricated; stamens 8, separate; carpels 4; ovary superior, 1-celled, or falsely 4-celled by the intrusion of the large parietal placenta; style and stigma 1; ovules many: fruit berry-like, pericarp leathery.

Only one genus and 4 species occur in Japan, China, and the Himalayas. The family is closely related to the Ternstroemiaceæ with which it was formerly united and from which it differs in the fewer stamens, 1-celled ovary and entire stigma. Useful apparently only as ornamental plants.

Two species are occasionally cultivated in America.

152. **Passifloraceæ** (from the genus *Passiflora*; early travelers thought they had found emblems of the crucifixion in the flower, for a detailed account of which see article on *Passiflora*). PASSION-FLOWER FAMILY. Fig. 40. Herbaceous or woody plants, usually climbing by axillary tendrils; leaves alternate, simple or compound; flowers bisexual, or unisexual, usually involucre, perigynous; calyx and corolla sometimes similar; sepals 4-5, imbricated, often petaloid; petals 4-5, rarely 0, imbricated, often smaller than the sepals, sometimes fringed; a crown (outgrowth of receptacle) of many filaments between the petals and stamens, sometimes tubular or scale-like; stamens 4-5, usually opposite the petals, inserted on the edge of the cup-shaped receptacle, or at the base of the corona, or at the base of the pistil at the summit of a long gynophore, separate or connate; ovary superior, raised on a more or less distinct stalk (gynophore), 1-celled with 3-5 parietal placenta; ovules numerous; styles 3-5: fruit a berry or capsule.

This family contains 18 genera and about 350 species, inhabitants principally of the tropical regions, especially of the New World. Two hundred and fifty species belong to the genus *Passiflora*, which extends as far north as southern Pennsylvania. The family is not closely related to other families, but finds its nearest affinities in the Loasaceæ, Turneraceæ and Begoniaceæ. The remarkable floral structure is distinctive.

The pulpy aril of the seeds of *Passiflora* is used in tropical America in the preparation of cooling drinks. The flowers and fruit of *P. rubra* are narcotic. The roots of *P. quadrangularis* are very poisonous and sometimes used in small doses as a vermifuge. Many *Passifloras* are cultivated in the tropics as fruit plants.

Many are in cultivation in America, namely *Passiflora* and *Tacsonia* (Granadilla, Jamaica Honeysuckle,



Water Lemon, May-Pop), some for the beautiful and odd flowers, some, especially in the South, for the fruit.

153. **Caricaceæ** (from the genus *Carica*, erroneously supposed to be a native of Caria; or from the Latin meaning a kind of dry fig). **PAWPAW FAMILY**. Fig. 41. Peculiar trees with straight, rarely branched, palm-like trunks, very abundant milky juice, and a terminal crown of very large, alternate, palmately-lobed, rarely entire, leaves; flowers unisexual, small, nearly regular; sepals 5; petals 5, in the staminate flowers connate, in the pistillate nearly separate; stamens about 10, inserted on the corolla; ovary superior, 1- or 5-celled, many-seeded; styles 5; fruit a large melon-like berry.

This is a small family of 2 genera and 27 species, confined to tropical and subtropical America; most abundant in the Andes. The **Caricaceæ** is united with the **Passifloraceæ** by some authors, but is similar only in

beyond the ovary); sepals 4-5, imbricated; petals 4-5, flat or cucullate; stamens 4-5, alternating with the petals, or more commonly very numerous through doubling, the outer often converted into staminodia which resemble the petals; ovary usually inferior, and 1-celled, with 3 parietal placentæ; ovules numerous: fruit a capsule, rarely indehiscent, often spirally constructed.

There are 13 genera and about 120 species confined to America from the Great Plains to Chile; most abundant in South America. This is a distinct family distantly related to the **Passifloraceæ** and the **Begoniaceæ**. The very peculiar hairs constitute a good recognition character. On *Mentzelia* there are three types of hairs: (1) Chinese pagoda-like, broad at the base; (2) tuberculate stem and harpoon-like top; (3) smooth stem and harpoon top. The flowers with many staminodia are often large and cactus-like. Very queer, grotesque, complex scales are produced in the flowers of certain genera (e. g., *Loasa*) through the union of several staminodia.

*Mentzelia hispida* is a strong purgative, and is used by the Mexicans for syphilis.

A few genera are in cultivation in North America. Of these, *Loasa* is like a nettle, and the sting is very painful, but the flowers are queer and interesting. *Mentzelia* comprises a number of garden annuals or biennials often with large showy flowers.

155. **Begoniaceæ** (from the genus *Begonia*, named in honor of Michael Begon, a French promoter of botany). **BEGONIA FAMILY**. Fig. 41. Herbs, rarely shrubby, hairs usually scale-like or branched: leaves alternate, usually oblique: flowers monœcious, regular, epigynous, cymose, the staminate opening first; perianth of the staminate flowers of 2 valvate sepals and 2 petals, all petaloid; perianth of the pistillate flowers of 2 to many similar petaloid parts; stamens numerous, separate or nearly so; ovary inferior, 2-3-celled, usually sharply angled and winged; ovules numerous; styles 3, more or less branched and bearing very peculiar crescent-shaped, kidney-shaped, or, more often, spiral, velvety stigmas, rarely straight: fruit a capsule, rarely a berry.

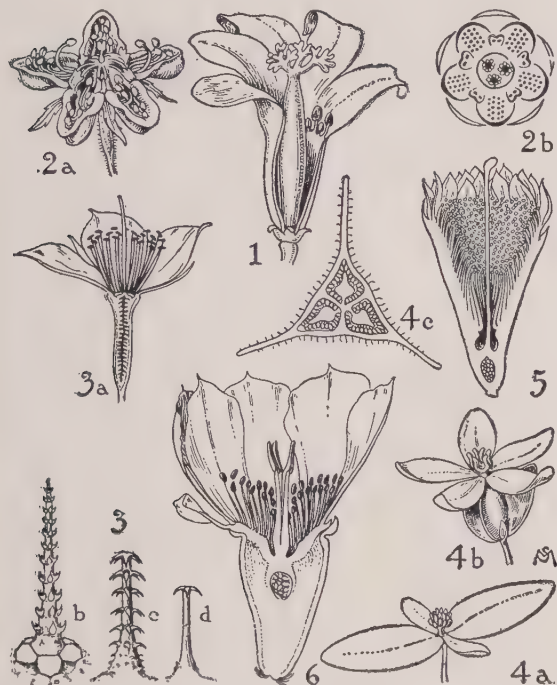
The *Begonia* family has 4 genera and about 500 species, most of which belong to the genus *Begonia*. They are widely distributed throughout the tropics, but perhaps most abundant in South America along the Andes to Mexico, and in the eastern Himalayas south-eastward to the Malay Peninsula. The **Begoniaceæ** constitute a distinct group remotely related to the **Cactaceæ**, **Loasaceæ**, **Passifloraceæ** and **Cucurbitaceæ**.

The family is of little economic importance except for ornamental purposes. Many species contain oxalic acid and are eaten as salad, and as a remedy for scurvy. The roots of some are astringent; others have a purgative root, used in certain tropics for syphilis and scrofula. The **Begoniaceæ** is one of the most important ornamental families.

Very many species and hybrids of *Begonia* are grown for greenhouse and bedding purposes, both for the flowers and the foliage.

#### Order 43. OPUNTIALES

156. **Cactaceæ** (from the old Linnæan genus *Cactus*, a name used by the ancients to denote any spiny plant). **CACTUS FAMILY**. Fig. 41. Fleshy plants with watery or milky juice, a great reduction or complete absence of foliage, and very thick, rather sparingly branched, rarely unbranched stems, which are cylindrical, globular, flattened, or fluted, and often constricted or jointed: leaves alternate, flat and leaf-like in *Pereskia*, scale-like or absent in other genera, usually bearing bundles of spines in the axils, which are trichomes, and which are of two kinds, long and stout, or minute and needle-like: flowers bisexual, mostly regular, perigynous or epigynous; sepals and petals rarely 8-10, usually very many, similar; stamens many, inserted spirally or in groups



41. **CARICACEÆ**: 1. *Carica*, one form of flower opened. **LOASACEÆ**: 2. *Loasa*, a flower; b, c, and d, types of foliage hairs. **BEGONIACEÆ**: 4. *Begonia*, a, male flower; b, female flower; c, cross-section ovary. **CACTACEÆ**: 5. *Pilocereus*, flower. 6. *Opuntia*, flower

the fruit. It is also related to the **Cucurbitaceæ** by the fruit. The peculiar habit and abundant milky juice are very distinctive.

The large melon-like fruits of *Carica Papaya* are now cultivated and eaten throughout the tropics; those of other species are also eaten. The milky juice of *C. Papaya* contains a pepsin-like substance which will curdle milk. This substance will separate the fibers of meat, and hence the leaves and fruit are cooked with too fresh tough meat to make it tender. The juice has also been used as a remedy for dyspepsia.

*Carica Papaya* (South American pawpaw) is commonly grown in greenhouses; and it, as well as two other species, are grown in southern California and Florida in the open.

154. **Loasaceæ** (from the genus *Loasa*, the meaning unknown). **LOASA FAMILY**. Fig. 41. Erect or climbing herbs, rarely shrubby, with very peculiar and characteristic hairs, some hooked, some stinging: leaves opposite or alternate, very diverse: flowers bisexual, regular, mostly perigynous (i.e., receptacle usually extended

on inside of the receptacle; ovary inferior, 1-celled, with 3 to many parietal placentæ; ovules numerous; style 1; stigmas as many as the placentæ: fruit a berry; embryo straight or curved.

The Cacti are almost entirely confined to the dry regions of tropical and subtropical America. Mexico is the center of this distribution, but the Cactaceæ extend from New York to Patagonia. A species of *Rhipsalis* has lately been found indigenous in West Africa. The family is related to the Begoniaceæ, Loasaceæ, and Passifloraceæ. The peculiar habit, perianth of many similar parts, many stamens, and inferior 1-celled ovary are distinctive. The Cactaceæ is divided into three groups: (1) *Cereus* group, with receptacle extended in a tube beyond the ovary (perigynous), and no hooked spines; (2) *Opuntia* group, tube of the receptacle wanting, hooked spines usually present; (3) *Pereskia* group, with foliaceous leaves, panicked flowers, and no hooked spines.

The seeds of *Rhipsalis*, an epiphytic genus, are often viscid so as to adhere to tree trunks and the like. The ovaries of some Cactaceæ are imbedded in the tissue of the stem. In this family, the thick stem is a water-storing organ. The flattened or fluted condition of the stem of most species is probably an adaptation which allows these stems to swell when water is abundant and contract when it is scarce without danger of rupturing the cuticle. The variation in size and form among cacti is very great. The largest species is *Carnegiea gigantea* of Mexico, candelabra-like, 60 feet high.

The fruit of *Opuntia Ficus-indica*, now naturalized in the Mediterranean region, is there eaten under the name of Indian fig. *Opuntia Tuna* of tropical America is the prickly pear, an edible fruit. *Opuntia vulgaris* of the eastern United States is also eaten under the name of prickly pear or Indian fig. Fruits of *Cereus triangularis*, *C. giganteus*, and *C. Thurberi* are much prized. The stem and flowers of *C. grandiflorus* are used in medicine, producing an action on the heart. Vermifugal properties are found in many Cactaceæ. An alcoholic drink is made by the Mexicans from the sap of species of *Cereus*. The cochineal insect, a scale insect yielding the well-known dye, cochineal, lives upon species of *Opuntia*, *Pereskia*, and *Nopalea*, in tropical America.

The total number of genera of Cactaceæ which have been described up to the present time is about 70, although Dr. Karl Schumann, who monographed the family in 1899, recognized but 21. Of the many genera described, most are good and will probably stand. A rational and uniform treatment of the family will doubtless show that there are no less than 75 tenable genera. The total number of names published is something over 3,800. This includes many species that have been transferred from one genus to another. The number of species recognized by Schumann is something less than 700. Many of these species of Schumann, however, are known to be aggregates, and it is not unlikely that there are about 1,200 species in the family.

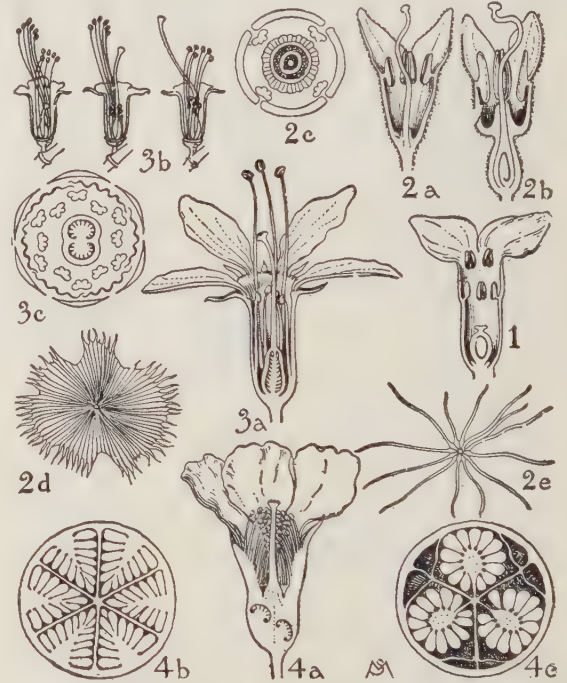
The number of genera treated in this work is 35. They are in cultivation in America as odd plants for desert gardens, and as greenhouse curiosities. Many have beautiful showy flowers, those of *Cereus grandiflorus* (night-blooming cereus) being nearly one foot across, and opening only in the night.

The reader will find the cacti described in this Cyclopedia under the following names: *Acanthocereus*; *Anhalonium*=*Ariocarpus*; *Aporocactus*; *Ariocarpus*; *Bergerocactus*; *Cactus*; *Carnegiea*; *Cephalocereus*; *Cereus*; *Disocactus*; *Echinocactus*; *Echinocereus*; *Echinopsis*; *Epiphyllum*=*Zygocactus*; *Escontria*; *Hariota*; *Harrisia*; *Heliocereus*; *Hylocereus*; *Lemaireocereus*; *Leptocereus*; *Leuchtenbergia*; *Lophophora*; *Mamillaria*; *Melocactus*=*Cactus*; *Myrtillocactus*; *Nopalea*;

*Opuntia*; *Pachycereus*; *Pelecypora*; *Pereskia*; *Peresklopsis*; *Phyllocactus*=*Epiphyllum*; *Pilocereus*=*Cephalocereus*; *Rathbunia*; *Selenicereus*; *Schlumbergera*; *Wilcoxia*; *Wittia*; *Zygocactus*.

#### Order 44. MYRTIFLORÆ

157. **Thymelæaceæ** (from the generic name *Thymelæa*, a Greek name meaning *thyme* + *olive* or *oil*). **MEZEREUM FAMILY.** Fig. 42. Shrubs or trees, rarely herbs: leaves alternate or opposite, simple, entire: flowers bisexual or unisexual, regular, receptacle developed into a long tube which bears appendages in the throat; perianth undifferentiated, often petaloid, parts 4-5, imbricated, perigynous; stamens as many as the sepals and alternate with them, or twice as many, or



42. **THYMELÆACEÆ:** 1. *Daphne*, flower. **ELEAGNACEÆ:** 2. *Elæagnus*, a, male flower; b, bisexual flower; c, floral diagram; 2a and 2b, halves from surface of leaf. **LYTHRACEÆ:** 3. *Lythrum*, a, flower; b, trimorphic flowers of *L. Salicaria*; c, floral diagram. **PUNICEÆ:** 4. *Punica*, a, flower; b, fruit, upper story; c, fruit, lower story.

reduced to 2, perigynous; ovary superior, 1-celled, rarely 2-celled; ovule solitary, pendulous; style 1 or 0, stigma 1: fruit indehiscent, a nut, drupe, or berry; rarely a capsule.

About 37 genera and 425 species are widely distributed over the earth. One species is native in north-western North America. The largest genera are *Gnidia* with 80-90 species, and *Pimelea* with 75 species. The family stands between the Myrtifloræ and the Cactales, and also somewhat suggests the Passifloraceæ. The single perianth, the tubular receptacle, perigynous, definite stamens, the appendages in the tube of the receptacle, and the superior 1-celled, 1-ovuled ovary are distinctive.

*Gnidia carinata* of South Africa and *Daphne Mezereum* (mezereon) of Europe have been used as a purge; as has also the spurge flax (*Daphne Gnidium*) of South Europe, the caustic juice of which is used in a blistering ointment. A blistering principle is obtained from the bark of *Funifera utilis* of Brazil; also from *Dirca palustris*. The roots of *Thymelæa tinctoria* yield a yellow dye. Paper is made from the cauline fibers of



several species, e.g., *Daphne cannabina* of India, *Dirca palustris* of the United States, *Gnidia* of Madagascar, and *Lagetta* of Jamaica. Cord is made from *Lagetta funifera* and *L. linearia* of South America. The wood of *Aquilaria Agallocha* of India is aromatic, called aloewood. One *Pimelea* yields a balsam. Lace-bark is the product of *Lagetta linearia*.

Six or more genera are in cultivation in this country for ornament. Among these are: *Daphne* (Mezereon), greenhouse and garden; *Dirca* (Leatherwood, Moosewood), native, hardy; and *Pimelea* (Rice Flower), greenhouse.

158. **Elæagnaceæ** (from the genus *Elæagnus*, derived from the Greek name of the olive combined with that of the Chaste tree). **OLEASTER FAMILY.** Fig. 42. Trees and shrubs, covered with silvery and brown, petate or stellate scales: leaves alternate or opposite, simple, entire: flowers bisexual or unisexual, regular, perigynous; receptacle developed into a long tube beyond the ovary, more or less persistent, and inclosing the fruit; perianth of 1 series; parts 4, rarely 2 or 6, valvate; stamens of the same number or double the number, inserted in the tube; perigynous disk prominent, lobed; ovary superior, 1-celled, 1-ovuled; style 1; stigma 1: real fruit dry, indehiscent, but appearing drupe-like because of the fleshy investing receptacle.

Three genera and about 30 species are found, of which about 25 belong to *Elæagnus*; mostly steppe or rock plants, chiefly of south Asia, Europe and North America. The family is closely related to the *Thymelæaceæ*, which see for further relationship. The peculiar scales, the perigynous flowers, the 1-celled, 1-seeded ovary, and the fleshy but free receptacle are distinctive.

The acid fruits of *Elæagnus angustifolia* of Persia are eaten; also those of *E. latifolia* of India, and the seeds of *Shepherdia argentea* of North America.

There are 3 genera in cultivation in America, principally as hardy ornamental plants with silvery foliage: *Elæagnus* (Oleaster, Goumi); *Hippophaë* (Sea Buckthorn, Swallow Thorn); *Shepherdia* (Buffalo Berry).

159. **Lythraceæ** (from the genus *Lythrum*, derived from the Greek meaning blood, in reference to the purple flowers). **LOOSESTRIFE FAMILY.** Fig. 42. Herbs, shrubs, or trees: leaves usually opposite or whorled: flowers bisexual, usually regular, perigynous; receptacle ("calyx-tube") tubular, ribbed, free from the ovary, bearing the 4 or 8 valvate sepals on its margin; petals of the same number as the sepals, or 0, and inserted with them, imbricated; stamens usually twice as many as the petals, rarely more (up to 200), or fewer (to 1); outer set alternate with the petals, and inserted some distance below them; ovary superior, 2-6-celled, many-ovuled: fruit a capsule, rarely indehiscent.

There are 22 genera and about 450 species known; generally distributed, but more abundant in the tropics, especially in America. The largest genus is *Cuphea* with about 160 species. The family is closely related to the *Onagraceæ*, but differs in the superior ovary; it is also related to the *Melastomaceæ*, but the stamens are normal.

*Lythrum Salicaria* has been used as an astringent; *Heimia* and *Cuphea* have been used as purgatives and emetics. *Lawsonia inermis* of Egypt is the famous henna, the perfume of the flower of which is renowned throughout the East; with an orange-red dye obtained from the leaves of this plant, women of the orient dye hair and nails. *Pemphis acidula* is used as a pot-herb in Asia. The flowers of *Woodfordia floribunda* yield the red dye of India called dhak. *Lagerstromia* furnishes very valuable timber.

In cultivation in N. America are several genera: *Cuphea*, species of garden annuals; *Decodon* (Swamp Loosestrife), native, but used for water-gardens; *Lythrum* (Loosestrife); *Lawsonia* (Henna), cultivated in southern Florida and southern California; *Lagerstromia indica* (Crape Myrtle) cultivated in the South.

160. **Punicaceæ** (from the genus *Punica*, derived from the Latin in reference to Carthage, near which city the plant is said to have grown; or from the Latin meaning scarlet, in reference to the flowers). **POMEGRANATE FAMILY.** Fig. 42. Shrubs or commonly small trees: leaves mostly opposite: flowers bisexual, usually perigynous; receptacle campanulate or tubular, thickened above the ovary; sepals 5-8, fleshy, valvate; petals 5-7, imbricated, inserted with the sepals on the edge of the receptacle; stamens very numerous, clothing the tube of the receptacle; carpels in 1-2 (rarely 3) superimposed series, 3 in the lower and usually 5-7 in the upper; ovary more or less inferior, with as many cells as carpels; placenta of the lower series axile, of the upper parietal, the cells many-ovuled; style and stigma 1: fruit a berry, the pulpy central mass of which is formed from the fleshy outer seed-coats.

This is a family of only 1 genus and 2 species, natives of the Mediterranean region and eastward to the Himalayas. It was formerly united with the *Lythraceæ*, but the peculiar ovary is unique. *Punica Granatum* is the famous pomegranate, cultivated for its fruit since the earliest times, and now widely spread over the tropics. This species is cultivated in the southern states and in greenhouses. It has escaped in Florida.

161. **Lecythidaceæ** (from the genus *Lecythis*, derived from the Greek meaning an oil-jar, in reference to the fruit). **LECYTHIA FAMILY.** Fig. 43. Trees: leaves alternate, large and striking: flowers bisexual, regular, perigynous or epigynous; sepals 4-6, rarely fewer, valvate; petals 4-6, imbricated, rarely more or fewer; stamens very numerous, somewhat monadelphous, many antherless; intra-staminal disk often present; ovary inferior, 2-6-celled, several ovules in each cell: fruit a hard-shelled berry or a capsule dehiscing by a lid.

The family has 18 genera and about 225 species, with a somewhat isolated distribution in various parts of the tropics, e.g., North Brazil, west coast of Africa, Malay Peninsula, Mozambique, and Samoa. The family was formerly united with the *Myrtaceæ* but is dissimilar in some important details of vascular structure, and in the absence of volatile oils.

The most important economic plant is the Brazil-nut or para-nut (*Bertholletia excelsa*) of northern South America, the oily seeds of which are an important article of food. The seeds are in a box-like capsule, the lid of which falls off. The oily seeds of several other species are eaten, e.g., the monkey-pot tree (*Lecythis*). The fruits and roots of a number of species of *Barringtonia* are used in Java and China to stupefy fish. The flowers of *Grias cauliflora* of the West Indies are used for tea. A cooling drink is made from the fruit of *Couroupita guianensis* of the West Indies.

The Brazil-nut or nigger-toe is sparingly planted in southern California, Florida and the West Indies.

162. **Rhizophoraceæ** (from the genus *Rhizophora*, root-bearing, because of the numerous aerial roots). **MANGROVE FAMILY.** Fig. 43. Trees or shrubs: leaves usually opposite, coriaceous: flowers bisexual, epigynous or perigynous; sepals 3-14, more or less connate, valvate; petals of the same number, small, often lacerate; stamens 2-4 times as many, often in pairs opposite the petals; ovary inferior, usually 2-5-celled: fruit somewhat juicy, crowned with the calyx, rarely dehiscent, usually a berry, rarely a drupe.

The 15 genera and about 50 species are distributed throughout the tropics. The family is related to the *Combretaceæ* and *Lythraceæ*; more distantly to the other families of the myrtaceous group.

This is a small family of remarkable plants, mostly inhabiting mud-flats along the coast in the tropics. The stem soon perishes at the base and then the plant is supported by its numerous prop-roots alone. The mud is so soft that otherwise the plants could probably not remain erect. The genus *Rhizophora* is almost unique in the vegetable kingdom because the seeds germi-

nate on the plant. The hypocotyl may reach the length of 3 feet, although usually less; it is club-shaped and heaviest at the apex, so that when the seedling eventually falls from the tree, it sticks in the mud vertically, with the hypocotyl down, ready to grow.

The Rhizophoraceæ are of little economic importance. Land is held in place and protected from the waves by the mangrove. The fruits of *Anisophyllum* are plum-like but poor. The mangrove grows wild on the Florida, Texas, and Mississippi coast, and has been offered for sale in California.

163. **Combretaceæ** (from the genus *Combretum*, a name given to this plant by Pliny). **COMBRETUM FAMILY.** Fig. 43. Trees or shrubs, erect or climbing; leaves

shade. *Poivrea* is a red-flowered shrub grown in southern Florida. One species of *Combretum* is a warmhouse climbing shrub. *Quisqualis*, or rangoon creeper, is a peculiar climbing shrub grown in the warmhouse. It is at first erect, later climbing.

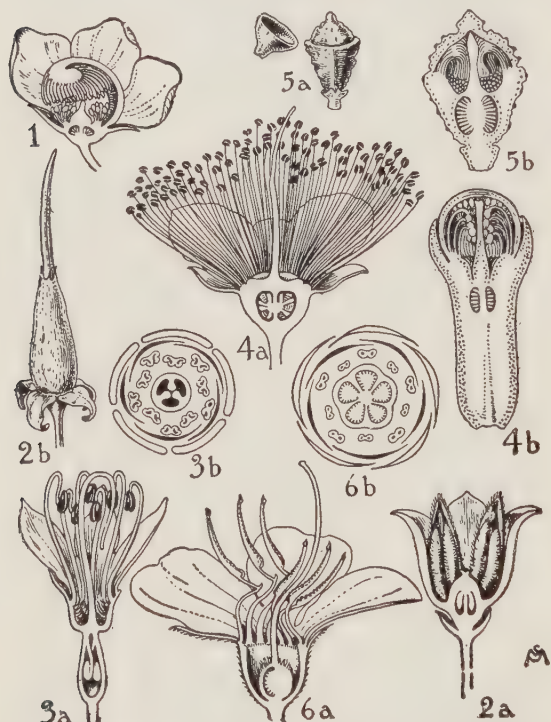
164. **Myrtaceæ** (from the genus *Myrtus* derived from the classical name myrtle, which probably meant perfume). **MYRTLE FAMILY.** Fig. 43. Usually shrubby or arborescent aromatically fragrant plants; leaves usually opposite, thick, entire and pellucid-dotted; flowers bisexual, regular, rarely perigynous; sepals mostly 4-5, imbricated; petals 4-5, imbricated; stamens very numerous by splitting, often in fascicles which are opposite the petals; ovary inferior, 1- to many-celled; fruit usually a berry, rarely a drupe or nut; seeds 1- to many.

The 72 genera and 2,750 species are confined almost entirely to the tropics, but with two great centers of distribution, one in tropical America and the other in Australia. *Eugenia* contains 625 species, and *Eucalyptus* more than 130 species. This is a large family related to the Melastomaceæ, Onagraceæ, and Lythraceæ. The very numerous stamens, derived by the splitting of the few original stamens, and the oil-glands are distinctive. The petals of *Eucalyptus* remain firmly grown together, and, when the flower opens, they separate along a transverse line and are thrown off as a lid.

The Myrtaceæ are rich in volatile oils; also in tannin, acids, sugars, mucilage, and fixed oils. Cloves are the flower-buds of *Jambosa caryophyllus*. The fruit of *Pimenta officinalis* is thought to combine the flavors of the nutmeg, cinnamon, and clove, and is therefore termed allspice. *Psidium Guajava* is a tree cultivated in the tropics for the much-prized fruits. Oil of myrica is obtained from the leaves of *Pimenta acris* of the West Indies and is used in making bay rum. Oil of cajuput, a fragrant oil used in medicine, is secured from the leaves and twigs of the East Indian *Melaleuca Leucadendron*. The leaves of the European myrtle (*Myrtus communis*) yield a distilled preparation known as eau-d'ange, used as a toilet article. Other edible fruits are rose apples (*Jambosa malaccensis* and *J. vulgaris*) of the East Indies and Pacific Ocean. Jambos berries are obtained from *Jambosa vulgaris*, which is extensively cultivated in the tropics. Oil of eucalyptus is an important aromatic oil obtained from the foliage of various species of that genus. The wood of *Eucalyptus* is hard, firm and elastic, and is much prized in wood-carving. Many other species of this family are in use locally for food, condiments, medicine, timber, and so on.

About 20 genera are in cultivation in North America, mostly in the South or Southwest. Among these are the Bottle-brush (*Callistemon*), Cajaput Tree (*Melaleuca*), *Eucalyptus* or Australian Blue-gum, Rose Apple or Jambos (*Jambosa*), Cayenne Cherry (*Eugenia*), Myrtle (*Myrtus*), Guava (*Psidium*), Allspice, Pimento (*Pimenta*), Brisbane Box (*Tristania*), Turpentine Tree (*Syncarpia*), and Downy Myrtle (*Rhodomyrtus*).

165. **Melastomaceæ** (from the genus *Melastoma*, derived from the Greek *black-mouth*, because the berries of some of the species when eaten stain the mouth black). **MELASTOMA FAMILY.** Fig. 43. Herbs, shrubs or trees; erect, climbing or epiphytic; branches often 4-sided; leaves opposite or whorled, simple, mostly entire, usually palmately nerved throughout with transverse nervelets; flowers bisexual, regular or slightly irregular; often perigynous; sepals 3-6, mostly 5, valvate, imbricated or united into a calyptra-like hood; petals commonly 5, convolute; stamens usually twice as many as the petals, rarely just as many; anthers mostly opening by terminal pores, inflexed in the bud, often curved; connective very peculiar and diverse, with various appendages; often one anther cell wanting, the other mounted on the end of the lever-like, versatile, curved connective; ovary usually 4-5-celled, more or



43. **LECYNTHIDACEÆ:** 1. *Lecythis*, flower. **RHIZOPHORACEÆ:** 2. *Rhizophora*, a, flower; b, germinating fruit. **COMBRETACEÆ:** 3. *Combretum*, a, flower; b, floral diagram. **MYRTACEÆ:** 4. *Jambosa*, a, flower; b, vertical section flower-bud. 5. *Eucalyptus*, a, flower-bud and lid; b, vertical section flower-bud. **MELASTOMACEÆ:** 6. *Melastoma*, a, flower; b, floral diagram.

alternate or opposite, simple or coriaceous; flowers bisexual or unisexual, regular, usually perigynous; receptacle enveloping the ovary and often projecting into a slender tube; sepals 4-5, valvate, connate; petals 4-5, or 0; stamens 4-5, alternating with the petals, or twice or thrice as many; ovary 1-celled, inferior, 2-4-ovuled; fruit a drupe, or dry and winged, rarely dehiscent.

In this family are 15 genera and about 280 species, mostly confined to the tropics of both hemispheres. The family is related to the Cornaceæ and the Rhizophoraceæ, as well as more distantly to the Onagraceæ.

The trees are valuable for their hard, close wood; the tannin-containing bark and galls are used locally for tanning leather. The seeds known as myrobalans (*Terminalia Chebula* and *T. Catappa*) are much eaten in India. A useful oil is obtained from these seeds. Black and yellow dyes are furnished by several species.

Four to 6 genera are in cultivation in the Southern States and the West Indies. *Terminalia Catappa* (tropical almond, myrobalan) is grown for nuts and



less inferior; ovules numerous in each cell; style and stigma 1: fruit a berry, drupe or capsule, or dry and indehiscent, usually inclosed in the calyx.

Most of the 148 genera and about 2,800 species, are found in tropical America, where the species are very abundant and form a characteristic component of the vegetation; represented in the eastern United States by 4 species of *Rhexia* (deer-grass, meadow beauty). Melastomaceæ is a very distinct, striking and peculiar tropical family related to the Myrtaceæ and the Lythraceæ, recognized by the venation of the leaves, and the unusual stamens. The so-called "cauliflower" species, with the flowers borne directly on the tree-trunks, are pollinated by butterflies in the deep tropical forests. Some Melastomaceæ are myrmecophilous, i.e., furnish habitations or food for ants, which in turn protect the plant.

The fruits of several species are eaten. The berries and bark of some yield coloring matter of some importance. A yellow dye is obtained from the leaves of *Mecycylon* of the East Indies and Africa; red and black dyes are secured from the berries of *Tamonea* (tropical America), *Melastoma* (East Indies), and so on. The leaves of *Tamonea theezans* are used by the Peruvians in place of tea. Some, because of astringent properties, are locally used as medicine. The most important use of the Melastomaceæ is ornamental. The large, showy, queer flowers and striking foliage render them popular greenhouse plants in the North.

Some 20 genera are cultivated in N. America, mostly as warmhouse decorative plants, or for summer bedding. Few, if any, have popular names.

166. **Onagraceæ** (from the genus *Onagra*, now a part of *Oenothera*, derived from the Greek, *a wild ass*, in reference to a fancied resemblance between the ears of that animal and the leaves of these plants). EVENING PRIMROSE FAMILY. Fig. 44. Mostly herbs, rarely shrubs: leaves opposite or alternate: flowers bisexual, regular, perigynous or epigynous; sepals 4, rarely 2-3, separate or united, valvate; petals 4, or rarely 2 or 0, mostly clawed, convolute; stamens of the same number as the petals or twice as many, outer alternate with the petals; ovary 2-4-celled, inferior; ovules numerous; style 1; stigmas 1-4: fruit a capsule, rarely a berry or nut.

The 36 genera and 470 species are mostly natives of the temperate portion of the New World (western United States and Mexico), but are also abundant in South America. *Epilobium*, containing 160 species, is widely distributed in the cooler regions of both hemispheres. This is a distinct family, recognized by the numerical plan of 2 or 4, the usually perigynous flowers, and the inferior ovary with many ovules. It is related to Lythraceæ, Melastomaceæ, Myrtaceæ, and other families of this group.

*Fuchsia* is shrubby or even arborescent, and its fruit is a berry. The tubular receptacle is prolonged beyond the ovary in most genera, but not in *Jussieua*, *Ludwigia*, and *Epilobium*. The seeds of *Epilobium* are comose, and are distributed, parachute-like, by the wind. The flowers of a number of species of *Oenothera* open only at night or in dark weather, and are pollinated by night-flying moths; hence the name evening primrose.

The wood of several species of *Fuchsia* furnishes ink and a black dye. *Jussieua pilosa* yields a yellow dye. The berries of many *Fuchsias* are eaten, and preserved with sugar. The young shoots of *Epilobium latifolium* are eaten as greens. The roots of *Oenothera biennis* have been improved in Europe and furnish "rhapontic" roots, which are eaten like celery. The coma of the seeds of *Epilobium* has been used in Lapland to make lamp-wicks and has been spun into cloth, but without great success. Many genera are cultivated for ornamental purposes because of the showy flowers.

About a dozen genera are cultivated in N. America,

among which are the following: *Circæa* (Enchanter's Nightshade); *Epilobium* (Willow Herb, Fire Weed); *Fuchsia*; *Ludwigia* (Water-purslane, Seed-box or Rattle-box); *Clarkia*; *Oenothera* (Evening Primrose, Sundrops); and *Godetia*. These are mostly grown in the open as annuals or as hardy perennials, except *Fuchsia*, which is a greenhouse plant but often bedded out in summer.

167. **Hydrocaryaceæ** (from the Greek signifying, *water-walnut*). WATER CHESTNUT FAMILY. Herbaceous, aquatic plants mostly floating: stems slender, clothed with cypose, pinnatifid roots: leaves alternate, crowded at the summit of the stem, floating, rhomboid, petioled; petioles forming thick, hollow floats: flowers bisexual, regular, slightly perigynous, axillary; sepals 4; petals 4; stamens 4, all sets alternating; ovary surrounded by an erect, corona-like disk, half-inferior, 2-celled; cells 1-ovuled; style and stigma 1: fruit a woody 1-celled, 1-seeded nut bearing on the surface the four divergent woody horn-like sepals and capped by the woody disk.

A single genus and 3 species occur, distributed in the Mediterranean region and eastward to eastern Asia. This is an ancient family, more common in the tertiary. The family is related to the Onagraceæ, with which it is frequently united, and to the Haloragidaceæ, and is somewhat intermediate between these two families. The fruit, disk, and habit are peculiar.

The starchy seeds have a chestnut-like flavor and are eaten raw or cooked, for which reason the plants are often cultivated. The fruits are regularly sold



44. ONAGRACEÆ: 1. *Oenothera*, a, flower; b, floral diagram. 2. *Epilobium*, a, flower; b, dehiscent fruit; c, seed. 3. *Circæa*, floral diagram. HALORAGIDACEÆ: 4. *Myriophyllum*, a, portion of flowering plant; b, female flower; c, male flower, petals removed.

in the markets of India; those of *Trapa natans* var. *verbanensis* are used as beads.

*Trapa natans* (Water Chestnut, Water Caltrops) and *T. bispinosa* (Singhara Nut) are grown in this country as aquarium plants. See article on *Trapa*.

168. **Haloragidaceæ** (from the genus *Haloragis*, meaning *sea + a berry*). WATER MILFOIL FAMILY. Fig. 44. Herbs, aquatic or terrestrial, of very diverse appearance: leaves opposite or alternate, often in the same genus, pectinate (aquatic) to very large and

divided: flowers bisexual or unisexual, regular; sepals 4; petals 4 or 0; stamens 8, the outer opposite the petals, or 4, rarely fewer; ovary inferior, 1-4-celled, each cell 1-ovuled: fruit nut-like, often crowned by the calyx.

Eight genera and about 100 species are known, of general distribution. These are most abundant in the southern hemisphere of the Old World. They are represented in South America and elsewhere by the queer *Gunnera* and in the eastern United States by *Hippuris*, *Myriophyllum* and *Proserpinaca*. The family is closely related to the *Onagraceæ*, but differs in having but 1 ovule in each cell of the ovary.

The aquatic forms are *Utricularia*-like and floating, with slender stems and either finely pectinate leaves with filiform divisions (*Myriophyllum*) or linear and entire leaves (*Hippuris*). *Gunnera* of South America has broad kidney-shaped leaves varying from small to gigantically large. The leaves of this genus in Costa Rica are said to be so large as to give shelter to three men on horseback.

The fruits of *Gunnera macrophylla* are used as a stimulant in Java. The giant leaves, six feet broad, of *Gunnera chilensis* are used in Chile for tanning skins.

Two species of *Gunnera* are almost, or quite, hardy in the mid-eastern United States, and are grown for luxuriant lawn foliage. Several species of the aquatic *Myriophyllum* are in cultivation, one of which is parrot's feather (*M. proserpinacoides*).

#### Order 45. UMBELLIFLORÆ

169 **Araliaceæ** (from the genus *Aralia*, the meaning of which is unknown). GINSENG FAMILY. Fig. 45. Herbs, shrubs, or trees, often prickly or climbing: stems solid, pithy: leaves usually alternate, simple, or pinnately or ternately compound: flowers bisexual or unisexual, small, regular, epigynous, commonly in umbels; sepals minute, often almost wanting; petals 5, rarely more, valvate or imbricated, sometimes cohering at the apex

and deciduous as a cap; stamens usually 5, alternate with the petals, and inserted at the edge of an epigynous disk, rarely twice or thrice as many; ovary inferior, 2-15-celled; cells 1-ovuled; styles as many as the carpels: fruit a berry, rarely splitting into segments.

Fifty-one genera and about 400 species are distributed in tropical and temperate regions of both hemispheres. The two great centers of distribution are tropical America and the Malay Peninsula. The family is very closely related to the *Umbelliferae*, but differs in the berry-like fruit with more numerous carpels.

The leaves of the English ivy (*Hedera Helix*) were used in medicine in olden times. The roots of ginseng (*Panax Ginseng* and *Panax quinquefolium*) are much prized in China where they are carried about on the person as a charm against disease. These roots are now extensively and profitably cultivated in America for the Chinese trade. The roots of *Aralia nudicaulis* (American sarsaparilla) are considered a tonic. Chinese rice-paper is made from the pith of *Tetrapanax papyriferum* simply by cutting the pith spirally into thin sheets. Many *Araliaceæ* are grown as ornamental plants.

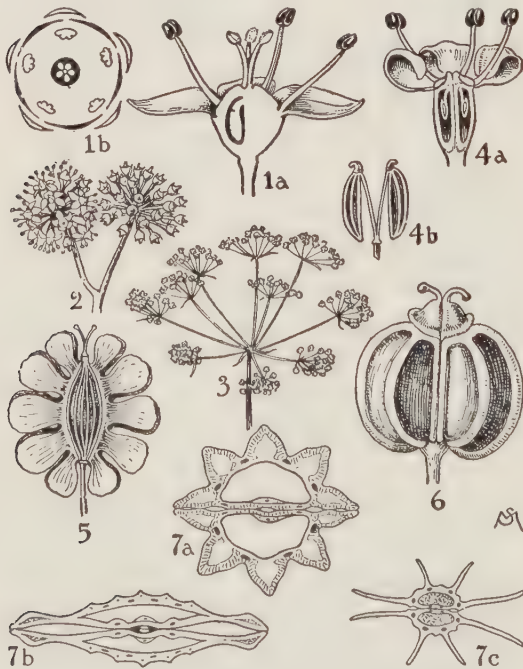
Many genera are cultivated in America. Among these are: *Acanthopanax*; *Aralia* (including *Spikenard*, *Hercules' Club* or *Devil's Walking-club*, *Wild Sarsaparilla*, *Bristly Sarsaparilla*, *Chinese Angelica Tree*); *Dizygotheca*; *Fatsia*; *Oreopanax*; *Polyscias*; *Pseudopanax*; *Hedera* (English Ivy); and *Panax* (*Ginseng*).

170. **Umbelliferae** (from the predominating type of flower cluster). PARSLEY FAMILY. Fig. 45. Herbs or rarely shrubs: stems often hollow: leaves alternate, rarely simple, usually ternately or pinnately compound: flowers minute, bisexual, regular or the outer irregular, epigynous, borne in simple or compound umbels; sepals minute or wanting; petals 5, valvate and incurved in the bud; stamens 5, alternating with the petals, inserted around an epigynous disk; ovary 2-celled, inferior, each cell 1-seeded; styles 2: fruit very special, consisting of 2 dry, ribbed or winged, 1-seeded, indehiscent carpels (mericarps), which separate at the base but remain attached at the top to a very slender and flexuous Y-shaped stalk (carpophore) from which they dangle; between or under the ribs are oil-tubes.

About 231 genera and 1,500 species are very commonly found in all boreal temperate and subtropical lands, but are rare in the tropics except in the mountains. The *Umbelliferae* is a distinct family, closely related to the *Araliaceæ*, and more distantly to the *Cornaceæ*. The umbels, the inferior ovary and the peculiar fruit are distinctive.

The leaves are exceedingly diverse in size, shape and extent to which compounded. Those of *Eryngium* are sword-shaped, or yucca-like, often spiny; those of *Hydrocotyle* are simple and often peltate. *Azorella* of the Andes and New Zealand is turf-like or cushion-like, a xerophytic adaptation. Some species of *Angelica* are immense herbs many feet high with enormous leaves. The flowers, in general, are uniform in structure and appearance, the greatest diversity being in the fruit.

Economic plants are abundant in the *Umbelliferae*; between 40 and 50 have been listed by some authors. Various alkaloids and other compounds, some very poisonous, together with many kinds of resins, produced in the foliage, roots or seeds, form the basis of their economic importance. Plants used for food are celery (*Apium graveolens*), carrot (*Daucus Carota*), and parsley (*Petroselinum sativum*). Those used for flavoring are caraway (*Carum Carui*), anise (*Pimpinella Anisum*), sweet Cicely (*Osmorhiza* or *Scandix*), chervil (*Anthriscus Cerefolium*), dill (*Anethum graveolens*), fennel (*Feniculum vulgare*), lovage (*Levisticum officinale*). Very poisonous plants are poison hemlock (*Conium maculatum*), fool's parsley (*Aethusa Cynapium*) and others. The following drugs are obtained from this family: coriander (*Coriandrum sativum*), ammoniac resin (from *Dorema Ammon-*



45. **ARALIACEÆ**: 1. *Aralia*, a. flower; b. floral diagram. 2. *Hedera*, portion of inflorescence. **UMBELLIFERÆ**: 3. *Cicuta*, inflorescence. 4. *Foeniculum*, a. flower; b. dehiscent fruit. 5. *Artedia*, fruit. 6. *Apium*, fruit. 7. a, b, and c, fruits of *Umbelliferae*, cross-section.



*iocum*), galbanum (a resin from species of *Ferula*). From various species of *Ferula* is obtained the vile-smelling gum-resin *asafetida*, used in medicine, which the Persians are said to praise as a delicious condiment.

There are 40–50 genera in cultivation in America, mostly hardy. Some are grown for food, others for ornament: Sea Holly (*Eryngium*); Sanicle, or locally Black Snakeroot (*Sanicula*); Carrot (*Daucus*); Coriander (*Coriandrum*); Cumin (*Cuminum*); Celery (*Apium*); Caraway (*Carum*); Gout-weed (*Ægopodium*); Sweet Cicely (*Osmorhiza*); Myrrh (not of medicine) or European Sweet Cicely (*Myrrhis* or, more properly, *Scandix*); Fennel (*Foeniculum*); Lovage (*Levisticum*); Angelica (*Angelica*); Cow-parsnip (*Heracleum*). Poison hemlock (*Conium*) is a roadside weed.

171. **Cornaceæ** (from the genus *Cornus*, derived from the Latin *horn*, referring to the hardness of the wood). **DOGWOOD FAMILY.** Trees or shrubs, rarely herbs: leaves opposite or alternate, entire, exstipulate; flowers bisexual, rarely unisexual, regular, epigynous; sepals 4, minute or absent; petals 4, usually valvate; stamens commonly of same number as petals and alternate with them, separate; epigynous disk usually present; ovary inferior, 2-celled, rarely 1–10-celled; ovules in each cell 1, rarely 2: fruit a drupe or berry.

The 15 genera and about 120 species, of which 45 species belong to the genus *Cornus*, are distributed in the temperate portions of the northern hemisphere, principally in North America and Asia; some, however, occur in South Africa and New Zealand. The relationships of the family are doubtful. *Cornus* is related to the *Caprifoliaceæ*, but some other genera suggest the *Araliaceæ*. The woody or sub-ligneous habit, 4-merous, polypetalous, epigynous flowers and the berry-like fruit with one seed in each cell are distinctive.

Many species of *Cornus* have capitate flowers surrounded by a large petaloid involucre (e.g., *Cornus mas*, *C. florida*, *C. canadensis*). *C. canadensis* and *C. suecica* are herbaceous dogwoods. *Helwingia rusciflora*, of China and Japan, is a most remarkable plant with flowers borne at the center of the leaf-blade attached to the midrib on the upper side.

The acid fruits of *C. mas* are edible, and are used as a sherbet in the East. Those of *C. capitata* of the Himalayas have a flavor like strawberries and are eaten. Many *Cornaceæ* are ornamental woody plants.

Several genera are in cultivation here, of which may be mentioned: *Cornus* (Dogwood, Osier Dogwood); *Aucuba*, from Japan; *Garrya* from southern United States; *Griselinia* from New Zealand; *Nyssa* (Sour Gum, Pepperidge, Tupelo) from the eastern United States. *Garrya*, *Nyssa* and others have been separated by some into other families.

#### Sub-class II. *Metachlamydeæ*, or *Sympetalæ*

##### Order 46. **ERICALES**

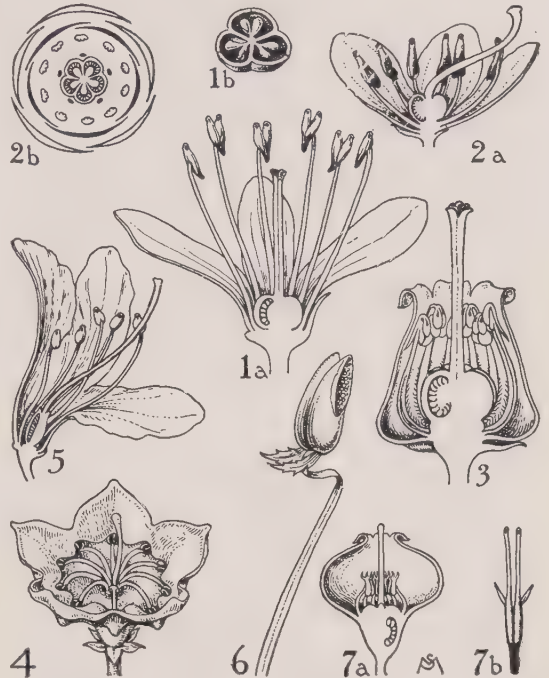
172. **Clethraceæ** (from the genus *Clethra*, the ancient Greek name of Alder). **PEPPERBUSH, or WHITE ALDER FAMILY.** Fig. 46. Tall shrubs or low trees: leaves alternate: flowers bisexual, regular, hypogynous; disk absent; calyx 5-parted, persistent; corolla saucer-shaped, of 5 separate petals; stamens 10, hypogynous; anthers opening by terminal pores, at first inverted, later erect; ovary superior, 3-celled; style 1; stigmas 3; ovules numerous: fruit a capsule.

A single genus and about 30 species are distributed in the tropical and subtropical regions of both hemispheres; mostly American. Two species reach the eastern United States. The family is closely related to the *Pyrolaceæ* and *Ericaceæ*. The polypetalous corolla, temporarily inverted anthers and the 3-celled ovary are important characteristics. There is one fossil species known.

A few species of *Clethra* are grown in North America

for ornamental purposes. *C. alnifolia* is the native white alder or sweet pepperbush.

173. **Pyrolaceæ** (from the genus *Pyrola*, diminutive of *Pyrus*; possibly a resemblance in the foliage). **SHIN-LEAF FAMILY.** Fig. 46. Very low perennial herbs:



46. **CLETHRACEÆ:** 1. *Clethra*, a, flower; b, cross-section ovary. **PYROLACEÆ:** 2. *Pyrola*, a, flower; b, floral diagram. **ERICA-CEÆ:** 3. *Andromeda*, flower. 4. *Kalmia*, flower. 5. *Rhododendron*, flower. 6. *Erica*, stamen. 7. *Vaccinium*, a, flower; b, stamen.

leaves alternate, basal or scattered, thick and evergreen in most species: flowers bisexual, regular, with or without a hypogynous disk; calyx 5-parted, persistent; corolla waxy, saucer-shaped, of 5 separate petals; stamens 10, hypogynous; anthers opening by terminal pores, inverted; ovary superior, 5-celled, many-ovuled; style and stigma 1: fruit a capsule.

There are 3 genera and 20 species distributed in the boreal and temperate parts of Europe, Asia and America. The polypetalous flowers, inverted anthers and 5 carpels are characteristic. The family is closely related to the *Ericaceæ* and *Clethraceæ*.

Two species of *Chimaphila* (*Pipsissewa*, Prince's Pine), one species of *Moneses* (*One-flowered Pyrola*), and a few species of *Pyrola* (*Shinleaf*) are offered in the American trade for ornamental purposes. Otherwise the family is of no economic importance.

174. **Monotropaceæ** (from the genus *Monotropa*, meaning *one turn*, in reference to the nodding flower). **INDIAN-PIPE FAMILY.** Low, saprophytic herbs, without chlorophyll, white, yellowish, brownish, or blood-red in color: leaves alternate, reduced to scales: flowers 1 to several, bisexual, regular, a lobed, hypogynous disk sometimes present; calyx 5-parted, rarely 0; corolla of 4–5, separate, gibbous petals, these rarely coherent; stamens 8–10, hypogynous; anthers opening by slits, 1–2-celled, often appendaged; ovary 4–5-celled, superior, many-ovuled; style and stigma 1: fruit a capsule.

The Indian-pipe family contains 8 genera and about 12 species, all North American except 1 Himalayan species and 1 found in both Europe and America; most abundant in the West. The family is closely related to the *Ericaceæ*, *Pyrolaceæ* and *Clethraceæ*, from which it differs mainly in method of nutrition.

*Sarcodes sanguinea*, the Sierran snow plant, is bright red in color.

The Monotropaceæ are not known to be in cultivation.

175 **Ericaceæ** (from the genus *Erica*, the ancient name of the heath, from *erico*, to break). **HEATH FAMILY.** Fig. 46. Shrubs or sub-shrubs: leaves alternate, often evergreen; flowers bisexual, regular or slightly irregular; calyx 4-5-fid, persistent; corolla gamopetalous, rarely polypetalous, often urceolate, 4-5-lobed, convolute or imbricated; stamens alternate with the petals, of the same number or double the number, inserted at the base of a hypogynous disk, not epipetalous; anthers sometimes appendaged, opening by terminal pores, rarely by longitudinal slits; ovary superior or inferior, 4-5-celled or falsely 10-celled, many ovuled; style and stigma 1: fruit a capsule, rarely a berry or drupe.

The 67 genera and about 1,400 species are very generally distributed. *Erica*, the largest genus, with 420 species, is confined to the Old World. The family is closely related to the Pyrolaceæ and Clethraceæ; also to the Epacridaceæ and Diapensiaceæ. The northern Ericaceæ are largely evergreen and variously adapted

ing on hilltops). **EPACRIS FAMILY.** Shrubs or small trees: leaves alternate, usually stiff, small, and heath-like: flowers bisexual, regular, hypogynous; disk present; calyx of 4-5 sepals bracted at the base; corolla gamopetalous, 4-5-lobed; stamens 4-5, hypogynous or epipetalous; anthers opening by longitudinal slits; carpels 4-5; ovary superior, 1-10-celled; ovules solitary or many; style and stigma 1: fruit a drupe or capsule.

The 21 genera and about 300 species are almost exclusively confined to Australia and New Zealand. One species is found in South America. The family is closely related to the Ericaceæ, but has one whorl of stamens. The genus *Styphelia* contains 172 species. *S. sapida* furnishes edible berries.

A few species of *Epacris* are grown as ornamental plants in the greenhouses of North America.

177. **Diapensiaceæ** (from the genus *Diapensia*, the derivation of which is obscure). **DIAPENSIA FAMILY.** Fig. 47. Low shrubs: leaves alternate, evergreen, reniform or imbricated or moss-like: flowers bisexual, regular, hypogynous; disk absent; calyx of 3-5 sepals; corolla with 5 separate petals, or gamopetalous; lobes imbricated; stamens 5, epipetalous or hypogynous, alternating with the corolla lobes, often also alternating with 5 staminodia; anthers opening by a longitudinal slit; ovary superior, 3-celled; ovules very numerous; style 1; stigmas 1-3: fruit a capsule.

Diapensiaceæ has 6 genera and about 10 species of circumpolar distribution, extending southward to Carolina and the Himalayas. The family is related to the Ericaceæ, and to the Epacridaceæ. The 3 carpels and 5 stamens are important distinguishing characteristics.

Four or more genera are in cultivation in America; of these, *Galax aphylla* (Galax) of North Carolina has reniform leaves; *Pyxidantha barbata* (Pyxie, Flowering Moss, or Pine-barren Beauty) of southern New Jersey has subulate leaves; *Shortia*, of North Carolina and Japan, and *Schizocodon soldanelloides* (Fringed Galax) of Japan both have orbicular leaves.

#### Order 47. PRIMULEALES

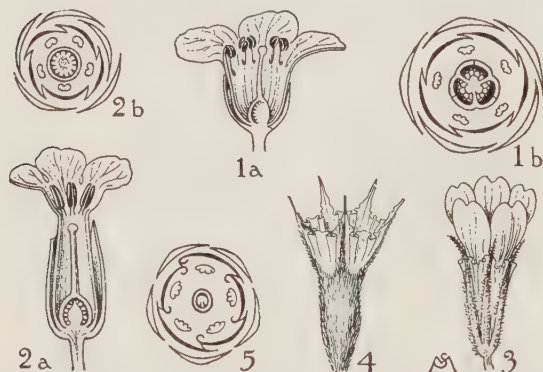
178. **Myrsinaceæ** (from the genus *Myrsine*, the Greek name of Myrrh). **MYRSINE FAMILY.** Trees or shrubs: leaves usually alternate, coriaceous, glandular-dotted: flowers bisexual or unisexual, regular, often very glandular; calyx 4-5-parted, persistent; corolla gamopetalous, rarely of separate petals, 4-5-lobed; stamens 5, opposite the lobes of the corolla, mostly epipetalous, separate or monadelphous; alternating staminodia often present; ovary superior or inferior, 1-celled, placenta basal or free-central; ovules few or numerous; style and stigma 1: fruit a few-seeded berry or drupe.

Widely distributed in the tropics are 32 genera and about 550 species. Two species reach Florida. The family is related to the Primulaceæ, but is woody, glandular, and has indehiscent fruits; also related to the Sapotaceæ.

The leaves of *Jacquinia* are used in America to stupefy fish; the fruits of this genus are poisonous. The fruits of some species of *Ardisia* are edible. Bread is made in San Domingo from the crushed seed of *Theophrasta Jussieu*.

About a half-dozen genera are in cultivation in this country, but are little known. *Jacquinia* and *Myrsine* are grown in southern Florida and southern California; *Ardisia* is a genus of greenhouse shrubs. The species ascribed in the trade to *Theophrasta* on further study have been referred to other genera.

179. **Primulaceæ** (from the genus *Primula*, from Latin *primus* (first), in reference to the early flowering of some European species). **PRIMROSE FAMILY.** Fig. 47. Herbs: leaves mostly opposite or whorled, often dotted or mealy: flowers bisexual, regular, rarely slightly irregular; calyx not bracteate, mostly 5-parted; corolla



47. **DIAPENSIACEÆ:** 1. *Diapensia*, a, flower; b, floral diagram. **PRIMULACEÆ:** 2. *Primula*, a, flower b, floral diagram. **PLUMBAGINACEÆ:** 3. *Armeria*, flower. 4. *Statice*, calyx. 5. *Plumbago*, floral diagram.

in foliage to a xerophytic habitat. *Ledum* is polypetalous. *Rhododendron* has a funnel-form corolla; *Kalmia*, a cup-shaped corolla with elastic stamens in pockets. The anthers of *Epigæa* dehisce longitudinally.

*Arctostaphylos Uva-Ursi* (bearberry) of Europe and America is medicinal. The volatile oil of wintergreen is obtained from the leaves, and stems, of the North American *Gaultheria procumbens*. A very poisonous substance is found in some species of *Rhododendron*, *Lyonia* and *Leucothoe*; and possibly the poisonous quality of *Kalmia* and *Rhododendron* honey is due to this. Species of *Gaylussacia* (North America) yield huckleberries; species of *Vaccinium* yield blueberries. The fruits of *V. Myrtillus* (Europe) are bilberries. The European heaths furnish commercial honey. Cranberries are the fruit of *V. macrocarpon* and *V. Oxycoccus*. Many species of Ericaceæ are ornamental.

Forty to 50 genera are in cultivation in N. America. Among these are the Strawberry Tree or Madrona (*Arbutus*); Bearberry (*Arctostaphylos*); Heather (*Calluna*); Heath (*Erica*); Trailing *Arbutus* or Mayflower (*Epigæa*); Labrador Tea (*Ledum*); Sourwood or Sorrel Tree (*Oxydendrum*); *Azalea*, *Rhodora*, *Rhododendron* or Pinxter Flower (*Rhododendron*); Laurel (*Kalmia*); Blueberry and Cranberry (*Vaccinium*); Huckleberry (*Gaylussacia*); also *Menziesia*, *Chamaedaphne*, *Cassiope*, *Andromeda*, and others.

176. **Epacridaceæ** (from the genus *Epacris*, derived from the Greek meaning on the top; many species grow-



gamopetalous, 5-lobed, rarely of separate petals; stamens 5, epipetalous, opposite the corolla lobes, often alternating with staminodia; ovary superior, rarely half-inferior, 1-celled, many-ovuled; placenta free-central; style and stigma 1; fruit a capsule opening by valves or by a transverse lid.

The family has 28 genera and about 320 species of more or less cosmopolitan distribution, but most abundant in north temperate regions. It is most closely related to the Myrsinaceæ and Plumbaginaceæ. The herbaceous habit, dehiscent fruit, and many seeds are important distinguishing characteristics. The flowers of this family often have styles and stamens of different lengths in the same species (heteromorphic), e. g., *Primula*. The free-central placentation is characteristic of this and related families.

Rhizomes of *Primula* were formerly used for diseases of the bladder. Primrose wine is made from the flowers of *Primula officinalis* and *P. vulgaris*. Rhizomes of *Cyclamen* are purgative and emetic. In some countries these rhizomes are used to stupefy fish; roasted they become good food for pigs (sowbread of Europe). Other species have been used in medicine. Many are ornamental plants.

Twelve to 18 genera are in cultivation in North America. Among these are the following well-known names: *Cyclamen*; *Dodecatheon* (Shooting-star); *Androsace* (Rock Jasmine); *Anagallis* (Pimpernel, Poor Man's Weather-glass); *Hottonia* (Featherfoil, Water-Violet, Water-Yarrow) with aquatic inflated stems and fine leaves; *Lysimachia* (Loosestrife, Moneywort, Creeping Charlie); *Primula* (Primrose); *Soldanella*; *Stieronema* (Loosestrife); *Trientalis* (Star Flower).

**180. Plumbaginaceæ** (from the genus *Plumbago*, from *plumbum*, lead; perhaps in reference to the lead-like stain given by the roots to the fingers). **LEADWORT FAMILY.** Fig. 47. Herbs or shrubs: leaves alternate, linear or lanceolate; flowers bisexual, regular; calyx bracteate, 5-fid, usually scarious, and plicate, angled or winged, sometimes colored, persistent; corolla gamopetalous, or of 5 nearly separate petals, mostly convolute; stamens 5, epipetalous, opposite the lobes of the corolla; ovary superior, 1-celled; ovule 1, basal; styles 5; fruit a capsule or utricle, invested by the calyx.

The ten genera and about 250 species, of almost cosmopolitan distribution, are found usually inhabiting seacoasts and alkaline regions; they are most abundant in the Mediterranean region, and in Central Asia. The family is closely related to the Primulaceæ, but has only one seed.

A fatty substance in the root of certain *Plumbagos* gives a lead-colored stain to the fingers and paper. These roots were formerly used for toothache, ulcers, and the like. Beggars are said still to use them to produce sores. The roots of *Statice latifolia* of Russia contain tannin and have been used for tanning.

There are 5 or 6 genera in cultivation in North America; *Acantholimon* from Armenia, hardy; *Armeria* (Sea Pink, Thrift) of Europe and Asia, hardy; *Ceratostigma* of China, hardy; *Plumbago* (Leadwort), of Asia, Africa, Australia, mostly of the greenhouse; *Statice* (Sea Lavender), of Europe, Asia, North America, hardy. Some species of this family are used for dry bouquets.

#### Order 48. EBENALES

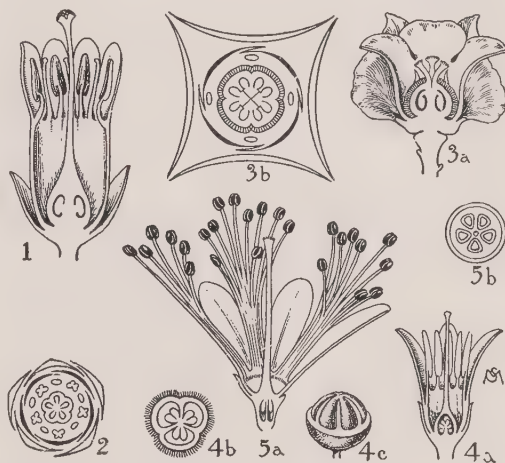
**181. Sapotaceæ** (from the old generic name *Sapota*, derived from a native name of *Achras Sapota*). **SAPOTILLA FAMILY.** Fig. 48. Trees or shrubs; juice milky; leaves alternate, entire, coriaceous; flowers usually bisexual, axillary, regular; calyx mostly of separate sepals in two whorls of 2, 3, or 4, or in one whorl of 5; corolla gamopetalous; lobes as many as the sepals, or twice as many, in one or two series, imbricated, sometimes with appendages which simulate extra corolla-lobes; stamens as many as the lobes of the corolla and opposite them,

sometimes with intermediate staminodia, or twice as many, epipetalous; ovary superior, 4- to many-celled; ovules 1 in each cell, basal; style and stigma 1; fruit a berry.

There are 31 genera and about 400 species, of tropical distribution, rarely reaching the warm temperate zone. One species extends to Virginia and two to Illinois. This is a distinct family, distantly related to the Myrsinaceæ, Ebenaceæ, and Styracaceæ.

The fruits of *Lucuma mammosa* (marmalade plum), and *Achras Sapota* (sapodilla), are very agreeable. Fruits of *Illipe* and *Mimusops*, both Asiatic, are edible. The oil from the seeds of the oriental *Illipe butyracea* and of other species is galam butter, and shea butter. It is used for food and soap. The wood of many species is very hard and valuable—so-called ironwoods. Several species of *Palaquium* of the East Indies yield gutta percha, as do other species of the family. Gum chicle is obtained from *Achras Sapota*. Star-Apple is *Chrysophyllum Cainilo*. West Indian medlar is *Mimusops Elengi*.

Six to 10 genera are in cultivation in North America, mostly in the warmer parts: *Mimusops*, *Lucuma* (Mar-



48. SAPOTACEÆ: 1. *Lucuma*, flower. 2. *Sideroxylon*, floral diagram. EBENACEÆ: 3. *Diospyros*, a, female flower; b, floral diagram, female flower. STYRACACEÆ: 4. *Styrax*, a, flower; b, cross-section ovary; c, fruit. SYMPLOCACEÆ: 5. *Symplocos*, a, flower; b, cross-section fruit.

malade Plum) and *Sideroxylon* are grown in southern California and Florida; *Dichopsis* or *Palaquium* (wrongly called *Isonandra*), the commercial gutta percha tree, is cultivated in the South. *Bumelia* and *Chrysophyllum* are ornamental, the former hardy to Massachusetts.

**182. Ebenaceæ** (from the Latin *ebenus*, meaning *ebony*). **EBONY FAMILY.** Fig. 48. Trees or shrubs; leaves alternate, coriaceous, entire; flowers rarely bisexual, usually dioecious, regular; calyx 3-6-parted, persistent; corolla 3-6-lobed, hypogynous, gamopetalous, urceolate, coriaceous, mostly imbricated and twisted; stamens short, usually double the number of the corolla-lobes, rarely as many or more numerous, hypogynous or epipetalous, separate or united in pairs; ovary superior, 2-16-celled, with 1-2 suspended ovules in each cell; styles and stigmas 2-8; fruit berry-like, rarely sub-dehiscent.

In this family are 5 genera and about 280 species, of which 180 belong to the genus *Diospyros*; they are inhabitants of tropical and subtropical regions, principally of the eastern hemisphere. The greatest development of the family is in the East Indies and Malay Archipelago. One species of *Diospyros* occurs in the eastern United States, from Rhode Island southward. The family is related to the Styracaceæ, Sym-

plocaceæ and Sapotaceæ. The superior several-celled ovary, unisexual flowers and absence of milky juice are important distinctive characters.

The wood of many species, especially of the genus *Diospyros*, furnishes the ebony of commerce. The fruit of *Diospyros Lotus* is known as date plum in Asia. The fruit of the persimmon (*Diospyros virginiana*) is also edible. The bark of persimmon is sometimes used in medicine.

Three or 4 genera are in cultivation in North America for ornamental purposes. Maba, from Natal, and Royena, from South Africa, are not hardy. *Diospyros* (Common Persimmon and Kaki), hardy or tender, depending on the species, is grown for ornament or fruit.

183. **Styracaceæ** (from the genus *Styrax*, the ancient Greek name of the storax tree). **STORAX FAMILY.** Fig. 48. Shrubs or small trees: leaves alternate, simple: flowers bisexual, regular; calyx 4-5-cleft; corolla mostly 4-5-lobed, the lobes almost separate, imbricated or valvate; stamens in one series, hypogynous or epipetalous, twice as many as the lobes of the corolla, rarely just as many, separate or more or less united; ovary superior, rarely half-inferior, 1-celled at the top, 3-5-celled at the bottom; 1, rarely several, ovules in each cell; style 1; stigmas 1-5: fruit a capsular drupe.

Six genera and about 100 species are distributed in the warmer regions of South and Central America, southeastern United States, eastern Asia, and the Mediterranean region. The family is very closely related to the Symplocaceæ; also to the Ebenaceæ and Sapotaceæ. The superior, imperfectly several-celled ovary, bisexual flowers and absence of milky juice are distinctive. Fossil species are known.

*Styrax Benzoin* of the East Indies yields the fragrant resin known as benzoin. It is a pathological product of the tree. Some Brazilian species of *Styrax* and some species of *Pamphilia* also yield a fragrant resin which is burned as incense in the churches. The storax of the ancients was obtained from *Liquidambar orientalis* (family Hamamelidaceæ).

Two or 3 genera are in cultivation in America: *Halesia* (Silver Bell, Snowdrop Tree), of eastern United States, is hardy; *Styrax* (Storax) of China, Japan, and America, is semi-hardy. *Pterostyrax* of Japan is by some referred to *Halesia*.

184. **Symplocaceæ** (from the genus *Symplocos*, derived from the Greek, meaning *connected*, referring to the stamens). **SYMPLOCOS FAMILY.** Fig. 48. Trees or shrubs: leaves alternate, simple: flowers bisexual, or less commonly unisexual, regular; calyx 5-lobed, gamosepalous, imbricated; corolla-lobes 5 or 10, in 1 or 2 series, gamopetalous, imbricated; stamens 15 to many in 1-3 or many series, separate, or slightly united with each other and the corolla, hypogynous or epipetalous; ovary inferior or half-inferior, 2-5-celled, with about 2 ovules in each cell; style 1; stigmas 1-5: fruit drupaceous.

Only one genus and about 275 species are found in tropical lands; they are most abundant in the Malay region and East India. A few species in Japan, and one in North America, extend the family into the temperate zone. *Symplocos tinctoria* reaches Delaware. The family is related to the Styracaceæ, and is often united with it. The inferior, completely several-celled ovary, and numerous stamens, are important characteristics. Fossil species are known.

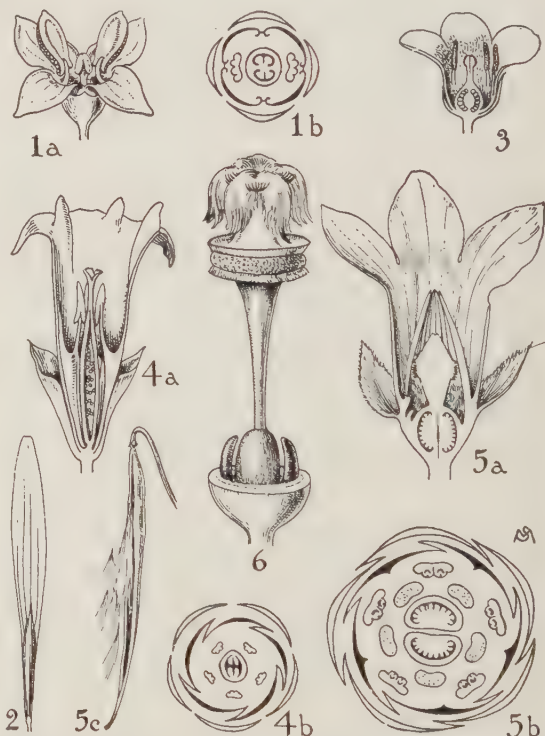
The bark of *Symplocos racemosa* is used as a medicine in the East Indies under the name lotus bark. The leaves of *S. spicata* and the roots of *S. tinctoria* are used in the preparation of yellow dye-stuffs. *S. crataegoides* is a hardy ornamental shrub from Japan.

#### Order 49. CONTORTÆ

185. **Oleaceæ** (from the genus *Olea*, derived from the Greek meaning, originally, *olive tree*, and later *oil*,

i. e., olive oil). **OLIVE FAMILY.** Fig. 49. Trees or shrubs: leaves opposite, simple or pinnate: flowers bisexual or unisexual, regular, small and numerous; calyx 4-lobed, rarely 4-15-lobed, valvate; corolla 4-lobed, rarely 6-12-lobed, gamopetalous, rarely polypetalous, or 0, hypogynous, valvate; stamens 2, rarely 3-5, epipetalous, alternate with the corolla-lobes; ovary superior, 2-celled; ovules usually 2 in each cell; style 1 or 0; stigmas 1-2: fruit a drupe, berry, capsule, or samara.

Oleaceæ has 20 genera and more than 400 species, of temperate and tropical lands; these are especially abundant in the East Indies and East Asia. About 10 species are native in northeastern North America. Fossil species are known. The family is related to the Loganiaceæ; possibly also to the Celastraceæ and



49. **OLEACEÆ:** 1. *Olea*, a, flower; b, floral diagram. 2. *Fraxinus*, fruit. **LOGANIACEÆ:** 3. *Logania*, flower. **GENTIANACEÆ:** 4. *Gentiana*, a, flower; b, floral diagram. **APOCYNACEÆ:** 5. *Apocynum*, a, flower; b, floral diagram; c, fruit. 6. *Vinca*, pistil.

**Rubiaceæ.** The numerical plan of 4, the 2 stamens and the superior ovary are important distinctive characteristics.

The most useful plant is the olive (*Olea europæa*) of the Orient, long cultivated in the Mediterranean region. The oil expressed from the fruit is used as food, and for other purposes. The unripe fruits, preserved in brine, are the olives of commerce. The bark of the fringe tree and privet contains medicinal principles of minor importance, as do also the leaves of the lilac. A saccharine exudation from the bark of *Fraxinus Ornus* of Sicily, induced by the puncture of a cicada, is manna (See, also, *Tamarix mannifera*). The wood of olive and ash are valuable. The flowers of *Osmanthus fragrans* have been used to scent tea in China.

A dozen genera are in cultivation in North America: *Chionanthus* (Fringe Tree), hardy; *Forsythia* (Golden Bell), hardy; *Fontanesia*, hardy; *Fraxinus* (Ash), hardy; *Jasminum* (Jasmine, Jessamine), of the greenhouse and the South; *Ligustrum* (Privet), hardy; *Olea* (Olive),



not hardy; *Osmanthus* (Fragrant Olive and Devil-wood), not hardy; *Phillyrea*, not hardy; *Schrebera*, not hardy; and *Syringa* (Lilac), hardy.

186. **Loganiaceæ** (from the genus *Logania*, named in honor of J. Logan, a botanist). **LOGANIA FAMILY.** Fig. 49. Herbs, shrubs, or trees: leaves opposite, simple; flowers usually bisexual, regular; calyx 4-5-lobed or parted; corolla 4-5-, or 10-lobed, imbricated or convolute; stamens epipetalous, of the same number as the lobes of the corolla and usually alternate with them, rarely reduced to 1; ovary superior, usually 2-celled, rarely 1-or 4-celled; ovules usually numerous; styles 1; stigmas 1-2: fruit a capsule, rarely a berry or drupe.

The family contains 32 genera and about 360 species, of tropical distribution. A few genera only reach the temperate zone, 4 species of which are native in northeastern North America. Fossil species are known. The family is related to the Apocynaceæ, Gentianaceæ, Solanaceæ, Rubiaceæ, and Scrophulariaceæ. The opposite stipulate leaves, and 2-celled superior ovary, are important distinctive characters.

The seeds and bark of *Strychnos nux-vomica* contain a very poisonous alkaloid, strychnine, used as a nerve tonic. Curare, with which the Indians of South America poisoned their arrows, is probably obtained from the bark of *S. toxifer*. Other species of *Strychnos* are used in Java to poison arrows. The root of *Spigelia* (pink-root), an American plant, has been used as a vermifuge. It is also poisonous. *Strychnos Ignatia* yields the poisonous ignatius bean of India. The nut of *S. potatorum* is the clearing nut of India, which is used to purify foul water, by rubbing it on the inside of the vessel. The roots of yellow jasmine (*Gelsemium sempervirens*) of the southeastern United States are used as a nerve tonic.

Three or 4 genera are in the North American trade, all ornamental: *Buddleia*, semi-hardy; *Gelsemium* (Yellow Jessamine), woody vine, semi-hardy; *Spigelia* (Pink-Root), herbaceous, hardy.

187. **Gentianaceæ** (from the genus *Gentiana*, named in honor of King Gentius of Illyria, who, according to Pliny, first discovered the medicinal properties of these plants). **GENTIAN FAMILY.** Fig. 49. Herbs, rarely shrubs or small trees: leaves opposite, rarely alternate or whorled, exstipulate: flowers bisexual, regular; calyx 4-5-parted, persistent; corolla 4-8-lobed, gamopetalous, hypogynous, convolute or induplicate, rarely valvate; stamens of the same number as the corolla-lobes and alternate with them, epipetalous; hypogynous disk usually present; ovary superior, 1-celled, with 2 parietal placentæ, rarely 2-celled; ovules numerous: fruit a capsule.

The 63 genera and about 750 species are almost cosmopolitan in distribution. Three hundred species belong to the genus *Gentiana*, distributed mostly in the mountains of the north temperate zone, in the arctic zone and in the Andes; they are wanting in Africa. Fossil species of *Menyanthes* are known. The family is closely related to the Loganiaceæ. The commonly 1-celled ovary, exstipulate leaves and the presence of a bitter principle are important characters.

The general occurrence of a bitter principle renders the majority of Gentianaceæ valuable as tonics, and appetizers. Most of the drug, gentian, is obtained from *Gentiana lutea* of Europe. *G. punctata*, *G. purpurea*, and *G. Pannonica* are also used. *Erythraea Centaureium* (centaury) furnishes a medicinal bitter principle. *Tachia guianensis* is used as bitters in South America, under the name quassia. The bitter principle of *Menyanthes* is used as a medicine, and also as a substitute for hops in flavoring beer. The Gentianaceæ are used medicinally in all parts of the globe.

Several genera are in cultivation in North America: *Erythraea*; *Eustoma*; *Fraseria*; *Gentiana* (Gentian); *Menyanthes* (Buckbean); *Sabbatia*; and *Swertia*. *Nymphoides* (*Limnanthemum*) (Floating Heart, Water

Snowflake) is a genus of peculiar aquatic plants. *Villarsia* is a close relative of *Nymphoides*.

188. **Apocynaceæ** (from the genus *Apocynum*, the ancient name of the dogbane, from the Greek). **DOGBANE FAMILY.** Fig. 49. Herbs, shrubs or trees with milky juice, often climbing: leaves opposite or whorled, rarely alternate, entire, exstipulate: flowers bisexual, regular; calyx 4-5-parted; corolla 4-5-lobed, hypogynous, gamopetalous, usually with appendages or folds in the throat, convolute or valvate; stamens 4-5, epipetalous, alternating with the corolla lobes; anthers usually sagittate and acute; pollen granular; hypogynous disk usually present and variously lobed; ovaries usually 2, rarely more or less united; mostly superior, each 1-celled, many-seeded, style 1, usually bearing a fleshy ring below the solitary stigma: fruit follicular with comose seeds, or indehiscent, or berry-like, or of nutlets, sometimes winged or prickly.

One hundred and thirty genera and about 1,000 species occur, mostly in tropical countries in both hemispheres. Five or 6 species reach northeastern North America. The family is related to the Asclepiadaceæ and Gentianaceæ. The milky juice, sagittate anthers, absence of corona, styler ring, and usually separate ovaries but connate styles and stigmas, are important characteristics.

Many species of *Landolphia* yield commercial caoutchouc, as do also other genera, such as *Urceola* and *Willoughbya*. Some are very poisonous, e.g., *Tanghinia* of Madagascar; also *Cerbera* and *Acocanthera*. *Tanghinia*, the ordeal tree of Madagascar, "is the most poisonous of plants; a seed no larger than an almond suffices to kill twenty people." Death has followed the use of oleander wood as meat-skewers. An infusion of its leaves is an insecticide; of its bark, a rat-poison. Some are heart-poisons, for example *Strophanthus* and *Aspidosperma* (quebracho bark). The bark of *Alstonia* is a tonic. *Allamanda cathartica* is purgative. Several species furnish edible fruits tasting like citron. *Wrightia tinctoria* furnishes an indigo; *W. tomentosa*, a yellow dye.

About 20 to 25 genera are in cultivation in N. America as ornamental plants, mostly in the South or in the greenhouse. Among these are: *Allamanda*; *Carissa* (Caraunda, Christ's Thorn); *Amsonia*; *Apocynum* (Dogbane); *Nerium* (Oleander); *Tabernaemontana* (Crape Jasmine, Nero's Crown); *Trachelospermum* (Star Jasmine); and *Vinca* (Periwinkle).

189. **Asclepiadaceæ** (from the genus *Asclepias*, dedicated to Æsculapius). **MILKWEED FAMILY.** Fig. 50. Herbs or shrubs, sometimes fleshy, often climbing, generally with milky juice: leaves opposite, rarely otherwise, exstipulate: flowers bisexual, regular, very frequently in umbels; calyx 5-parted, imbricated; corolla 5-parted or lobed, gamopetalous, hypogynous; a crown present, which is either an outgrowth of the corolla, or of the stamens, or of both; stamens 5, mostly hypogynous, alternating with the lobes of the corolla, usually monadelphous, sometimes united with the styles; pollen usually agglutinated into pollinia, which are attached to glandular appendages of the stigma; disk absent; ovaries 2, superior, each 1-celled, many-seeded; styles 2; stigmas united: fruit of two follicles; seeds usually comose.

There are 217 genera and about 1,900 species, principally of the tropics, but many reach the temperate zone. The family is distinct, and closely related only to the Apocynaceæ. The Asclepiadaceæ is one of the most extraordinary of families. Most species have a milky juice. Many in South Africa are fleshy, cactus-like plants. Some are epiphytes with variously modified foliage. One genus of epiphytes bears foliar pitchers that catch and hold rain-water. Some species are like a bundle of leafless whip-lashes; others have remarkable tuberous bases to store water. The floral crown is most diverse; and the details of insect-pollination, especially the behavior of the pollinia, is very compli-

cated. The union of the two carpels by the stigma only is unique.

Pleurisy root (*Asclepias tuberosa*) was formerly used extensively for lung and catarrhal disorders. Condurango, from the bark of *Marsdenia Condurango*, is a stomach tonic. The milky juice of many is medicinal; some are emetics (*Vincetoxicum*, *Gomphocarpus*, *Secamone*); others are purgative (*Solenostemma*,

gamopetalous, hypogynous, convolute; stamens 5, slightly epipetalous, alternating with the corolla-lobes; hypogynous disk present, usually lobed; ovary superior, 2-celled, rarely more or fewer celled; each cell 1-2-ovuled, micropyle directed downward and outward; styles 1-2; stigmas 1-2: fruit a capsule or a berry, very rarely breaking into 4 1-seeded nutlets.

Convolvulaceæ has 40 genera with about 1,000 species, of which 300 species belong to the genus *Ipomœa* and 160 species to the genus *Convolvulus*. They are distributed in all regions except the arctics; but are especially numerous in tropical Asia and tropical America. The family is related to the Solanaceæ and Boraginaceæ, but also to the Polemoniaceæ and Hydrophyllaceæ. The absence of a circinate inflorescence, the plaited corolla, the direction in which the micropyle is turned and the few-seeded fruit are important distinguishing characteristics. The genus *Cuscuta* is parasitic and chlorophyllless, receiving its nutriment by means of haustoria from the plant upon which it twines.

Because of the substances contained in the milky juice, many species are medicinal. The following are purges: jalap (*Exogonium Purga*), of Mexico; turbith (*Operculina Turpethum*), of the East Indies; and scammony (*Convolvulus Scammonia*), of the orient. The fleshy roots of *Ipomœa Batatas* (sweet potato) are edible; also those of *Convolvulus Sepium*. *Ipomœa Pes-capræ* is used in India to bind the sands along the coast. *Convolvulus scoparius* of the Canaries furnishes the fragrant oil of rhodium, used to adulterate oil of rose, and sold also to rat-catchers as a lure for rats. *Cuscuta Epilinum*, and several other species, are bad pests in cultivated fields.

Several genera are in cultivation in N. America: *Argyrea*, tender twiners; *Breweria*, trailing, grown in Florida; *Convolvulus* (Bindweed, California Rose, Rutland Beauty), mostly twining; *Ipomœa* (Morning-glory, Moonflower, Cypress Vine, Indian Pink, Man-of-the-Earth, Blue Dawn Flower, Sweet Potato, Jalap), mostly twining; *Jacquemontia*, garden twiners; *Lettosmia*, twiners, grown in Florida.

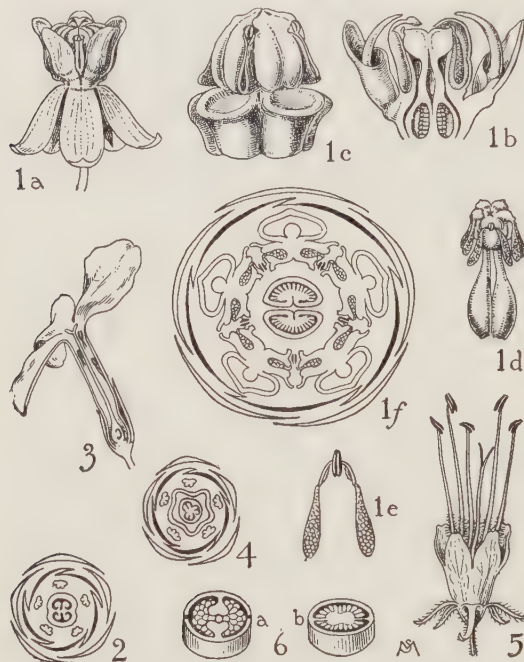
191. **Polemoniaceæ** (from the genus *Polemonium*, an ancient name of doubtful application). **POLEMONIUM FAMILY.** Fig. 50. Herbs, rarely woody; leaves alternate, or the lower sometimes opposite, simple or pinnate; flowers bisexual, regular, or nearly so; calyx 5-cleft; corolla 5-lobed, gamopetalous, hypogynous, convolute; stamens 5, epipetalous, alternate with the corolla-lobes; hypogynous disk present; ovary superior, 3-, rarely 2- or 5-, celled; ovules in each cell many, rarely 1; style 1, 3-fid, rarely 5-fid; stigmas 3, rarely 5: fruit a capsule.

About 8 genera and 200 species are known; these are almost entirely American and principally North American. Nearly 100 species belong to the genus *Gilia*. The family is closely related to the Convolvulaceæ, and difficult to separate from that family. The 3 many-ovuled cells of the ovary are important. The disk of *Cobæa* is large and 5-lobed. The terminal leaflet of this plant is a branched tendril.

Many Polemoniaceæ are grown as ornamental plants. *Polemonium cæruleum* (Jacob's ladder, or Greek valerian) is used in some countries as a remedy for various ailments.

About 6 to 8 genera are cultivated in this country as ornamental plants: *Cantua*, a shrub in the greenhouse; *Cobæa*, a climbing herb, mostly in the greenhouse; *Gilia*, many species, for bedding; *Læselia* in the cool-house; *Phlox* (*Phlox*, Ground or Moss Pink), for bedding; *Polemonium*, for bedding.

192. **Hydrophyllaceæ** (from the genus *Hydrophyllum*, meaning water-leaf). **WATER-LEAF FAMILY.** Fig. 50. Annual or perennial herbs: leaves mostly alternate, often lobed: flowers bisexual, regular, mostly in circinate raceme-like clusters; calyx 5-cleft; corolla 5-lobed, often



50. ASCLEPIADACEÆ: 1. *Asclepias*, a, flower; b, flower, vertical section; c, stamens; d, pistil and pollinia; e, pollinia and gland; f, floral diagram. CONVOLVULACEÆ: 2. *Convolvulus*, floral diagram. POLEMONIACEÆ: 3. *Phlox*, flower. 4. *Polemonium*, floral diagram. HYDROPHYLLACEÆ: 5. *Hydrophyllum*, flower. 6. *Phacelia*, a, and b, ovary of two species.

*Cynanchum*); others are sudorifics (*Hemidesmus*). The acrid juice of *Gonolobus* is used to poison arrows; that of *Periploca* to poison wolves, hence the name wolfbane and dogbane. The milk of *Gynmema lactiferum*, the cow-plant of Ceylon, is edible; also that of the Cape, *Oxystelma esculentum*. Some Indian species yield good bast fibers. *Marsdenia tinctoria* yields a dye. Several species yield caoutchouc. The oschur or modar (*Calotropis procera*) is probably the sodom apple of the Bible. The herbage of several species is cooked and eaten. The acid stem of *Sarcostemma* is eaten as a salad. In East Africa, *Cynanchum sarcostemmoides* is used to poison fish. Many Asclepiadaceæ are ornamental plants.

About 20 genera are in cultivation in N. America, mostly in the tropical horticulture of Florida and California. More generally cultivated and better known are: *Asclepias* (Milkweed); *Cynanchum* (Mosquito Plant, Cruel Plant); *Hoya* (Wax-plant); and *Periploca* (Silk Vine).

#### Order 50. TUBIFLORÆ

190. **Convolvulaceæ** (from the genus *Convolvulus*, signifying to entwine). **MORNING-GLORY FAMILY.** Fig. 50. Herbs, shrubs or small trees, twining or erect, turf-forming shrubs, thorny shrubs, "switch plants," or yellow, leafless, twining parasites, often with milky juice: leaves alternate: flowers bisexual, regular; peduncles very often bi-bracteate; calyx 5-parted, persistent; corolla more or less 5-lobed, usually plaited,



with scales in the throat, gamopetalous, hypogynous, imbricated; stamens 5, alternating with the corallolobes, slightly epipetalous; hypogynous disk present; ovary superior, 1-celled, rarely incompletely 2-celled; ovules 2 to several; style 1; stigmas 2; fruit a capsule.

The 17 genera and about 170 species are found most abundantly in temperate North America, less commonly southward to Patagonia. A very few are found in south and east Africa, India, Japan, and the Hawaiian Islands. The family is most closely related to the Boraginaceæ, but has a 1-celled ovary; more distantly related to the Convolvulaceæ and Polemoniaceæ.

*Eriodictyon glutinosum* (yerba santa) of California has lately come into use as an expectorant in throat and lung trouble. *Hydrophyllum canadense* has long had a reputation as a remedy for snake-bites, poison-ivy poisoning, erysipelas, and other skin troubles.

About a half dozen genera are in cultivation in N. America as ornamental plants. They are used principally for outdoor bedding. *Emmenanthe* (California Yellow or Golden Bells); *Hesperochiron*; *Hydrophyllum* (Waterleaf); *Nemophila*; and *Phacelia*.

**193. Boraginaceæ** (from the genus *Borago*, an ancient name having reference to the roughness of the foliage). BORAGE FAMILY. Fig. 51. Herbs, rarely shrubs or trees; leaves usually alternate, very frequently rough-hairy; flowers bisexual, regular, rarely irregular; inflorescence usually cinate; calyx 4-5-cleft, persistent; corolla 4-5-lobed, gamopetalous, hypogynous, imbricated, often with scales or folds in the throat; stamens 5, epipetalous, alternating with the corallolobes; hypogynous disk usually present; carpels 2; ovary superior, 4-celled, either entire and style terminal, or 2-lobed, or more commonly deeply 4-lobed with the style basal between the lobes; each cell 1-ovuled; style 1; stigmas usually 2; fruit rarely a berry, usually of 4 1-seeded nutlets, with the surface variously smooth, polished, wrinkled, barbed, winged, or crested.

There are 85 genera and about 1,500 species widely distributed in the temperate and tropical zones, most abundant in the Mediterranean region and in western North America. The largest genera are *Cordia* with 230 species, and *Heliotropium* with 220 species. The family is most closely related to the Hydrophyllaceæ; also related to the Verbenaceæ and Labiata. The cinate inflorescence, and 2-carpeled, 4-celled ovary with 1 seed in each cell, are distinctive characteristics. The fruit of the Boraginaceæ is most diverse, and very important in classification within the family.

Many species, native in Europe, were formerly used for medicine; for example, comfrey (*Symphytum officinale*), borage (*Borago officinalis*), hound's-tongue (*Cynoglossum officinale*), lungwort (*Pulmonaria officinalis*), viper's bugloss (*Echium vulgare*), bugloss (*Anchusa officinalis*), gromwell (*Lithospermum officinale*), and heliotrope (*Heliotropium europæum*). *Tournefortia umbellata* was used in Mexico as a febrifuge. The roots of alkanet (*Alkanna tinctoria*) of South Europe and Asia contain a red dye of commercial importance. The roots of some species of *Anchusa*, *Onosma*, *Lithospermum* and *Arnebia* also contain a red pigment. The wood of some species of *Cordia* is of value, as are also its bast fibers. The wood of several species of *Ehretia* is valuable, and the fruit is edible.

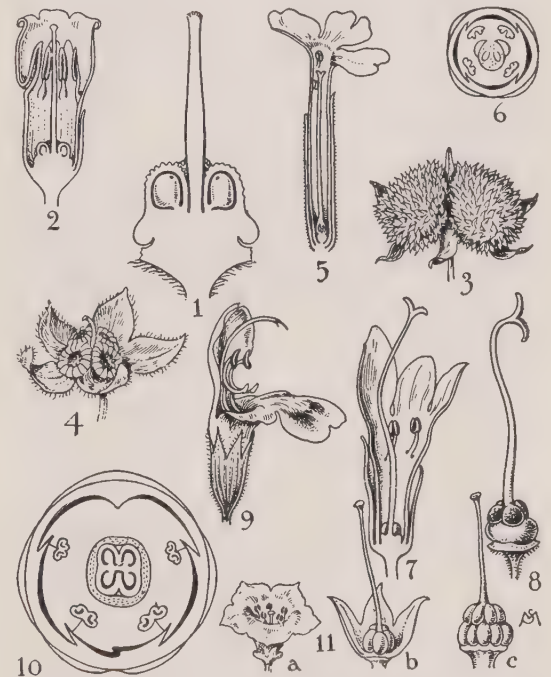
About 30 genera are in cultivation in N. America, mostly as hardy ornamental border plants. Among these are: *Arnebia* (Prophet's Flower, Arabian Primrose); *Anchusa* (Alkanet, not the real); *Borago* (Borage), used as a pot-herb or bee-plant; *Cerinthe* (Honeywort); *Cynoglossum* (Hound's-tongue); *Echium* (Viper's Bugloss); *Lithospermum* (Gromwell, Puccoon, Indian Paint); *Myosotidium* (Giant Forget-me-not); *Myosotis* (Forget-me-not); *Mertensia* (Virginian Cowslip, Virginian Lungwort); *Omphalodes* (Navelwort, Creeping Forget-me-not); *Onosma* (Golden Drops); *Onosmodium*

(False Gromwell); *Pulmonaria* (Lungwort, Bethlehem Sage); and *Symphytum* (Comfrey).

**194. Verbenaceæ** (from the genus *Verbena*, the Latin name for any sacred herb; application obscure). VERVAIN FAMILY. Fig. 51. Herbs, shrubs, or trees; leaves opposite, rarely whorled or alternate, simple or compound; flowers bisexual, rarely regular, usually oblique or 2-lipped; calyx 4-5-, rarely 6-8-, toothed; corolla 4-5-lobed gamopetalous, hypogynous, lobes imbricated; stamens 4, didynamous, rarely 5 or 2, epipetalous, hypogynous; disk present; ovary superior, of 2, rarely of 4 or 5, carpels, 2-5-celled, but by false partitions 4-10-celled, entire or 2-4-lobed; ovule usually solitary in each cell; style 1; stigma usually 1; fruit a drupe or berry, often separating into drupelets.

Verbenaceæ has 67 genera and about 750 species, mainly of tropical and subtropical distribution. Eleven species reach the northeastern United States. *Lippia* is the largest genus with 100 species; *Clerodendron* has 90 species, and *Verbena* 80 species. The family is closely related to the Labiata and not clearly distinct from that family. The predominatingly terminal style, and not deeply lobed ovary are the only differentiating characters.

Many species have been used in medicine: *Verbena hastata* as bitters; species of *Lippia* as tonics; *Ægiphila salutaris* as a purge and remedy for snake-bites. Species of *Clerodendron* have very sweet-scented flowers. They



51. BORAGINACEÆ: 1. *Borago*, pistil. 2. *Symphytum*, flower. 3. *Cynoglossum*, fruit. 4. *Omphalodes*, fruit. VERBENACEÆ: 5. *Verbena*, flower. 6. *Lantana*, floral diagram. LABIATÆ: 7. *Mentha*, flower. 8. *Thymus*, pistil. 9. *Salvia*, flower. 10. *Lamium*, floral diagram. NOLANACEÆ: 11. *Nolana*, a, flower; b and c, pistils of different species.

are used as purges, diuretics, and for liver, stomach, and lung complaints. *Lippia citriodora* yields a fragrant substance used in flavoring cream, and other foods. Several species have been used as tea in America. *Duranta Ellisia* and species of *Lantana* have edible fruit. *Verbena officinalis* of Europe is a tonic, but more famous for its use in witchcraft. It was celebrated among the Romans and Druids of Gaul and used by them in religious ceremonies. The very valuable teak-

wood is obtained from *Tectona grandis* of farther India and the East Indies. The white mangrove trees of Brazil belong to various species of the tribe Avicenniæ.

A score of genera are in cultivation in North America. Among these are: *Amsonia*, a greenhouse shrub; *Calli-carpa*, greenhouse or hardy shrubs; *Caryopteris*, a shrub, not hardy; *Clerodendron* (Turk's Turban), greenhouse or hardy; *Duranta* (Golden Dewdrop), cultivated in the South; *Lantana*, greenhouse or bedding herbs or shrubs; *Lippia* (Lemon Verbena), greenhouse or hardy shrubs or herbs; *Petræa* (Purple Wreath), greenhouse climber; *Verbena*, bedding or greenhouse herbs; *Vitex* (Chaste Tree, Hemp Tree, Monk's Pepper Tree), semi-hardy shrubs or trees.

195. **Labiata** (the name refers to the 2-lipped [bilabiate] character of the corolla of most species). MINT FAMILY. Fig. 51. Herbs or shrubs, commonly with a four-angled stem, and usually containing a fragrant oil: leaves opposite or whorled: flowers bisexual, very rarely unisexual, irregular, rarely regular, usually bilabiate; calyx 5-toothed or cleft, regular or 2-lipped; corolla 5-lobed, rarely 4-lobed, gamopetalous and hypogynous, 1 lip sometimes obsolete, the lobes imbricated; stamens 4, didynamous, or only 2, epipetalous; hypogynous disk well developed, thick, entire or lobed; ovary superior, of 2 carpels, deeply 4-lobed, 4-celled, each cell 1-ovuled; style basal or sub-basal; stigmas 2: fruit of 4 1-seeded nutlets; the ectocarp rarely fleshy.

One hundred and fifty-seven genera and about 2,800 species are distributed over the whole earth, but are especially abundant in the Mediterranean region and the orient; they are also abundant in the mountains of the subtropics. The larger genera are *Salvia*, 500 species; *Hyptis*, 300 species; *Stachys*, 180–200 species; *Scutellaria*, 180 species; *Nepeta*, 150 species; *Satureia*, 130 species; and *Teucrium*, 100 species. The family is related to the Verbenaceæ and to the Boraginaceæ, also to the Scrophulariaceæ and Acanthaceæ. The 4-angled stem, fragrant oil, 4-lobed ovary, the solitary ovules, and the basal style are distinctive. This is a difficult family for the student. The characters for separating the genera reside mostly in the calyx, corolla and stamens. The nutlets are less important in classification than in the Boraginaceæ.

Owing to the volatile oil and bitter principles, the Labiata are of more than usual economic importance: *Scutellaria lateriflora* (skullcap), tonic, nervine; *Salvia officinalis* (garden sage), tonic, also used as a condiment; *Marrubium vulgare* (hoarhound), tonic, antelmintic, and expectorant; *Hedeoma pulegioides* (American pennyroyal), carminative and stimulant; *Mentha spicata* (spearmint) and *Mentha piperita* (peppermint), carminative; *Mentha Pulegium* (European pennyroyal), carminative; mints are also used as condiments. The following oils are from Labiata: Oil of thyme (*Thymus Serpyllum*); rosemary (*Rosmarinus officinalis*); Lavender (*Lavandula officinalis*); spike (*Lavandula Spica*); origanum (*Origanum Majorana*). Catnip (*Nepeta Cataria*) is a family sudorific. Mother-wort (*Leonurus Cardiacus*) is a family stimulant and bitters. The leaves of lavender and patchouli (*Pogostemon Patchouli*) are used to keep insects from woollens, furs, and the like. Many other species have been used locally for various purposes.

Fifty or more genera are in cultivation in North America. Most of these are garden annuals or hardy perennials cultivated for the flavor or odor, for ornamental purposes, or for medicine. Among these are: *Acanthomintha* (Thorny Mint); *Ajuga* (Bugle Weed); *Cedronella* (Balm of Gilead); *Coleus*; *Collinsonia* (Horse-balm, Horse-weed, Stonewort); *Cunila* (Maryland Ditany); *Hedeoma* (American Pennyroyal); *Hyssopus* (Hyssop), hardy shrub; *Lamium* (Dead Nettle); *Lavandula* (Lavender); *Leonotis* (Lion's Ear, Lion's Tail); *Lophanthus* (Giant Hyssop); *Marrubium* (Hore-

hound); *Melissa* (Balm); *Mentha* (Mint, Spearmint, Peppermint, Japanese Mint, Bergamot Mint, Black Mint, White Mint, European Pennyroyal); *Micromeria* (*Yerba Buena*); *Moluccella* (Shell Flower, Molucca Balm); *Monarda* (Horsemint, Oswego Tea, Bee-balm, Fragrant Balm, Wild Bergamot); *Nepeta* (Catnip, Ground Ivy, Gill-run-over-the-ground); *Ocimum* (Basil); *Origanum* (Marjoram); *Phlomis* (Jerusalem Sage); *Physostegia* (False Dragonhead, Obedient Plant); *Plectranthus* (Cockle-spur Flower); *Pogostemon* (Patchouli Plant); *Prunella* or *Brunella* (Self-heal, Heal-all); *Pycnanthemum* (Mountain Mint); *Rosmarinus* (Rosemary, Old Man); *Salvia* (Sage, Clary, Scarlet Sage); *Satureia* (Savory); *Scutellaria* (Skull-cap); *Stachys* (Woundwort, Choro-gi, Chinese or Japanese Artichoke, Knot-root, Betony); *Teucrium* (Germander); *Thymus* (Thyme, Mother-of-Thyme); *Trichostema* (Blue Curls, Bastard Pennyroyal, Ramero); *Westringia* (Victorian Rosemary).

196. **Nolanaceæ** (from the genus *Nolana*, derived from *nola*, a little bell, in reference to the corolla). NOLANA FAMILY. Fig. 51. Herbs or small shrubs: leaves alternate, or opposite: flowers bisexual, regular; calyx 5-cleft; corolla 5-lobed, gamopetalous, hypogynous, plicate in the bud; stamens 5, slightly epipetalous, alternating with the lobes of the corolla; hypogynous disk well developed, often lobed; ovary superior, typically of 5 carpels, radially lobed, or both radially and transversely lobed, lobes 5–30, in fruit forming 5–30 nutlets which are each 1–7-seeded, or sometimes both radially and transversely lobed.

There occur 3 genera and 50 species, confined to the west coast of South America. Many species are maritime. The family is related to the Convolvulaceæ, also to the Boraginaceæ and Solanaceæ. The plicate corolla and very peculiarly lobed ovary derived from 5 carpels are distinctive.

A few species of *Nolana*, all prostrate plants, are cultivated in this country for ornamental purposes.

197. **Solanaceæ** (from the genus *Solanum*, the significance unknown). NIGHTSHADE FAMILY. Fig. 52. Herbs, erect or climbing shrubs, or small trees: leaves usually alternate: flowers bisexual, rarely unisexual, regular, rarely irregular; calyx 5-cleft; corolla 5-lobed, gamopetalous, hypogynous, usually plicate in the bud, the folds twisted to right or left, rarely the tips of the folds valvate or imbricated; stamens 5, epipetalous, alternating with the corolla-lobes; hypogynous disk present; ovary superior, 2-celled, rarely falsely 1-, or more, celled; ovules in each cell 1 to many; style 1; stigmas 1–2: fruit a berry or capsule.

About 70 genera and 1,600 species, 900 of which belong to *Solanum*, are distributed in the tropical and warm temperate regions, the greatest number being in Central and South America. The family is related to the Scrophulariaceæ, Convolvulaceæ and Nolanaceæ. The regular, plaited corolla, and usually numerous seeds are important distinguishing characteristics. *Datura* has a prickly fruit. The calyx of *Physalis* is accrescent and inflated, surrounds the fruit, and is often colored.

Many Solanaceæ contain narcotic or poisonous alkaloids and are used in medicine. Belladonna (alkaloid atropine) is obtained from the roots of *Atropa Belladonna*; it was formerly used by women to dilate the pupils of the eye, hence the specific name. The leaves and flowers of *Datura Stramonium* (Jimson weed) constitute the stramonium of medicine (alkaloid daturine). Stramonium seeds were formerly used by magicians to produce fantastic visions, and by thieves to stupefy their victims. Henbane (alkaloid hyoscyamine) consists of the leaves and tops of *Hyoscyamus niger* and is narcotic. Mandragora is similar in effect to belladonna. It was used by sorcerers to produce hallucinations in their victims. *Scopolia carniolica* and *Solanum carolinense* (horse-nettle) have been used in medicine. The remedy, pichi, con-



sists of the dried twigs of *Fabiana imbricata* of Chile. European bittersweet (*S. Dulcamara*) has been used as medicine; it is poisonous. Black nightshade (*S. nigrum*) and others are poisonous. Tobacco is the dried leaves of *Nicotiana Tabacum*. Winter cherry (*Physalis Alkekengi*) is diuretic. Chilli is a name for the fruits of *Capsicum annuum* of South America. Cayenne pepper is the fruit of various species of *Capsicum*. Tomato, or love apple, is the fruit of *Lycopersicum esculentum* (= *Solanum Lycopersicum*). Species of nightshade, when cooked, are eaten as greens. Eggplant is the fruit of *S. Melongena* of Asia. Potatoes are the tubers of *S. tuberosum* of Peru and Chile.

About 30 genera are cultivated in North America as ornamental plants or for food. Among these are: *Atropa* (Belladonna); *Capsicum* (Red or Cayenne Pepper); *Cestrum*; *Cyphomandra* (Tree Tomato); *Datura* (Angel's Trumpet, Datura); *Hyoscyamus* (Henbane); *Lycium* (Matrimony Vine, Box Thorn); *Lycopersicum* (Tomato), [Engler and Prantl unite this with *Solanum*]; *Mandragora* (Mandrake of history); *Nicotiana* (*Nicotina*, Tobacco); *Nicandra* (Apple of Peru); *Nierembergia* (Cup-flower, White Cup); *Petunia*; *Physalis* (Ground Cherry, Strawberry Tomato, Alkekengi, Bladder Cherry, Cape Gooseberry, Chinese Lantern Plant); *Salpiglossis*; *Schizanthus* (Butterfly Flower, Poor man's Orchid); *Streptosolen*; *Solandra*; and *Solanum* (Nightshade, Potato, Pepino, Melon Pear, Melon Shrub, Eggplant, Guinea Squash, Aubergine, Jerusalem Cherry, Potato Vine, Bittersweet).

198. **Scrophulariaceæ** (from the genus *Scrophularia*, a reputed remedy for scrofula). FIGWORT FAMILY. Fig. 52. Herbs, shrubs, or small trees: leaves alternate, opposite or whorled; flowers bisexual, regular or commonly irregular, often bilabiate, in which case the throat is often closed by a palate; calyx 5-cleft; corolla 5-lobed, gamopetalous, hypogynous, rarely spurred at the base, imbricated; fertile stamens rarely 5, usually 4 and didynamous, rarely 2; sterile often present as stamodia; epipetalous; hypogynous disk annular or unilateral; ovary superior, 2-celled; ovules many; style 1; stigmas 1-2: fruit generally a capsule, rarely a berry.

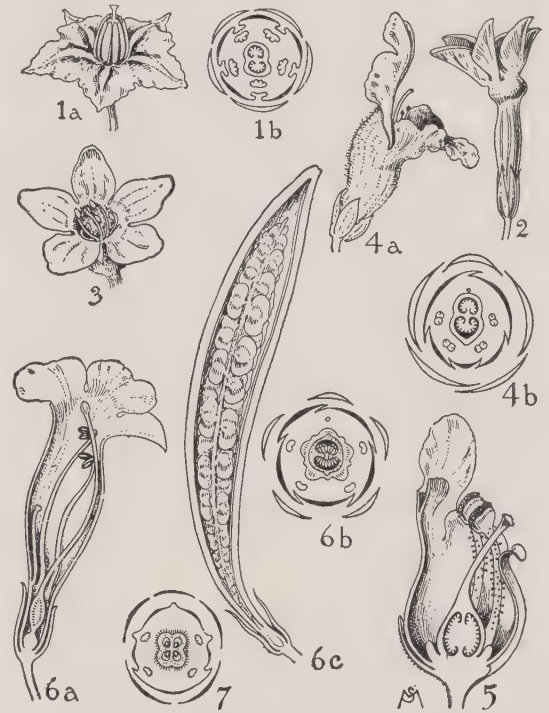
Scrophulariaceæ is a family of 179 genera and about 2,500 species, distributed very generally over the whole earth. A few are aquatic and have finely divided leaves. Some are half-parasites on the roots of other plants. A few are total parasites without chlorophyll. The largest genera are *Verbascum* containing 160 species, *Calceolaria* with 134 species, *Veronica* with 200 species, and *Pedicularis* with 250 species. The family is related to the Solanaceæ, to the Orobanchaceæ and Gesneriaceæ. The non-plicate imbricated usually irregular corolla, reduced number of stamens, and 2-celled, many-ovuled ovary, are distinctive characters.

The economic uses of the Scrophulariaceæ are medicinal and ornamental. *Veronica officinalis* has been used as a tonic and an astringent. *Veronica Beccabunga* has been used for scurvy. *Scrophularia nodosa* was a remedy for fevers. *Antirrhinum* was used as a diuretic. *Euphrasia officinalis* was used in ophthalmia, and hence the name "eye-bright." *Gratiola officinalis* (poor man's herb) is a violent purgative. *Digitalis purpurea* is the most valuable medicinal plant in the family. It is poisonous, and a well-known diuretic and sedative-narcotic. The tropical *Scoparia dulcis* is a febrifuge. *Veronica virginica* (Culver's root), *Verbascum Thapsus*, *Linaria vulgaris*, and *Chelone glabra* have also been used in medicine. The snapdragon and foxglove are well-known garden plants of this family.

Because of the showy flowers, 30 to 40 genera are in cultivation in N. America for ornamental purposes. Among these are: *Antirrhinum* (Snapdragon), garden and greenhouse; *Calceolaria*, greenhouse plants, mostly from South America; *Castilleja* (Painted Cup), garden plants; *Chelone* (Turtlehead), hardy garden

plants; *Collinsia*, garden annuals; *Digitalis* (Foxglove), hardy garden plants; *Erinus*, hardy; *Gerardia*, hardy; *Gratiola*, hardy; *Halleria* (African Honey-suckle), cultivated in the southern borders; *Linaria* (Butter-and-Eggs, Kenilworth Ivy, Mother-of-Thousands, Toad-flax), hardy and greenhouse; *Mimulus* (Monkey Flower, Musk Plant), garden annuals or hardy; *Paulownia*, semi-hardy tree; *Pedicularis* (Lousewort, Wood Betony), hardy; *Pentstemon* (Beard Tongue, Pentstemon), hardy; *Phygelia* (Cape Fuchsia), mostly greenhouse; *Rhodochiton* (Purple Bells), vine, garden annual; *Russelia*, greenhouse; *Scrophularia* (Figwort), hardy; *Tetranema* (Mexican Foxglove), greenhouse; *Torenia*, garden; *Verbascum* (Mullein), hardy; *Veronica* (Speedwell, Culver's Root, Fluellen, Ground Hele, Angel's Eyes, Bird's Eyes), garden, mostly hardy or annual.

199. **Bignoniaceæ** (from the genus *Bignonia*, named for the Abbe Jean Paul Bignon, court librarian at Paris,



52. SOLANACEÆ: 1. *Solanum*, a, flower; b, floral diagram. 2. *Nicotiana*, flower. SCROPHULARIACEÆ: 3. *Verbascum*, flower. 4. *Antirrhinum*, a, flower; b, floral diagram. 5. *Scrophularia*, flower. BIGNONIACEÆ: 6. *Campsis*, a, flower; b, floral diagram; c, fruit and seeds. PEDALIACEÆ: 7. *Sesamum*, floral diagram.

and a friend of the botanist Tournefort). BIGNONIA FAMILY. Fig. 52. Woody plants, rarely herbs, usually climbing or twining in the tropical forests: leaves opposite, rarely alternate, usually compound; flowers bisexual, more or less irregular, scarcely bilabiate; calyx 5-cleft, rarely bilabiate or spathe-like, sometimes with appendages; corolla 5-lobed, gamopetalous, hypogynous, imbricated; stamens 4, didynamous, or only 2, the others staminodial, epipetalous; anthers various; hypogynous disk present; ovary superior, 2-celled, rarely 1-celled; many-ovuled; style 1; stigmas 2: fruit a woody capsule; seeds usually winged and very compressed; endosperm 0.

The family contains 100 genera and from 500-600 species, principally natives of the tropics; these are most abundant in America. Three species reach the northeastern United States, from New Jersey and Ohio southward. The largest genus is *Tabebuia* with

80 species. The family is related to the Scrophulariaceae; but the peculiar fruit with winged seeds and the absence of endosperm are distinctive. The climbing species may or may not have foliar tendrils. These, when present, terminate in adherent disks. The woody, tropical, climbing Bignoniaceae are famed for the peculiar cambium growth which produces secondary thickening of such a nature as to give to the cross-section very odd and very diverse patterns, some of which are almost geometrical in their regularity. The wood in these patterns may be either divided into four wedges at right angles to each other, or four wedges may be superimposed on a smaller circle of wood, or the wedges may be divided toward the periphery into peculiar finger-like portions, or there may be concentric rings of wood.

Catalpa and Tecoma have been used in medicine but are not officinal. Caraboa (*Jacaranda Copaia*) contains an aromatic resin of the odor of coumarin. Many are ornamental plants with large, handsome flowers.

About 20 genera are in cultivation in North America, all as ornamental plants. Among these are: Bignonia (Trumpet Flower, Cross Vine, Quarter Vine), mostly greenhouse climbers; Catalpa, semi-hardy or hardy trees; Chilopsis (Desert Willow, Flowering Willow, Mimbrés) cultivated in the South; Crescentia (Calabash Tree), cultivated South. Others are Campsis (Trumpet Creeper, T. Vine, T. Honeysuckle); Tecoma (Yellow Elder); Pandorea (Wonga-Wonga Vine; Bower Plant of Australia); Tecomaria (Cape Honeysuckle, climbing or erect shrubs or trees, cultivated mostly in the South, only one of which is fully hardy North).

200. **Pedaliaceae** (from the genus *Pedaliu*m, signifying a rudder, in reference to the winged angles of the fruit). **PEDALIUM FAMILY.** Fig. 52. Herbs, rarely shrubs, covered with peculiar slime-secreting glands: leaves opposite, or alternate above: flowers bisexual, irregular; calyx 5-cleft; corolla 5-lobed, gamopetalous, more or less curved but indistinctly if at all 2-lipped; stamens 4, didynamous, often with an extra staminodium, subepipetalous; hypogynous disk inequilateral; ovary superior or rarely inferior, 2-4-celled or falsely 1-celled; style 1; stigmas 2-4: fruit a capsule, or a hard indehiscent structure which is often covered with stiff or hooked spines or wings; seeds 1 to several, attached to central placenta.

In this family are 14 genera and about 50 species, of tropical and subtropical regions of Africa, Arabia, farther India, Ceylon, Australia, and East Indies. They are mostly strand or xerophytic plants. The family is most closely related to the Scrophulariaceae, and to the Martyniaceae, with which latter family it is often united. The peculiar slime-glands, the queer fruit, and the axial seeds are important characters.

The seeds of *Sesamum indicum* yield an oil called benne oil or oil of sesame, which is used as food after the manner of olive oil. The oil is also used as a cosmetic and as a medicine. This plant has been cultivated for ages in the orient, and is now cultivated in other lands, the oil being used in the manufacture of soap. *Harpagophytum procumbens* is the famous grapple-plant of South Africa, the fruits of which are difficult to separate from wool and clothing. The fruits of several species of *Uncarina* are almost as bad. A mucilaginous medicinal drink is made from the leaves of *Pedaliu*m *Murex* in India. These leaves are also used to thicken milk, to which they give a rich appearance.

The genera in cultivation in N. America are: *Ceratotheca*, ornamental greenhouse plants, and grown in Florida, with indistinctly hooked capsules; *Sesamum*, grown for oil, medicine, or ornament, outdoor annual, capsule not hooked.

201. **Martyniaceae** (from the genus *Martynia*, in honor of Prof. John Martyn of Cambridge, England).

**MARTYNIA FAMILY.** Fig. 53. Annual or perennial, glandular-hairy herbs: leaves opposite, or alternate: flowers bisexual, irregular, but not bilabiate; calyx 5-cleft; corolla 5-lobed, gamopetalous, hypogynous; stamens 4, didynamous, rarely 2, the others staminodial, epipetalous, alternating with the corolla-lobes; hypogynous disk present, regular; ovary superior, of 2 carpels but



53. **MARTYNIACEAE:** 1. *Martynia*, a, flower; b, floral diagram; c, fruit. **GESNERIACEAE:** 2. *Gesneria*, flower. 3. *Achimenes*, floral diagram. **LENTIBULARIACEAE:** 4. *Utricularia*, a, part of leaf with bladder; b, flower; c, floral diagram. **GLOBULARIACEAE:** 5. *Globularia*, flower. 6. *Cockburnia*, vertical section ovary.

1-celled; placenta parietal; ovules several; style 1; stigmas 2: fruit a more or less long, curved, beaked capsule, with a fleshy pericarp, becoming falsely 4-celled.

About 3 genera and 10 species inhabit tropical and subtropical America. One species reaches southern Indiana. The family is closely related to the Pedaliaceae, with which it has generally been united. The horned fruit, 1-celled ovary, parietal placenta and less slimy pubescence, are distinctive characters.

The turnip-like root of *Craniolaria annua*, known in South America as escorzonera, is cooked with sugar or eaten as a vegetable. The fruits of *Martynia* (or *Proboscidea*) *louisiana* (*M. proboscidea*) are sometimes used as pickles.

One genus is in cultivation in this country, namely *Martynia* (Unicorn Plant, Proboscis Flower), of which 3 or 4 species are grown. The *Craniolarias* of the trade seem to be *Martynias*.

202. **Gesneriaceae** (from the genus *Gesneria*, named after the early botanist Conrad Gesner of Zurich). **GESNERIA FAMILY.** Fig. 53. Herbs, rarely shrubs or small trees, sometimes climbing: leaves usually opposite or whorled, simple: flowers bisexual, irregular, often bilabiate; calyx 5-parted; corolla 5-lobed, gamopetalous, hypogynous, often gibbous below, imbricated; stamens rarely 5, usually 4 and didynamous, rarely 2, the sterile usually present as staminodia, epipetalous; hypogynous disk present, diverse; ovary superior or inferior, of 2 carpels but 1-celled with 2 parietal placenta, often falsely 2-4-celled; ovules numerous; style 1; stigmas 1-2: fruit fleshy with pulpy placenta, or capsular, or silique-like with twisted valves.



Eighty-four genera and about 500 species are widely distributed in the tropics and subtropics of both hemispheres. The largest genera are *Cyrtandra* containing 180 species and *Rottlera* with about 100 species. The family is related to the *Scrophulariaceae*, *Orobanchaceae* and *Bignoniaceae*. The 1-celled ovary without winged seeds, and the non-parasitic habit are distinctive.

The only economic plants in the family are the ornamental, of which there are many. The flowers throughout the family are uncommonly large and showy.

Twenty or more genera are in cultivation in N. America. Among these are the following, all of greenhouse culture: *Agalmyla*, climbers; *Episcia*; *Gesneria*; *Isoloma* (*Kohleria*); *Nagelia* (*Smithiantha*); *Saintpaulia* (*Usambara Violet*; *African Violet*); *Sinningia*, including the *Gloxinias*; *Streptocarpus* (*Cape Primrose*); *Trichosporum* (or *Æschynanthus*), trailing or drooping.

203. **Lentibulariaceae** (from the old generic name *Lentibularia*, said to mean *lens*, + *a small pipe*, significance obscure). **BLADDERWORT FAMILY.** Fig. 53. Aquatic or marsh herbs, or epiphytes: leaves alternate, rarely whorled, very diverse; sometimes finely dissected, or peltate, or oval, or lanceolate; sometimes of two very distinct kinds; usually with very small scattered bladder-like lobes consisting of a complicated trap-like mechanism for catching tiny swimming organisms, or with the whole upper surface of the undivided leaf very glutinous so that insects stick fast to it; either all basal or all cauline, or both: flowers bisexual, irregular; calyx 2-5-cleft, persistent; corolla 5-lobed, more or less 2-lipped and with a spur or sack at the base; upper lip 2-lobed; lower 3-lobed, often with a palate in the throat; stamens 2, epipetalous; ovary superior, of 2 carpels but 1-celled; placenta free-central; style 1; stigmas 2; fruit a capsule.

Belonging to this family are 5 genera and about 300 species, of which at least 200 belong to *Utricularia*; they are distributed in all parts of the globe but are more numerous in the tropics. One fossil species is known. The family is related to the *Scrophulariaceae*. The irregular corolla, 2 stamens, and 1-celled ovary with central placenta, are important characters. This is a most interesting family of insectivorous plants; with the exception of *Pinguicula*, they are adapted to catch organisms that swim in the water of ponds, or, in case of the epiphytes, in the rain-water in the cracks and crevices of the host plant.

*Utricularias* were formerly used locally as medicine. The secretion of the leaves of *Pinguicula* contains a pepsin-like digestive ferment. The Lapps use these leaves to curdle the reindeer milk, hence the common name, butterwort. Danish peasant girls are said to use the juice as a hair-pomade. Another account says, "Pinguicula leaves, whether fresh or dry, are used by the Lapps to thicken fresh still-warm milk, which neither curdles nor gives cream thereafter, but forms a delicious compact tenacious mass, a small portion of which will act similarly on another quantity of fresh milk."

Two genera are in cultivation in N. America for their peculiar habit and curious orchid-like flowers, which are often very showy: *Pinguicula* (*Butterwort*); and *Utricularia* (*Bladderwort*), mostly epiphytic.

204. **Globulariaceae** (from the genus *Globularia*, so named because the flowers are borne in heads). **GLOBULARIA FAMILY.** Fig. 54. Shrubs or herbs: leaves alternate, simple: flowers bisexual, bilabiate, borne in involucrate heads on a chaffy receptacle; calyx mostly 5-parted, bilabiate or regular; corolla 5-lobed, gamopetalous, hypogynous, upper lip sometimes obsolete; the lobes imbricated; stamens 4, didynamous, epipetalous; anthers exserted, by constriction often falsely 4-celled; hypogynous disk usually reduced to a gland on one side; ovary superior, 1-celled; ovule solitary; style

1; stigmas 1-2; fruit a nutlet inclosed in the persistent calyx.

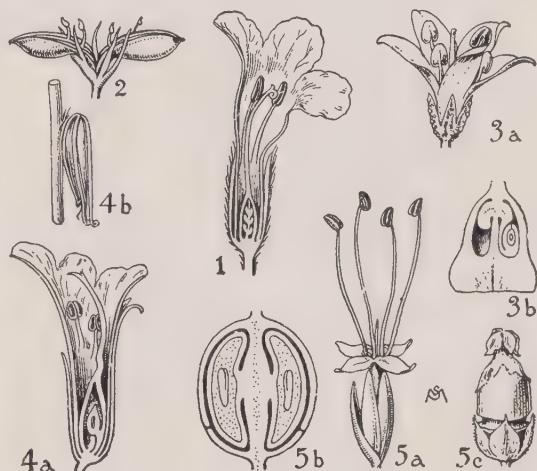
The 3 genera and 20 species are confined to the Mediterranean region. Seventeen species belong to the genus *Globularia*. The family is related to the *Scrophulariaceae*, but is distinguished by the solitary ovule and 1-celled ovary. *Globularias* are easily mistaken for *Scabiosas*, because of the involucrate heads and exserted stamens.

Some species are locally used as remedies.

A few species of *Globularia* are in cultivation in this country; two are hardy, and a third is a greenhouse plant.

205. **Acanthaceae** (from the genus *Acanthus*, derived from the Greek, *a spine*; some of the plants are spiny). **ACANTHUS FAMILY.** Fig. 54. Herbs, or rarely shrubs or trees: leaves opposite, rarely whorled; flowers bisexual, irregular, usually bilabiate; calyx 5-cleft; corolla 5-lobed, gamopetalous, hypogynous, the lobes imbricated; stamens usually 4, didynamous, rarely 2, sometimes a staminodium present, epipetalous; hypogynous disk present, mostly small; ovary superior, 2-celled, each cell 2-4-, rarely many-, ovuled; style 1; stigmas 1-2, one lobe often small or wanting; fruit a capsule; seeds exalbuminous, aided in distribution by peculiar outgrowths of the funiculus.

*Acanthaceae* has 173 genera and about 1,500 species, of tropical distribution. Few species extend into the Mediterranean region and into the United States. Six species are found in the northeastern United States. Two hundred species belong to the genus *Ruellia*, and 250 to *Justicia*. The family is related to the *Bignoniaceae*, and to the *Scrophulariaceae*, as well as to the other



54. **ACANTHACEAE:** 1. *Ruellia*, flower. 2. *Justicia*, opened fruit. **MYOPORACEAE:** 3. *Myoporium*, a, flower; b, vertical section ovary. **PHRYMACEAE:** 4. *Phryma*, a, flower; b, fruiting calyx. **PLANTAGINACEAE:** 5. *Plantago*, a, flower; b, vertical section ovary; c, fruit.

families of this group. The 2-celled ovary with 2-4 ovules and the queer outgrowths of the funiculus are distinctive.

Many species are used in the tropics for medicine; for example, *Asteracantha longifolia*, a purge and sudorific; *Justicia Gendarussa*, astringent, used in India for rheumatism, and the leaves sprinkled in clothing to keep insects away; *Justicia pectoralis*, used for lung troubles. The young flowers of *Blepharis edulis* and *Asystasia gangetica* are eaten as vegetables. *Ruellia ciliosa* of the United States has recently been sold spuriously as *Spigelia* (pink root).

Twenty to 30 genera are in cultivation in N. America, except in a few cases, as ornamental greenhouse plants. Among these are: *Acanthus* (*Bear's Breech*), hardy

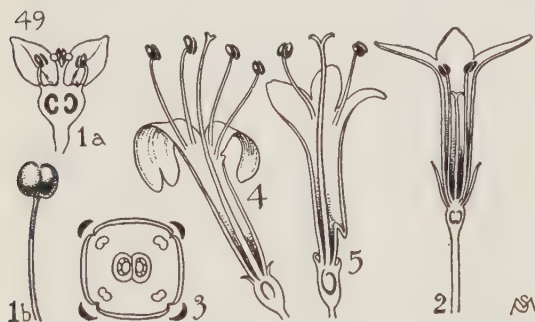
herbs; Adhatoda, shrubs; Aphelandra, shrubs; Crossandra, shrub; Fittonia, herbs; Graptophyllum (Caricature Plant), shrubs; Jacobinia, herbs; Justicia, referred to other genera; Peristrophe; Ruellia, herbs or shrubs; Strobilanthes, often used also for bedding

206. **Myoporaceæ** (from the genus *Myoporum*, signifying to *shut a pore*, in reference to the spots in the leaves which are closed by a membrane). **MYOPORUM FAMILY.** Fig. 54. Shrubs or trees: leaves alternate, rarely opposite, usually glandular or woolly; flowers bisexual, regular or irregular; calyx 5-cleft, persistent; corolla 5-lobed, gamopetalous, hypogynous; stamens 4, didynamous, the fifth a staminodium, epipetalous; ovary superior, 2-celled or falsely 3-10-celled; usually 1-2, rarely 8, ovules in each cell; style 1; stigmas 1-2: fruit drupaceous.

There are 5 genera and about 90 species, of which 57 belong to Pholidia and 25 to Myoporum. They are mainly natives of Australia, but scattered species occur in the West Indies, Japan, China, Hawaiian Islands, and elsewhere. The family is related to the Scrophulariaceæ and to the Verbenaceæ. The few ovules, the presence of oil-glands and the pendulous seeds are distinctive.

*Myoporum platycarpum* is the sandal-tree or sugar-tree or dogwood of Australia. From it, a kind of manna is secreted; also a resin that is used like sealing-wax.

Two species of Myoporum are grown as ornamental plants in this country.



55. RUBIACEÆ: 1. *Galium*, a, flower; b, fruit. 2. *Houstonia*, flower. 3. *Bouvardia*, floral diagram. CAPRIFOLIACEÆ: 4. *Lonicera*, flower. VALERIANACEÆ: 5. *Valeriana*, flower.

207. **Phrymaceæ** (from the genus *Phryma*, a name of unknown derivation). **LOPSEED FAMILY.** Fig. 54. Perennial herbs: leaves opposite, simple; flowers bisexual, bilabiate; calyx 5-cleft, 2-lipped; corolla 5-lobed, 2-lipped, gamopetalous, hypogynous; stamens 4, didynamous, included, epipetalous; ovary superior, 1-celled; ovule 1, sub-basal, straight (orthotropous); style 1; stigmas 2: fruit dry, indehiscent, inclosed in the abruptly reflexed calyx, the teeth of which are hooked.

A single genus and species occurs in the eastern United States and East Asia. The family is related to the Verbenaceæ and was formerly united with that family; but the peculiar, 1-seeded fruit, with a straight orthotropous seed is distinctive.

*Phryma leptostachya* (lopseed) has been in the trade as an ornamental garden plant.

#### Order 51. PLANTAGINALES

208. **Plantaginaceæ** (from the genus *Plantago*, the Latin name of the plant). **PLANTAIN FAMILY.** Fig. 54. Annual or perennial herbs: leaves alternate or opposite; flowers bisexual, or rarely unisexual, regular; calyx 4-cleft; corolla 4-lobed, gamopetalous, hypogynous, scarious, imbricated; stamens 4, epipetalous or hypogynous, exerted, alternate with the corolla-lobes; ovary superior, 1-2-celled, rarely 4-celled; ovules 1 to many in each cell; style and stigma 1: fruit a circumscissile cap-

sule, or an indehiscent nutlet, invested by the persistent calyx; seeds usually peltate.

Three genera and about 200 species, of which all but 3 belong to the genus *Plantago*, are distributed over the whole earth. The centers of distribution are the Mediterranean region and the Andes. This is a very distinct gamopetalous family of doubtful relationship, possibly allied to the Labiate.

Many European species were formerly used in medicine; the seeds as mucilaginous emollients in inflammatory ophthalmia, and the like; the leaves as bitters. The seeds are used in India to stiffen muslins. *Plantago lanceolata*, *P. Coronopus* and *P. major* are eaten as greens. The seeds of several species are sold for feeding birds. *P. lanceolata* is used for early pasturage.

The family is not cultivated in N. America, except possibly for bird-seed, pasturage, or pond-border planting.

#### Order 52. RUBIALES

209. **Rubiaceæ** (from the genus *Rubia*, signifying red, from the color of the roots of some species). **MADDER FAMILY.** Fig. 55. Trees, shrubs or herbs: leaves opposite or whorled, simple, usually entire; flowers bisexual, rarely unisexual, regular, rarely slightly irregular; calyx 2-6-cleft, or 0; corolla gamopetalous, 4-6-lobed, mostly valvate; stamens 4-6, epipetalous; ovary inferior, 1 to many-, commonly 2-, celled; ovules 1 to many in each cell; style 1; stigma 1, capitate or several-branched: fruit a capsule, berry, or drupe.

Rubiaceæ is a family of 343 genera and about 4,500 species, mainly tropical; about 34 species reach the northeastern United States. The family is closely related to the Caprifoliaceæ, but usually has stipules or whorled leaves; it is also related to the Cornaceæ, Valerianaceæ, Compositæ, and the like.

A number of tropical Rubiaceæ are myrmecophilous, i. e., provide a dwelling-place for protective ants. The whorled leaves of some species have probably been developed from stipules.

This is an important economic family. *Coffea arabica* (Abyssinia coffee) is generally cultivated in the tropics and used elsewhere as a beverage. *Cinchona Ledgeriana* and *C. succirubra* of the Andes furnish quinine. *Uragoga* (*Caphelis*) *Ipecacuanha* of Brazil is the source of the emetic ipecac. *Cephalanthus* of North America, and several species of *Galium* have been used in medicine. *Rubia tinctoria* (Mediterranean) furnishes the red dye, madder. Roots of *Asperula* and some species of *Galium* yield red dyes. *Morinda citrifolia* (tropics) yields a yellow dye, morindin. *Orouparia Gambir* (Malay) yields the dye known as catechu, gambir, or terra japonica. The foliage of *Asperula odorata* has the fragrance of sweet grass, and is used for a similar purpose, and for flavoring wines. *Galium triflorum* has a similar odor. *Galium verum*, the yellow bedstraw (Europe) contains a milk-curdling ferment, hence the name, "galium;" also formerly given to women to increase lactation. Berries of *Mitchella* contain a saponin-like substance. The fruits of *Vangueria edulis* and several other species of Rubiaceæ are edible. The wood of many species is valuable.

Forty to 50 genera and a great many species are in cultivation in N. America, mostly in the greenhouse and in tropical horticulture. Among these are Indian Mulberry (*Morinda*); Cape Jasmine (*Gardenia*); Bluets (*Houstonia*); Manettia Vine (*Manettia*); Madder (*Rubia*); Buttonbush (*Cephalanthus*, hardy); Bedstraw or Cleavers (*Galium*); Coffee (*Coffea*); *Cinchona* (*Cinchona*); and Partridge Berry (*Mitchella*).

210. **Caprifoliaceæ** (from the old genus *Caprifolium*, meaning a goat-leaf, possibly in reference to the climbing habit). **HONEYSUCKLE FAMILY.** Fig. 55. Shrubs, very rarely herbs: leaves opposite, simple or pinnate; flowers bisexual, regular or irregular; calyx 4-5-toothed,



or 4-5-fid; corolla gamopetalous, 4-5-lobed, tubular or rotate; stamens of the same number as the corolla-lobes and alternate with them, epipetalous; ovary inferior, 1-5-celled; each cell 1 to many-ovuled; style 1 or obsolete; stigmas 1-5; fruit a berry or capsula.

The 11 genera and about 350 species are distributed principally in the north temperate zone. The tropical species are mostly confined to the mountains. A few species of *Sambucus* and *Viburnum* occur in the southern hemisphere. The family is very closely related to the Rubiaceæ but the leaves are exstipulate; also to the Cornaceæ and Valerianaceæ. Some fossil species have been found.

Many species of Honeysuckle exhale a sweet odor after sunset. The berries of *Lonicera Caprifolium* are said to be diuretic; those of *L. Xylosteum* are laxative. The berries of the European elder (*Sambucus nigra*), and of the American elder (*S. canadensis*) are cooked and eaten and are also made into wine. The dried flowers of elder were formerly used in cases of fever. The roots of the North American *Triosteum perfoliatum* furnish a kind of ipecac. Other species are locally used in medicine. Many are ornamental.

Eight or 10 genera are in cultivation in N. America: *Viburnum* (Sheepberry, Hobble-bush, Wayfaring Tree, Arrowwood, High Cranberry, Snowball Bush); *Sambucus* (Elder); *Triosteum* (Feverwort, Horse Gentian, Wild Ipecac); *Symphoricarpos* (Snowberry, Coral Berry); *Abelia*; *Diervilla* (Weigela, Bush Honeysuckle); *Linnaea* (Twin-flower); *Lonicera* (Bush Honeysuckle); *Honeysuckles*, *Woodbine*, *Trumpet Honeysuckle*.

**211. Valerianaceæ** (from the genus *Valeriana*, a word of uncertain origin). **VALERIAN FAMILY.** Fig. 55. Annual or perennial herbs, often strongly scented; leaves basal and cauline, the latter opposite, simple or pinnate; flowers bisexual or unisexual, regular or irregular, epigynous; calyx of 1-3 minute, but often accrescent, sepals; corolla 5-, rarely 3-4, lobed, gamopetalous, often produced into a spur at the base; lobes imbricated; stamens 1-4, rarely 5, epipetalous, exserted; ovary inferior, 3-celled, only 1 cell maturing; seed 1; style 1; stigmas 3; fruit dry, indehiscent, 1-seeded.

Eight genera and about 280 species are known, mostly in the north temperate regions of the Old World, especially in the region just north of the Mediterranean, and in South America, where the genus *Valeriana* is mostly distributed. The family is related to the Dipsacaceæ and the Caprifoliaceæ, and more remotely to the Compositæ. The epigynous, gamopetalous flower, separate stamens, 3 carpels and 1-seeded fruit are distinctive.

*Valeriana officinalis* is a powerful nerve sedative with a peculiar odor. Many other Valerianaceæ are used as local remedies for the same purpose. The foliage of various species of *Valerianella* (lamb's lettuce, corn salad) is eaten as a salad, less commonly as a pot-herb.

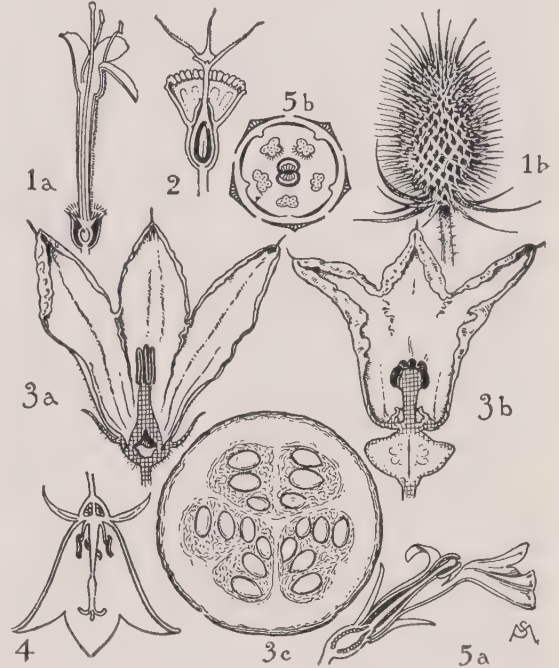
In this country few genera are in cultivation: *Patrinia* as a pot-herb; *Centranthus* (Red Valerian, Jupiter's Beard) and *Valeriana* (Valerian) as ornamental plants; and *Valerianella* (Corn Salad, Fetticus) for food.

**212. Dipsacaceæ** (from the genus *Dipsacus*, derived from the Greek *to thirst*, in allusion to the water-holding leaf-bases). **TEASEL FAMILY.** Fig. 56. Annual or perennial herbs; leaves opposite, rarely whorled; flowers small, bisexual, mostly irregular, epigynous, in dense involucrate heads; each flower also surrounded by a cup-shaped, more or less scarious, involucre, which is a metamorphosed bracteole; calyx of setaceous segments or crown-like, or plumose, or various; corolla 4-5-lobed, gamopetalous, usually irregular; lobes imbricated; stamens 4, rarely 2-3, mostly epipetalous; ovary inferior, 1-celled, 1-ovuled; style 1; stigmas 2; fruit an achene.

The family has 10 genera and about 150 species, all natives of warm-temperate regions of the Old World, and mostly of the eastern Mediterranean region. The

family is related to the Valerianaceæ, and more distantly to the Compositæ. The gamopetalous corolla, 2 carpels, involucrate heads and involucrate flowers are distinctive.

*Dipsacus* and *Scabiosa* have been used in medicine. The spiny hooked bracts of *Dipsacus ferox* (fuller's teasel of southwestern Asia) have been used to full cloth, whence the common name; and the plant was once cultivated extensively for this purpose. The connate leaf-bases of *Dipsacus sylvestris* hold several ounces of rain-water until evaporated. This contrivance



56. **DIPSACACEÆ**: 1. *Dipsacus*, a, flower; b, fruiting head. 2. *Scabiosa*, fruit. **CUCURBITACEÆ**: 3. *Cucurbita*, a, male flower; b, female flower; c, cross-section fruit. **CAMPANULACEÆ**: 4. *Campanula*, flower. 5. *Lobelia*, a, flower; b, floral diagram.

may be of benefit in preventing the ascent of harmful insects.

Four genera are in cultivation in North America: *Cephalaria*, *Morina*, and *Scabiosa* as ornamental plants; *Dipsacus ferox* (*D. fullonum*), locally cultivated in New York state for fulling cloth.

#### Order 53. CAMPANULALES

**213. Cucurbitaceæ** (from the genus *Cucurbita*, the classical name for the gourd). **GOURD FAMILY.** Fig. 56. Herbs, rarely shrubs, climbing, usually with branched tendrils; leaves alternate, more or less rounded; veins palmate; flowers usually unisexual, perigynous, regular; stamens 5, rarely separate, usually connate in 2 pairs and 1 free stamen (thus apparently, stamens 3), or monadelphous, inserted at the summit of the ovary; anthers 2-celled, the cells often queerly curved and contorted; carpels usually 3, rarely more or fewer; ovary inferior, mostly 3-celled, many-ovuled; fruit a dry berry with thick rind and spongy center (Pepo), or juicy with hard rind, very exceptionally dehiscent.

There are 87 genera and about 650 species, widely distributed over the earth but most abundant in the tropics; they are wanting in the cold regions. Several are wild in the eastern United States. The family is related to the Campanulaceæ, possibly also to the Passi-

floraceæ. The tendrils are usually borne singly at the nodes and are thought to be modified axillary branches. The fruits are exceedingly diverse and odd. Some are the largest fruits of the vegetable kingdom, others are very tiny. The gourds are very diverse in shape and color,—club-shaped, globular, or flattened from above, or curiously curved.

The family is of considerable economic importance. The fruits of many are edible; e.g., *Cucurbita Pepo* (pumpkin, summer crookneck squash), *C. maxima* (squash), *C. moschata* (winter crookneck squash), *Cucumis Melo* (muskmelon and other melons), *C. sativa* (cucumber), *Citrullus vulgaris* (watermelon). The gourds are cultivated as curiosities and for the fruit to be used as household utensils, e.g., bottle-gourds and calabash (*Lagenaria*). The leaves, stems, or roots of very many species contain bitter, subresinous substances which render them drastic purgatives. The roots of *Bryonia alba* (bryony) of Europe are highly purgative. The fruits of colocynth (*Citrullus Colocynthis*) of the orient and North Africa furnish a purgative known to the ancients. The fruit of Luffa of India and Arabia is purgative when ripe but edible when green. The outer portion of the fruit of Luffa is very fibrous and reticulated, and, when cleaned, serves as a sponge or dish-cloth in the Antilles (luffa-sponge or Egyptian bath-sponge). The small gourd of *Benincasa hispida* (wax gourd or Chinese watermelon) of tropical Asia is considered an emblem of fertility in India and is presented to newly married couples. *Acanthosicyos* of the South African desert is remarkably erect and spiny, but the small fruit is considered a delicacy. *Elaterium* is a drug obtained from the juice of *Ecballium Elaterium*.

The most remarkable fruit is the squirting cucumber (*Ecballium Elaterium*) of the Mediterranean region. The prickly fruit, about 2 inches long, becomes very turgid and finally explodes with a considerable report. The basal end is blown out like a cork from a bottle, and the pulpy interior, containing the seeds, is projected to a considerable distance.

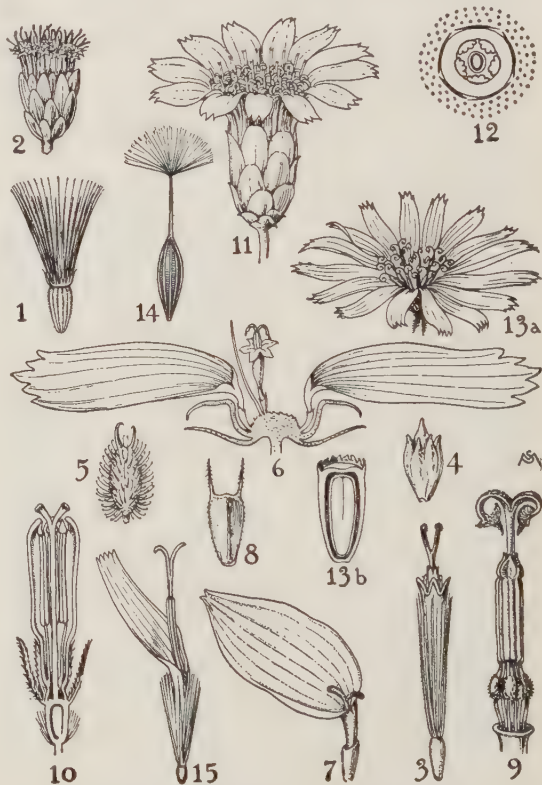
Twenty to 30 genera are in cultivation in N. America. Among these are the various melons, squashes, gourds, and the like, mentioned above; also Bryony, Wax Gourd, Balsam Pear or Balsam Apple (*Momordica*), Dish-cloth Gourd, Squirting Cucumber, Curuba (*Sicana*), and Snake Gourd (*Trichosanthes*).

**214. Campanulaceæ** (from the genus *Campanula*, a diminutive of *campana*, a little bell). **BELLFLOWER FAMILY.** Fig. 56. Herbs, shrubs, or trees, mostly with milky juice; leaves usually alternate, exstipulate, rarely lobed or divided; flowers bisexual, rarely unisexual, regular or irregular, often bilabiate and split down the back, usually epigynous; calyx of usually 5, separate, valvate sepals; corolla usually 5-lobed, gamopetalous, very rarely polypetalous; stamens as many as the lobes of the corolla, often slightly epipetalous, separate or united; ovary usually inferior, 2-5-celled or 6-10-celled, rarely 1-celled; ovules many; style 1; stigmas 1 to several: fruit a capsule, rarely a berry.

Campanulaceæ has 59 genera and about 1,500 species, occurring in all parts of the world but mostly in the temperate regions. A large part are alpine. Arborescent forms occur in the Hawaiian Islands. The family is rather distantly related to the Compositæ, Dipsacaceæ, Caprifoliaceæ. Formerly the Lobeliaceæ were separated as a distinct family, but the only differences are in the irregular flowers and syngenesious or monadelphous stamens, both of which show abundant transitions. When united, the family constitutes a very distinct group. The gamopetalous epigynous flower, the many ovules and the frequently united stamens are distinctive. The stamens are sometimes united by their filaments with the anthers free (monadelphous), or by the anthers with the filaments free (syngenesious), or by both filaments and anthers.

*Lobelia inflata* (lobelia, Indian tobacco) of North America is poisonous. The foliage furnishes the medicinal lobelia. *L. syphilitica* was used for syphilis by the Indians, but is of no value. The roots of this latter plant and of the cardinal flower (*L. cardinalis*) are more or less poisonous. The berries and fleshy roots of some Campanulaceæ have been used as food.

In cultivation in N. America are some 20 genera. Among these are: Shepherd's Scabious, or Sheep's-bit (*Jasione*); Chinese or Japanese Bellflower or Balloon Flower (*Platycodon*); Venus's Looking-glass (*Specularia*); Horned Rampion (*Phyteuma*); Giant Bellflower (*Ostrowskia*); Lobelia and the Cardinal Flower (*Lobelia*); and the Bellflowers or Bluebells (*Campanula*).



57. **COMPOSITÆ:** 1. Vernonia, fruit. 2. Eupatorium, head. 3. Erigeron, disk flower. 4. Ambrosia, fruiting involucre. 5. Xanthium, fruiting involucre. 6. Coreopsis, head. 7. Dahlia, ray flower. 8. Bidens, fruit. 9. Cosmos, disk flower, corolla removed. 10. Helenium, disk flower, vertical section. 11. Mutisia, head. 12. Senecio, floral diagram. 13. Cichorium, a, head; b, fruit. 14. Lactuca, fruit. 15. Hieracium, ray flower.

**215. Compositæ** (name having reference to the aggregation of the flowers into heads or false flowers, i.e., composite flowers). **COMPOSITE FAMILY.** Fig. 57. Herbs, shrubs, or rarely trees, sometimes twining, often with milky juice; leaves alternate, opposite or whorled, very diverse in shape, size and texture; flowers bisexual or unisexual, regular or irregular, epigynous; subtended by a bract called chaff; aggregated into 1- to many-flowered involucre heads; calyx (pappus) reduced to hairs, scales, awns, or a border, or wanting; corolla gamopetalous, normally regular, 4-5-lobed; the lobes valvate; in one tribe bilabiate; often enlarged and split down one side, and flattened out (ligulate or ray flowers); stamens usually 4-5, epipetalous, syngenesious, alternating with the corolla lobes; carpels 2, rarely 1-celled, 1-ovuled, inferior; style 1; stigmas 2, rarely 1; fruit an achene, often crowned by the persistent pappus; seed exalbuminous.



This is the largest family of flowering plants, consisting of more than 800 genera and 10,000 to 12,000 species, distributed over all parts of the earth, each tribe usually having a definite center of distribution. The largest genera are: *Senecio*, 1,200 species; *Centaurea*, 470; *Vernonia*, 450; *Hieracium*, 400; *Helichrysum*, 300; *Baccharis*, 275; *Cousinia*, 210; *Artemisia*, 200; *Crepis*, 170; *Erigeron*, 150; *Chrysanthemum*, 140; *Saussurea*, 125; *Gnaphalium*, 120; *Circium*, 120; *Scorzonera*, 100; *Anthemis*, 100. The *Compositæ*, taken in the broad sense, is a well-defined family not closely related to any other large families. Its affinities are with the *Campanulaceæ*, *Dipsacaceæ*, and *Valerianaceæ*. In general, the involucre heads, epigynous gamopetalous flowers, syngenesious stamens, 1-seeded dry fruits and exalbuminous seeds are distinctive. In some genera the heads have no ray flowers (discoid), in others they have a marginal row, and in still others all the flowers are ligulate. Except in the last case, the ray flowers are without stamens, and frequently without a pistil (neutral). The style-branches are very diverse, and are important in the characterization of tribes. They are often provided with sweeping hairs which push the pollen from the introrse anthers up out of the anther tube as the style elongates. The anthers are caudate in two tribes, and in some genera the filaments contract abruptly when stimulated by touch. In *Ambrosia* and *Xanthium*, the anthers are separate, and the bracts of the 1-2-flowered pistillate involucre are fused, woody, indehiscent, and covered with spines or hooks.

The family is divided by Hoffman into 13 tribes, several of which are by some authors considered separate families.

Sub-family I. Disk flowers not ligulate; no milky sap. Consists of twelve tribes, separated on a basis of style-branches, anther-tails, chaff on the receptacle, and so on, as follows: Ironweed Tribe, Boneset T., Aster T., Elecampane T., Sunflower T., Sneezeweed T., Chamomile T., Senecio T., Pot Marigold T., Arctotis T., Thistle T., Mutisia T.

Sub-family II. All flowers ligulate; juice milky. One tribe,—the Dandelion or Lettuce Tribe.

Medicinal Plants: The *Compositæ* are rich in ethereal oils, fatty oils, resins and bitter principles, and therefore many species are used in medicine. Among others of less importance, the following may be noted: *Artemisia Absinthium* (wormwood), tonic, febrifuge, anthelmintic; *A. Cina* which furnishes santonina from which santonin is extracted, anthelmintic, stimulant; *A. vulgaris* (mugwort) has been used as an emmenagogue and for epilepsy; *Anthemis nobilis* (Roman chamomile), tonic, nerve, emmenagogue; *Matricaria Chamomilla* (German chamomile), with similar properties; *Tanacetum vulgare* (tansy), tonic, anthelmintic, emmenagogue, diuretic; *Arnica montana* (arnica, leopard's bane), skin stimulant, diuretic; *Inula Helenium* (elecampane), skin stimulant; *Eupatorium perfoliatum* (boneset, thoroughwort), tonic, diaphoretic, laxative; many *Eupatoriums* of the tropics, famed remedies for snake-bites; *Tussilago Farfara* (coltsfoot), sedative; *Arctium Lappa* and *A. minus* (burdock), diaphoretic, alterative, used for rheumatism; *Calendula officinalis* (marigold), diaphoretic, alterative; *Lactuca sativa* (lettuce), the thickened juice a narcotic, a substitute for opium; *L. virosa* (wild lettuce), furnishing lactucarium or lettuce opium, a poisonous anodyne, hypnotic, and sedative; *Taraxacum officinale* (dandelion), tonic, but injurious to digestion; species of *Grindelia*, tonic, sedative, used for asthma and rheumatism; *Erigeron canadense* (heabane), used for diarrhea and uterine hemorrhage; *Anacyclus Pyrrholum* (pellitory), skin irritant; *Achillea Millefolium* (yarrow), an old remedy, styptic, tonic, sudorific, antispasmodic. *Brauneria* (Echinacea), *Prenanthes*, *Xanthium*, *Helenium*, *Spilanthes*, *Baccharis*, and

*Chrysanthemum Leucanthemum* have been used locally to some extent. The pollen of ragweed (*Ambrosia artemisiifolia*), less commonly of species of *Solidago* and other *Compositæ*, is said to be the cause of autumnal hay-fever.

The following are used for food, as salads or cooked in various ways: Young foliage of *Circium* (thistles), *Cynara Cardunculus* (cardoon), *Taraxacum officinale* (dandelion), *Cichorium Intybus* (chicory), *Lactuca sativa* (lettuce), *Cichorium Endivia* (endive, succory), *Pacourina edulis*, and *Scolymus hispanicus*, (Spanish oyster plant); young flower heads of *Cynara Scolymus* (globe artichoke); roots of *Tragopogon porrifolius* (vegetable oyster, salsify), *Scorzonera hispanica* (*Scorzonera*, black salsify), *Helianthus tuberosus* (Jerusalem artichoke). Roots of chicory, roasted, are a substitute for coffee.

The following yield dyes: *Carthamus tinctorius*, (safflower) yields the red dye, carthamine; *Serratula tinctoria* (dyer's savory) yields a yellow dye.

The powdered heads of species of *Chrysanthemum* furnish insect powder. An oil is obtained from the seeds of *Guzotia abyssinica* (niger seeds) of India and Abyssinia, used for food, painting, and burning. Seeds of *Madia sativa* furnish an oil similar to olive oil, edible, illuminating, and lubricating. The seeds of *Helianthus annuus* also furnish a commercial oil.

Many *Compositæ* are ornamental. The species of *Helichrysum*, *Anaphalis*, and related genera, have papery involucre, and furnish well-known everlasting.

More than one hundred and fifty genera are in cultivation in N. America, or are important weeds. Many of our most important and most showy ornamental plants belong to the *Compositæ*. Among these genera are: *Achillea* (Milfoil, Yarrow, Sneezewort); *Ageratum*; *Anaphalis* (Everlasting, Moonshine); *Antennaria* (Everlasting, Cat's-ear, Pussy's Toes, Ladies' Tobacco); *Anthemis* (Chamomile, Mayweed, Golden Marguerite); *Arctium* (Burdock); *Arnica* (Mountain Tobacco, Mountain Snuff); *Artemisia* (Wormwood, Tarragon, Estragon, Southernwood, Roman Wormwood, Old Man and Old Woman, Sage Brush); *Aster* (*Aster*, Starwort, Michaelmas Daisy); *Bidens* (Bur Marigold, Beggar's Ticks, Pitchfork Bur); *Boltonia* (False Chamomile); *Brachycome* (Swan River Daisy); *Brickellia* (Tassel Flower); *Bupthalmum*; *Calendula* (Marigold); *Callistephus* (China Aster); *Cnicus* or *Carbenia* (Blessed Thistle); *Carthamus* (Safflower, False Saffron); *Centaurea* (Centauray, Dusty Miller, Bachelor's Button, Cornflower, Knapweed, Bluebottle, Bluet, Ragged Sailor, Sweet Sultan, Basket Flower, Hardheads); *Chenactis*; *Chrysanthemum* (Feverfew, Golden Feather, Turfing Daisy, Marguerite, Paris Daisy, Costmary, Mint Geranium, Giant Daisy, Ox-eye Daisy, White-weed); *Cichorium* (Chicory, Succory); *Cineraria*; *Circium* or *Cnicus* (Common Thistles); *Coreopsis* (Tickseed, Golden Wave); *Cosmos*; *Cynara* (Artichoke, Cardoon); *Dahlia*; *Doronicum* (Leopard's-Bane); *Echinacea* or *Brauneria* (Purple Coneflower); *Echinops* (Globe Thistle); *Emilia* (Tassel Flower); *Erigeron* (Fleabane, Poor Robin's Plantain); *Eupatorium* (Boneset, Joe-Pye Weed, Thoroughwort, White Snakeroot); *Felicia* (Blue Daisy, Blue Marguerite); *Gaillardia*; *Gazania* (Peacock Gazania); *Grindelia* (Gum Plant); *Gynura* (Velvet Plant); *Helenium* (Sneezeweed); *Helianthus* (Sunflower, Indian Potato, Jerusalem Artichoke); *Helichrysum*; *Heliopsis*; *Helipterum*; *Hidalgoa* (Treasure Vine); *Hieracium* (Hawkweed, Rattlesnake Weed, Devil's Paint-brush); *Inula* (Elecampane); *Krigia* (Dwarf Dandelion); *Lactuca* (Lettuce); *Leontopodium* (Edelweiss); *Leptosyne*; *Liatris* (Blazing Star, Button Snakeroot); *Lonas* (African Daisy); *Madia* (Tarweed); *Matricaria*; *Mikania* (Climbing Hempweed, Climbing Boneset); *Onopordon* (Scotch Thistle); *Parthenium* (American Feverfew, Prairie Dock); *Pentachæta*; *Petasites* (Winter Heliotrope, Sweet Coltsfoot); *Pteris*; *Podolepis*; *Polymnia* (Leaf-cup); *Prenanthes* (Rattle

snake Root); *Rudbeckia* (Black-eyed Susan, Yellow Daisy, Coneflower, Golden Glow); *Santolina* (Lavender Cotton); *Scolymus* (Golden Thistle, Spanish Oyster Plant); *Scorzonera* (Black Salsify); *Senecio* (Groundsel, Canada Plant, Ragwort, German Ivy, Leopard Plant, Dusty Miller); *Silphium* (Rosin-Weed, Compass Plant, Prairie Dock, Cup Plant); *Solidago* (Goldenrod); *Spil-*

*anthes* (Para Cress); *Stokesia* (Stoke's Aster); *Tagetes* (French Marigold, African Marigold); *Tanacetum* (Tansy); *Taraxacum* (Dandelion); *Thelysperma*; *Townsendia*; *Tragopogon* (Salsify, Goat's Beard, Vegetable Oyster, Oyster Plant); *Trilisa* (Vanilla Plant); *Tussilago* (Coltsfoot); *Verbesina* (Crownbeard); *Vernonia* (Ironweed); *Zinnia* (*Zinnia*, Youth-and-Old-Age).

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| <b>Celastraceæ, 49.</b>     | <b>Iridaceæ, 21.</b>        | <b>Papaveraceæ, 35.</b>   | <b>Tiliaceæ, 52.</b>        |
| <b>Cephalotaceæ, 38.</b>    | <b>Juglandaceæ, 25.</b>     | <b>Passifloraceæ, 56.</b> | <b>Tremandraceæ, 46.</b>    |
| <b>Ceratopteridaceæ, 8.</b> | <b>Juncaceæ, 19.</b>        | <b>Pedaliaceæ, 72.</b>    | <b>Trochodendraceæ, 32.</b> |
| <b>Chenopodiaceæ, 29.</b>   | <b>Jungermanniales, 6.</b>  | <b>Phascales, 7.</b>      | <b>Tropæolaceæ, 43.</b>     |
| <b>Chloranthaceæ, 24.</b>   | <b>Labiata, 70.</b>         | <b>Phrymaceæ, 74.</b>     | <b>Typhaceæ, 13.</b>        |
| <b>Cistaceæ, 55.</b>        | <b>Lardizabalaceæ, 33.</b>  | <b>Phytolaccaceæ, 30.</b> | <b>Ulmaceæ, 25.</b>         |
| <b>Clethraceæ, 63.</b>      | <b>Lauraceæ, 35.</b>        | <b>Pinaceæ, 12.</b>       | <b>Umbelliferæ, 62.</b>     |
| <b>Combretaceæ, 60.</b>     | <b>Lecythidaceæ, 59.</b>    | <b>Piperaceæ, 23.</b>     | <b>Urticaceæ, 26.</b>       |
| <b>Commelinaceæ, 18.</b>    | <b>Leguminosæ, 41.</b>      | <b>Pittosporaceæ, 39.</b> | <b>Valerianaceæ, 75.</b>    |
| <b>Compositæ, 76.</b>       | <b>Lemnaceæ, 18.</b>        | <b>Plantaginaceæ, 74.</b> | <b>Verbenaceæ, 69.</b>      |
| <b>Convolvulaceæ, 68.</b>   | <b>Lentibulariaceæ, 73.</b> | <b>Platanaceæ, 40.</b>    | <b>Violaceæ, 56.</b>        |
| <b>Coriariaceæ, 47.</b>     | <b>Liliaceæ, 19.</b>        | <b>Plumbaginaceæ, 65.</b> | <b>Vitaceæ, 51.</b>         |
| <b>Cornaceæ, 63.</b>        | <b>Limnathaceæ, 48.</b>     | <b>Polemoniaceæ, 68.</b>  | <b>Zingiberaceæ, 21.</b>    |
| <b>Crassulaceæ, 38.</b>     | <b>Linaceæ, 43.</b>         | <b>Polygalaceæ, 46.</b>   | <b>Zygomycetes, 5.</b>      |
| <b>Cruciferæ, 36.</b>       | <b>Loasaceæ, 57.</b>        | <b>Polygonaceæ, 28.</b>   | <b>Zygophyllaceæ, 44.</b>   |
| <b>Cucurbitaceæ, 75.</b>    | <b>Loganiaceæ, 67.</b>      |                           |                             |







IV. Upland vegetation.—Trees on a wind-swept plateau.



## KEY TO THE FAMILIES AND GENERA

In one of the editions of the *Cyclopedia of American Horticulture*, a key to the families and genera contained therein was placed in the introductory part to Vol. I. This key is now modified and adapted to the present work. The original key was prepared by Wilhelm Miller, Associate Editor of that *Cyclopedia*. The main part of Dr. Miller's introduction to that key is here reprinted, with adaptations, as explaining the purpose of a key and the way in which it is constituted.

The key has now been extensively revised, but the original form and method are still retained.

### *The purposes of the key.*

The following key attempts to supply what is probably the greatest deficiency in cyclopedic works on horticulture:

(1) It helps the gardener to determine the name of any plant cultivated in America, including the wild flowers and other plants native to the United States and Canada that are commonly or even frequently offered for sale.

(2) It helps the student towards a scientific knowledge of the plant world, since it gives a condensed and orderly catalogue of that part of the vegetable kingdom which is of interest to gardeners, farmers and foresters.

No merely alphabetical work can accomplish either of these results. For example, suppose the person has a flower that is known to be an *Iris*, but of what species of *Iris* is not clear to him; and that he wishes to find the name. If he were to consult the best works in which the species of *Iris* are arranged alphabetically, it might require hours to read the pages of description, comparing the items with the specimen, and the chances are that in the end he would not be sure of a determination, since related species are not compared and contrasted.

It was to provide a short-cut to such information that every large genus or group of plants described in the *Cyclopedia of American Horticulture* was classified according to shape, color, size, season, height or other characters of interest to the gardener. These short-cuts, or "keys," have long been in common use with students of botany, and are a feature of all floras, but they have not been sufficiently employed in writings on horticultural subjects.

No valid objection can be made to keys, synopses or other classified arrangements, since they do three things more clearly and briefly than any other device: (1) They help one to find out the name of a plant. (2) They show the difference between the given species and other species of the same genus. (3) They show the relation of each species to every other, i. e., some of the points of likeness and unlikeness.

But classified schemes alone have one serious limitation: They are not so convenient for ready reference if one knows one's plant and merely wishes to find out the native country or how to spell the name. The *Cyclopedia of American Horticulture* met this need by numbering the species and providing an alphabetical list or index in each large genus. It therefore met the needs by presenting both systems—the classified and the alphabetical—one for taxonomic study, the other for convenience.

All this supposes that one knows the genus to which the plant belongs,—whether it is an *Iris*, *Pæonia* or *Rhododendron*. But he may not know the genus: the key will aid him to determine it. The key leads to the family and the genus; having the genus, he can run down the species in the *Cyclopedia* itself, for the genera are to be found in alphabetical order. This key, therefore, deals only with families and genera,

since the species are described and distinguished elsewhere. It ties the whole work together and makes it an organism, instead of a series of detached articles on *Iris*, *Rosa*, *Solanum*, and other genera. In other words, the key is not merely supplementary: it is structural and even fundamental.

### *The preparation of the key.*

It must be confessed, however, that the preparation of the key was undertaken with serious misgivings. During the preparation of the *Cyclopedia of American Horticulture*, the Editor was often importuned for something of the kind, by students, botanists, and others who made increasing use of the volumes as issued. In response to these urgent appeals, it was necessary to point out three objections: (1) Such a key would necessarily be highly technical. (2) It would have to use a scheme of arrangement that may pass with another generation. (3) The labor and expense would be great.

In response to this demand the following key has been prepared. It is based on the system of Bentham and Hooker as set forth in their "*Genera Plantarum*," a work published in parts from 1862 to 1883. The system of Bentham and Hooker is not now the latest, but it is the only one that was in general use at the time the first *Cyclopedia* was begun. The system of Engler and Prantl in "*Die Natürlichen Pflanzenfamilien*" is now well known; this no doubt presents the best system for the present generation, but in its turn it is likely to be superseded. In Engler and Prantl's system the plants are arranged, as far as possible, in the order in which the various families probably have made their appearance on the earth's surface, or at all events in accordance with the evolution from simple to complex. Perhaps the new system is better adapted for showing relationship or likeness, while the old system is well adapted for bringing out differences. This furnishes an additional reason for the use of the older system on the present occasion, as most of those who use this part of the *Cyclopedia* will probably be in search of differences.

In the present revision, the Bentham and Hooker key-plan has been retained. The authors of the main groups in the new *Cyclopedia* have made revisions and adaptations to meet the changes and requirements of their own work. New conceptions of the limitations of families and genera have naturally found expression in the revision. It is not designed to insert in the key all the genera that are mentioned in a minor or incidental way, for to include them all would unnecessarily encumber and complicate the lists and tend to make them unworkable; but it is intended to include all the genera that afford species prominently in the trade in the United States and Canada. When it has seemed to be desirable to omit genera from the key, the relatively unimportant native groups have often been left out, for they may be readily traced in the current botanies.

The way to use a key is explained in the prefatory part to this volume (page xii).

### The general plan.

The key is divided into two main parts: a key to the families (page 80), and a key to the genera (page 86). When the student has determined the family to which the plant belongs, the further tracing of it is to be made in the key to the genera; when the genus has been found, he turns to its alphabetic place in one of the volumes and there runs down the plant to its species.

The families are arranged in accordance with the following framework (for another and fuller outline of the vegetable kingdom, see pages 2-4).

	Families
Division 1. Flowering Plants or Phanerogams.....	1-209
Subdivision 1. Dicotyledons or Exogens.....	1-181
Class 1. Angiosperms.....	1-176
Subclass 1. Polypetales.....	1-101
Series 1. Thalamifloræ.....	1-39
Cohort 1. Ranales.....	1-12
Cohort 2. Parietales.....	13-22
Cohort 3. Polygalales.....	23-25
Cohort 4. Caryophyllales.....	26-29
Cohort 5. Guttiferales.....	30-34
Cohort 6. Malvales.....	35-39
Series 2. Discifloræ.....	40-69
Cohort 1. Geraniales.....	40-53
Cohort 2. Olacales.....	54-56
Cohort 3. Celastrales.....	57-60
Cohort 4. Sapindales.....	61-69
Series 3. Calycifloræ.....	70-101
Cohort 1. Rosales.....	70-79
Cohort 2. Myrtales.....	80-88
Cohort 3. Passiflorales.....	89-93
Cohort 4. Ficoidales.....	94-95
Cohort 5. Umbellales.....	96-101
Subclass 2. Gamopetales.....	102-144
Series 1. Inferæ.....	102-107
Cohort 1. Rubiales.....	102-103
Cohort 2. Asterales.....	104-106
Cohort 3. Campanales.....	107
Series 2. Heteromæræ.....	108-120
Cohort 1. Ericales.....	108-113
Cohort 2. Primulales.....	114-116
Cohort 3. Ebenales.....	117-120
Series 3. Bicarpellatæ.....	121-144
Cohort 1. Gentianales.....	121-125
Cohort 2. Polemoniales.....	126-131
Cohort 3. Personales.....	132-138
Cohort 4. Lamiales.....	139-144
Subclass 3. Apetalæ or Monochlamydeæ.....	145-176
Series 1. Curvembryæ.....	145-149
Series 2. Multiovulatæ Terrestres.....	150-151
Series 3. Micrembryæ.....	152-156
Series 4. Daphneæ.....	157-160
Series 5. Achlamydosporæ.....	161-162
Series 6. Unisuales.....	163-174
Series 7. Anomalous Families.....	175-176
Class 2. Gymnosperms.....	177-181
Subdivision 2. Monocotyledons or Endogens.....	182-209
Series 1. Microspermæ.....	182-183
Series 2. Epigynæ.....	184-193
Series 3. Coronariæ.....	194-196
Series 4. Calycinæ.....	197-198
Series 5. Nudifloræ.....	199-203
Series 6. Apocarpæ.....	204-207
Series 7. Glumacæ.....	208-209
Division 2. Pteridophyta.....	210-223

## PART I.—KEY TO THE FAMILIES

(See page 86 for Part II.)

**Division 1. FLOWERING PLANTS OR PHANEROGAMS OR SPERMATOPHYTES:** those producing real flowers and seeds (pages 80 to 86).

**Subdivision 1. DICOTYLEDONS.** Sts. formed of bark, wood and pith, the wood forming a zone between the other two, and increasing when the st. continues from year to year by the annual addition of a new layer to the outside next to the bark: lvs. usually netted-veined: embryo with a pair of opposite cotyledons, or, in Subdivision 2, often 3 or more in a whorl: parts of the fl. mostly in 4's or 5's (pages 80-84).

**Class 1. ANGIOSPERMS.** Pistil consisting of a closed ovary, which contains the ovules: cotyledons 2.

**Subclass 1. POLYPETALES.** Calyx and corolla both present, the latter of separate petals. (See exceptions listed under Subclass 2, Gamopetales, page 82.)

**Series 1. THALAMIFLORE.** Calyx mostly inserted under the ovary; petals often in 2 or more series, sometimes 1 series; stamens

$\infty$  or definite, inserted on the often small or raised or stipitate receptacle, which is not developed into a glandular disk; ovary very generally free.

**Cohort 1. RANALES.** Stamens  $\infty$ , or if definite then the perianth in 3- $\infty$  series; carpels 1 or more, usually distinct, rarely united. (See exceptions in Saxifragaceæ; also hypogynous Leguminosæ.)

- A. Sepals 5, or fewer, or 0; petals in about 1 series.
- B. Seeds not arillate; sepals deciduous, usually colored: herbs or shrubs. . . . . 1. **RANUNCULACEÆ**.
- BB. Seeds not arillate: calyx and corolla wanting; ovary of 2 carpels but 1-celled. . . . . 7. **EUCOMMIACEÆ**.
- BBB. Seeds arillate: sepals persistent, herbaceous: shrubs or trees. . . . . 2. **DILLENIACEÆ**.
- AA. Sepals or petals in 2- $\infty$  series, rarely wanting.
- B. Plants not aquatic.
- C. Perianth wanting; stamens numerous; fls. polygamous, dioecious, or perfect.
- D. Lvs. pinnately veined, alternate. 5. **TROCHODENDRA-CEÆ**.
- DD. Lvs. palmately veined, opposite. 6. **CERCIDIPHYLLACEÆ**.
- CC. Perianth present.
- D. Petals and stamens mostly  $\infty$ : ovules 1- $\infty$ .
- E. Torus tubular, inclosing carpels: endosperm 0: lvs. opposite: shrubs. . . . . 3. **CALYCANTHACEÆ**.
- EE. Torus short or long, bearing carpels outside: endosperm copious: lvs. alternate: woody. . . . . 4. **MAGNOLIACEÆ**.
- DD. Petals 5: stamens 10: carpels 5-10: ovule solitary: lvs. opposite. (See No. 68, **CORIARIACEÆ**.)
- DDD. Petals and stamens mostly multiples of 3 or 2.
- E. Stamens and carpels usually numerous: ovules 1- $\infty$ : sepals 3; petals 6; fls. bisexual: shrubs or trees. . . . . 8. **ANNONACEÆ**.
- EE. Stamens usually 6: ovule solitary: carpels 3; sepals and petals usually 6: fls. dioecious: mostly woody or herbaceous vines. . . . . 9. **MENISPERMACEÆ**.
- EEE. Stamens 4, 6, or 9; anthers opening by 2 lids rarely birimose: carpel 1: ovules 2- $\infty$ : fls. bisexual: herbs or shrubs. . . . . 10. **BERBERIDACEÆ**.
- EEEE. Stamens usually 6; anthers birimose: carpels mostly 3: ovules many: fls. unisexual: vines or erect, woody. . . . . 11. **LARDIZABALACEÆ**.
- BB. Plants aquatic. . . . . 12. **NYMPHÆACEÆ**.

**Cohort 2. PARIETALES.** Stamens definite or  $\infty$ : ovary 1-celled, or several-celled by spurious partitions; carpels several; placentæ parietal. (See Actæa in Ranunculaceæ, also Berberidaceæ.)

- A. Embryo minute, near the base of the fleshy endosperm.
- B. Pitcher plants. . . . . 13. **SARRACENIACEÆ**.
- BB. Not pitcher plants.
- C. Petals all alike, or nearly so. . . . . 14. **PAPAVERACEÆ**.
- CC. Petals in 2 series, the inner unlike the outer. . . . . 15. **FUMARIACEÆ**.
- AA. Embryo curved; endosperm 0.
- B. Stamens 6, tetradynamous, rarely 4. . . . . 16. **CRUCIFERÆ**.
- BB. Stamens  $\infty$ , or, if few, not tetradynamous. . . . . 17. **CAPPARIDACEÆ**.
- BBB. Stamens usually  $\infty$ , not covered in aestivation by the small petals: ovary often open above. . . . . 18. **RESEDACEÆ**.
- AAA. Embryo not curved, rather large; endosperm fleshy.
- B. Radicle remote from hilum: ovule generally orthotropous. . . . . 19. **CISTACEÆ**.
- BB. Radicle very near hilum: ovule anatropous, or amphitropous.
- C. Anthers dehisce introrsely: mostly herbs. . . . . 20. **VIOLACEÆ**.
- CC. Anthers dehisce extrorsely or at apex: insectivorous plants with capitate glandular tentacles on lvs. (See No. 76, **DROSERACEÆ**.)
- CCC. Anthers dehisce by apical cracks or pores: woody.
- D. Slime-cells present; receptacle not enlarged. . . . . 21. **BIXACEÆ**.
- DD. Slime-cells absent; receptacle enlarged. . . . . 22. **FLACOURTIACEÆ**.
- CCCC. Anthers versatile, dehiscing by longitudinal fissures: woody. (See No. 34, **STACHYURACEÆ**.)



**Cohort 3. POLYGALAEAE.** Stamens as many or twice as many as petals; carpels usually 2; ovary usually perfectly or imperfectly 2-celled, usually compressed.

- A. Fls. regular or slightly oblique.
- B. Stamens 5, as many as sepals or petals: woody.....23. *PITTOSPORACEAE*.
- BB. Stamens twice as many as sepals or petals, which are usually 4 or 5, rarely 3: woody.....24. *TREMANDRACEAE*.
- AA. Fls. irregular; herbaceous or woody.....25. *POLYGALACEAE*.

**Cohort 4. CARYOPHYLLALES.** Stamens definite, rarely  $\infty$ ; ovary 1-celled or imperfectly septate; placenta central, rarely parietal; embryo curved, or coiled, rarely straight.

- A. Sepals of same number as petals: placenta 1, central: herbs.....26. *CARYOPHYLLACEAE*.
- AA. Sepals fewer than petals: placenta 1, central: herbs.....27. *PORTULACACEAE*.
- AAA. Sepals of same number as petals: placenta several; mostly woody.
- B. Corolla polypetalous; stamens without scale, glabrous; fls. spicate or racemose.....28. *TAMARICACEAE*.
- BB. Corolla gamopetalous; stamens with scale, hairy; fls. thyrsoid-paniculate.....29. *FOQUIERACEAE*.

**Cohort 5. GUTTIFERALES.** Stamens usually  $\infty$ ; sepals imbricated; ovary septate; placenta on the inner angles of the cells, i.e., axile. (See also, as exceptions with disk absent, the *Linaceae*, *Erythroxylaceae*, *Malpighiaceae*, *Geraniaceae*, *Tropaeolaceae*, *Limnanthaceae*, *Oxalidaceae*, *Balsaminaceae*, *Ochnaceae*, *Rutaceae*, *Anacardiaceae* and *Sapindaceae*, all belonging to the *Disciflorae*. (See also *Nigella* of the *Ranunculaceae*.)

- A. Lvs. opposite or whorled, herbaceous: fls. cymose or paniced, bisexual.....30. *HYPERICACEAE*.
- AA. Lvs. opposite or whorled, coriaceous: fls. cymose or paniced.
- B. Receptacle not enlarged; fls. unisexual.....31. *GUTTIFERAE*.
- BB. Receptacle enlarged, barrel-shaped between pistil and corolla, bearing the stamens; fls. bisexual.....32. *EUCRYPHIACEAE*.
- AAA. Lvs. alternate, coriaceous: fls. mostly racemose.
- B. Cells of ovary 2-10: stamens numerous.....33. *TERNSTROMIACEAE*.
- BB. Cells of ovary 1: stamens 8.....34. *STACHYURACEAE*.

**Cohort 6. MALVALES.** Stamens usually  $\infty$  or monadelphous; sepals valvate; ovary septate; placenta axile.

- A. Anthers 1-celled; pollen rough: herbs or woody.....35. *MALVACEAE*.
- AA. Anthers 1- to several-celled; pollen smooth: woody plants.....36. *BOMBACACEAE*.
- AAA. Anthers 2-celled: fls. with staminodia and queer stamen-tube: woody plants.....37. *STERCULIACEAE*.
- AAAA. Anthers 2-celled; stamens nearly free; no staminodia: ovule often pendulous with raphe toward axis.
- B. Petals ordinary: herbs or woody.....38. *TILIACEAE*.
- BB. Petals firm, often hairy or incised: woody plants.....39. *ELEOCARPACEAE*.

**Anomalous Group.** Stamens  $\infty$ ; sepals valvate; carpel 1; ovary 1-celled: fls. regular: lvs. compound: herbs or woody..... (Mimosae, incl. in *Leguminosae*.)

**Series 2. DISCIFLOREAE.** Calyx usually inserted under the ovary; petals in 1 series: stamens usually definite, inserted within or upon or around the receptacle, which is usually expanded as a disk within the calyx: ovary usually free, or imbedded in the disk. (See *Flacourtiaceae* and *Trapaceae*.)

**Cohort 1. GERANIALES.** Disk usually a ring between stamens, or adnate to staminal tube, or reduced to glands alternating with the petals, rarely 0: ovary commonly lobed, rarely entire or subapocarpous; ovules 1-2 in each cell, pendulous; raphe toward axis. (See *Stackhouseiaceae*.)

- A. Ovary more or less lobed or grooved.
- B. Anthers elongated; disk enlarged in fr.....51. *OCHNACEAE*.
- BB. Anthers normal.
- C. Calyx-lobes 5, all or mostly with 2 glands outside: woody.....42. *MALPIGHIACEAE*.
- CC. Calyx-lobes not biglandular.
- D. Foliage glandular-dotted: carpels sometimes separate.....49. *RUTACEAE*.
- DD. Foliage not glandular-dotted.
- E. Lvs. usually opposite, compound.....43. *ZYGOPHYLLACEAE*.
- EE. Lvs. alternate.
- F. Disk well developed, irregular; petals often irregular; ovary usually open above: herbs, rarely shrubs. (See No. 18, *Resedaceae*.)

FF. Disk well developed, regular: petals regular: ovary closed: woody plants.....50. *SIMARUBACEAE*.

- FFF. Disk indistinct, otherwise as in the last: herbaceous.
- G. Ovule solitary: stamens 6-10.
- H. Fr. dehiscent: stamens connate at base; fls. regular or irregular.....44. *GERANIACEAE*.
- HH. Fr. indehiscent: stamens free; fls. irregular: ovule pendulous.....45. *TROPEOLACEAE*.
- HHH. Fr. indehiscent: stamens free: fls. regular: ovule ascending.....46. *LIMNANTHACEAE*.
- GG. Ovules several: fr. dehiscent.
- H. Stamens 10: fls. regular.....47. *OXALIDACEAE*.
- HH. Stamens 5: fls. irregular.....48. *BALSAMINACEAE*.

- AA. Ovary entire.
- B. Stamens monadelphous, at least below: woody plants.
- C. Stamen-tube stipitate; disk vari-ous.....53. *MELIACEAE*.
- CC. Stamen-tube sessile; disk 0.
- D. Petals not appendaged: fr. capsular.....40. *LINACEAE*.
- DD. Petals appendaged: fr. drupaceous.....41. *ERYTHROXYLACEAE*.
- BB. Stamens free.
- C. Ovules several or many.
- D. Mostly herbaceous plants. (See No. 17, *Capparidaceae*.)
- DD. Woody plants. (See No. 22, *Flacourtiaceae*.)
- CC. Ovules 1-2.....52. *BURSERACEAE*.

**Cohort 2. OLACALES.** Disk cup-shaped or ring-shaped, free, or bearing the stamens and petals on its edge: ovary 1- $\infty$ -celled, entire; ovule solitary, pendulous; raphe away from axis.

- A. Petals or corolla-lobes usually valvate: woody.....54. *OLACACEAE*.
- AA. Petals or corolla-lobes imbricate or convolute.
- B. Fr. drupaceous, slightly fleshy, 3-18-stoned; stones 1-seeded: fls. not racemose: woody.....55. *AQUIFOLIACEAE*.
- BB. Fr. crustaceous or spongy, 2-4-celled, 1-4-seeded: fls. racemose: woody.....56. *CYRILLACEAE*.

**Cohort 3. CELASTRALES.** Disk tumid or adnate to the calyx or covering its base: stamens inserted around the disk or affixed to its margin: ovary usually entire; ovules usually 2 in each cell, erect: raphe turned toward axis: lvs. simple or rarely compound.

- A. Calyx valvate; petals small, concave; stamens opposite the petals: woody.....59. *RHAMNACEAE*.
- AA. Calyx imbricate.
- B. Stamens alternate with the petals, the latter imbricate.
- C. Petals spreading: calyx small: woody.....57. *CELASTRACEAE*.
- CC. Petals erect, often connate: calyx-tube hemispherical: herbs.....58. *STACKHOUSEIACEAE*.
- BB. Stamens opposite the petals, the latter valvate, dropping off early: woody, rarely herbaceous.....60. *VITACEAE*. (Incl. *Leeaceae*.)

**Cohort 4. SAPINDALES.** Disk various; stamens variously inserted on the disk: ovary entire, or more often lobed, or subapocarpous; ovules commonly 1-2 in each cell, ascending, with raphe toward axis, or reversed, or solitary and pendulous from an ascending funicle, rarely  $\infty$  and horizontal: lvs. pinnate, rarely simple (No. 62), or (No. 65) digitate.

- A. Carpels 2: fr. a samara.....62. *ACERACEAE*.
- AA. Carpels 2-3: fr. a drupe, 1-seeded.....61. *SABIACEAE*.
- AAA. Carpels 3-5: fr. rarely samaroid in *Sapindaceae*.
- B. Bark containing resin: disk intrastaminal.....67. *ANACARDIACEAE*.
- BB. Bark not resinous, or, if so, disk extrastaminal.
- C. Endosperm abundant; embryo straight.
- D. Disk intrastaminal; carpels 3.....63. *STAPHYLEACEAE*.
- DD. Disk extrastaminal; carpels 4-5.....64. *MELIANTHACEAE*.
- CC. Endosperm sparse or wanting; embryo curved: disk extrastaminal. (See *Sapindaceae*, No. 66.)
- D. Lvs. opposite, palmately compound.....65. *HIPPOCASTANACEAE*.
- DD. Lvs. alternate, variously compound, or simple.....66. *SAPINDACEAE*.

**Anomalous Families.** Disk 0: sepals and petals 5: stamens 10; carpels 5-10, distinct: ovule solitary, pendulous; raphe away from axis. Approaches Thalamifloræ.....68. CORIARIACEÆ.

Disk investing calyx-tube: stamens 10, of which 5 have no anthers: ovary 1-celled, with 3-parietal placentæ; ovules  $\infty$ . Approaches Calycifloræ.....69. MORINGACEÆ.

**Series 3. CALYCIPIORÆ.** Petals in 1 series: stamens  $\infty$  or definite, inserted with the petals and sepals on the edge of the cup-shaped receptacle (hypanthium), or on a disk lining the latter: ovary often adnate to this receptacle; and therefore inferior. (See also Calycanthaceæ.)

**Cohort 1. ROSALES.** Carpels superior solitary or free or united only at base, sometimes to the apex and then rarely inferior: styles distinct, rarely united in a column and easily separated (styles connate in some Bruniaceæ and Saxifragaceæ). (See also Tropæolaceæ and Capparidaceæ.)

- A. Endosperm rare.
  - B. Fr. a legume, when rarely otherwise the corolla is either papilionaceous or the stamens are very numerous and exserted: lvs. usually compound with pulvini.....70. LEGUMINOSÆ.
  - BB. Fr. not a legume, either a follicle, drupe, pome, achene or aggregate: lvs. simple or compound without pulvini.....71. ROSACEÆ.
- AA. Endosperm moderate or copious.
  - B. Plants insectivorous.
    - C. Lvs. bearing many tentacles tipped with capitate viscid glands: herbs.....76. DROSERACEÆ.
    - CC. Lvs. bearing pitchers.....74. CEPHALOTACEÆ.
  - BB. Plants not insectivorous.
    - C. Carpels 5, rarely 3 or more, separate, with a scale at the base of each, superior: ovules many: often fleshy plants: herbs.....75. CRASSULACEÆ.
    - CC. Carpels 2 to several, rarely separate, no scale at the base: plants not conspicuously fleshy.
      - D. Ovary usually 2-celled, usually superior; ovules  $\infty$ , usually axile: fr. a caps. or berry or follicle.
        - E. Lvs. opposite, stipulate.....73. CUNONIACEÆ.
        - EE. Lvs. alternate, or opposite and exstipulate.....72. SAXIFRAGACEÆ.
      - DD. Ovary 2-celled, inferior or rarely superior; ovules 1- $\infty$ , pendulous or axile: fr. a woody 2-valved caps., with a separating inner layer of different texture.....77. HAMAMELIDACEÆ.
      - DDD. Ovary 1-4-celled, usually inferior; ovules 1 to several, pendulous: fr. indehiscent or cocci irregularly and tardily dehiscent.
        - E. Plants heath-like: stamens and petals 5.....78. BRUNIACEÆ.
        - EE. Plants ordinary: stamens often many.....79. HALORAGIDACEÆ.

**Cohort 2. MYRTALES.** Ovary syncarpous, inferior or inclosed in a cup-shaped receptacle, usually divided into cells; style undivided; ovules 2- $\infty$  in the cells.

- A. Ovules pendulous from apex of cells: woody.
  - B. Ovary 2-6-celled.....80. RHIZOPHORACEÆ.
  - BB. Ovary 1-celled.....81. COMBRETACEÆ.
- AA. Ovules affixed to the inner angles of the cells or to basilar placentæ, ascending, horizontal or pendulous.
  - B. Stamens  $\infty$ , rarely definite: woody.
    - C. Oil-glands in foliage; sieve-tubes in pith-rays.....82. MYRTACEÆ.
    - CC. Oil-glands absent; no sieve-tubes in pith-rays.....83. LECYTHIDACEÆ.
  - BB. Stamens definite, rarely  $\infty$ .
    - C. Calyx-lobes usually imbricate or open; anthers curved, usually opening by pores at the apex; connective usually appendaged or thickened.....84. MELASTOMACEÆ.
    - CC. Calyx-lobes usually valvate; anthers normal, not appendaged, opening longitudinally.
      - D. Ovary superior; petals corrugated.....85. LYTHRACEÆ.
      - DD. Ovary inferior or half-inferior.
        - E. Carpels in stries, superimposed: petals corrugated.....86. PUNICACEÆ.
        - EE. Carpels in 1 whorl: petals convolute.....87. ONAGRACEÆ.

EEE. Carpels in 1 whorl: petals imbricate; a dentate or wavy cup-shaped disk under ovary: water-plants.....88. TRAPACEÆ.

**Cohort 3. PASSIFLORALES.** Ovary syncarpous, inferior, semi-inferior, or inclosed in the hollow receptacle, rarely exserted, 1-celled with parietal placentation, or divided into cells; ovules 1- $\infty$ ; styles united or distinct from the base.

- A. Crown inserted on calyx-tube or within petals, single, double or multiple.....90. PASSIFLORACEÆ.
- AA. Crown 0.
  - B. Fls. bisexual (see Caricaceæ); petals unlike the sepals: foliage-hairs stinging or rigid or queerly constructed.....89. LOASACEÆ.
  - BB. Fls. unisexual.
    - C. Stamens 5 or 10: perianth of the 2 sexes unlike.....91. CARICACEÆ.
    - CC. Stamens usually 3: perianth of both sexes similar.....92. CUCURBITACEÆ.
    - CCC. Stamens  $\infty$ : perianth of the 2 sexes often unlike.....93. BEGONIACEÆ.

**Cohort 4. FICOIDALES.** Ovary syncarpous, inferior or superior, divided into cells with sub-basilar placentation, or rarely 1-celled with parietal placentæ; ovules 1- $\infty$ ; styles distinct or united to near apex; embryo curved or excentric.

- A. Calyx-lobes, petals and stamens usually  $\infty$ : ovary 1-celled.....94. CACTACEÆ.
- AA. Calyx-lobes usually 4-5: ovary 2- $\infty$ -celled.....95. AIZOACEÆ.

**Cohort 5. UMBELLALES.** Ovary syncarpous, inferior, crowned by the disk, divided into cells, or 1-carpelled; styles distinct or united part way; ovules solitary and pendulous in the cells.

- A. Fr. separating into 2 dry indehiscent carpels.....96. UMBELLIFERÆ.
- AA. Fr. usually drupaceous, the stones distinct but not separating naturally.
  - B. Lvs. compound, or simple, and palmately veined.....97. ARALIACEÆ.
  - BB. Lvs. simple, pinnately veined.
    - C. Ovules 2 in each cell: ovary 1-celled: raphe toward axis: fls. in catkins: lvs. opposite.....98. GARRYACEÆ.
    - CC. Ovule 1 in each cell.
      - D. Raphe toward axis: ovary 1-celled: fls. in heads: lvs. alternate.....99. NYSSACEÆ.
      - DD. Raphe lateral: ovary 1-2-celled; fls. in cymes: lvs. alternate....100. ALANGIACEÆ.
      - DDD. Raphe exterior: ovary 1-5-celled: fls. in heads or cymes: lvs. opposite or alternate.....101. CORNACEÆ.

**Subclass 2. GAMOPETALÆ.** Calyx and corolla both present, the petals usually more or less united; stipules present only in the Rubiaceæ and Loganiaceæ, rarely in the Caprifoliaceæ; corolla polypetalous in some Ericaceæ, in Monotropaceæ, Pyrolaceæ, Clethraceæ, some Styrraceæ and Oleaceæ; also in Galax, Staticæ, Lysimachia; corolla gamopetalous in some Fouquieriaceæ, Stackhousiaceæ, Leguminosæ, Fumariaceæ, Polygalaceæ, and Oxalidaceæ of the Polypetalæ.

**Series 1. INFERÆ.** Ovary inferior (see Ericaceæ); stamens as many as lobes of the corolla, rarely fewer.

**Cohort 1. RUBIALES.** Stamens affixed to the corolla: ovary 2- $\infty$ -celled; cells 1- $\infty$ -ovuled: lvs. opposite or whorled.

- A. Fls. regular or irregular: stipules usually absent.....102. CAPRIFOLIACEÆ.
- AA. Fls. regular: stipules present, interior intrapetalous, various in form, sometimes like the lvs. and disposed in the same whorl with them.....103. RUBIACEÆ.

**Cohort 2. ASTERALES.** Stamens affixed to corolla: ovary of the 2-merous pistil 1-celled, 1-ovuled.

- A. Anthers free: lvs. opposite or whorled.
  - B. Endosperm 0.....104. VALERIANACEÆ.
  - BB. Endosperm present.....105. DIPSACACEÆ.
- AA. Anthers united in a ring around the style except in a few genera: lvs. alternate or opposite.....106. COMPOSITEÆ.

**Cohort 3. CAMPANALES.** Stamens usually free from the corolla: ovary 2-6-celled; the cells usually  $\infty$ -ovuled: lvs. usually alternate.

107. CAMPANULACEÆ.  
(Incl. Lobeliaceæ.)

**Series 2. HETEROMERÆ.** Ovary usually superior: stamens free from the corolla, or opposite the lobes or twice as many, or  $\infty$ , or, if borne on the corollan, the alternate with its lobes and equal in number to them; carpels more than 2.



**Cohort 1. ERICALES.** Stamens twice as many as the corolla-lobes, or as many and opposite them: ovary 2- $\infty$ -celled; ovules numerous (except in Epacridaceae): fr. fleshy or berry-like.

- A. Anthers dehisce by an apical crack or pore, often produced into a tube; stamens usually 8 or 10 (5 in some Ericaceae).
- B. Chlorophyllous plants: polypetalous. 108. MONOTROPACEAE.
- BB. Chlorophyll-bearing plants.
  - C. Anthers inverted, at least at first; polypetalous.
    - D. Ovary 3-celled: shrubs. 109. CLETHRACEAE.
    - DD. Ovary 5-celled: low or acaulescent plants. 110. PYROLACEAE.
  - CC. Anthers erect; rarely polypetalous (Ledum). 111. ERICACEAE.
- AA. Anthers dehisce by longitudinal fissures (see also Epigaea); stamens 5.
  - B. Plants shrubs or trees: carpels 4-5. 112. EPACRIDACEAE.
  - BB. Plants low or acaulescent: carpels 3. 113. DIAPENSACEAE.

**Cohort 2. PRIMULALES.** Stamens as many as the corolla-lobes and opposite them; ovary 1-celled; placenta free-central or basal.

- A. Ovary 1-ovuled. 114. PLUMBAGINACEAE.
- AA. Ovary 2 to many-ovuled.
  - B. Fr. capsular: herbs. 115. PRIMULACEAE.
  - BB. Fr. indehiscent: trees or shrubs. 116. MYRSINACEAE.

**Cohort 3. EBENALES.** Stamens as many as lobes of the corolla and opposite them or twice as many, or  $\infty$ ; ovary 2- $\infty$ -celled; seeds usually few and rather large: woody.

- A. Fls. usually bisexual; stamens usually borne on the corolla.
  - B. Stamens 15- $\infty$ : ovary inferior, 2-5-celled. 117. SYMPLOCACEAE.
- BB. Stamens 5-10: ovary superior.
  - C. Ovary 1-celled at top. 118. STYRACACEAE.
  - CC. Ovary 4- $\infty$ -celled. 119. SAPOTACEAE.
- AA. Fls. dioecious; stamens usually free from corolla. 120. EBENACEAE.

**Series 3. BICARPELLATE.** Ovary usually superior: stamens alternate with corolla-lobes, as many as them or fewer: carpels 2, or rarely 1 or 3.

**Cohort 1. GENTIANALES.** Corolla regular: stamens alternate with corolla-lobes and equal to them in number, or, if fewer, usually alternate with carpels: lvs. usually opposite.

- A. Stamens 2, alternate with the carpels, rarely 4; stigma terminal; ovary 2-celled; ovules affixed to septum: rarely herbaceous. 121. OLEACEAE.
- AA. Stamens and corolla-lobes usually 5, sometimes 4, rarely  $\infty$ .
  - B. Ovary usually compound, with 2 or 3 (rarely 4 or 5) cells or placentae.
  - C. Caps. mostly 2-celled: lvs. connected by transverse lines or stipules. 122. LOGANIACEAE.
  - CC. Caps. mostly 1-celled, with parietal placenta: lvs. not connected as above. 123. GENTIANACEAE.
- BB. Ovaries 2, usually becoming follicles.
  - C. Anthers permanently attached to a large stigmatic body; pollen mostly in waxy masses. 124. ASCLEPIADACEAE.
  - CC. Anthers distinct or merely connivent; pollen ordinary. 125. APOCYNACEAE.

**Cohort 2. POLEMONIALES.** Corolla regular: stamens as many as lobes of corolla: lvs. usually alternate: ovary 1- $\infty$ -ovuled.

- A. Pistil 3-merous; corolla-lobes convolute. 126. POLEMONIACEAE.
- AA. Pistil not 3-merous.
  - B. Corolla-lobes imbricated or rarely convolute.
    - C. Style usually deeply 2-cut, or even split into 2 distinct styles: caps. 1-celled, 2-valved, with 2 parietal or introflexed placenta, or sometimes 2-celled. 127. HYDROPHYLLACEAE.
  - CC. Style usually entire or shortly 2-cut, rarely otherwise; ovary 4-ovuled, usually 4-lobed and maturing as 4 separate or separable nutlets; or not lobed, 3-4-celled, and separating when ripe into 2 or 4 nutlets. 128. BORAGINACEAE.
- BB. Corolla-limb more or less plicate or rarely imbricate.
  - C. Ovary 2-celled (sometimes 3- or spuriously 4-celled, becoming a globular 4-6-seeded caps.: seeds basal. 129. CONVULVULACEAE.

- CC. Ovary 2-celled (rarely 3-5-celled), with numerous ovules on expanded axillary placenta, becoming a pod or berry. 130. SOLANACEAE.
- CCC. Ovary 5-30-celled, 5-30-lobed, often transversely as well as longitudinally so. 131. NOLANACEAE.

**Cohort 3. PERSONALES.** Corolla usually irregular or oblique: posterior stamen differing from the others, abortive or even absent: carpels  $\infty$ -ovuled, or with 2 ovules, one above the other.

- A. Seeds usually with endosperm: ovary perfectly 2-celled; placenta central. 132. SCROPHULARIACEAE.
- AA. Seeds without endosperm. [CEAE.]
  - B. Plants insectivorous, often aquatic: ovary 1-celled, globose, with a free-central or basal placenta. 133. LENTIBULARIACEAE.
- BB. Plants not insectivorous; not aquatic. [CEAE.]
  - C. Seeds winged: ovary 2-, rarely 1-, celled: trees or climbing shrubs. 134. BIGNONIACEAE.
- CC. Seeds not winged.
  - D. Ovary 1-celled or falsely 2-4-celled.
    - E. Fr. straight or spiral. 135. GESNERIACEAE.
    - EE. Fr. falcate-rostrate. 136. MARTYNIACEAE.
  - DD. Ovary 2-4-celled.
    - E. Plant very mucilaginous: no hooks among seeds: fr. often hooked or spiny. 137. PEDALIACEAE.
    - EE. Plants not conspicuously mucilaginous: hooks in caps. aiding in seed-dissemination. 138. ACANTHACEAE.

**Cohort 4. LAMIALES.** Corolla usually irregular or oblique: posterior stamen smaller than the others, usually abortive or quite deficient: carpels with 2 ovules placed side by side, or else 1-ovuled

- A. Fr. not divided into 4 nutlets: ovary not 4-lobed.
  - B. Ovary 1-celled, 1-ovuled.
    - C. Fls. in heads: plant often heath-like. 139. GLOBULARIACEAE.
    - CC. Fls. in slender interrupted spikes. 140. PHRYMACEAE.
  - BB. Ovary 2-10-celled.
    - C. Cells with 2-10 ovules: trees or shrubs. 141. MYOPORACEAE.
    - CC. Cells with 1 ovule: herbs or shrubs. 142. VERBENACEAE.
- AA. Fr. divided into 4 nutlets: ovary 4-lobed. 143. LABIATEAE.

**Anomalous Family.** Remarkable for its scarious 4-lobed corolla: stamens few; ovary 1-4-celled: fr. a circumscissile caps., or rarely indehiscent; seeds peltate. 144. PLANTAGINACEAE.

**Subclass 3. APETALE OR MONOCHLAMYDEAE.** Corolla wanting or undifferentiated from the calyx (except in some Euphorbiaceae and one genus of Phytolaccaceae), and sometimes also the calyx wanting; perianth simple, the lobes or segms. in 1 or 2 series, similar among themselves and usually calyx-like, sometimes minute or wanting. (See also Ranunculaceae, Flacourtiaceae, Menispermaceae, Trochodendraceae, Rosaceae, Lythraceae, Onagraceae, Hamamelidaceae, Rutaceae, Aceraceae, Rhamnaceae, Eucornaceae, Cornaceae, and Caryophyllaceae with corolla sometimes absent.)

**Series 1. CURVEMBRYEAE.** Embryo curved, excentric, lateral or peripheral, rarely straightish, subcentral and narrow (Polygonaceae); ovule solitary in the ovary or in each carpel or in the Amarantaceae more than 2 ovules erect in the center of the cell: fls. bisexual or, in a few genera, unisexual or polygamous; petals very rarely present; stamens as many as the perianth-segms. or fewer, rarely more.

- A. Fr. the hardened or membranous closed base of the corolla-like perianth with a utricle inclosed. 145. NYCTAGINACEAE.
- AA. Fr. a utricle; ovule not orthotropous; embryo annular or spiral: perianth mostly persistent, small 4-5-lobed, or parted, or 0.
  - B. Perianth herbaceous, or scarious at the margin, persistent; stamens perigynous; style branched or styles 2-3: stipules scarious. (Illecebreaceae, incl. in Caryophyllaceae).
  - BB. Perianth dry, chaff-like, not herbaceous, subtended by a bract and 2 bractlets; stamens hypogynous or perigynous; filaments connate at base; style simple or 2-3-fid: stipules 0. 146. AMARANTACEAE.
- BBB. Perianth-lobes or segms. membranous or herbaceous; stamens hypogynous or perigynous, nearly always free; style simple or 2-3-lobed, or styles 2-5: stipules none. 147. CHENOPODIACEAE.

- AAA. Fr. composed of 1 to several carpels, which are crowded or connate in a ring, each with a style, baccate, coriaceous or samaroid; ovule not orthotropous; embryo coiled; stamens hypogynous; perianth herbaceous or coriaceous, rarely membranous.....148. **PHYTOLACCACEÆ.**
- AAAA. Fr. an achene, triangular or lens-shaped; style branched or styles 2-3; ovule orthotropous; embryo straight; perianth herbaceous, membranous or colored, rarely adherent to base of ovary; usually a stipular sheath at each lf.-node.....149. **POLYGONACEÆ.**

**Series 2. MULTIOVULATÆ TERRESTRES.** Terrestrial herbs or shrubs, often climbers: ovary syncarpous; ovules in each cell or on each placenta numerous.

- A. Fls. dioecious; ovary superior; lvs. bearing tendrils and pitchers.....150. **NEPENTHACEÆ.**
- AA. Fls. bisexual; ovary inferior: lvs. without tendrils and pitchers.....151. **ARISTOLOCHIA-  
[CEÆ.]**

**Series 3. MICREMBRYEÆ.** Ovary syncarpous, monocarpous or apocarpous; ovules solitary for each carpel, rarely 2 or few; endosperm copious, fleshy or mealy; embryo minute.

- A. Perianth 0.  
B. Lvs. alternate: carpels 3-4; ovules 2 to several; stamens 3-6.....152. **SAURURACEÆ.**
- BB. Lvs. alternate, rarely opposite or whorled; carpel 1; ovule 1, basal; stamens 2-8.....153. **PIPERACEÆ.**
- BBB. Lvs. opposite: carpel 1; ovule 1, pendent; stamens 1-3.....154. **CHLORANTHACEÆ.**
- AA. Perianth calyx-like.  
B. Carpel solitary: perianth of 3 parts, connate.....155. **MYRISTICACEÆ.**
- BB. Carpels several, together with the stamens scattered over the face of the cup-shaped receptacle.....156. **MONIMIACEÆ.**

**Series 4. DAPHNEÆ.** Ovary monocarpous, 1-celled, rarely syncarpous with 2-4 cells; ovules solitary, or twin and side by side in the ovary or in each cell, rarely a few pairs superposed.

- A. Radicle superior; ovule solitary, pendulous.  
B. Anthers dehiscing by uplifting valves, rarely laterally dehiscent; perianth-tube short, lobes 6 or 4, in 2 series, usually imbricated; ovary 1-celled; woody.....157. **LAURACEÆ.**
- BB. Anthers normal: perianth-tube long; lobes 4-5, imbricated; ovary 1-2-celled; woody.....158. **THYMELÆACEÆ.**
- AA. Radicle inferior.  
B. Perianth-tube cylindraceous; lobes 4, valvate; stamens as many and opposite them: ovule erect or pendulous, or geminate, rarely  $\infty$ .....159. **PROTEACEÆ.**
- BB. Perianth-tube medium, constricted above the ovary, persistent at base, deciduous above; lobes 2 or 4; stamens twice as many as the lobes; silvery-scaly plants; woody.....160. **ELÆAGNACEÆ.**

**Series 5. ACHLAMYDOSPOREÆ.** Ovary 1-celled; cells 1-3-ovuled; cells and ovules often inconspicuous before anthesis; endosperm of seed without a coat, either free in the pericarp or attached to its walls; plants often parasitic.

- A. Ovule 1, not easily distinguishable from ovary.....161. **LORANTHACEÆ.**
- AA. Ovules 1-3, pendulous from summit of free-central placenta.....162. **SANTALACEÆ.**

**Series 6. UNISEXUALEÆ.** Fls. unisexual; ovary syncarpous or monocarpous; ovule solitary or in pairs side by side in the ovary or in each cell; trees or shrubs, rarely herbs.

- A. Ovary 1-celled.  
B. Ovule solitary; stamens 2 to many.  
C. Fls. of both sexes in globose long-peduncled pendent heads, crowded very densely on a central receptacle; radicle inferior; woody.....163. **PLATANACEÆ.**
- CC. Fls. not as above; radicle superior.  
D. Male perianth free from the bract; stamens as many as its lobes and opposite them, or by abortion fewer, rarely numerous.  
E. Stamens uncoiling elastically.  
F. Ovule suspended, anatropous.....164. **MORACEÆ.**
- FF. Ovule basal, orthotropous.....165. **URTICACEÆ.**

- EE. Stamens not elastic: ovule suspended, anatropous.....166. **ULMACEÆ.**
- DD. Male perianth wanting, sometimes grown to the bract in Juglandaceæ; stamens  $\infty$ , often 2 in Myricaceæ.  
E. Lvs. pinnate: male fls. in catkins; woody.....167. **JUGLANDACEÆ.**
- EE. Lvs. simple: male infl. spicate, subamentaceous; woody.  
F. Carpel 1; placenta parietal: ovule amphitropous.....168. **LEITNERIACEÆ.**
- FF. Carpels 2; placenta basal: ovule orthotropous.....169. **MYRICACEÆ.**
- BB. Ovules 2; stamen 1: equisetum-like plants; woody.....170. **CASUARINACEÆ.**
- AA. Ovary 2-3-celled, rarely more-celled.  
B. Endosperm usually copious; fr. usually separating into 2-valved berries, sometimes fleshy and indehiscent, or various: infl. various.  
C. Hypogynous disk present; micropyle externally directed; juice often milky.....171. **EUPHORBIACEÆ.**
- CC. Hypogynous disk absent: micropyle toward axis; no milky juice.....172. **BUXACEÆ.**
- BB. Endosperm 0; fr. a nut; male infl. usually in catkins; woody.  
C. Carpels 2; pistillate fls. usually in spikes.....173. **BETULACEÆ.**
- CC. Carpels 3; pistillate fls. not in spikes.....174. **FAGACEÆ.**

**Series 7. Anomalous Families.** Somewhat related to the Unisexuales.

- A. Fls. in catkins: caps. 2-4-valved; woody.....175. **SALICACEÆ.**
- AA. Fls. axillary, or rarely in a terminal head: drupe 2- $\infty$ -stoned, stones 1-seeded; low shrubs.....176. **EMPETRACEÆ.**

**Class 2. GYMNOSPERMÆ.** Ovules naked upon a scale, bract or disk: cotyledons 2 or more; fls. unisexual.

- A. Lvs. undivided.  
B. The lvs. fan-shaped: fls. in pairs.....177. **GINKGOACEÆ.**
- BB. The lvs. not fan-shaped.  
C. Perianth present: no resin-tubes, but true vessels in wood.....178. **GNETACEÆ.**
- CC. Perianth wanting: no true vessels, but resin-tubes present.  
D. Ovule solitary, arillate.....179. **TAXACEÆ.**
- DD. Ovules in cones, not arillate.....180. **PINACEÆ.**
- AA. Lvs. pinnatisect, ample, crowded at apex of the woody st.: fls. of both sexes in cones.....181. **CYCADACEÆ.**

**Subdivision 2. MONOCOTYLEDONS.** St. without central pith or annular layers, but having the woody bundles distributed irregularly through it (a transverse section showing the bundles as dots scattered through the cellular tissue); embryo with a single cotyledon: early lvs. always alternate: parts of the fl. usually in 3's, never in 5's; lvs. mostly parallel-veined.

**Series 1. MICROSPERMÆ.** Perianth corolla-like, at least inside; ovary inferior, 1-celled with 3 parietal placentæ, or rarely 3-celled with axile placenta: seeds very small and numerous; without endosperm.

- A. Fls. regular, usually unisexual; stamens usually 2, 6, or 9; aquatic herbs.....182. **HYDROCHARI-  
[TACEÆ.]**
- AA. Fls. usually very irregular; stamens and styles connate into a column; anther 1, rarely 2: terrestrial or epiphytic herbs, rarely climbers.....183. **ORCHIDACEÆ.**

**Series 2. EPIGYNEÆ.** Perianth corolla-like, at least within: ovary generally inferior: endosperm copious.

- A. Fls. normally unisexual; stamens 6, or those opposite the inner perianth-lobes imperfect or deficient; ovary 3-celled; seeds 2.....184. **DIOSCOREACEÆ**
- AA. Fls. normally bisexual, sometimes polygamous or otherwise.  
B. Stamens regular, perianth regular or nearly so: embryo small, included in the endosperm.  
C. Ovary 1-celled; endosperm solid; embryo minute: stamens 6, hooded.....185. **TACCACEÆ.**
- CC. Ovary usually 3-celled.  
D. Stamens 3, opposite the outer lobes: endosperm horny.....186. **IRIDACEÆ.**
- DD. Stamens 6, rarely 3 and opposite the inner lobes, rarely  $\infty$ ; endosperm fleshy.  
E. Placentæ scarcely intruding.....187. **AMARYLLIDACEÆ.**



- EE. Placentæ intruding lamella-like, and peltate.....188. VELLOSIACEÆ.
- BB. Stamens 1 or 5 perfect, the other 5 or 1, variously changed into antherless staminodia; fls. irregular: embryo in a central canal of endosperm, straight, incurved, or horseshoe-shaped.
- C. Fertile stamens 5.....189. MUSACEÆ.
- CC. Fertile stamen 1.
- D. Staminodium 1, often traces of more; a ligule at top of petiole; anther 2-celled.....190. ZINGIBERACEÆ.
- DD. Staminodia 5; no ligule; anther 1-celled.
- E. Ovary-cells 1-seeded: a joint at summit of petiole.....191. MARANTACEÆ.
- EE. Ovary-cells  $\infty$ -seeded: no joint.....192. CANNACEÆ.
- BBB. Stamens regular or nearly so: perianth regular: embryo in a small marginal cave or pit of endosperm, rarely much intruded, never wholly included.
- C. Endosperm mealy: perianth calyx-like outside; stamens 6: lvs. rigid.....193. BROMELIACEÆ.
- CC. Endosperm fleshy: perianth corolla-like or woolly outside; stamens sometimes 6 and equal, sometimes 1-3 and slightly dissimilar, or 3 opposite the inner lobes.
- (Hæmendoraceæ, mostly incl. in Liliaceæ and Amaryllidaceæ.)

**Series 3. CORONARIÆ.** Perianth corolla-like, at least inside: ovary free, rarely shortly adnate at the base: endosperm copious.

- A. Embryo minute or more or less elongated, included in fleshy or horny endosperm: perianth regular: stamens 6: ovary usually 3-celled.....194. LILIACEÆ.
- AA. Embryo straight, in a central canal of mealy endosperm: perianth regular or irregular, from a spathe; stamens 3 or 6: ovary 1- or 3-celled.....195. PONTEDERIACEÆ.
- AAA. Embryo marginal, lying in mealy endosperm and under a little callosity of the seed-coat: perianth regular or slightly irregular, of 3 herbaceous sepals and 3 deliquescent colored petals: some stamens usually sterile and altered; stamen-hairs conspicuous.....196. COMMELINACEÆ.

**Series 4. CALYCINÆ.** Perianth calyx-like, small, somewhat rigid or glumaceous, or rarely herbaceous: ovary free; endosperm copious.

- A. Fr. a 3-valved, many-seeded caps; embryo included in more or less fleshy endosperm: plant grass-like.....197. JUNCACEÆ.
- AA. Fr. berry- or drupe-like, 1-seeded, rarely 2-3-seeded; embryo immersed in a small pit near the periphery of the endosperm: palm-like plants.....198. PALMACEÆ.

**Series 5. NUDIFLORE.** Perianth 0, or reduced to scales or bristles; ovary superior; carpels solitary or, if more, syncarpous, 1- $\infty$ -ovuled: seeds usually with endosperm.

- A. Plants minute, thalloid, 1-3 lines wide, aquatic: fls. solitary or in pairs from marginal fissures.....199. LEMNACEÆ.
- AA. Plants larger: fls. on spadices.
- B. Fls. dioecious; perianth 0; carpels usually confluent in clusters; spadices clustered or paniced: stiff plants.....200. PANDANACEÆ.
- BB. Fls. dioecious, or monœcious in different spadices; perianth 0, or the short segms. distinct or connate; spadices solitary: stiff plants.....201. CYCLANTHACEÆ.
- BBB. Fls. monœcious in different spadices, rarely dioecious; perianth reduced to membranous scales or thread-like chaff; spadices rarely solitary: reed-like marsh plants.....202. TYPHACEÆ.
- BBBB. Fls. bisexual, or monœcious in same spadix, rarely dioecious; perianth 0, or of 4 membranous or fleshy imbricate scales; spadices solitary: herbaceous or fleshy plants.....203. ARACEÆ.

**Series 6. APOCARPÆ.** Perianth in 1-2 series, or 0: ovary superior; carpels solitary, or, if more, distinct: seeds without endosperm.

- A. Embryo complicate or horseshoe-shaped: perianth-segms. 6, in 2 series, the inner petaloid.
- B. Ovules 1, rarely 2-5, basal.....204. ALISMACEÆ.

- BB. Ovules numerous, borne between the margins and midrib of the carpel....205. BUTOMACEÆ.
- AA. Embryo curved: perianth of 4 herbaceous segms., or 0: ovule solitary....206. NAIADACEÆ.
- AAA. Embryo straight: perianth of several petaloid parts: ovules 2-6.....207. APONOGETONACEÆ.

**Series 7. GLUMACEÆ.** Fls. disposed in spikes or spikelets which are variously arranged; bracts of the spikelet scale-like (glumes), usually imbricate; perianth-segms. small, scale-like, bristle-like, or 0; ovary 1-celled, 1-ovuled: seeds with endosperm.

- A. Fr. an achene; seed free from the pericarp; palea and lodicules 0.....208. CYPERACEÆ.
- AA. Fr. a caryopsis; seed usually adherent to pericarp; palea and lodicules present.....209. GRAMINEÆ.

Other families, of which plants are more or less in cultivation and described in this Cyclopædia, are: Adoxaceæ (Adoxa), Basellaceæ (Anredera), Candolleaceæ (Candollea), Caryocaraceæ (Caryocarp), Datisaceæ (Datisca), Frankeniaceæ (Frankenia), Goodeniaceæ (Goodenia, Scævola), Incacinaceæ (Pyrenacantha), Orobanchaceæ (Aphyllon), Restiaceæ (Restio), Turneraceæ (Turnera), Vochysiaceæ (Vochysia).

**Division 2. PTERIDOPHYTA.** Bearing spores instead of seeds, but with a usually separate more insignificant stage which bears sexual organs. Ferns, lycopods, horsetails and the like.

- A. Plants like large moss-plants, with scale- or needle-like lvs.
- B. Spores all alike, minute.....210. LYCOPODIACEÆ.
- BB. Spores of two kinds, larger (megaspores) and smaller (microspores).211. SELAGINELLACEÆ.
- AA. Plants consisting mainly of slender-jointed herbaceous sts. with whorls of scale-like appressed lvs. at the joints.....212. Equisetaceæ.
- AAA. Plants true ferns, with usually expanded lvs. (Azolla, a moss-like water-plant is exceptional.) (Filicales.)
- B. Ferns epiphytic or terrestrial (one Ceratopteris partly aquatic): spores uniform, minute.
- C. Sporangia with thick walls, arising from tissues beneath the epidermis.
- D. The sporangia in spikes or panicles.....213. OPHIOGLOSSACEÆ.
- DD. The sporangia in round or oval sori on under surface of ordinary lf.....214. MARATTIACEÆ.
- CC. Sporangia walls only 1 cell thick, derived from epidermis.
- D. Small membranous ferns: sporangia borne on thread-like projections along margin of lvs.....215. HYMENOPHYLLACEÆ.
- DD. Usually larger, thicker-lvd. ferns: sporangia not on thread-like projections. [ACEÆ]
- E. Plants terrestrial.
- F. Ring of sporangia obsolete; sporangia in panicles.....216. OSMUNDACEÆ.
- FF. Ring of sporangia apical; sporangia ovate, sessile.....217. SCHIZACEÆ.
- FFF. Ring of sporangia vertical.
- G. The sporangia mostly long-stalked: lvs. pinnate or palmate.....218. POLYPODIACEÆ.
- GG. The sporangia mostly sessile or very short-stalked.
- H. Sporangia in sori of 2-8, radiating in a single plane; lf. branching often dichotomous; growth indeterminate.....219. GLEICHENIACEÆ.
- HH. Sporangia numerous in the globose sori: mostly arborescent.....220. CYATHEACEÆ.
- EE. Plants aquatic, with floating sterile lvs. and pod-like sporophylls: sporangia sessile with broad ring or 0....221. CERATOPTERIDACEÆ.
- BB. Ferns, aquatic, urn-like in appearance; spores of 2 sorts,—large macrospores and minute microspores.
- C. Plants floating: lvs. simple, folded: microspores and macrospores in separate sporocarps.....222. SALVINIACEÆ.
- CC. Plants rooting in mud: lvs. quadrifoliate, cloverlike: microspores and macrospores in the same sporocarp.....223. MARSILEACEÆ.

## PART II.—KEY TO THE GENERA

## 1. RANUNCULACEÆ.

- A. Sepals usually valvate; lvs. opposite..... 1. *Clematis*.  
 AA. Sepals imbricate.  
 B. Carpels 1-ovuled; fr. an indehiscent schene.  
 C. Ovule pendulous; raphe dorsal.  
 D. Petals conspicuous..... 2. *Adonis*.  
 DD. Petals 0, or very small.  
 E. Fls. not subtended by involucre..... 3. *Thalictrum*.  
 EE. Fls. subtended by involucre remote from the calyx or close under it.  
 F. Involucre remote from calyx..... 4. *Anemone*.  
 FF. Involucre of 3 simple, sessile lvs. closer under the fl..... 5. *Hepatica*.  
 FFF. Involucre of 3 compound sessile lvs..... 6. *Syndesmon*.  
 CC. Ovules ascending.  
 D. Petals wanting..... 7. *Troutvel-  
[teria]*.  
 DD. Petals 3 to many..... 8. *Ranunculus*.  
 BB. Carpels several- or many-ovuled; fr. usually dehiscent at maturity, rarely berry-like.  
 C. Petals large and showy..... 9. *Paeonia*.  
 CC. Petals medium small, deformed, or 0.  
 D. Fls. irregular.  
 E. Posterior sepal forms a spur..... 10. *Delphinium*.  
 EE. Posterior sepal forms a hood..... 11. *Aconitum*.  
 DD. Fls. regular.  
 E. Infl. racemose.  
 F. Stamens 5 or 10; shrubs..... 12. *Xanthorrh-  
[iza]*.  
 FF. Stamens numerous; herbs.  
 G. Fr. a berry..... 13. *Actæa*.  
 GG. Fr. consisting of follicles, dehiscent..... 14. *Cimicifuga*.  
 EE. Infl. paniculate, or fls. solitary.  
 F. Lvs. palmately veined or cut; not ternate.  
 G. Petals wanting.  
 H. Ovules many, in 2 series along the ventral suture..... 15. *Caltha*.  
 HH. Ovules only 2..... 16. *Hydrastis*.  
 GG. Petals small or narrow; mostly nectar-bearing.  
 H. Sepals commonly deciduous; petals not 2-lipped, nor scale-bearing..... 17. *Trollius*.  
 HH. Sepals persistent; broad petals 2-lipped or bearing a scale..... 18. *Helleborus*.  
 HHH. Sepals deciduous, narrow; petals bearing a scale..... 19. *Eranthis*.  
 FF. Lvs. ternately or subpinnately decompound.  
 G. Sepals 5-6.  
 H. Petals spurred..... 20. *Aquilegia*.  
 HH. Petals not spurred; often small or 0.  
 I. The carpels connate at the base or higher..... 21. *Nigella*.  
 II. The carpels free.  
 J. Carpels stalked..... 22. *Coptis*.  
 JJ. Carpels not stalked..... 23. *Isopyrum*.  
 GG. Sepals and petals numerous..... 24. *Anemonop-  
[sis]*.

The genus *Callianthemum* is also in cultivation.

## 2. DILLENIACEÆ.

- A. Anthers adnate, linear; carpels 5-20, partly connate; upright trees or shrubs..... 1. *Dillenia*.  
 AA. Anthers oblong or rarely orbicular, the cells parallel and contiguous..... 2. *Hibbertia*.  
 AAA. Anthers versatile, emarginate at the base; carpels completely connate; fr. a berry; twining shrubs.  
 B. Stamens and carpels  $\infty$ ; winter-buds inclosed in the swollen base of the petiole..... 3. *Actinidia*.  
 BB. Stamens 10; carpels 5; winter-buds free..... 4. *Clemato-  
[clethra]*.

## 3. CALYCANTHACEÆ.

- A. Stamens 10- $\infty$ ; all sepals brownish red..... 1. *Calycanthus*.  
 AA. Stamens 5; outer sepals white, inner purple..... 2. *Meratia*.

## 4. MAGNOLIACEÆ.

- A. Stamens  $\infty$ ; perianth-segms. 6- $\infty$ .  
 B. Fls. bisexual; upright trees or shrubs.  
 C. Stipules 0..... 1. *Illicium*.

- CC. Stipules present, inclosing young lvs. in the bud.  
 D. Anthers face out..... 2. *Lirioden-  
[dron]*.  
 DD. Anthers face in.  
 E. Structure bearing the carpels stalked..... 3. *Michelia*.  
 EE. Structure bearing the carpels sessile.  
 F. Dehiscence of carpel circumscissile..... 4. *Talauma*.  
 FF. Dehiscence 2-valved..... 5. *Magnolia*.  
 BB. Fls. unisexual; twining shrubs.  
 C. Carpels after anthesis spicate..... 6. *Schizandra*.  
 CC. Carpels after anthesis globose-capitate..... 7. *Kadsura*.  
 AA. Stamens 4; perianth-segms. 4; fls. in slender spikes, small; lvs. palminerved; tree..... 8. *Tetracen-  
[tron]*.

Members of the genus *Drimys* are sometimes cultivated.

## 5. TROCHODENDRACEÆ.

- A. Carpels 5-8, sessile, with many seeds; fls. perfect; evergreen tree..... 1. *Trochoden-  
[dron]*.  
 AA. Carpels  $\infty$ , stipitate, developing into winged nutlets with 1 or few seeds; fls. polygamous; deciduous tree..... 2. *Euptelea*.

## 6. CERCIDIPHYLLACEÆ.

The only genus..... *Cercidiphyllum*.

## 7. EUCOMMACEÆ.

The only genus..... *Eucommia*.

## 8. ANNONACEÆ.

- A. Fr. an aggregation of many carpels closely crowded into a spheroid or ovoid mass; ovules solitary.  
 B. Carpels fused together with the receptacle (torus) into a fleshy (often edible) syncarpium.  
 C. Corolla gamopetalous, 3-lobed or 3-spurred, almost closed, with only a minute opening above the stamens and pistils..... 1. *Rollinia*.  
 CC. Corolla polypetalous; petals 6 in 2 series, inner series sometimes minute or even wanting, outer petals valvate..... 2. *Annona*.  
 BB. Carpels distinct, rigid, polygonal, becoming detached from the receptacle when mature; corolla polypetalous, the petals imbricate or overlapping..... 3. *Duguetia*.  
 AA. Fr. a cluster of distinct carpels, usually stipitate, never crowded so closely as to become polygonal or prism-shaped; ovules geminate or many in 1 or 2 series.  
 B. Ovules geminate, vertical, parallel..... 4. *Artabotrys*.  
 BB. Ovules horizontal or in 2 vertical rows.  
 C. Petals narrow, long, strap-shaped..... 5. *Canangium*.  
 CC. Petals suborbicular to obovate-oblong.  
 D. Inner petals with their margins involute, ear-shaped or boat-shaped..... 6. *Cymbopet-  
[alum]*.  
 DD. Inner petals with margins not involute..... 7. *Asimina*.

*Fusæa*, *Unona*, *Uvaria*, and *Xylopia* are also slightly in cultivation.

## 9. MENISPERMACEÆ.

- A. Filaments coalesced into a column which is subpetalate at apex.  
 B. Sepals 6; petals 0..... 1. *Anamirta*.  
 (See article *Cocculus*.)  
 BB. Sepals 4; petals grown together, making a small cup..... 2. *Cissampelos*.  
 AA. Filaments free, either at base or apex.  
 B. Stamens 9-20.  
 C. Sepals and petals 6, in whorls; stamens 9-12..... 3. *Sinomen-  
[ium]*.  
 CC. Sepals and petals irregularly arranged; sepals 4-10; petals 6-9; stamens 12-24..... 4. *Menisper-  
[mum]*.  
 BB. Stamens 6.  
 C. Petals 6, shorter than sepals, stamens high-monoadelphous..... 5. *Cocculus*.  
 CC. Petals 0, unless the 3 inner and larger sepals are regarded as petals; outer stamens free..... 6. *Abuta*.

*Calyocarpum* and *Jatrochirrhiza* are sometimes cultivated.



## 10. BERBERIDACEÆ.

- A. Venation or lobing pinnate; lvs. penninerved, pinnatisect, pinnately 2-3-ternate or compound.  
 B. Ovules few, erect from the base.  
 C. Plants are shrubs.  
 D. Foliage-lvs. simple, often fascicled; branches usually bearing reduced spine-lvs. .... 1. *Berberis*.  
 DD. Foliage-lvs. pinnate; evergreen branches unarmed.  
 E. Lfts. serrate; lvs. simply pinnate. .... 2. *Mahonia*.  
 EE. Lfts. entire; lvs. 2-3-pinnate. .... 3. *Nandina*.  
 CC. Plants are herbs.  
 D. Petals 6, reduced to small nectaries. .... 4. *Leontice*.  
 DD. Petals 6, scarcely smaller than sepals and flat. .... 5. *Leontice*, § [*Bongardia*].  
 BB. Ovules placed ventrally in 2 series; herbs.  
 C. Sepals 12-15; petals 0, reduced to nectaries. .... 6. *Vancouveria*.  
 CC. Sepals 8; petals 4, reduced to nectaries. .... 7. *Epimedium*.  
 CCC. Sepals 7-8; petals 4, a little smaller; flat. .... 8. *Aceranthus*.  
 AA. Venation or lobing palmate; lvs. palminerved, palmilobed, or 2-parted.  
 B. Sepals 6; petals 6; ovules in 2 series. .... 9. *Diphylleia*.  
 BB. Sepals 6; petals 6-9; ovules in many series. .... 10. *Podophyl- lum*.  
 BBB. Sepals 4; petals 8. .... 11. *Jeffersonia*.  
 BBBB. Sepals and petals 0. .... 12. *Achlys*.

The species of *Caulophyllum* may be expected in wild gardens.

## 11. LARDIZABALACEÆ.

- A. Lvs. pinnate; upright shrub. .... 1. *Decaisnea*.  
 AA. Lvs. digitate; twining shrubs.  
 B. Carpels 3, many-seeded.  
 C. Stamens monadelphous.  
 D. Sepals 6; petals 6, much smaller. .... 2. *Lardizabala*.  
 DD. Sepals 6; petals 0. .... 3. *Stauntonia*.  
 CC. Stamens free.  
 D. Sepals 6; petals 6.  
 E. Pedicels elongated; sepals acuminate; connective produced above the anthers. .... 4. *Holboellia*.  
 EE. Pedicels short; sepals rounded; connective not produced; racemes very long. .... 5. *Sinofranchetia*.  
 DD. Sepals 3; petals 0. .... 6. *Akebia*.  
 BB. Carpels ∞, 1-seeded; stamens free; lvs. deciduous. .... 7. *Sargentodoxa*.

## 12. NYMPHÆACEÆ.

- A. Fls. small ( $\frac{1}{2}$ -1 in.).  
 B. Stamens 3-6; submerged lvs. dissected. .... 1. *Cabomba*.  
 BB. Stamens 12-25; lvs. all petulate. .... 2. *Brasenia*.  
 AA. Fls. large and showy ( $1\frac{1}{2}$ -12 in.); sepals 4-5; petals and stamens ∞.  
 B. Carpels in pits in a top-shaped receptacle. .... 3. *Nelumbo*.  
 BB. Carpels forming a distinct many-seeded ovary.  
 C. Plants prickly.  
 D. Stamens, inner ones, sterile. .... 4. *Victoria*.  
 DD. Stamens all fertile. .... 5. *Euryale*.  
 CC. Plants not prickly.  
 D. Ovary wholly free and superior. .... 6. *Nuphar*.  
 DD. Ovary with stamens and inner petals inserted on it. .... 7. *Nymphaea*.

## 13. SARRACENIACEÆ.

- A. Style umbrella-shaped. .... 1. *Sarracenia*.  
 AA. Style 5-cut at apex. .... 2. *Darlingtonia*.

*Heliamphora* may be expected in choice botanical collections.

## 14. PAPAVERACEÆ.

- A. Stigmas distinct; lvs. mainly opposite or whorled; sepals usually 3; petals usually 6, in 2 series; placenta never separate from the valves.  
 B. Lvs. lobed. .... 1. *Romneya*.  
 BB. Lvs. entire.  
 C. Filaments dilated; stigmas ∞, linear; fr. not capsular. .... 2. *Platystemon*.  
 CC. Filaments slightly dilated; stigmas 3, broader; fr. capsular. .... 3. *Platystigma*.

- AA. Stigmas confluent; lvs. alternate, ternately compound; sepals 2; petals 4; placenta remain attached to the margin of the valves.  
 B. Sepals coherent and covering fl. like a candle-extinguisher. .... 4. *Eschscholtzia*.  
 BB. Sepals separate.  
 C. Lobes of stigma 2, erect. .... 5. *Dendromecon*.  
 CC. Lobes of stigma 4, spreading. .... 6. *Hunneimannia*.  
 AAA. Stigmas confluent; lvs. alternate or mainly so; fls. rarely 3-merous; caps. dehiscing by pores or valves, the placenta remaining as a frame alternate with and free from the valves.  
 B. Caps. dehiscing by pores near the top. .... 7. *Papaver*.  
 BB. Caps. shortly dehiscing by valves.  
 C. Stigmatic lobes radiating on the depressed summit of a very short style. .... 8. *Argemone*.  
 CC. Stigmatic lobes radiating on the club-shaped top of a distinct style. .... 9. *Meconopsis*.  
 BBB. Caps. dehiscing by valves to the base or nearly so.  
 C. The caps. long and linear.  
 D. Seeds pitted. .... 10. *Glaucium*.  
 DD. Seeds crested. .... 11. *Chelidonium*.  
 CC. The caps. ovoid, oblong or cylindrical.  
 D. Petals 4.  
 E. Style distinct, but short. .... 12. *Stylophorum*.  
 EE. Style long. .... 13. *Eomecon*.  
 DD. Petals 8-12. .... 14. *Sanguinaria*.  
 DDD. Petals 0. .... 15. *Bocconia*.  
 Hypecoum is in the trade.

## 15. FUMARIACEÆ.

- A. Corolla 2-spurred or bigibbous, the 2 outer and larger (lateral) petals similar.  
 B. Seeds crestless; petals permanently united into a subcordate persistent corolla which incloses the ripe caps. .... 1. *Adlumia*.  
 BB. Seeds mostly crested; petals less or slightly united into a 2-spurred or bigibbous corolla. .... 2. *Dicentra*.  
 AA. Corolla with only 1 of the outer petals spurred or gibbous by torsion becoming posterior; a nectariferous spur from the base of the filaments projects into the petal-spur.  
 B. Style mostly persistent. .... 3. *Corydalis*.  
 BB. Style deciduous; fl. smaller. .... 4. *Fumaria*.

## 16. CRUCIFERÆ.

- A. The silique transversely 2-jointed.  
 B. Lower joint indehiscent pedicel-shaped, the larger joint globose, 1-loculed, 1-seeded. .... 1. *Crambe*.  
 BB. Lower joint dehiscent, 2-valved, many seeded. .... 2. *Morisia*.  
 AA. The silique not 2-jointed, indehiscent.  
 B. Siliques in pairs. .... 3. *Senebiera*.  
 BB. Siliques not in pairs.  
 C. Texture horny or bony. .... 4. *Isatis*.  
 CC. Texture leathery, or membranaceous.  
 D. Shape straight. .... 5. *Raphanus*.  
 DD. Shape curved. .... 6. *Sobolewskaia*.  
 DDD. Shape orbicular. .... 7. *Pellaria*.  
 AAA. The silique dehiscent for its whole length (except that some Brassicas are not dehiscent at the apex).  
 B. Valves markedly concave, compressed contrary to the septum, which is often very narrow; silique short.  
 C. Cotyledons accumbent.  
 D. Sts. leafy. .... 8. *Iberis*.  
 DD. Sts. scapes. .... 9. *Hutchinsia*.  
 CC. Cotyledons incumbent.  
 D. The valves usually wingless.  
 E. Fls. rosy or violet. .... 10. *Ionopsis*.  
 EE. Fls. white. .... 11. *Lepidium*.  
 DD. The valves winged. .... 12. *Ethionema*.  
 BB. Valves (transversely septiferous in *Anastatica*), flat or concave, not compressed contrary to the septum (*Smelowskia* and certain *Vesicarias* are laterally compressed); septum as wide as the valves; silique long or short.  
 C. Cotyledons longitudinally conduplicate.  
 D. Seeds in 1 series. .... 13. *Brassica*.  
 DD. Seeds in 2 series. .... 14. *Eruca*.  
 CC. Cotyledons accumbent (sometimes incumbent or convolute in *Cheiranthus*).  
 D. Seeds in 1 series (except certain species of *Radicula* and *Arabis*; siliques long and narrow (except in *Anastatica* and sometimes *Radicula* and *Parrya*).

- E. Valves appendaged**.....15. *Anastatica*.  
(See article Resurrection Plants.)
- EE. Valves not appendaged.**
- F. Stigmatic lobes erect, connate or decurrent along the style.**
- G. Plants are herbs or branched sub-shrubs; woolly**.....16. *Matthiola*.
- GG. Plants are tufted, scape-bearing herbs**.....17. *Parrya*.
- FF. Stigma undivided or shortly lobed.**
- G. Valves elastic; seeds in 1 or 2 series, siliqua long and linear**...18. *Arabis*.
- GG. Valves not elastic.**
- H. Sepals unequal, the lateral ones saccate at the base**...19. *Cheiranthus*.
- HH. Sepals equal.**
- I. Seeds in 2 series**.....20. *Radicula*.
- II. Seeds in 1 series.**
- J. Fls. yellow**.....21. *Barbarea*.
- JJ. Fls. white or purple.**
- K. Rhizome not scaly; valves delicately netted-nerved**.....22. *Cardamine*.
- KK. Rhizome scaly; valves with very delicate midrib**.....23. *Dentaria*.
- DD. Seeds in 2 series and siliques short and broad (except in some species of Aubrietia, Draba and Cochlearia).**
- E. Siliques 2-locular, many-seeded; seeds much compressed, winged or margined.**
- F. Lvs. entire or dentate; siliques long-stalked, very broad**.....24. *Lunaria*.
- FF. Lvs. pinnatisect; siliques sessile**...25. *Selenia*.
- EE. Siliques 1-2-loculed, 2- to many-seeded; seeds rarely winged; valves often turgid.**
- F. Sepals often unequal, the lateral saccate at the base.**
- G. Fls. purple; siliques oblong; lateral sepals saccate**.....26. *Aubrietia*.
- GG. Fls. generally yellow; siliques mostly oblong; sepals equal or unequal**.....27. *Vesicaria*.
- FF. Sepals equal.**
- G. Stamens often appendaged**.....28. *Alyssum*.
- GG. Stamens not appendaged.**
- H. Plants tomentose**.....29. *Draba*.
- HH. Plants glabrous**.....30. *Cochlearia*.  
(See also Kerneria.)
- CCC. Cotyledons incumbent, straight, convolute or transversely plicate.**
- D. The cotyledons transversely biplicate**...31. *Heliotheca*.
- DD. The cotyledons not transversely biplicate.**
- E. Petals pinnatifid**.....32. *Schizopetalon*.
- EE. Petals not pinnatifid.**
- F. Stigmas erect, free or connate into a cone; sepals long and straight.**
- G. The stigmas bilamellate; lamellae erect**.....33. *Hesperis*.
- GG. The stigmas bilamellate; lamellae connivent or connate into a cone**.....34. *Malcomia*.
- FF. Stigma simple, capitate, emarginate or shortly 2-lobed; cotyledons straight.**
- G. Siliqua stipitate**.....35. *Stanleya*.
- GG. Siliqua sessile.**
- H. Sepals equal**.....36. *Smelowskia*.
- HH. Sepals unequal**.....37. *Erysimum*.

The additional genera are also treated: *Braya*, *Physaria*, and *Physotrichis*.

### 17. CAPPARIDACEÆ.

- A. Fr. capsular, 1-loculed; herbs.**
- B. Torus short, often produced into a posterior appendage**.....1. *Cleome*.
- BB. Torus long, produced into a gynophore which is elongated at the middle and bears the pistil to which the filaments are united**.....2. *Gynandropsis*.
- AA. Fr. berry-like or drupe-like.**
- B. Lvs. simple**.....3. *Capparis*.
- BB. Lvs. with 3 lfts.**.....4. *Cratæva*.

*Polanisia* is also to be expected in cultivation.

### 18. RESEDACEÆ.

In cultivation.....*Reseda*.

### 19. CISTACEÆ.

- A. Placentæ with many seeds; lvs. opposite at least below, flat.**
- B. Valves 5, rarely 3; embryo circinate or spiral; fls. solitary or cymose, rarely racemose**.....1. *Cistus*.
- BB. Valves 3; embryo biplicate, runcinate or circumflex; fls. commonly racemose**.....2. *Helianthemum*.
- AA. Placentæ with 2 seeds; lvs. alternate, scale-like or awl-shaped; heath-like shrubs**.....3. *Hudsonia*.

### 20. VIOLACEÆ.

- A. Sepals subequal, produced or spurred at base; lower petal spurred or saccate; herbs**.....1. *Viola*.
- AA. Sepals not produced at base.**
- B. Lower petal spurred or enlarged.**
- C. With a very large spur; seeds complanate; woody climber**.....2. *Corynolysis*.
- CC. With lower petal merely gibbous; seeds obovoid-subglobose; herbs**.....3. *Solea*.
- BB. Lower petal not greatly unlike the others; shrubs or trees**.....4. *Hymenanthera*.

### 21. BIXACEÆ.

- A. Caps. 2-valved; seeds straight and naked; lvs. entire**.....1. *Bixa*.
- AA. Caps. 3-valved; seeds spiral, hairy or woolly; lvs. digitate or palmately lobed**.....2. *Maximiliana*.

### 22. FLACOURTIACEÆ.

- A. Sepals and petals alike, 9-15, spirally arranged, red; stamens 7-10; twining shrub**...1. *Berberidopsis*.
- AA. Sepals 3-6, whorled; stamens usually numerous (except in No. 4); upright trees or shrubs.**
- B. Petals 4-10; sepals 3-5**.....2. *Oncoba*.
- BB. Petals wanting.**
- C. Infl. axillary; lvs. penninerved, leathery; fr. a berry or drupe.**
- D. Style simple, sometimes lobed at apex; ovary 1-celled.**
- E. The sepals imbricate; style short**.....3. *Xylosma*.
- EE. The sepals valvate; style elongated; stamens sometimes 5 or 10**.....4. *Azara*.
- DD. Styles several; ovary irregularly divided.**
- E. Fls. perfect or polygamous, in axillary racemes or panicles; fr. a drupe**.....5. *Flacourtia*.
- EE. Fls. dioecious, the pistillate solitary or few; fr. a berry**.....6. *Aberia* (or *Doryalis*).
- CC. Infl. terminal; lvs. hand-nerved or 3-nerved at base, long-stalked, deciduous.**
- D. Fr. a berry; styles usually 5; sepals imbricate**.....7. *Idesia*.
- DD. Fr. a caps.**
- E. Styles 3, 2-parted at apex; sepals valvate**.....8. *Poliathyrsis*.
- EE. Styles 3-4, 3-parted at apex; sepals reduplicate, large**.....9. *Carriera*.

### 23. PITTOSPORACEÆ.

- A. Fr. indehiscent.**
- B. Filaments longer than anthers; petals more or less connivent from the base to beyond the middle**.....1. *Billardiera*.
- BB. Filaments shorter than anthers; petals spreading from the base**.....2. *Sollya*.
- AA. Fr. a caps. which is loculicidally dehiscent.**
- B. Caps. thick-coriaceous; seeds numerous.**
- C. Seeds not winged, thick or slightly compressed**.....3. *Pittosporum*.
- CC. Seeds winged, flat, compressed, horizontal.**
- BB. Caps. thinly coriaceous; seeds 1-2 in each locule, compressed, not winged, vertical**...4. *Bursaria*.

### 24. TREMANDRACEÆ.

- A. Anthers 2-celled, or 4-celled in 2 planes**.....1. *Tetradlea*.
- AA. Anthers 4-celled in 1 plane**.....2. *Platytheca*.

### 25. POLYGALACEÆ.

In cultivation.....*Polygala*.



## 26. CARYOPHYLLACEÆ.

- A. Ovary 1-ovuled; corolla absent.  
 B. Segms. of involucrate perianth hooded near apex and mucronate on back..... 1. *Paronychia*.  
 BB. Segms. of hardly involucrate perianth not hooded, and blunt..... 2. *Herniaria*.  
 AA. Ovary several-ovuled; petals usually present.  
 B. Sepals coalesced into a toothed or lobed calyx; petals and stamens hypogynous, being raised with the ovary on a gynophore, rarely sessile; petals with or without a scale at the apex of the claw.  
 C. Hilum facial; embryo straight.  
 D. Calyx tubular, multistriate..... 3. *Dianthus*.  
 DD. Calyx top-shaped or long-tubular, 5- or 15-ribbed; plants and fls. smaller..... 4. *Tunica*.  
 CC. Hilum lateral; embryo peripheral.  
 D. Calyx 10-nerved, rarely with many parallel nerves.  
 E. Styles commonly 3: caps. shortly 3- or 6-valved..... 5. *Silene*.  
 EE. Styles commonly 5 or 4: caps. shortly 5-10- or 4-8-valved..... 6. *Lychnis*.  
 DD. Calyx obscurely veined..... 7. *Saponaria*.  
 DDD. Calyx broadly or obscurely 5-nerved..... 8. *Gypsophila*.  
 BB. Sepals free or only coalesced at the very base; petals and stamens hypogynous on a short torus or usually very shortly perigynous.  
 C. Stipules small, scarious..... 9. *Spergula*.  
 CC. Stipules 0.  
 D. Valves (or rather teeth) of the caps. twice as many as the styles..... 10. *Cerastium*.  
 DD. Valves of the caps. as many as the styles.  
 E. Petals 2-fid; styles commonly 3..... 11. *Stellaria*.  
 EE. Petals entire; styles commonly 3..... 12. *Arenaria*.  
 EEE. Petals entire or 0; styles as many as the sepals..... 13. *Sagina*.

Alsine is also cultivated.

## 27. PORTULACACEÆ.

- A. Ovary cohering below with the calyx-tube..... 1. *Portulaca*.  
 AA. Ovary free from the calyx.  
 B. Embryo arched; endosperm scant..... 2. *Anacamp-*  
 BB. Embryo more incurved or annular, including the endosperm. [seros].  
 C. Sepals usually deciduous..... 3. *Talinum*.  
 CC. Sepals persistent, at least usually in Calandrinia.  
 D. Number of sepals 5-8..... 4. *Lewisia*.  
 DD. Number of sepals 2.  
 E. Shape of sepals roundish heart-shaped, scarious..... 5. *Spraguea*.  
 EE. Shape of sepals ovate, herbaceous.  
 F. Stamens 3, rarely 5..... 6. *Montia*.  
 FF. Stamens definitely 5..... 7. *Claytonia*.  
 FFF. Stamens indefinitely 5 to many..... 8. *Calandrinia*.

## 28. TAMARICACEÆ.

- A. Stamens 4-5, free..... 1. *Tamarix*.  
 AA. Stamens 10, connate below..... 2. *Myricaria*.

## 29. FOUQUIERIACEÆ.

The only genus..... *Fouquieria*.

## 30. HYPERICACEÆ.

- A. Fls. 4-merous..... 1. *Ascyrum*.  
 AA. Fls. 5-merous..... 2. *Hypericum*.

## 31. GUTTIFERÆ.

- A. Style very short or 0: ovules solitary in each locule of the ovary.  
 B. Sepals 4..... 1. *Garcinia*.  
 BB. Sepals 2..... 2. *Rheedia*.  
 AA. Style elongated; ovules solitary or 2.  
 B. Ovary 1-loculed, 1-ovuled..... 3. *Calophyl-*  
 lum.  
 BB. Ovary 2-4-loculed, 4-ovuled..... 4. *Mammea*.

The genera *Ochrocarpus* and *Platonia* are also treated.

## 32. EUCRYPHIACEÆ.

The only genus..... *Eucryphia*.

## 33. TERNSTRÆMIACEÆ.

- A. Anthers basifixed.  
 B. Calyx of 5 sepals, sub-connate at the base, at length fleshy and adhering to the ovary... 1. *Visnea*.  
 BB. Calyx inferior; sepals free.  
 C. Fls. rather large; petals coalesced at base; anthers glabrous; ovules 2-4 in each locule, pendulous from the apex..... 2. *Ternstræmia*.  
 CC. Fls. medium-sized; petals free or hardly coalesced; anthers pilose; ovules  $\infty$  in the middle of the locule..... 3. *Cleyera*.  
 CCC. Fls. small, dioecious; petals coalesced at base; anthers glabrous; ovules  $\infty$  in the middle of the locule..... 4. *Eurya*.  
 AA. Anthers versatile.  
 B. Radicles inferior.  
 C. Ovules ascending; seeds lens-shaped; embryo straight..... 5. *Stuartia*.  
 CC. Ovules laterally affixed; seeds flat, winged on back; cotyledons flat and radicle inflexed..... 6. *Schima*.  
 BB. Radicles superior.  
 C. Ovules  $\infty$ ; seeds winged above..... 7. *Gordonia*.  
 CC. Ovules few in each locule; seeds not winged.  
 D. Fls. sessile; sepals deciduous..... 8. *Camellia*.  
 DD. Fls. pedicelled; sepals persistent..... 9. *Thea*.

## 34. STACHYURACEÆ.

The only genus..... *Stachyurus*.

## 35. MALVACEÆ.

- A. Fr. a caps., loculicidally dehiscent (in *Adansonia* indehiscent, and woody).  
 B. Seeds usually kidney-shaped; stigmas or style-branches finally spreading.  
 C. Bractlets 5 to many, rarely 0, or reduced to teeth: style-branches finally spreading..... 1. *Hibiscus*.  
 CC. Bractlets 0 or 3; stigmas distinct, free, radiating..... 2. *Lagunaria*.  
 BB. Seeds obovoid or angled; style club-shaped at apex, undivided or with short erect branches.  
 C. Bractlets 3-5, small..... 3. *Thespesia*.  
 CC. Bractlets 3, large, cordate..... 4. *Gossypium*.  
 AA. Fr. composed of carpels which separate at maturity.  
 B. Staminal column anther-bearing outside; truncate or 5-toothed at the apex; style-branches 10.  
 C. Bractlets 5-8, herbaceous or setiform; carpels with or without 1-3 awns..... 5. *Pavonia*.  
 CC. Bractlets  $\infty$ , herbaceous or setiform; carpels fleshy outside, connate into a berry, later separating..... 6. *Malvaviscus*.  
 CCC. Bractlets 4-6, large and colored; carpels naked, mucous..... 7. *Gæthea*.  
 BB. Staminal column bearing anthers at or near the apex.  
 C. Carpels  $\infty$ , crowded into a mass without order.  
 D. Bractlets 3..... 8. *Malope*.  
 DD. Bractlets 0..... 9. *Palava*.  
 CC. Carpels in a single whorl.  
 D. Ovules 2 or more.  
 E. Bractlets 4-6..... 10. *Kydia*.  
 EE. Bractlets 0..... 11. *Abutilon*.  
 EEE. Bractlets 3..... 12. *Sphæralcea*.  
 DD. Ovule solitary.  
 E. The ovule ascending.  
 F. Styles longitudinally stigmatose inside.  
 G. Fls. dioecious..... 13. *Napæa*.  
 GG. Fls. bisexual. (See article *Sida*.)  
 H. Staminal column double, the outer of 5 clusters..... 14. *Sidalcea*.  
 HH. Staminal column single.  
 I. Bractlets 3-9, connate at base.  
 J. Axis of fr. not surpassing carpels..... 15. *Althæa*.  
 JJ. Axis of fr. surpassing carpels..... 16. *Lavatera*.  
 II. Bractlets 0-3, distinct.  
 J. Carpels with transverse appendages inside under the beak..... 17. *Callirhoë*.

- JJ. Carpels not appendaged... 18. *Malva*.  
 FF. Style-branches tipped with small  
 capitate or club-shaped stigmas... 19. *Malvastrum*.  
 EE. The ovules pendulous.  
 F. Style-branches longitudinally stig-  
 matose inside... 20. *Plagianthus*.  
 FF. Style-branches truncate at apex or  
 with small capitate stigmas... 21. *Sida*.

Other genera described are *Hoheria*, *Ingenhousia*, *Kitabelia*,  
 and *Kosteletzkya*.

### 36. BOMBACACEÆ.

- A. Lvs. digitate: cotyledons conduplicate or  
 convolute.  
 B. Staminal column separated above into  
 numerous filaments.  
 C. Caps. 5-valved, densely woolly within... 1. *Bombax*.  
 CC. Caps. woody, not woolly within.  
 D. Calyx 5-cut... 2. *Adansonia*.  
 DD. Calyx truncate... 3. *Pachira*.  
 BB. Staminal column 5-cut or 5-toothed, the  
 branches bearing 2-3 anthers.  
 C. Column outside below the middle annu-  
 lately 5-10-lobed... 4. *Chorisia*.  
 CC. Column not annulate... 5. *Ceiba*.  
 AA. Lvs. simple, feather-veined, entire: cotyledons  
 plane, leafy or fleshy... 6. *Durio*.

### 37. STERCULIACEÆ.

- A. Petals concave or hooded at the base.  
 B. Anthers solitary between the staminodes... 1. *Rulingia*.  
 BB. Anthers 2 or more between the staminodes.  
 C. Fr. a membranous caps... 2. *Abroma*.  
 CC. Fr. a woody caps... 3. *Guazuma*.  
 CCC. Fr. drupaceous... 4. *Theobroma*.  
 AA. Petals flat.  
 B. The petals deciduous.  
 C. Anthers sessile; calyx club-shaped or bell-  
 shaped... 5. *Reevesia*.  
 CC. Anthers stipitate; sepals at length free... 6. *Pterosper-*  
*ium*.  
 BB. The petals persistent or marcescent.  
 C. Anthers 10 or 15, rarely 20.  
 D. Ovules 2 in each locule... 7. *Dombeya*.  
 DD. Ovules ∞... 8. *Pentapetes*.  
 CC. Anthers 5... 9. *Mahernia*.  
 AAA. Petals 0.  
 B. Fls. bisexual... 10. *Fremontia*.  
 BB. Fls. unisexual or polygamous.  
 C. Anthers crowded without order: seeds  
 without endosperm... 11. *Sterculia*.  
 CC. Anthers in a single ring: seeds with en-  
 dosperm... 12. *Cola*.

*Brachychiton*, *Chiranthodendron*, and *Heritiera* are also treated.

### 38. TILIACEÆ.

- A. Calyx bell-shaped, 3-5-cut... 1. *Beria*.  
 AA. Calyx composed of distinct sepals.  
 B. Petals pitted at the base, inserted around  
 the base of a more or less elevated torus.  
 C. Fr. unarmed, glabrous, or tomentose... 2. *Grewia*.  
 CC. Fr. echinate or setose... 3. *Triumfetta*.  
 BB. Petals not pitted, inserted immediately  
 around the stamens.  
 C. Fr. indehiscent globose, usually 1-seeded... 4. *Tilia*.  
 CC. Fr. a caps.  
 D. Caps. loculicidally dehiscent.  
 E. The stamens all bear anthers.  
 F. The caps. globose, echinate... 5. *Entelea*.  
 FF. The caps. pod-like, usually naked... 6. *Corchorus*.  
 EE. The outer stamens have no anthers... 7. *Sparmannia*.  
 DD. Caps. dehiscent at the apex... 8. *Luehea*.

### 39. ELÆOCARPACEÆ.

- A. Fr. a berry... 1. *Aristolelia*.  
 AA. Fr. a drupe... 2. *Elæocarpus*.  
 AAA. Fr. a dehiscent loculicidal caps... 3. *Tricuspid-*  
*laria*.

### 40. LINACEÆ.

- A. Styles 5: lvs. entire; glands equal... 1. *Linum*.  
 AA. Styles 3-4: lvs. usually serrate; glands usually  
 unequal or absent... 2. *Reinwardtia*.

### 41. ERYTHROXYLACEÆ.

- In cultivation... *Erythroxylon*.

### 42. MALPIGHIACEÆ.

- A. Fr. a fleshy 3-stoned drupe... 1. *Malpighia*.  
 AA. Fr. a caps. composed of 3 dehiscent berries:  
 fls. in terminal racemes... 2. *Galphimia*.  
 AAA. Fr. consists of 1-3 samaras: fls. in umbel-like  
 corymbs... 3. *Stigmaphyl-*  
*lon*.

Other genera described are *Byrsonima*, *Janusia*, *Sphegamno-*  
*carpus* and *Tristellateia*.

### 43. ZYGOPHYLLACEÆ.

- A. Ovary sessile: lvs. with 2 lfts., rarely 1 lft... 1. *Zygophyl-*  
*lum*.  
 AA. Ovary stalked: lvs. abruptly pinnate... 2. *Guaiacum*.

### 44. GERANIACEÆ.

- A. Fls. irregular, the posterior sepal spurred;  
 spur adnate to the pedicel... 1. *Pelargonium*.  
 AA. Fls. regular or nearly so.  
 B. Stamens 10, usually all fertile: tails of car-  
 pels usually not bearded inside... 2. *Geranium*.  
 BB. Stamens, 5 fertile and 5 reduced to scales;  
 tails of carpels usually bearded inside... 3. *Erodium*.  
 BBB. Stamens 15, anther-bearing, in groups of 5... 4. *Monsonia*.

### 45. TROPÆOLACEÆ.

- The only genus... *Tropæolum*.

### 46. LIMNANTHACEÆ.

- In cultivation... *Limnanthes*.

### 47. OXALIDACEÆ.

- A. Fr. a loculicidal caps.  
 B. Valves of caps. separating to the middle... 1. *Oxalis*.  
 BB. Valves of caps. separating to the base... 2. *Biophytum*.  
 AA. Fr. an indehiscent berry... 3. *Averrhoa*.

### 48. BALSAMINACEÆ.

- In cultivation... *Impatiens*.

### 49. RUTACEÆ.

- A. Ovary entire or slightly 2-5-lobed; style ter-  
 minal, entire at base: fr. drupe-like or berry-  
 like, but leathery, usually indehiscent.  
 B. Fls. hermaphrodite; petals and stamens  
 free or connate; ovules 1, 2 or many: fr.  
 usually with a cortex outside and pulpy  
 within: seeds ex-albuminous. (Subfamily  
*Citrææ*.)  
 C. Cotyledons thin and twisted in seed: frs.  
 dry... 1. *Micromelum*.  
 CC. Cotyledons thick and fleshy, plano-con-  
 vex: frs. more or less fleshy or pulpy.  
 D. Thorns absent: lvs. pinnate: lfts. alter-  
 nate on rachis: frs. fleshy berries.  
 E. Styles very short and thick, persist-  
 ent: fls. small, urceolate: young  
 growth densely covered with brown  
 velvety pubescence... 2. *Glycosmis*.  
 EE. Styles long or, if short, dehiscent.  
 F. Fls. small: ovarian cells with scat-  
 tered hairs: frs. with thick fleshy  
 dissepiments... 3. *Clauцена*.  
 FF. Fls. large: ovarian cells with tufted  
 conducting hairs: frs. fleshy but  
 with thin dissepiments... 4. *Chalcas*.  
 DD. Thorns usually present: lvs. simple or,  
 if compound, with the lateral lfts.  
 exactly opposite. (Tribe *Citrææ*.)  
 E. Frs. large, hard-shelled: cells filled  
 with mucilage. (Subtribe *Æglinae*.)  
 F. Lvs. pinnate: ovary 5-celled but  
 by confluence becoming 1-celled.  
 G. Seeds woolly; exocarp woody,  
 continuous... 5. *Feronia*.  
 GG. Seeds smooth; exocarp prismatic... 6. *Feroniella*.  
 FF. Lvs. trifoliate or simple: ovary  
 6-15-celled.



- G.** The lvs. always simple; fr. with thin dissepiments, 6-celled; seeds smooth..... 7. *Eglopsis*.
- GG.** The lvs. trifoliate; fr. 8-15-celled. H. Seeds woolly.
- I.** The frs. hard-shelled, 10-15-celled..... 8. *Egle*.
- II.** The frs. long-oval, leathery, 8-10-celled..... 9. *Chaetospermum*.
- HH.** Seeds smooth; fr. subglobose, very hard-shelled..... 10. *Balsamocitrus*.
- EE.** Frs. not hard-shelled. (Subtribe Lavanginae.)
- F.** The frs. small, fleshy or with mucilage in cells, without pulp-vesicles.
- G.** Petioles very long; lvs. trifoliate; climbing shrubs..... 11. *Lavanga*.
- GG.** Petioles short, often winged.
- H.** The lvs. pinnate; rachis broadly winged; frs.  $\frac{1}{2}$  in. diam..... 12. *Hesperethusa*.
- HH.** The lvs. trifoliate or simple.
- I.** Lvs. trifoliate or bifoliate.
- J.** Petioles of medium length, narrowly winged; frs. 1 in. diam..... 13. *Pleiospermum*.
- JJ.** Petioles very short, wingless; frs. 3-merous; frs.  $\frac{1}{2}$  in. diam..... 14. *Triphasia*.
- II.** Lvs. simple or unifoliate.
- J.** Frs. angled; seeds very long, flattened..... 15. *Merope*.
- JJ.** Frs. not angled.
- K.** Plant a climbing shrub; petioles long..... 16. *Paramignya*.
- KK.** Plant a shrub or tree; petioles short.
- L.** Diam. of frs.  $\frac{1}{2}$  in.; lvs. venose; cells not filled with mucilage..... 17. *Severinia*.
- LL.** Diam. of frs. 1 in.; cells filled with mucilage; lvs. smooth..... 18. *Pamburus*.
- FF.** The frs. hesperidia, the cells filled with stalked pulp-vesicles containing juice. (Subtribe Citrinae.)
- G.** Lvs. pinnate; rachis broadly winged; ovules 1 in each cell..... 19. *Citropsis*.
- GG.** Lvs. trifoliate or simple; ovules usually 2 or more in each cell.
- H.** The lvs. trifoliate, deciduous..... 20. *Poncirus*.
- HH.** The lvs. simple, persistent.
- I.** Stamens 8 or 10, twice as many as the petals..... 21. *Atalantia*.
- II.** Stamens 16-40, 4 or more times as many as petals.
- J.** Lvs. isofacial, gray-green, with stomates and hairs on both faces; frs. small, 3-4-celled..... 22. *Eremocitrus*.
- JJ.** Lvs. not isofacial, without stomates on upper surface.
- K.** Ovary 3-5-celled; lvs. pale below, punctate..... 23. *Fortunella*.
- KK.** Ovary 6-15-celled.
- L.** The stamens polyadelphous..... 24. *Citrus*.
- LL.** Stamens free.
- M.** Cotyledons aerial on germination; first foliage lvs. opposite; fr. small, 10-12-celled..... 25. *Papeda*.
- MM.** Cotyledons hypogeous; first foliage lvs. alternate cataphylls; frs. 5- or 6-celled..... 26. *Microcitrus*.
- BB.** Fls. usually polygamo-dioecious; petals and stamens free; ovules 2, except in the first 2 genera; seeds usually aluminous.
- C.** Ovules solitary.
- D.** Petals 4-5, valvate; stamens 4-5; drupe 2-4-stoned..... 27. *Skimmia*.
- DD.** Petals 5, valvate; stamens 5; ovary 5-lobed; stigma sessile..... 28. *Casimiroa*.
- CC.** Ovules twin.
- D.** Petals 2-5, valvate or imbricate; stamens 2-5; fr. 4-7-loculed..... 29. *Toddalia*.
- DD.** Petals 5-8, valvate; stamens 5-6; fr. a 5-stoned drupe..... 30. *Phellodendron*.
- DDD.** Petals 4-5, imbricate; stamens 4-5; fr. a 2-3-loculed samara..... 31. *Ptelea*.
- AA.** Ovary deeply 2-5-lobed; styles basilar or ventral, or the stigmas connate; fr. capsular or 3-5-berried.
- B.** Ovules 3 or more in each locule.
- C.** Petals 4-5, equal; stamens 8-10, straight..... 32. *Ruta*.
- CC.** Petals 5, unequal; stamens 10, declinate..... 33. *Dictamnus*.
- BB.** Ovules 2 in each locule.
- C.** Fls. irregular..... 34. *Ravenia*.
- CC.** Fls. regular.
- D.** The fls. unisexual or polygamous.
- E.** Lvs. alternate.
- F.** Foliage pinnate; fls. polygamous..... 35. *Xanthoxyrum*.
- FF.** Foliage simple; fls. unisexual..... 36. *Oriza*. (lum.)
- EE.** Lvs. opposite; fls. unisexual..... 37. *Evodias*.
- DD.** The fls. hermaphrodite.
- E.** Albumen fleshy (unknown in Choisyia).
- F.** Petals erect, long, connate or connivent, forming a cylindrical tube..... 38. *Correa*.
- FF.** Petals free, spreading.
- G.** The petals imbricate.
- H.** Stamens 8; petals 4; lvs. opposite..... 39. *Boronia*.
- HH.** Stamens 8-10; petals 4-5; lvs. alternate..... 40. *Eriostemon*.
- HHH.** Stamens 10; petals 5; lvs. opposite..... 41. *Choisyia*.
- GG.** The petals valvate..... 42. *Pilocarpus*.
- EE.** Albumen 0.
- F.** The caps. 5-loculed..... 43. *Calodendrum*.
- FF.** The ovary-lobes 1-5, free..... 44. *Diosma*.
- G.** Staminodes 0..... 44. *Diosma*.
- GG.** Staminodes 5.
- H.** Style short; stigma capitate; fls. terminal..... 45. *Adenandra*.
- HH.** Style long; stigma simple; fls. axillary..... 46. *Barosma*.
- The following genera are also described: Amyris, Chloroxylon, Diplolæna, Limonia, and Spathelia.

## 50. SIMARUBACEÆ.

- A.** Stamens 10, twice as many as petals.
- B.** Petals united into a tube..... 1. *Quassia*.
- BB.** Petals spreading..... 2. *Ailanthus*.
- AA.** Stamens 4-5, as many as petals..... 3. *Picrosma*.

## 51. OCHNACEÆ.

- A.** Ovary 3-10-loculed; locules 1-ovuled; seeds without endosperm.
- B.** Stamens many; panicle lateral..... 1. *Ochna*.
- BB.** Stamens 10; panicle terminal..... 2. *Ouratea*.
- AA.** Ovary 2-5-loculed, many-ovuled, with endosperm..... 3. *Cespedesia*.

## 52. BURSERACEÆ.

- A.** Calyx-tube broadly urn-shaped, covered by the torus..... 1. *Garuga*.
- AA.** Calyx small, 4-6-parted..... 2. *Bursera*.

## 53. MELIACEÆ.

- A.** Stamens free.
- B.** Ovary 4-5-celled; cells 8-12-ovuled..... 1. *Cedrela*.
- BB.** Ovary 2-celled; cells 1-ovuled..... 2. *Pteroxylon*.
- AA.** Stamens coalesced into a tube, at least at base.
- B.** Locules of the ovary many-ovuled..... 3. *Sweetenia*.
- BB.** Locules of the ovary 1-2-ovuled.
- C.** Lvs. simple..... 4. *Turraea*.
- CC.** Lvs. 3-foliolate or 1-3-pinnate.
- D.** Anthers 5..... 5. *Aglaia*.
- DD.** Anthers 8-12.
- E.** Disk cup-like..... 6. *Melia*.
- EE.** Disk ring-like..... 7. *Trichilia*.

## 54. OLACACEÆ.

- A.** Stamens twice as many as the petals, all fertile. 1. *Ximenia*.
- AA.** Stamens anther-bearing, 3-5, staminodia 6 or less..... 2. *Olaz*.

## 55. AQUIFOLIACEÆ.

- A.** Petals connate at base; ovary 4-5-loculed.... 1. *Ilex*.
- AA.** Petals free, linear; ovary 3-5-loculed..... 2. *Nemopanthes*.

## 56. CYRILLACEÆ.

- A.** Racemes terminal; stamens 10; caps. winged.. 1. *Cliftonia*.
- AA.** Racemes lateral; stamens 5; caps. not winged. 2. *Cyrilla*.

## 57. CELASTRACEÆ.

- A. Fr. indehiscent..... 1. *Elæoden-*  
 AA. Fr. a dehiscent caps. [dron.  
 B. Lvs. opposite.  
 C. Ovules 1-2, in the axis of the locule..... 2. *Evonymus*.  
 CC. Ovules 2, in the locules, erect..... 3. *Pachystima*.  
 BB. Lvs. alternate.  
 C. Ovary confluent with the disk.  
 D. Locules generally 1-ovuled: plants un-  
 armed: fls. solitary, clustered or  
 cymose..... 4. *Maytenus*.  
 DD. Locules 2-ovuled: plants often armed:  
 fls. cymose..... 5. *Gymnos-*  
 [poria.  
 CC. Ovary free..... 6. *Celastrus*.  
 Other genera treated are Cassine, Catha, and Tripterygium.

## 58. STACKHOUSIACEÆ.

In cultivation..... *Stackhousia*.

## 59. RHAMNACEÆ.

- A. Calyx-lobes persistent, the often star-shaped  
 disk joining its tube to the entire surface of  
 the ovary: fr. dry, 3-winged..... 1. *Gouania*.  
 AA. Calyx-lobes deciduous.  
 B. Disk lining the shallow calyx-tube nearly or  
 quite free from the ovary: fr. drupaceous,  
 mostly fleshy and often edible, with a  
 single 1-4-celled stone inclosing as many  
 seeds, or 1-seeded by abortion; seed-coats  
 membranous.  
 C. Petals 0: endosperm copious, ruminant .. 2. *Reynosia*.  
 CC. Petals 5.  
 D. Fr. winged, dry, leathery: plants  
 prickly: lvs. 3-nerved..... 3. *Paliurus*.  
 DD. Fr. a fleshy drupe: plants prickly: lvs.  
 3-nerved..... 4. *Zizyphus*.  
 DDD. Fr. a drupe with leathery sarcocarp:  
 plants unarmed: lvs. penninerved... 5. *Berchemia*.  
 BB. Disk lining the calyx-tube, or both adherent  
 to ovary: fr. drupaceous or becoming dry.  
 C. Lvs. very small or wanting, the spines li-  
 ke..... 6. *Colletia*.  
 CC. Lvs. ordinary.  
 D. Fr. a fleshy drupe free from calyx, con-  
 taining 2-4 separate nut-like stones... 7. *Rhamnus*.  
 DD. Fr. becoming nearly or quite dry,  
 partly inferior, separating into 3  
 nutlets: ovary adnate to disk at its  
 base..... 8. *Ceanothus*.  
 DDD. Fr. a caps. with membranous covering,  
 inferior, separating into 3 cocci,  
 which are dehiscent inside..... 9. *Pomaderris*.  
 DDDD. Fr. indehiscent, pea-shaped, 3-celled,  
 3-seeded: ovary free..... 10. *Hovenia*.  
 The genus *Rhamnella* is sometimes cultivated.

## 60. VITACEÆ.

- A. Stamens free: climbing shrubs or herbs.  
 B. Petals expanding; fls. in cymes: bark close;  
 pith white.  
 C. Plants climbing, mostly by adhesion of  
 dilated and disk-shaped tips of the  
 tendril-branches: no distinct disk or  
 free nectariferous glands, but a nec-  
 tariferous and wholly confluent thick-  
 ening of the base of the ovary, or even  
 this obsolete: lvs. never pinnate..... 1. *Partheno-*  
 [cissus.  
 CC. Plants climbing by the prehension and  
 coiling of naked-tipped tendrils: nec-  
 tariferous disk or glands surrounding  
 the ovary or its base, and at least partly  
 free from it.  
 D. Fls. 5-merous: woody plants, mostly  
 hardy..... 2. *Ampelopsis*.  
 DD. Fls. 4-merous: more or less fleshy,  
 woody or herbaceous; mostly tropi-  
 cal or subtropical..... 3. *Cissus*.  
 BB. Petals cast off from the base while cohering  
 by their tips; hypogynous disk or 5  
 nectariferous glands alternate with the  
 stamens; fls. in panicles: berries usually  
 edible: lvs. rarely compound, never pin-  
 nate..... 4. *Vitis*.  
 AA. Stamens with connate filaments: lvs. 1-3-pin-  
 nate: upright trees or shrubs..... 5. *Leea*.  
 Tetrastigma is also briefly treated.

## 61. SABIACEÆ.

In cultivation..... *Meliosma*.

## 62. ACERACEÆ.

- A. Nutlets winged all around: lvs. pinnate, with  
 9-15 lfts..... 1. *Dipteronia*.  
 AA. Nutlets with an elongated wing on one side:  
 lvs. simple or compound..... 2. *Acer*.

## 63. STAPHYLEACEÆ.

- A. Lvs. opposite: several seeds in each cell.  
 B. Ovary 2-3-parted at base.  
 C. Caps. vesiculose..... 1. *Staphylea*.  
 CC. Follicles coriaceous..... 2. *Euscaphis*.  
 BB. Ovary 3-lobed: fr. fleshy or leathery..... 3. *Turpinia*.  
 AA. Lvs. alternate: 1 seed in each cell: fr. berry-  
 like..... 4. *Tapiscia*.

## 64. MELIANTHACEÆ.

- A. Calyx subsaccate, the segms. narrow, very  
 unequal at base; ovules in the locules 2-4... 1. *Melanthus*.  
 AA. Calyx of 5 free, roundish sepals: ovules  
 numerous in 2 series on the placenta..... 2. *Greya*.

## 65. HIPPOCASTANACEÆ.

In cultivation..... *Æsculus*.

## 66. SAPINDACEÆ.

- A. Fls. irregular.  
 B. Ovules solitary in the locules (rarely 2 in  
 Paullinia): plant climbing..... 1. *Serjania*.  
 C. Fr. a winged samara..... 2. *Cardiosper-*  
 [mum.  
 CC. Fr. bladder, membranous, loculicidal... 3. *Paullinia*.  
 CCC. Fr. a pear-shaped, septicidal caps..... 4. *Kalreuteria*.  
 BB. Ovules 2 or more in the locules: plant erect.  
 C. Sepals valvate; petals 3-4..... 5. *Ungnadia*.  
 CC. Sepals imbricate; petals 4-5.....  
 AA. Fls. regular, or nearly so.  
 B. Stamens inserted at the base of the ovary  
 inside the disk, often unilateral.  
 C. Fr. dehiscent; ovules 2 or more in cells.  
 D. Disk produced into 5 horns; fls. in  
 racemes before the lvs., showy..... 6. *Xanthoceras*.  
 DD. Disk annular or cup-shaped; fls.  
 usually in panicles.  
 E. Lvs. ternate: sepals glabrous; disk  
 cupular..... 7. *Delavaya*.  
 EE. Lvs. pinnate.  
 F. Petals 5; sepals imbricate, pubes-  
 cent..... 8. *Blighia*.  
 FF. Petals 0; sepals valvate..... 9. *Stadmannia*.  
 CC. Fr. indehiscent.  
 D. Aril present; fr. edible.  
 E. Calyx deeply 5-parted, imbricate;  
 petals present..... 10. *Euphoria*.  
 EE. Calyx with small valvate lobes or  
 obsoletely toothed; petals 0..... 11. *Litchi*.  
 DD. Aril wanting.  
 E. Fr. deeply lobed or divided into 3  
 (-1) cocci: sepals 5: lfts. usually  
 many..... 12. *Sapindus*.  
 EE. Fr. not deeply lobed: sepals 4: lfts.  
 2-4..... 13. *Melicocca*.  
 BB. Stamens inserted outside the disk or disk  
 wanting; petals 0: caps. winged, papery  
 or leathery: lvs. simple or pinnate..... 14. *Dodonæa*.  
 Additional genera are somewhat cultivated, as *Alectryon*, *Ber-*  
*samo*, and *Diploglottis*.

## 67. ANACARDIACEÆ.

- A. Lvs. simple  
 B. Stamens 5; styles 3..... 1. *Semecarpum*.  
 BB. Stamens 8-10 (all or some fertile); style  
 eccentric; stigma a mere dot..... 2. *Anacardium*.  
 BBB. Stamens 1-5; style lateral; stigma simple. 3. *Mangifera*.  
 AA. Lvs. pinnate or composed of 3 lfts.  
 B. Ovary 1-celled.  
 C. Ovules suspended at or near the apex.  
 D. Styles in the pistillate fls. short, in  
 the staminate fls. 4-5..... 4. *Tapiria*.  
 DD. Styles 3..... 5. *Cyrtocarpa*.  
 CC. Ovules suspended by a basilar funiculus.  
 D. Styles 3..... 6. *Schinus*.  
 DD. Styles 3..... 7. *Pistacia*.



- DD. Petals 4-6 or more.  
 E. Stamens in a single whorl.  
 F. The petals valvate. .... 8. *Sorindeia*.  
 FF. The petals imbricate.  
 G. Style lateral in fr.; pedicels becoming plumose; lvs. simple. .... 9. *Cotinus*  
 GG. Style terminal in fr.; pedicels not plumose in fr.; lvs. compound, rarely simple. .... 10. *Rhus*.  
 EE. Stamens in 2 whorls, the outer alternate with the petals; petals valvate. .... 11. *Lithræa*.  
 BB. Ovary 2-5-celled.  
 C. Fls. polygamous; stamens 8-10; petals subvalvate. .... 12. *Spondias*.  
 CC. Fls. diœcious; stamens 8-9; petals imbricate. .... 13. *Harpehylum*.  
 The genera *Corynocarpus* and *Smodingium* are also described in this Cyclopædia.

## 68. CORIARIACEÆ.

The only genus. .... *Coriaria*.

## 69. MORINGACEÆ.

The only genus. .... *Moringa*.

## 70. LEGUMINOSÆ.

## I. Summary of Suborders and Tribes.

Ignoring exceptions and six tribes of which no examples appear to be cult. in America. (Other genera of Leguminosæ may be met with now and then in cultivation, but they are so little grown and so many that the introduction of them here would make the key unnecessarily complicated; some of these are mentioned at the end of the Leguminosæ, p. 95.)

## Suborder I.—MIMOSEÆ.

- A. Fls. regular, small; calyx gamosepalous or valvately parted; petals valvate, often connate, below the middle.  
 B. Stamens numerous, ∞.  
 C. The stamens free. .... 1. ACACIA TRIBE.  
 CC. The stamens monadelphous. .... 2. INGA TRIBE.  
 BB. Stamens fewer, definite.  
 C. Anthers usually appendaged with a stalked gland; stamens twice as many as the petals, rarely as many; fls. generally 5-merous. .... 3. ADENANTHERA [TRIBE].  
 CC. Anthers not glandular; stamens as many as the petals, rarely twice as many; fls. 4-5-merous, rarely 3- or 6-merous. .... 4. MIMOSA TRIBE.  
 AA. Fls. irregular and truly papilionaceous, i. e., like a sweet pea, the standard outside of the other petals and inclosing them in the bud; sepals more or less united above the disk into a tube or cup; radicles inflexed, acuminate or rarely very short and straight. (Compare AAA.)

## Suborder II.—PAPILIONÆÆ.

- B. Lvs. simple, or else digitately compound. (Exceptions: A few members of the Trifolium Tribe are digitately compound and some of the Phaseolus Tribe are subdigitately compound. Some lvs. that appear to be simple have been reduced from several lfts. to 1, generally leaving a gland, joint or other indication of the reduction.)  
 C. Stamens 10, free; shrubs, rarely herbs. .... 5. PODALYRIA TRIBE.  
 CC. Stamens 10, monadelphous, rarely diadelphous; racemes terminal or opposite the lvs. or the fls. solitary or subsessile at the axils. .... 6. GENISTA TRIBE.  
 BB. Lvs. pinnate, rarely digitate in the Trifolium Tribe, or subdigitate in the Phaseolus Tribe or the lvs. sometimes reduced to a single lft.  
 C. Stamens 10, free; lfts. 5 or more, sometimes reduced to 1 large lft., rarely 3. .... 7. SOPHORA TRIBE.  
 CC. Stamens monadelphous or diadelphous.

- D. The pod jointed, rarely 1-jointed; 1-seeded by abortion. Otherwise like the Lotus, Galega and Phaseolus Tribes. An artificial division. .... 8. HEDYSARUM [TRIBE].  
 DD. The pod not jointed.  
 E. Pod indehiscent, larger than calyx, membranous, leathery, woody or drupaceous; lfts. 5 or more, rarely 3-1; trees or tall shrubs or climbers. .... 9. DALBERGIA [TRIBE].  
 EE. Pod dehiscent or if indehiscent usually of small size, generally 2-valved.  
 F. Fls. in heads or umbels, rarely solitary; lfts. 3 or more, entire; alternate filaments usually dilated at the apex; herbs or shrubs. .... 10. LOTUS TRIBE.  
 FF. Fls. solitary or racemose, sometimes paniced or fascicled.  
 G. Plants typically climbing herbs, raising themselves by means of tendrils at the tips of the petioles; sometimes there is a mere bristle; lfts. often denticulate at apex. .... 11. VICIA TRIBE.  
 GG. Plants twining or erect, not climbing by tendrils.  
 H. Lfts. generally 3.  
 I. Habit of plants mostly twining. .... 12. PHASEOLUS [TRIBE].  
 II. Habit of plants mostly erect. .... 13. TRIFOLIUM TRIBE.  
 HH. Lfts. mostly 5 or more. .... 14. GALEGA TRIBE.  
 AAA. Fls. more or less irregular, but not truly papilionaceous. When they seem to be so, the petal answering to the standard will be found within the other petals instead of outside as in AA: radicle straight, very rarely slightly oblique.

## Suborder III.—CÆSALPINIÆÆ.

- B. Calyx gamosepalous beyond the disk or valvately parted; lvs. simple and entire or 2-lobed, or rarely cut into 2 lfts.; stipe of ovary free or adnate to calyx-tube. .... 15. BAUHINIA TRIBE.  
 BB. Calyx usually parted to the very disk and the segms. imbricate.  
 C. Stipe of ovary adnate to the disk-bearing calyx-tube; lvs. mostly abruptly pinnate. .... 16. AMHERSTIA TRIBE.  
 CC. Stipe of ovary free in the bottom of the calyx.  
 D. Anthers versatile; lvs. mostly bipinnate. .... 17. CÆSALPINIA TRIBE.  
 DD. Anthers basifixed, erect but longitudinally dehiscent by 2 pores or short cracks. .... 18. CASSIA TRIBE.

## II. Key to the Tribes.

## 1. Acacia Tribe.

The only genus. .... 1. *Acacia*.

## 2. Inga Tribe.

- A. Lvs. once pinnate. .... 2. *Inga*.  
 AA. Lvs. mostly twice pinnate.  
 B. Shape of pods circinate, arched or variously twisted.  
 C. Pod usually 2-valved; seeds generally surrounded by a thin pulp. .... 3. *Pithecolobium*.  
 CC. Pod indehiscent, usually septate between the seeds. .... 4. *Enterolobium*.  
 BB. Shape of pods straight, or at most slightly sickle-shaped.  
 C. Valves separating from the persistent sutures. .... 5. *Lysiloma*.  
 CC. Valves elastically dehiscent and revolute from apex to base. .... 6. *Calliandra*.  
 CCC. Valves not elastic; pod often indehiscent. .... 7. *Albizzia*.

## 3. Adenanthera Tribe.

- A. Fls. short-pedicel. .... 8. *Adenanth-  
era*.  
 AA. Fls. sessile.  
 B. The pod indehiscent (presumably so in *Stryphnodendron*).

- c. Pod straight, thick-compressed, transversely septate inside between the seeds. .... 9. *Stryphnodendron*.
- cc. Pod straight, falcate or variously twisted, thick-compressed or subterete, usually septate inside between the seeds. .... 10. *Prosopis*.
- BB. The pods 2-valved. (See also BBB.)
- c. Pod straight or arched, flat; valves entire, continuous within: shrubs or trees. .... 11. *Piptadenia*.
- cc. Pod obliquely oblong, deflexed from the stipe: herbs or diffuse sub-shrubs, prostrate or floating. .... 12. *Neptunia*.
- BBB. The pod flat, with thickened persistent continuous sutures, the valves transversely jointed between the sutures, the joints 1-seeded. .... 13. *Entada*.

#### 4. Mimosa Tribe.

- A. Pods provided with a replum, i. e., a frame-like placenta, which remains after the valves have fallen away from it.
- B. Valves wider than replum. .... 14. *Mimosa*.
- BB. Valves narrower than the replum or hardly wider. .... 15. *Schrankia*.
- AA. Pods 2-valved in the ordinary fashion. .... 16. *Leucaena*.

#### 5. Podalyria Tribe.

- A. Keel-petals free or slightly connate: foliage herbaceous.
- B. Pod linear or oblong-inflated. .... 17. *Thermopsis*.
- BB. Pod globose or ovoid, turgid or inflated. .... 18. *Baptisia*.
- AA. Keel-petals connate on the back: foliage mostly leathery.
- B. Ovules 4 or more.
- c. Keel about as long as the wings. .... 19. *Oxylobium*.
- cc. Keel much shorter than wings. .... 20. *Chorizema*.
- BB. Ovules 2.
- c. Pod indehiscent: calyx shortly 5-toothed. .... 21. *Viminaria*.
- cc. Pod 2-valved: calyx 5-fid, or bilabiate. .... 22. *Pullenaea*.

#### 6. Genista Tribe.

- A. Stamens coalesced into a sheath which is split above the middle.
- B. Seeds strophiolate.
- c. Lvs. simple or reduced to mere scales. .... 23. *Templetonia*.
- cc. Lvs. pinnate; lfts. 3. .... 24. *Goodia*.
- BB. Seeds not strophiolate. .... 25. *Crotalaria*.
- AA. Stamens coalesced into a closed tube.
- B. Seeds not strophiolate.
- c. Calyx-lobes or lips much longer than the tube. .... 26. *Lupinus*.
- cc. Calyx-lobes or -teeth shorter than the tube, rarely somewhat longer.
- d. Lfts. 3.
- E. Pod stalked. .... 27. *Laburnum*.
- EE. Pod sessile.
- F. Claws of petals adnate to staminal tube. .... 28. *Petteria*.
- FF. Claws of petals free.
- G. Shrubs unarmed: upper calyx-lobes distinct. .... 29. *Adenocarpus*.
- GG. Shrubs usually spinescent: calyx short, truncate. .... 30. *Calycotome* [pus].
- DD. Lfts. usually all wanting, rarely 3 or 1: shrubs with spiny or rush-like branches.
- E. Shrub with rush-like branches. .... 31. *Spartium*.
- EE. Shrubs spiny or unarmed: lfts. reduced to 1 or 0, rarely 3.
- F. Fls. yellow; calyx not inflated. .... 32. *Genista*.
- FF. Fls. violet or bluish; calyx inflated: spiny shrub. .... 33. *Erinacea*.
- BB. Seeds strophiolate.
- c. Calyx colored, 2-parted; the upper segms. 2-toothed, lower 3-toothed: leafless shrubs, the branchlets and petioles transformed into spines. .... 34. *Ulex*.
- CC. Calyx with the 2 upper lobes or teeth connate or free, the 3 lower connate into a lower lip. .... 35. *Cytisus*.

#### 7. Sophora Tribe.

- A. Fl. with petals all nearly alike. .... 36. *Cadia*.
- AA. Fl. distinctly papilionaceous.
- B. Pod 2-valved. .... 37. *Castanospermum*.
- BB. Pod indehiscent or at most tardily dehiscent to a slight extent.
- C. The pod moniliform. .... 38. *Sophora*.
- CC. The pod not moniliform, linear.
- d. Color of fls. yellow in axillary racemes. .... 39. *Calpurnia*.
- DD. Color of fls. white, panicle.
- E. Winter-buds inclosed in the base of the enlarged petiole: panicle loose, drooping. .... 40. *Cladrastis*.
- EE. Winter-buds free: panicle dense, upright. .... 41. *Maackia*.

#### 8. Hedysarum Tribe.

- A. Stamens all free among themselves. .... 42. *Adesmia*.
- AA. Stamens all connate in a closed tube. .... 43. *Arachis*.
- AAA. Stamens nearest the standard free or connate with the others only at the base or at the middle.
- B. Filaments all dilated above or only alternate ones.
- C. Keel obtuse. .... 44. *Ornithopus*.
- CC. Keel acute or beaked. .... 45. *Coronilla*.
- BB. Filaments normal.
- C. Wings short or very short, rarely as long as the keel; lfts. not provided with minute stipules.
- D. Pod flat or compressed.
- E. Joints many, rarely 2: standard-stamens free. .... 46. *Hedysarum*.
- EE. Joints 2: standard-stamen connate with others at middle. .... 47. *Onobrychis*.
- DD. Pod thickish, subterete. .... 48. *Alhagi*.
- CC. Wings as long as or longer than the keel: partial petioles of lfts. bear minute stipules (except in *Lespedeza* 0).
- D. Pod indehiscent, rarely opening at the lower suture; joints flat. .... 49. *Desmodium*.
- DD. Pod of about 4 small, distinct, 1-seeded, smooth, veined joints included in the calyx. .... 50. *Uraria*.
- DDD. Pod 1-seeded, indehiscent; no joints. .... 51. *Lespedeza*.

#### 9. Dalbergia Tribe.

- A. Fr. drupaceous, globose or ovoid, indehiscent, the endocarp woody. .... 52. *Andira*.
- AA. Fr. not drupaceous.
- B. Lfts. mostly alternate.
- C. Anthers versatile, the locules parallel, longitudinally dehiscent. .... 53. *Tipuana*.
- CC. Anthers small, erect, didymous, the locules placed back to back; generally dehiscent at apex by a short crack. .... 54. *Dalbergia*.
- BB. Lfts. opposite.
- C. Pod longitudinally 4-winged. .... 55. *Piscidia*.
- CC. Pod with a narrow wing along the upper suture or both sutures. .... 56. *Derris*.

#### 10. Lotus Tribe.

- A. Pod indehiscent or tardily 2-valved. .... 57. *Anthyllis*.
- AA. Pod 2-valved.
- B. Calyx-lobes usually longer than tube; keel rostrate. .... 58. *Lotus*.
- BB. Calyx-teeth shorter than tube; keel obtuse. .... 59. *Hosackia*.

#### 11. Vicia Tribe.

- A. St. woody: infl. subterminal; stamens 9, the standard-stamen absent. .... 60. *Abrus*.
- AA. St. herbaceous: fls. solitary or racemose in the axils; stamens 10.
- B. Wings adherent to the keel. .... 61. *Lens*. (See article Lentil.)
- BB. Wings free or only slightly adherent.
- C. Sheath of stamens oblique at the mouth; style slender, bearded or hairy only at the apex or all around the upper part. .... 62. *Vicia*.
- CC. Sheath of stamens equal at the mouth.
- D. Calyx-lobes leafy; style rigid, dilated above and the margins reflexed and joined together so that it becomes flattened laterally; bearded down the inner edge. .... 63. *Pisum*.
- DD. Calyx-lobes not leafy; style flattened above on the back and front; bearded down one face. .... 64. *Lathyrus*.

#### 12. Phaseolus Tribe.

- A. Style longitudinally bearded above on the inner side or rarely pilose only around the stigma; petals normal or the keel long-beaked or spiral: infl. nodose-racemose.
- B. Calyx-teel not longer than lobe.
- C. Keel spiral. .... 65. *Phaseolus*.
- CC. Keel obtuse or arched beaked.
- D. Stigma strongly oblique or introrse. .... 66. *Vigna*.
- DD. Stigma subglobose on inner face; style flattened out at apex. .... 67. *Pachyrhizus*.
- DDD. Stigma small, terminal; style filiform or subulate at apex. .... 68. *Dolichos*.
- BB. Calyx-tube cylindrical, longer than lobes. .... 69. *Clitoria*.
- AA. Style not bearded.
- B. Standard-stamen free only at the very base, thence connate with the rest into a closed tube; calyx mostly 4-lobed.
- C. Calyx bell-shaped.
- D. Pod broad, the upper suture thickened or 2-winged. .... 70. *Dioclea*.
- DD. Pod linear, narrow or flat. .... 71. *Pueraria*.



- cc. Calyx bilabiate, the upper lip larger, entire or 2-lobed or 2-parted.....72. *Canavalia*.
- BB. Standard-stamen free or connate only at the base.
- c. Calyx 4-lobed.....73. *Galactia*.
- CC. Calyx not 4-lobed.
- D. Infl. usually racemose, the rachis of the raceme jointed.
- E. Standard much larger than the wings and keel.....74. *Erythrina*.
- EE. Standard smaller than the keel.
- F. Pod 2-valved.
- G. Anthers of 2 kinds.....75. *Mucuna*.
- GG. Anthers uniform.....76. *Apios*.
- FF. Pod not dehiscent, except at the top.....77. *Butea*.
- DD. Infl. sometimes racemose but the rachis of the raceme not jointed.
- E. Lvs., especially beneath, with minute resinous dots: infl. racemose or subumbellate or the fls. solitary.
- F. Ovules 2.....78. *Flemingia*.
- FF. Ovules 4 or more.
- G. Pod turgid; seeds strophiolate...79. *Fagelia*.
- GG. Pod compressed; seeds not strophiolate.....80. *Cajanus*.
- EE. Lvs. without minute resinous dots: fls. clustered or racemose in the axils, solitary or twin along the rachis.
- F. Fls. showy; standard large, flattened out; bracts persistent....81. *Centrosema*.
- FF. Fls. medium-sized; standard erect, complicate, sides often reflexed: bracts persistent.....82. *Amphicarapa*.
- FFF. Fls. small (showy in *Kennedy*); standard spreading or reflexed; bracts persistent or small and deciduous.
- G. Seeds not strophiolate.....83. *Glycine*.
- GG. Seeds strophiolate.
- H. The fls. small; keel usually much smaller than wings...84. *Hardenbergia*.
- HH. The fls. showy; keel usually equaling or surpassing the wings.....85. *Kennedy*.
- 13. Trifolium Tribe.**
- A. Standard-stamen connate with the others into a closed tube; keel beaked.....86. *Ononis*.
- AA. Standard-stamen free; keel obtuse or in Parochetus acutish.
- B. Lfts. digitate (rarely pinnate in Trifolium).
- c. Pod 2-valved: keel acutish; petals not adnate.....87. *Parochetus*.
- cc. Pod usually indehiscent: claws of all or the lower petals adnate to the staminal tube.....88. *Trifolium*.
- BB. Lfts. 3, pinnate.
- c. Pod straight, sickle-shaped or arched, sometimes thick and beaked, sometimes linear, sometimes broad and flat, indehiscent or folliculately gaping or rarely 2-valved.....89. *Trigonella*.
- cc. Pod spirally falcate, circinnate or cochleate.....90. *Medicago*.
- CCC. Pod small, subglobose or ovoid, thick, indehiscent or tardily 2-valved.....91. *Melilotus*.
- 14. Galega Tribe.**
- A. Connective of the anthers appendaged with a small gland or mucro: ovules mostly  $\infty$ , 1-2 in a few species; pod 2-valved.....92. *Indigofera*.
- AA. Connective not appendaged.
- B. Ovules 1-2, rarely 3-4. (See also BB.)
- c. Number of ovules 1.....93. *Psoralea*.
- cc. Number of ovules 2, rarely 3-4.
- d. Stamens 10.....94. *Amorpha*.
- DD. Stamens 5.....95. *Petalostemon*.
- BB. Ovules  $\infty$  (1-2 in a few species of Tephrosia).
- c. Infl. terminal or opposite the lvs., mostly racemose (in Galega both axillary and terminal, in some Tephrosias axillary): pod 2-valved.
- D. Style longitudinally bearded on the inner side; calyx long-tubular; petals very long-clawed.....96. *Barbieria*.
- DD. Style glabrous (or merely penicillate at the stigma in some tephrosias).
- E. Standard-stamen connate with the rest from the base.....97. *Galega*.
- EE. Standard-stamen free or connate with the others from the middle.
- F. The pod narrow or short, with slender valves and nerviform or hardly thickened sutures.....98. *Tephrosia*.
- FF. The pod thick, leathery or woody.
- G. Pod usually tardily dehiscent: infl. mostly panicle.....99. *Milletia*.
- GG. Pod easily dehiscent: infl. racemose.....100. *Wistaria*.
- cc. Infl. axillary, except where noted below.
- D. Pod flat, except where the seeds finally make it turgid.....101. *Robinia*.
- DD. Pod inflated, turgid or terete, longitudinally septate or undivided, rarely flat and when so always longitudinally septate.
- E. Styles variously bearded above
- F. Petals acuminate.....102. *Clanthus*.
- FF. Petals not acuminate.
- G. Standard erect.....103. *Sutherlandia*.
- GG. Standard spreading or reflexed.
- H. Stigma small.....104. *Swainsona*.
- HH. Stigma prominent.....105. *Colutea*.
- EE. Style not bearded.
- F. Lvs. even-pinnate: shrubs or trees.
- G. The pod stipitate, obovoid or oblong.....106. *Halimodendron*.
- GG. The pod linear, usually acute.....107. *Caragana*.
- FF. Lvs. odd-pinnate or with a spiny petiole instead of an odd lft.
- G. Anther-cells confluent at apex...108. *Glycyrrhiza*.
- GG. Anthers uniform.....[iza].
- H. Petals not all narrow, the standard obovate or orbicular.....109. *Calophaea*.
- HH. Petals narrow.
- I. Keel blunt.....110. *Astragalus*.
- II. Keel acute.....111. *Oxytropis*.
- 15. Bauhinia Tribe.**
- A. Petals erect or spreading, only slightly unequal.....112. *Bauhinia*.
- AA. Petals falsely pea-like, the standard inmost.....113. *Cercis*.
- 16. Amherstia Tribe.**
- A. The petals absent; sepals 4.....114. *Saraca*.
- AA. The petals present.
- B. Bractlets persistent, inclosing the bud.
- c. Petals 5, slightly unequal.....115. *Brownea*.
- cc. Petals unequal, 1 very wide, 2 narrow, 2 minute and rudimentary.....116. *Amherstia*.
- BB. Bractlets small or deciduous.
- c. Lfts. 1 pair.....117. *Hymenaea*.
- cc. Lfts. 2 or more pairs.
- D. Petals 5, 3 perfect, 2 rudimentary....118. *Tamarindus*.
- DD. Petals 5, slightly unequal.....119. *Schotia*.
- 17. Cæsalpinia Tribe.**
- A. Calyx-lobes strongly imbricate; disk-bearing tube short; seed not albuminous.
- B. Pod indehiscent: stigma peltate.....120. *Peltopodium*.
- BB. Pod 2-valved: stigma not peltate.....121. *Cæsalpinia*.
- AA. Calyx-tube long, or top-shaped or bell-shaped; segms. short or narrow and open: seeds, when known, albuminous.
- B. Pod turgid or subterete.....122. *Gymnocladus*.
- BB. Pod flattish.....123. *Gleditsia*.
- AAA. Calyx-segms. valvate.
- B. Segms. 4, the upper ones connate; highest petal widest, lowest narrow.....124. *Colvillea*.
- BB. Segms. 5; petals roundish, about equal.....125. *Poinciana*.
- AAAA. Calyx-segms. slightly imbricate or valvate: seeds albuminous.
- B. Ovary adnate to calyx-tube.....126. *Schizolobium*.
- BB. Ovary free in bottom of calyx.....127. *Parkinsonia*.
- 18. Cassia Tribe.**
- A. Petals 5; fls. hermaphrodite.....128. *Cassia*.
- AA. Petals 0; fls. polygamous.....129. *Ceratonina*.
- The following genera also are described as having more or less horticultural interest: *Azelia*, *Amicia*, *Aotus*, *Baikia*, *Baphia*, *Brachysema*, *Camdensia*, *Carmichaelia*, *Cicer*, *Copaifera*, *Dalea*, *Desmanthus*, *Dichroanthus*, *Diphysa*, *Ebenus*, *Eutaxia*, *Galedupa*, *Gliricidia*, *Hematoxylon*, *Hippocrepis*, *Hoffmannseggia*, *Hovea*, *Jacksonia*, *Kerstingia*, *Krameria*, *Lonchocarpus*, *Minklersia*, *Piptanthus*, *Podalyria*, *Pterocarpus*, *Pterolobium*, *Rhynchosia*, *Scorpiurus*, *Sesbania*, *Toluifera*, *Youapa*.

## 71. ROSACEÆ.

## I. Summary of Tribes.

- A. Ovary inferior; carpels 2-5, more or less connate and adnate to the cup-shaped receptacle, the whole developing into a fleshy fr. (pome): trees or shrubs with free stipules..... 4. POME TRIBE.
- AA. Ovary superior.
- B. Carpels usually many, if 1 or 2, fr. not drupaceous; calyx persistent.
- C. Fr. follicular, dehiscent.
- D. Seeds not winged; fls. small.... 1. SPIRÆA TRIBE.
- DD. Seeds winged, flattened; fls. rather large..... 2. QUILLAJA TRIBE.
- CC. Fr. not follicular, indehiscent, or carpels growing into drupelets.
- D. Pistils borne on a flat, hemispherical or convex receptacle, subtended by a cup-shaped portion of the receptacle (hypanthium), usually many.
- E. The pistils 2-5: shrubs, with simple lvs.
- F. Stipules wanting; fls. small, in large panicles..... 3. HOLODISCUS TRIBE.
- FF. Stipules present: fls. solitary or in few-fl. corymbs..... 5. KERRIA TRIBE.
- EE. The pistils many (if few, lvs. compound): herbs or shrubs.
- F. Carpels becoming dry achenes.
- G. Ovules 2; carpels 5-15: calyx without bractlets: herbs..... 9. ULMARIA TRIBE.
- GG. Ovules 1: carpels many; calyx usually with bractlets alternating with the lobes..... 6. POTENTILLA [TRIBE].
- DD. Pistils inclosed in the tubular or urn-shaped receptacle (hypanthium).
- E. Number of pistils 1 or 4; petals sometimes wanting.
- F. Hypanthium tubular or campanulate, the achenes loosely and usually only partly inclosing; pistils usually 1: shrubs..... 8. CERCOCARPUS [TRIBE].
- FF. Hypanthium urceolate, completely inclosing the 1-4 achenes; sepals usually 4: herbs or shrubs..... 10. SANGUISORBA [TRIBE].
- EE. Number of pistils many; calyx tube becoming fleshy; petals present: shrubs with odd-pinnate lvs..... 11. ROSE TRIBE.
- BB. Carpels 1, rarely 2: fr. drupaceous; calyx usually deciduous.
- C. Fls. symmetrical; style subterminal; ovules pendulous; radicles superior..... 12. PRUNUS TRIBE.
- CC. Fls. often unsymmetrical; style basilar; ovules ascending; radicles inferior..... 13. CHRYSOBALANUS [TRIBE].

## II. Key to the Tribes.

## 1. Spiræa Tribe.

- A. Pistils opposite to the petals or less than 5.
- B. Lvs. simple, often lobed, rarely pinnatifid: stamens inserted on the margin of the hypanthium: shrubs, rarely undershrubs.
- C. Stipules large, caducous: staminal disk wanting: seeds shining, crustaceous.
- D. Follicles dehiscent along both sutures, often inflated, 1-5: fls. in terminal corymbs..... 1. Physocarpus.
- DD. Follicles dehiscent only along the ventral suture, 1-2, not inflated.
- E. Fls. in terminal panicles; style terminal; pistils 2, rarely 1: follicles usually 5-seeded..... 2. Neillia.
- EE. Fls. in small terminal corymbs; style lateral; pistil 1: follicles 1-or rarely 2-seeded..... 3. Stephanandra.
- CC. Stipules wanting: staminal disk usually present: seeds dull.
- D. The lvs. entire, serrate or lobed: stamens free.
- E. Carpels free.
- F. Fls. in panicles, corymbs or umbel-like racemes; carpels dehiscent along the ventral suture: lvs. usually serrate or lobed..... 4. Spiræa.

- FF. Fls. in racemes; carpels dehiscent on both sutures: lvs. entire, evergreen: cespitose undershrub..... 5. Petrophytum.
- EE. Carpels connate at the base; fls. polygamo-dioecious, in panicles: lvs. entire, deciduous: upright shrub..... 6. Sibiræa.
- DD. The lvs. twice trifid: stamens connate at the base: fls. in racemes: prostrate undershrub..... 7. Luetkea.
- BB. Lvs. 2-3-pinnate: fls. dioecious, in ample panicles composed of slender spikes: herbs..... 8. Aruncus.
- AA. Pistils opposite to the sepals, 5.
- B. Petals roundish, imbricate in the bud; carpels connate at the base: lvs. pinnate or bipinnate: shrubs.
- C. Lvs. pinnate; lfts. coarsely serrate..... 9. Sorbaria.
- CC. Lvs. bipinnate; segms. minute, entire..... 10. Chamæbatiaria.
- BB. Petals strap-shaped, convolute in the bud: carpels distinct: lvs. ternate: herbs..... 11. Gillenia.

## 2. Quillaja Tribe.

- A. Carpels free, spreading, star-like at maturity: evergreen trees.
- B. Stamens 10..... 12. Quillaja.
- BB. Stamens 20..... 13. Kageneckia.
- AA. Carpels connate into a 5-celled caps.: stamens 15-20: deciduous shrub..... 14. Ezechorda.

## 3. Holodiscus Tribe.

- Lvs. doubly serrate or slightly lobed..... 15. Holodiscus.

## 4. Pome Tribe.

- A. Carpels bony at maturity: fr. hence with 1-5 stones.
- B. Pistils with 2 fertile ovules: lvs. entire or crenate.
- C. Lvs. entire: spineless shrubs: styles 2-5..... 16. Cotoneaster.
- CC. Lvs. crenate, persistent: usually spiny shrubs: styles 5..... 17. Pyracantha.
- BB. Pistils with only 1 fertile ovule: lvs. usually doubly serrate or lobed.
- C. Ovules 2, 1 fertile and 1 sterile: lvs. simple, often pinnately lobed.
- D. Number of carpels 5, wholly connate and covered at the top by the flesh of the fr.: fls. solitary, 2 in. across: lvs. entire or occasionally dentate..... 18. Mespilus.
- DD. Number of carpels 1-5, more or less distinct at the ventral suture and free at the top: fls. 1 in. or less across, usually in corymbs: lvs. often lobed..... 19. Crataegus.
- CC. Ovule but 1; stones 5: lvs. pinnate (the simple-lvd. species belong to Hespecomeles, which is not in cult.)..... 20. Osteomeles.
- AA. Carpels with leathery or papery walls at maturity: fr. hence 1-5-celled, each cell with 1 or 2, rarely many seeds.
- B. Fls. in compound corymbs.
- C. Styles 1-5, distinct or connate; carpels partly free.
- D. Fr. solid and pointed at the top; walls of cells leathery: lvs. deciduous, simple or pinnate.
- E. Sepals deciduous: lvs. always simple, serrate with excurrent veins: styles 2-3..... 21. Micromeles.
- EE. Sepals persistent.
- F. Number of styles usually 2, rarely 3 or 5, free or connate: lvs. pinnate or simple and serrate or lobed with excurrent veins, deciduous..... 22. Sorbus.
- FF. Number of styles 3-5: lvs. serrate to crenulate, with curving veins.
- G. Lvs. deciduous, with glands on the midrib above: styles 5, connate below: endocarp thin..... 23. Aronia.
- GG. Lvs. evergreen, without glands on the midrib: styles 3-5: endocarp firm..... 24. Stranvæsia.
- DD. Fr. hollow and rounded at the top, small, 1- or 2-seeded; walls usually papery: styles usually 2: lvs. simple, deciduous or evergreen with curving veins..... 25. Photinia.
- CC. Styles 5, distinct; carpels wholly connate: fr. pear-shaped, rather large, yellow: lvs. evergreen with excurrent veins..... 26. Eriobotrya.
- BB. Fls. in umbels, racemes or solitary.
- C. The carpels 4- to many-seeded.
- D. Styles free: lvs. entire..... 27. Cydonia.
- DD. Styles connate at the base: lvs. serrate or serrulate.
- E. Ovules many in each cell: calyx glabrous outside..... 28. Chanomeles.
- EE. Ovules 4-5 in each cell; calyx densely tomentose outside..... 29. Docynia.
- CC. The carpels 1-2-seeded.



- D. Cells of the ovary as many as styles, each with 2 ovules.  
 E. Ovary 2-celled: fr. 1-2-seeded, black; fls. in upright racemes, sometimes paniced; lvs. evergreen. 30. *Raphiolepis*.  
 EE. Ovary 3-5-celled: fls. in umbels; lvs. deciduous.....31. *Pyrus*.  
 DD. Cells of the ovary twice as many as styles, each with 1 ovule.  
 E. Styles usually 5; fls. in racemes: lvs. serrate, or crenate at the apex.....32. *Amelanchier*.  
 EE. Styles 2-3; fls. in few-fl. umbels; calyx-tube cylindric; lvs. entire or denticulate, narrow.....33. *Peraphyllium*.  
**5. Kerria Tribe.**  
 A. Petals wanting; fls. in few-fl. corymbs; achenes 2-5, drupaceous.....34. *Nerissa*.  
 AA. Petals present; fls. solitary, large.  
 B. Lvs. alternate: fls. 5-merous, yellow; achenes drupaceous, yellow.....35. *Kerria*.  
 BB. Lvs. opposite: fls. 4-merous, white; achenes dry, black.....36. *Rhodotypos*.

- 6. Potentilla Tribe.**  
 A. Style deciduous.  
 B. Receptacle in fr. much enlarged, colored.  
 c. Fls. white: receptacle pulpy, juicy.....37. *Fragaria*.  
 cc. Fls. yellow: receptacle dry.....38. *Duchesnea*.  
 BB. Receptacle not fleshy, even in fr.  
 c. Pistils only 1-12.  
 d. Stamens 5; petals minute.....39. *Sil. baldia*.  
 DD. Stamens numerous; petals conspicuous. 40. *Waldsteinia*.  
 CC. Pistils very numerous.  
 d. Petals white or yellow, obtuse or emarginate.....41. *Potentilla*.  
 DD. Petals purple, abruptly acuminate, much smaller than calyx.....42. *Comarum*.  
 AA. Style elongated after anthesis, often plumose.  
 B. Fls. 5-merous: lvs. pinnate or pinnatifid.  
 c. Sepals valvate; hypanthium flat: herbs. 43. *Geum*.  
 cc. Sepals imbricate; hypanthium concave: shrubs.  
 d. Calyx with bracts outside.....44. *Fallugia*.  
 DD. Calyx without bracts.....45. *Cowania*.  
 BB. Fls. 8-9-merous: lvs. undivided: prostrate undershrub.....46. *Dryas*.

- 7. Rubus Tribe.**  
 A. Drupelets pulpy.....47. *Rubus*.  
 AA. Drupelets nearly dry, inclosed by calyx.....48. *Dalibarda*.

- 8. Cercocarpus Tribe.**  
 A. Fls. apetalous; style elongated and plumose in fr.; hypanthium tubular.....49. *Cercocarpus*.  
 AA. Fls. with petals.  
 B. Style with terminal stigma: lvs. linear, needle-shaped.....50. *Adenostoma*.  
 BB. Style with decurrent stigma.  
 c. Lvs. 3-fid at the apex: sepals imbricate: fr. inclosed about half.....51. *Purshia*.  
 cc. Lvs. bipinnate: sepals valvate: fr. inclosed.....52. *Chamaebatia*.

- 9. Ulmaria Tribe.**  
 Herbs with large pinnate lvs. and large stipules and small white or pink fls. in large panicles...53. *Filipendula*.

- 10. Sanguisorba Tribe.**  
 A. Calyx with 5-6 bractlets or 10-12-out in 2 series or in Agrimonia with a setose limb.  
 B. Petals 0.....54. *Alchemilla*.  
 BB. Petals 4 or 5.....55. *Agrimonia*.  
 AA. Calyx without bractlets; petals 0; lvs. pinnate.  
 B. Fls. axillary, solitary.....56. *Margyricarpus*.  
 BB. Fls. spicate or capitate.  
 c. The calyx valvate; stamens 1-10, short; carpels 1-2.....57. *Acæna*.  
 CC. The calyx imbricate.  
 d. Fr. rarely rugose: fls. usually bisexual; carpel 1; stamens 4-12.....58. *Sanguisorba*.  
 DD. Fr. often rugose: fls. polygamodigious, rarely bisexual; carpels 2; stamens ∞.....59. *Poterium*.

- 11. Rose Tribe.**  
 The only genus.....60. *Rosa*.

- 12. Prunus Tribe.**  
 A. Sepals usually 10, small; petals often wanting or small; carpels in the staminate fl. 2, 1 in the fertile fl.....61. *Maddenia*.

- AA. Sepals 5.  
 B. Carpels solitary.  
 c. Style terminal: lvs. usually serrate; pith of branches solid.....62. *Prunus*.  
 cc. Style lateral: lvs. entire: pith lamellate.....63. *Prinsevia*.  
 BB. Carpels 5: lvs. entire.....64. *Osmaronia*.

### 13. Chrysobalanus Tribe.

- Anthers small, short, didymous; ovary 1-loculed, inserted in the base of the calyx-tube; stamens 15 or more.....65. *Chrysobalanus*.  
 The genus *Plagiospermum* is also cultivated.

## 72. SAXIFRAGACEÆ.

### I. Summary of Tribes.

1. Plants are trees or shrubs.  
 B. Lvs. opposite.....1. **HYDRANGÆA TRIBE**  
 BB. Lvs. alternate.  
 c. Stipules absent: lvs. often coriaceous or glandular-serrate: stamens usually isomerous with petals.....2. **ESCALLONIA TRIBE**  
 cc. Stipules absent or adnate to petiole at base: fls. generally racemose; ovary 1-locular, 2-merous; seeds immersed in pulp.....3. **RIBES TRIBE**.  
 AA. Plants are herbs.  
 B. Fls. 4-merous.....4. **FRANCOA TRIBE**.  
 BB. Fls. generally 5-merous.....5. **SAXIFRAGÆ TRIBE**.

### II. Key to the Tribes.

#### 1. Hydrangea Tribe.

- A. Ovary superior  
 B. Number of petals 4; stamens 10; filaments 2-lobed; styles 3.....1. *Fendlera*.  
 BB. Number of petals 5 or 6.  
 c. Ovules solitary: stamens 4-12; styles 3-5. 2. *Whipplea*.  
 cc. Ovules 4; stamens 15; carpels 2, separate. 3. *Lyonothamnus*.  
 d. Petals 5, convolute: stamens 10; styles 3-5.....4. *Jamesia*.  
 DD. Petals 5 or 6, imbricate: stamens numerous; style 1, with a 5-7-lobed stigma.....5. *Carpenteria*.  
 AA. Ovary inferior or semi-superior.  
 B. Stamens 8, 10 or 12.  
 c. Petals induplicate or imbricate: fr. capsular.....6. *Deutzia*.  
 CC. Petals valvate.  
 d. Fr. a caps.  
 E. Styles 4 or 5, free or connate at the base; petals 4 or 5.....7. *Hydrangea*.  
 EE. Style 1, with a 4-5-lobed stigma; petals 5.....8. *Schizophragma*.  
 DD. Fr. a berry: petals 5 or 6; styles 3-5, club-shaped.....9. *Dichroa*.  
 BB. Stamens ∞.  
 c. Petals induplicate, 7-10; style 1.....10. *Decumaria*.  
 CC. Petals imbricate; styles 1-5.....11. *Philadelphus*.  
 CCC. Petals valvate.  
 d. Styles 2; petals 4.....12. *Platycrater*.  
 DD. Styles 3; petals 5.....13. *Cardiandra*.

#### 2. Escallonia Tribe.

- A. Petals imbricate; style 1; ovary 2- or 3-loculed.....14. *Escallonia*.  
 AA. Petals valvate; styles divisible into 2; ovary 2-loculed.....15. *Itea*.

#### 3. Ribes Tribe.

- The only genus.....16. *Ribes*.

#### 4. Francoa Tribe.

- Sepals and petals equal.....17. *Francoa*.

#### 5. Saxifrage Tribe.

- A. Ovary 1-loculed.  
 B. Placentæ basilar or nearly so.....18. *Tiarella*.  
 BB. Placentæ parietal, opposite the stigmas.....19. *Parnassia*.  
 BBB. Placentæ parietal, alternate with stigmas.  
 c. Stamens 3; petals 5, capillary.....20. *Tolmiea*.  
 CC. Stamens 5-10.  
 d. Caps. not beaked, superior: petals 5, 3-cut or pinnatifid.....21. *Mitella*.  
 DD. Caps. 2-beaked.  
 E. Number of stamens 5; petals 5 or 0; caps. inferior.....22. *Heuchera*.

- |   |                          |
|---|--------------------------|
| EE. Calyx-tube urn-shaped, much longer than ovary; sepals and stamens 5; fls. in long and slender racemes...              | 5. <i>Sinowilsonia</i>   |
| BB. Petals as many as calyx lobes.  |                          |
| c. Fls. borne in catkins, 5-merous.   |                          |
| d. Shape of petals broad; stamens with long-filament; disk present.....   | 6. <i>Corylopsis</i> .   |
| DD. Shape of petals subulate, as long as sepals; stamens nearly sessile; disk 0.  | 7. <i>Fortunearia</i> .  |
| CC. Fls. in clusters, 4-merous.   |                          |
| d. Lvs. deciduous, crenate; anthers obtuse, the locules opening with 1 valve.   | 8. <i>Hamamelis</i> .    |
| DD. Lvs. persistent, entire; anthers beaked, the locules opening with 2 valves....  | 9. <i>Loropetalum</i> .  |
| AA. Ovary-locules 2- or more-ovuled.  |                          |
| B. Fls. unisexual.....  | 10. <i>Liquidambar</i> . |
| BB. Fls. bisexual.....  | 11. <i>bar.</i>          |
| C. The fls. 5, in a head, surrounded by an involucre of which the outer bracts are small, the inner gradually larger..... | 11. <i>Rhodoleia</i> .   |
| CC. The fls. 2 together with very short bracts at the base.....   | 12. <i>Disanthus</i> .   |

78. BRUNIACEÆ.

In cultivation..... *Audouinia*.  
(See article *Diosma*.)

## 79. HALORAGIDACEÆ.

- A. Stamens 1-2; calyx 3-4-lobed; ovary 1-loculed 1. *Gunnera*.  
 AA. Stamens 2-8; calyx truncate or 4-toothed;  
 ovary deeply 2- or 4-grooved..... 2. *Myriophyl-  
 lum*.  
 AAA. Stamen 1; calyx truncate; ovary 1-loculed ... 3. *Hippuris*.

## 80. RHIZOPHORACEÆ.

A. Anthers 8, subsessile.....	1. <i>Rhizophora</i> .
AA. Anthers 15-30, on filaments.....	2. <i>Cassipourea</i> .

## 81. COMBRETACEÆ.

- |   |                        |
|---|------------------------|
| A. Petals 0; calyx-tube not produced beyond ovary.....          | 1. <i>Terminalia</i> . |
| AA. Petals 5 (0 in a few species of <i>Combretum</i> ).....     |                        |
| b. Calyx-tube straight, constricted above ovary.....            |                        |
| c. Cotyledons convolute.....                                    | 2. <i>Poirrea</i> .    |
| cc. Cotyledons deeply furrowed or twisted and plaited.....      | 3. <i>Combretum</i> .  |
| BB. Calyx-tube produced to a great length beyond the ovary..... | 4. <i>Quisqualis</i> . |

## 82. MYRTACEÆ.

- |  |                        |
|--|------------------------|
| A. Ovary 1-located.....  | 1. <i>Thrypto-</i>     |
| AA. Ovary 2- or more-located.  | <i>[mene.]</i>         |
| B. Fr. a caps., which is loculicidally dehiscent at apex, rarely 1-2-seeded and sub-indehiscent. |                        |
| C. Anthers basifixed.....  | 2. <i>Calotham-</i>    |
| CC. Anthers versatile.   | <i>[nus.]</i>          |
| D. Individual fls. pedicelled.   |                        |
| E. Stamens 5-adelphous.....  | 3. <i>Tristania.</i>   |
| EE. Stamens free.  |                        |
| F. Fls. in globose heads.....  | 4. <i>Syncarpia.</i>   |
| FF. Fls. in forking cymes.....   | 5. <i>Metrosid-</i>    |
| DD. Individual fls. not pedicelled.  | <i>[eros.]</i>         |
| E. Fls. solitary in the axils of the floral lvs. or bracts.                                      |                        |
| F. Stamens distinct, not longer than petals.....   | 6. <i>Leptosper-</i>   |
| FF. Stamens distinct, long-exserted....  | <i>[mum.]</i>          |
| FFF. Stamens united in clusters, long-exserted .....   | 7. <i>Callistemon.</i> |
| EE. Fls. in cymose or umbellate heads.   |                        |
| F. Petals distinct....   | 8. <i>Melaleuca.</i>   |
| FF. Petals wanting (or adnate to the calyx-lid).....   | 9. <i>Angophora.</i>   |
| BB. Fr. a berry or rarely an indehiscent drupe: lvs. opposite, punctate.                         | 10. <i>Eucalyptus.</i> |
| C. Stamens straightish in the bud: seeds with endosperm.....                                     | 11. <i>Peisjoa.</i>    |
| CC. Stamens inflexed or involute in the bud: seeds without endosperm.                            |                        |
| D. Calyx-limb closed in bud, deeply divided in anthesis.....                                     | 12. <i>Psidium.</i>    |
| DD. Calyx 4-5-lobed or -parted in the bud, not cut-deeper in anthesis.                           |                        |

76. DROSERACEÆ.

- |  |                                |
|--|--------------------------------|
| A. Stamens 4-8; styles 2-5; placentæ parietal....            | 1. <i>Drosera</i> .            |
| AA. Stamens about 15; style columnar; placentæ<br>basal..... | 2. <i>Dionæa</i> .             |
| AAA. Stamens 10-20; styles 5, filiform.....                  | 3. <i>Drosophyl-<br/>lum</i> . |

## 77. HAMAMELIDACEÆ.

- A. Ovary-locules 1-ovuled.  
 B. Petals 0.  
 C. Lvs. evergreen.  
   D. Stamens 2-8, with long filaments; fls. in racemes. 1. *Distylium*.  
 DD. Stamens  $\infty$ , with short filaments; fls. in heads; calyx-tube in the pistillate fl. tubular. 2. *Sycopsis*.  
 CC. Lvs. deciduous.  
   D. Number of stamens about 24; fls. in dense spikes. 3. *Fothergilla*.  
 DD. Number of stamens 5-7.  
   E. Calyx-tube not urn-shaped; sepals and stamens 5-7; fls. in short head-like racemes. 4. *Parrotia*.



- The only genus..... *Trapa*.

## 89. LOASACEÆ.

- A. Petals hooded.  
 B. Caps. 3-5-valved at apex, rarely twisted.... 1. *Loasa*.  
 BB. Caps. longitudinally 5-10-valved, usually twisted spirally..... 2. *Blumenbachia*.  
 BBB. Caps. narrow, straight, longitudinally 5-valved ..... 3. *Scyphanthus*.  
 AA. Petals not hooded.  
 B. Seeds very numerous, arranged in many series..... 4. *Eucnide*.  
 BB. Seeds few or, if numerous, arranged in 2 series..... 5. *Mentzelia*.

## 90. PASSIFLORACEÆ.

- A. Hypanthium long; petals and stamens 5.... 1. *Tacsonia*.  
 AA. Hypanthium short; petals 4-5, rarely 0; stamens 4-5..... 2. *Passiflora*.  
 AAA. Hypanthium medium or short; fls. unisexual. 3. *Modecca*.

## 91. CARICACEÆ.

In cultivation ..... *Carica*.

## 92. CUCURBITACEÆ.

## I. Summary of Tribes.

- A. Series 1. Ovules horizontal..... 1. CUCURBITA TRIBE.  
 AA. Series 2. Ovules erect or ascending, rarely horizontal  
 B. Fr. ruptures elastically..... 2. CYCLANTHERA [TRIBE].  
 BB. Fr. does not rupture elastically.... 3. ABOBRA TRIBE.  
 AA. Series 3. Ovules pendulous..... 4. SICYOS TRIBE.

## II. Key to the Tribes.

## 1. Cucurbita Tribe.

- A. Anther-cells straight, rarely curved, not flexuous..... 1. *Melothria*.  
 AA. Anther-cells flexuous or conduplicate.  
 B. Corolla bell-shaped, 5-lobed to the middle or a little below.  
 C. Anthers free..... 2. *Sicana*.  
 CC. Anthers coherent.  
 D. Filaments connate..... 3. *Coccinia*.  
 DD. Filaments free..... 4. *Cucurbita*.  
 BB. Corolla rotate and 5-petaled or bell-shaped and 5-parted to the base.  
 C. Petals fimbriate or tendril-bearing.  
 D. Seeds large, fibrous..... 5. *Telfairea*.  
 DD. Seeds small, not fibrous..... 6. *Trichosanthes*.  
 CC. Petals entire.  
 D. Hypanthium of male fls. long; anthers coherent in an oblong head, usually included.  
 E. Pistillodes in male fls. 1-3, subulate or setiform..... 7. *Gymnopetalum*.  
 EE. Pistillode absent or reduced to a gland  
 F. Anthers coherent..... 8. *Peponia*.  
 FF. Anthers free..... 9. *Lagenaria*.  
 DD. Hypanthium of male fls. short; anthers free or slightly coherent, usually exerted.  
 E. Stamens inserted in the mouth of the hypanthium.  
 F. Scales in bottom of hypanthium..... 10. *Thladiantha*.  
 FF. Scales in bottom of hypanthium 2-3..... 11. *Momordica*.  
 EE. Stamens inserted in hypanthium.  
 F. Male fls. in racemes.  
 G. Fr. dry, fibrous, dehiscent by lid at top..... 12. *Luffa*.  
 GG. Fr. fleshy, not fibrous.  
 H. Female fls. solitary..... 13. *Ecballium*.  
 HH. Female fls. racemose or clustered..... 14. *Bryonia*.  
 FF. Male fls. solitary or fascicled.  
 G. Sepals somewhat leafy, serrate, reflexed..... 15. *Benincasa*.  
 GG. Sepals awl-shaped, entire, erect.  
 H. Pollen minutely muricate; pistillode 0..... 16. *Bryonopsis*.  
 HH. Pollen smooth; pistillode reduced to a small gland.  
 I. Tendrils not branched; connective usually produced upward beyond locule..... 17. *Cucumis*.  
 II. Tendrils 2-3-fid; connective not produced..... 18. *Citrullus*.

## 2. Cyclanthera Tribe.

- A. Fr. oblique, gibbous, rupturing elastically.... 19. *Cyclanthera*.  
 AA. Fr. not gibbous, opening by 1 or 2 pores at the top or by irregular rupture..... 20. *Echinocystis*.  
 (Incl. *Megarrhiza*.)

## 3. Abobra Tribe.

Anther-cells flexuous; stamens free..... 21. *Abobra*.

## 4. Sicyos Tribe.

Fls. 5-merous, monœcious: fr. fleshy..... 22. *Sechium*.

The genera *Actinostemma*, *Gurania*, *Herpetospermum*, *Hodgsonia* and *Sicyos* are sometimes cultivated.

## 93. BEGONIACEÆ.

- A. Ovary wholly inferior.  
 B. Petals all free ..... 1. *Begonia*.  
 BB. Petals of pistillate fl. grown together..... 2. *Symbegonia*.  
 AA. Ovary partly superior..... 3. *Hillebrandia*.

## 94. CACTACEÆ.

- A. Fl.-tube wanting.  
 B. Lvs. large and persistent.  
 C. Seeds black and shining..... 1. *Pereskia*.  
 CC. Seeds white, dull and covered with hairs. 2. *Peresklopsis*.  
 BB. Lvs. wanting or minute and caducous.  
 C. Plant epiphytic, spineless: fls. small.  
 D. Flowering joints bottle-shaped..... 3. *Hariota*.  
 DD. Flowering joints not bottle-shaped.... 4. *Rhipsalis*.  
 CC. Plant not epiphytic, usually very spiny: fls. large.  
 D. Petals spreading; filaments much shorter than the petals..... 5. *Opuntia*.  
 DD. Petals erect and closely surrounding the stamens; filaments longer than the petals..... 6. *Nopalea*.  
 AA. Fl.-tube present, often much elongated.  
 B. Plants epiphytic or nearly so, either flat or 3-angled, usually spineless and always with spineless fr.  
 C. Sts. 3-angled, bearing small spines at the areoles; ovary and fr. bearing large bracts..... 7. *Hylocereus*.  
 CC. Sts. normally flat, spineless; ovary and fr. bearing only minute bracts.  
 D. The sts. weak, divided into many short joints.  
 E. Fls. irregular..... 8. *Zygocactus*.  
 EE. Fls. regular..... 9. *Schlumbergera*.  
 DD. The sts. stouter than the last, with elongated joints.  
 E. Fl.-tube very short or nearly wanting..... 10. *Disocactus*.  
 EE. Fl.-tube very definite, often much elongated.  
 F. Fls. small, diurnal..... 11. *Wittia*.  
 FF. Fls. large, nocturnal ..... 12. *Epiphyllum*.  
 BB. Plants not epiphytic, never flat, with several to many ribs.  
 C. Sts. globular or cylindrical, not jointed.  
 D. Plant-body covered with more or less definite tubercles: fr. naked.  
 E. The plant terminated by a cephalium..... 13. *Cactus*.  
 EE. The plant without a terminal cephalium.  
 F. Without spines except in the seedlings.  
 G. Plant tumid, without woody tubercles..... 14. *Lophophora*.  
 GG. Plant with dry prominent woody tubercles..... 15. *Ariocarpus*.  
 FF. With spines on the tubercles.  
 G. Tubercles terete or angled, with various kinds of spines..... 16. *Mammillaria*.  
 GG. Tubercles flattened, with pectinate spines..... 17. *Pelecypophora*.  
 DD. Plant-body covered with more or less definite ribs: fr. scaly.  
 E. Tubercles elongated, finger-like..... 18. *Leuchtenbergia*.  
 EE. Tubercles, if present, always low.  
 F. Top of plant naked or nearly so..... 19. *Echinocactus*.  
 FF. Top of plant very woolly..... 20. *Malacocarpus*.  
 CC. Sts. often tall, cylindrical, more-or-less branched, erect or climbing, sometimes low and then always with spiny fr.  
 D. Flowering plants taking on various forms like a cephalium, long hairs or wool, peculiar bristles or spines from near the top.  
 E. Ribs of sts. 4-7..... 21. *Lophocereus*.  
 EE. Ribs of sts. many.



- F. Fls. diurnal; flowering areoles with acicular spines, but no wool. 22. *Carnegiea*.  
 FF. Fls. nocturnal; wool or hairs usually produced in abundance with the fls.  
 G. Ovary and fr. nearly smooth, the few minute bracts with no hairs in their axils. .... 23. *Cephalocereus*.  
 GG. Ovary and fr. covered with bracts with long hairs in their axils. .... 24. *Oreocereus*.  
 DD. Flowering plants not different from the sterile plants.  
 E. Plants tall erect trees.  
 F. Fl., after withering, dropping from the ovary. .... 25. *Cereus*.  
 FF. Fl., after withering, persisting on the ovary.  
 G. Fr. and fls. minute, often several coming from each flowering areole. .... 26. *Myrtillocactus*.  
 GG. Fr. and fls. medium-sized or larger, only 1 coming from each flowering areole.  
 H. Ovary and fr. covered with thin scales, but no fls. .... 27. *Escontria*.  
 HH. Ovary and fr. spiny but not bearing large chartaceous scales.  
 I. The fr. edible, juicy. .... 28. *Lemnaireocereus*.  
 II. The fr. dry. .... 29. *Pachycereus*.  
 EE. Plants low, often vines; or, if at first elongated and erect, finally becoming procumbent or clambering.  
 F. Fls. nocturnal.  
 G. Fr. smooth, yellow. .... 30. *Harrisia*.  
 GG. Fr. spiny, red.  
 H. Sts. producing an abundance of aerial roots. .... 31. *Selenicereus*.  
 HH. Sts. not producing an abundance of aerial roots.  
 I. Ribs usually 3. .... 32. *Acanthocereus*.  
 II. Ribs 10 or more. .... 33. *Nyctocereus*.  
 FF. Fls. diurnal.  
 G. The fls. irregular, narrow.  
 H. Sts. slender, weak. .... 34. *Aporocactus*.  
 HH. Sts. stout, at first erect.  
 I. Fr. spiny, with red pulp. .... 35. *Rathbunia*.  
 II. Fr. not spiny, with white pulp. .... 36. *Cleistocactus*.  
 GG. The fls. regular.  
 H. Fl.-tube much elongated; spines on the ovary reduced to stiff bristles. .... 37. *Echinopsis*.  
 HH. Fl.-tube short, at least never much elongated.  
 I. Plants producing a cluster of tubers. .... 38. *Wilcoxia*.  
 II. Plants without tubers.  
 J. Usually stout but low, sometimes procumbent; stigmas green. .... 39. *Echinocephalus*.  
 JJ. Viny; stigmas not green.  
 K. Fls. small, yellow. .... 40. *Bergerocactus*.  
 KK. Fls. large, red or white. .... 41. *Hellocereus*.

Epiphyllanthus and Pterocactus are described.

## 95. AIZOACEÆ.

- A. Petals numerous; caps. 5- or more valved. .... 1. *Mesembryanthemum*.  
 AA. Petals 0; drupe 3-8-stoned. .... 2. *Tetragonia*.  
 AAA. Petals 5-∞; caps. circumscissile. .... 3. *Sesuvium*.

## 96. UMBELLIFERÆ.

Key condensed from Coulter & Rose's "Monograph of North American Umbelliferae." Not arranged in sequence of relationship.

- A. Fls. in dense heads. .... 1. *Eryngium*.  
 AA. Fls. not in heads, evidently umbellate.  
 B. Fr. conspicuously bristly.  
 C. The fr. covered with spines or hooked bristles. .... 2. *Sanicula*.  
 CC. The fr. with bristles only on the ribs. .... 3. *Daucus*.  
 BB. Fr. not bristly (except *Osmorhiza* and *Cuminum*).  
 C. Oil-tubes obsolete or obscure.  
 D. The fr. strongly flattened laterally: lvs. simple. .... 4. *Hydrocotyle*.  
 DD. The fr. not strongly flattened.  
 E. Seed-face concave.  
 F. Stylopodium conical.  
 G. At base, fr. attenuate. .... 5. *Osmorhiza*.

- GG. At base, fr. rounded.  
 H. Ribs slender. .... 6. *Scandix*.  
 HH. Ribs broad, 3-angled, or almost wing-like. .... 7. *Myrrhis*.  
 FF. Stylopodium flat or wanting.  
 G. Lvs. simple and perfoliate. .... 8. *Bupleurum*.  
 GG. Lvs. large and compound. .... 9. *Conium*.  
 EE. Seed-face plane. .... 10. *Ægopodium*.  
 CC. Oil-tubes distinct.  
 D. Dorsally the fr. strongly flattened, with lateral ribs more or less prominently winged (see *Musineon*).  
 E. The oil-tubes solitary in the intervals between the ribs, rarely 2.  
 F. Stylopodium conical.  
 G. Slender and glabrous plants. .... 11. *Ozypolis*.  
 GG. Stout and pubescent, at least in the umbel. .... 12. *Heracleum*.  
 FF. Stylopodium flat or wanting.  
 G. Plants caulescent and branching.  
 H. Color of fls. white.  
 I. Lvs. pinnately dissected; dorsal ribs filiform: plant slender. .... 13. *Anethum*.  
 II. Lvs. ternately or pinnately compound; dorsal ribs prominent but slender: plant stout. .... 14. *Angelica*.  
 III. Lvs. pinnately compound; dorsal ribs winged: plant stout. .... 15. *Selinum*.  
 HH. Color of fls. yellow. .... 16. *Levisticum*.  
 II. Dorsal ribs filiform. .... 17. *Pastinaca*.  
 GG. Plants acaulescent or nearly so. .... 18. *Lomatium*.  
 EE. The oil-tubes more than 1 in the intervals, usually several.  
 F. Plants caulescent or nearly so: fls. yellow or white. .... 18. *Lomatium*.  
 FF. Plants caulescent and branching.  
 G. Fr. winged: fls. white. .... 19. *Archangel*.  
 GG. Fr. not winged: fls. yellow. .... 20. *Ferula*.  
 DD. Dorsally the fr. not strongly flattened, usually more or less laterally flattened.  
 E. The oil-tubes solitary in the intervals between the ribs.  
 F. Stylopodium conical: lfts. linear or filiform.  
 G. Involucre wanting.  
 H. Fls. white. .... 21. *Coriandrum*.  
 HH. Fls. yellow. .... 22. *Feniculum*.  
 GG. Involucre present.  
 H. Fls. rose-color: fr. bristly. .... 23. *Cuminum*.  
 HH. Fls. white: fr. smooth. .... 24. *Carum*.  
 FF. Stylopodium flat or wanting.  
 G. Fls. white. .... 25. *Apium*.  
 GG. Fls. yellow. (See article *Celery*).  
 H. Ribs equal, broad and corky. .... 26. *Petroselinum*.  
 HH. Ribs winged or filiform.  
 I. The ribs conspicuously winged. .... 27. *Thaspium*.  
 II. The ribs filiform. .... 28. *Zizia*.  
 EE. The oil-tubes more than 1 in the intervals.  
 F. Stylopodium conical. .... 29. *Ligusticum*.  
 FF. Stylopodium flat or wanting.  
 G. Seed-face sulcate or decidedly concave.  
 H. Carpels flattened dorsally. .... 30. *Musineon*.  
 HH. Carpels strongly flattened laterally. .... 31. *Erigenia*.  
 GG. Seed-face plane or but slightly concave.  
 H. Ribs all filiform: lfts. entire. .... 32. *Tamaria*.  
 HH. Ribs corky at least the lateral.  
 I. Lvs. simple and perfoliate: oil-tubes continuous about seed-cavity. .... 8. *Bupleurum*.  
 II. Lvs. pinnate, usually serrate: oil-tubes 1-3 in the intervals. .... 33. *Sium*.

The following genera are also treated: *Aciphylla*, *Arracacia*, *Astrantia*, *Chaerophyllum*, *Crithmum*, *Dorema*, *Hacquetia*, *Meum*, *Molopospermum*, *Peucedanum*, *Portenschlagia*, and *Seseli*.

## 97. ARALIACEÆ.

- A. Petals more or less imbricate, broadly affixed at base.  
 B. Lvs. pinnate.  
 C. Lfts. entire or indistinctly crenate: ovary 2-celled: glabrous evergreen shrubs. .... 1. *Delarbrea*.  
 CC. Lfts. serrate: ovary 2-5-celled: herbs or small deciduous trees. .... 2. *Aralia*.  
 BB. Lvs. digitate, whorled: fls. in simple terminal umbels; styles 2-3, distinct in the fertile fls.: herbs. .... 3. *Panax*.

- AA. Petals valvate.  
 B. Pedicels jointed or fls. sessile: evergreen tropical or subtropical trees or shrubs.  
 C. Fls. pedicelled.  
 D. Lvs. 1-3-pinnate: ovary 1-10-celled; styles usually distinct..... 4. *Polyscias*.  
 DD. Lvs. digitate or occasionally simple: styles 5, distinct..... 5. *Pseudo*-[*panax*.]  
 CC. Fls. sessile: ovary usually 5-celled, rarely 1-4- or 6-12-celled; endosperm usually ruminate: lvs. usually simple and lobed, rarely digitate..... 6. *Oreopanax*.  
 BB. Pedicels not jointed.  
 C. Lvs. digitate.  
 D. Anthers 4-celled; ovary 10-celled, styles distinct: evergreen..... 7. *Dizygotheca*.  
 DD. Anthers 2-celled; styles usually connate.  
 E. Stipules wanting: lvs. deciduous: ovary 2 5-celled..... 8. *Acantho*-[*panax*.]  
 EE. Stipules developed: lvs. evergreen: ovary 5- to many-celled..... 9. *Schefflera*.  
 CC. Lvs. simple, usually lobed.  
 D. Fls. 4- or 8-12-merous: lvs. palmately lobed, large.  
 E. Styles, connate into a column: fls. 8-12-merous..... 10. *Trevesia*.  
 EE. Styles distinct, 2: fls. 4-merous: lvs. deciduous..... 11. *Tetrapanax*.  
 DD. Fls. 5-merous, rarely 5-8-merous.  
 E. With distinct styles.  
 F. Shrub, evergreen, unarmed: styles 5..... 12. *Fatsia*.  
 FF. Shrub deciduous, prickly: styles 2..... 13. *Echino*-[*panax*.]  
 EE. With connate styles.  
 F. Habit climbing: endosperm ruminate: lvs. simple, usually lobed, evergreen..... 14. *Hedera*.  
 FF. Habit upright.  
 G. Ovary 5-8-celled; calyx indistinctly toothed: lvs. usually entire, occasionally 2-5-lobed, evergreen..... 15. *Gilibertia*.  
 GG. Ovary 2-celled; calyx with 5 short teeth: lvs. palmately lobed or digitate, deciduous... 8. *Acantho*-[*panax*.]

*Meryta* and *Tupidanthus* are also in cultivation.

### 98. GARRYACEÆ.

The only genus..... *Garrya*.

### 99. NYSSACEÆ.

- A. Ovary 1-celled; calyx minute; petals usually 5: pistillate and staminate fls. in distinct heads with small deciduous bracts..... 1. *Nyssa*.  
 AA. Ovary 6-10-celled; perianth 0 in staminate fls.; heads consisting of 1 pistillate fl. and numerous staminate fls. with 2 or 3 very large white bracts at the base..... 2. *Davidia*.

### 100. ALANGIACEÆ.

The only genus..... *Alangium*.

### 101. CORNACEÆ.

- A. Fls. bisexual, usually in cymes; petals short, valvate; ovary 2-celled: lvs. usually opposite..... 1. *Cornus*.  
 AA. Fls. unisexual.  
 B. Lvs. opposite, evergreen: fls. in terminal panicles; ovary 1-celled..... 2. *Aucuba*.  
 BB. Lvs. alternate.  
 C. Petals valvate, 4: fls. in few-fl. cymes on the upper surface of the lvs..... 3. *Helwingia*.  
 CC. Petals imbricate, 5: fls. in terminal racemes or panicles..... 4. *Griselinia*.

### 102. CAPRIFOLIACEÆ.

- A. Corolla rotate or nearly so; limb regular; style short, deeply 2-5-cut.  
 B. Lvs. pinnately cut..... 1. *Sambucus*.  
 BB. Lvs. simple..... 2. *Viburnum*.  
 AA. Corolla tubular or bell-shaped; limb usually irregular; style long, usually with capitate stigma.

- B. Ovary 2-5-celled; all the cells 1-ovuled: herbs with rather small whorled fls..... 3. *Triosteum*.  
 BB. Ovary 3-4-celled; 1 or 2 cells 1-ovuled, the others with numerous ovules.  
 C. Fr. a berry, usually 2-seeded: corolla campanulate or tubular-funnelform, nearly regular..... 4. *Symphoricarpos*.  
 CC. Fr. a leathery achene.  
 D. Achene inclosed between large peltate bracts: corolla campanulate-funnelform, 2-lipped; ovary 4-celled..... 5. *Dipelta*.  
 DD. Achene not inclosed between bracts: ovary 3-celled; corolla nearly or quite regular.  
 E. Ovary narrow; sepals 2-5, large, persistent; corolla tubular or campanulate-funnelform..... 6. *Abelia*.  
 EE. Ovary subglobose; sepals 5, lanceolate deciduous; corolla campanulate-funnelform: trailing under-shrub with the fls. in pairs on slender upright stalks..... 7. *Linnæa*.  
 BBB. Ovary 2-8-celled, the cells with many ovules or 1 cell empty.  
 C. Fr. an achene or caps.  
 D. Stamens 4: fls. in coalescent pairs inserted at unequal height; ovary 3-celled, often 1 cell empty: fr. an achene..... 8. *Kolkwitzia*.  
 DD. Stamens 5: fls. in cymes: fr. a 2-celled dehiscent caps..... 9. *Diervilla*.  
 CC. Fr. a berry.  
 D. Cells of ovary 2-3, rarely 4-5: fls. in pairs or whorls; calyx deciduous... 10. *Lonicera*.  
 DD. Cells of ovary 5-8: fls. in whorls; calyx persistent..... 11. *Leycesteria*.

*Alseuosmia* is also briefly treated.

## 103. RUBIACEÆ.

### 1. Summary of Tribes.

Ignoring exceptions and omitting eight tribes not within the scope of this work.

- A. Number of ovules in each locule ∞.  
 B. Fr. dry, capsular or 2-5-berried or nutlike.  
 C. Fls. compacted or confluent into a spherical head..... 1. NAUCLEA TRIBE.  
 CC. Fls. not disposed in a spherical head.  
 D. Seeds winged or appendaged, with endosperm: caps. 2-celled, 2. CINCHONA TRIBE.  
 DD. Seeds not winged.  
 E. Corolla valvate.  
 F. The seeds with endosperm: caps. 2-celled..... 3. CONDAMINEA [TRIBE].  
 FF. The seeds minute: fr. indehiscent, 2-berried or capsular, 2-4-celled..... 4. HEDYOTIS TRIBE.  
 EE. Corolla imbricate or convolute: caps. 2-celled; seeds with endosperm..... 5. RONDELETIA [TRIBE].  
 BB. Fr. fleshy, bursting irregularly or dehiscent at apex, or a drupe with 2 or more stones, the stones many-seeded.  
 C. Corolla valvate: seeds numerous, minute, angled..... 6. MUSSENDA TRIBE.  
 CC. Corolla imbricate or convolute: seeds numerous, minute, often angled..... 7. HAMELIA TRIBE.  
 CCC. Corolla strictly convolute: seeds numerous or few, large and compressed or smaller and angled.... 8. GARDENIA TRIBE.  
 AA. Number of ovules in each locule 1.  
 B. Radicles superior.  
 C. Stamens inserted at base of corolla; corolla valvate or imbricate.... 9. CHIOCOCCA TRIBE.  
 CC. Stamens inserted at throat of corolla.  
 D. Corolla strictly convolute..... 10. ALBERTA TRIBE.  
 DD. Corolla valvate..... 11. VANGUERIA TRIBE.  
 BB. Radicles inferior.  
 C. Corolla strictly convolute..... 12. IXORA TRIBE.  
 CC. Corolla valvate.  
 D. Ovules affixed to septum, rarely basilar, generally amphitropous: trees and shrubs..... 13. MORINDA TRIBE.  
 DD. Ovules affixed to septum, amphitropous or anatropous: herbs..... 14. GALIUM TRIBE.  
 DDD. Ovules basilar, erect, anatropous.  
 E. Stamens inserted on the throat of the corolla: fr. indehiscent: style entire or with short branches... 15. PSYCHOTRIA TRIBE.



- EE. Stamens inserted on the throat, rarely at base of corolla: fr. capsular or 2-berried: style-branches filiform.....16. *PÆDERIA* TRIBE.
- EEE. Stamens inserted at base of corolla, rarely on throat: fr. berry-like or indehiscent: style entire or with long branches.....17. *ANTHOSPERMA* TRIBE.

## II. Key to the Tribes.

### 1. Nauclea Tribe.

- Calyx-tubes confluent: fr. a globose, fleshy syncarp: ovary 2-celled; ovules solitary, pendulous.....1. *Cephalanthus*.

### 2. Cinchona Tribe.

- A. Corolla valvate.  
 B. Placentæ ascending from the base of the septum, or erect.....2. *Manettia*.  
 BB. Placentæ adnate to the middle of the septum.  
 C. Caps. septicidal.....3. *Cinchona*.  
 CC. Caps. loculicidal.....4. *Bouvardia*.  
 AA. Corolla imbricate; stamens inserted in the throat.  
 B. Sepals never bract-like.....5. *Luculia*.  
 BB. One of the sepals in some fls. in each infl. developing into a large white persistent appendage.....6. *Emmenopteris*.

### 3. Condaminea Tribe.

- One calyx-lobe dilated into an ample colored blade.....7. *Pinckneya*.

### 4. Hedyotis Tribe.

- A. Calyx-lobes unequal: caps. loculicidal.....8. *Pentas*.  
 AA. Calyx-lobes equal: caps. loculicidal at the top.....9. *Houstonia*.

### 5. Rondeletia Tribe.

- Corolla imbricate, lobes equal or nearly so.....10. *Rondeletia*.

### 6. Mussænda Tribe.

- Infl. terminal, corymbose; ovary 1-2-celled; calyx-lobes 5, 1 dilated and colored.....11. *Mussænda*.

### 7. Hamelia Tribe.

- A. Corolla 5-ribbed: berry 5-celled.....12. *Hamelia*.  
 AA. Corolla 4-5-lobed: berry 2-3-celled.....13. *Hoffmannia*.

### 8. Gardenia Tribe.

- A. Infl. usually terminal.  
 B. Corolla-tube short.....14. *Burchellia*.  
 BB. Corolla-tube long.  
 C. Calyx 5-toothed.....15. *Posoqueria*.  
 CC. Calyx-lobes large and leafy.....16. *Leptactina*.  
 AA. Infl. usually axillary.  
 B. Style has a spindle or club-shaped stigma, entire or 2-toothed.  
 C. Seed-coat membranous.  
 D. Calyx-limb various; ovary 2-celled.....17. *Randia*.  
 DD. Calyx-limb often tubular; ovary 1-celled.....18. *Gardenia*.  
 CC. Seed-coat fibrous or subfibrous.  
 D. Corolla-tube long and slender.....19. *Oxyanthus*.  
 DD. Corolla-tube short.  
 E. Calyx 5-parted.....20. *Mitrostigma*.  
 EE. Calyx truncate or 5-toothed.....21. *Genipa*.  
 BB. Style-branches 2, distinct (except sometimes in *Kraussia*).  
 C. Throat of corolla bearded.....22. *Kraussia*.  
 CC. Throat of corolla glabrous.....23. *Tricalysia*.

### 9. Chiococca Tribe.

- Corolla valvate: infl. axillary, racemose; anthers dorsifixed; stigma club-shaped.....24. *Chiococca*.

### 10. Alberta Tribe.

- Infl. terminal; the 2-4 calyx-lobes dilated; anthers pilose on back.....25. *Alberta*.

### 11. Vangueria Tribe.

- A. Drupe 1-2-stoned.....26. *Plectronia*.  
 AA. Drupe 3-6-stoned.....27. *Vangueria*.

### 12. Ixora Tribe.

- A. Fls. clustered in axils.....28. *Coffea*.  
 AA. Fls. in 2-3-forking corymbs.  
 B. Style-branches 2, short, rarely connate: lvs. leathery.....29. *Ixora*.  
 BB. Style very far exserted, the slender spindle-shaped stigma usually long: lvs. usually membranous.....30. *Pavetta*.

### 13. Morinda Tribe.

- A. Fls. confluent in heads, which are many-fld., solitary or umbellate.....31. *Morinda*.  
 AA. Fls. free; calyx-limb 4-5-fld; corolla villous at throat; stigma club-shaped, 2-4-lobed; drupe 1-4-stoned: infl. axillary.....32. *Damnanus*.

### 14. Galium Tribe.

- A. Corolla funnel-shaped or somewhat tubular.  
 B. Fls. 4-merous, with or without bracts, but no bractlets; style-branches subequal.....33. *Asperula*.  
 BB. Fls. 4-5-merous, bracted and with 2 bractlets; style-branches unequal.....34. *Crucianella*.  
 AA. Corolla rotate or rotate-campanulate.  
 B. Fls. 5-merous.....35. *Rubia*.  
 BB. Fls. 4-merous.....36. *Galium*.

### 15. Psychotria Tribe.

- Infl. terminal; calyx usually 5-toothed; corolla 5-lobed, rarely 4-lobed; tube usually short.....37. *Psychotria*.

### 16. Pæderia Tribe.

- A. Ovary 2-celled; stigma 2, capillary, twisted: fr. drupaceous: twining plant.....38. *Pæderia*.  
 AA. Ovary 5-celled: fr. a caps.: small upright shrubs.....39. *Leptodermis*.

### 17. Anthosperma Tribe.

- A. Stamens inserted in throat; style-branches 4.....40. *Mitchelia*.  
 AA. Stamens inserted at or near base of corolla.  
 B. Fls. bisexual; style shortly 2-cut; shrub.....41. *Serissa*.  
 BB. Fls. unisexual or bisexual; style 2-parted to the base or near it.  
 C. Plants are creeping herbs.....42. *Nertera*.  
 CC. Plants are shrubs or small trees.....43. *Coprosma*.

Other genera incidentally described are: *Catesbæa*, *Cephaelis*, *Exostemma*, *Fernelia*, *Guettarda*, *Oldenlandia*, *Plocama*, and *Sarcocephalus*.

### 104. VALERIANACEÆ.

- A. Stamens 4.....1. *Patrinia*.  
 AA. Stamens 1, rarely 2: corolla-tube spurred, the limb spreading.....2. *Centranthus*.  
 AAA. Stamens 2; corolla-tube spurred, the limb 2-lipped.....3. *Fedia*.  
 AAAA. Stamens usually 3.  
 B. Calyx-limb finally pappiform.....4. *Valeriana*.  
 BB. Calyx-limb various but not pappiform.....5. *Valerianella*.

### 105. DIPSACACEÆ.

- A. Stigma terminal, straight: fls. densely crowded in the axils of the floral lvs., forming whorls after the manner of the mint family.....1. *Morina*.  
 AA. Stigma oblique or lateral, rarely straightish: fls. in terminal heads.  
 B. Bracts of involucre generally herbaceous; chaff of receptacle rigidly awl-shaped-acuminate or spinescent; corolla 4-fld.....2. *Dipsacus*.  
 BB. Bracts and chaff rigidly paleaceous, rarely sub-herbaceous; corolla 4-fld.....3. *Cephalaria*.  
 BBB. Bracts leafy, in about 2 series; chaff short, or very narrow or abortive; corolla 4-5-cut.....4. *Scabiosa*.

### 106. COMPOSITÆ.

#### I. Summary of Tribes.

**Series I. TUBULIFLOREÆ.** Corollas tubular and regular in all the bisexual fls.

- A. Heads composed entirely of disk-fls., which are all perfect and never truly yellow.  
 B. Style-branches awl-shaped, acute, minutely hairy: lvs. generally alternate: anthers sagittate at base.... 1. **VERNONIA TRIBE.**

- BB. Style-branches subterete, obtuse, covered with minute papillae: lvs. opposite or alternate: anthers subentire at base..... 2. EUPATORIUM [TRIBE.]
- AA. Heads with all perfect or some imperfect fls., with or without rays and often yellow.
- B. Anthers tailed.
- C. Style-branches linear: heads with or without rays..... 3. INULA TRIBE.
- CC. Style-branches united or short; heads without rays; typically with spiny or scarious appendages, many-bracted involucre and fleshy receptacle..... 4. CYNARA TRIBE.
- BB. Anthers not conspicuously tailed.
- C. Style-branches in disk-fls. flattened out, and with a distinct though sometimes very short terminal appendage..... 5. ASTER TRIBE.
- CC. Style-branches not flattened out.

NOTE.—It is impossible to make a key to separate the following tribes from one another. Some of the important characters are italicized:

- Receptacle chaffy or rarely naked under the sterile disk-fls.: style-branches truncate or appendaged or the style of the sterile fls. undivided; pappus sometimes absent but generally of 2-4 awns, which are slender or somewhat chaffy and with or without intermediate scales which are free or connate at base: lvs. opposite, rarely alternate.....* 6. HELIANTHUS [TRIBE.]
- Receptacle naked; style-branches truncate or appendaged; pappus usually chaffy, rarely of awns or bristles, or absent: lvs. opposite or alternate: involucre bracts in 1 or 2 series, rarely 3-4, herbaceous or membranous: herbage often resinous-dotted.....* 7. HELENIUM TRIBE.
- Receptacle chaffy or naked; style-branches truncate; pappus when present crown-shaped, rarely of short chaff: lvs. mostly alternate: involucre bracts in 2 or more series, dry or scarious at apex.....* 8. ANTHEMIS TRIBE.
- Receptacle usually naked; style-branches truncate or appendaged; pappus usually of bristles: lvs. mostly alternate: inner involucre bracts in 1 series, subequal, the outer ones small or wanting, or rarely all imbricate in numerous series.....* 9. SENECIO TRIBE.
- Receptacle naked; style-branches truncate or the style of the sterile fls. undivided; pappus absent or wool-like: lvs. usually alternate or radical: involucre bracts in 1-2 series, subequal, narrow.....* 10. CALENDULA TRIBE.
- Receptacle naked, chaffy or alveolate; style-branches rounded at apex, obtuse or rarely truncate or the style of the sterile fls. undivided; pappus absent, or chaffy or crown-shaped: lvs. radical or alternate: involucre bracts in an indefinite number of series, often scarious at apex or spinescent.....* 11. ARCTOTIS TRIBE.

Series 2. LABIATIFLORÆ. Corollas of all or only of the bisexual fls. bilabiate..... 12. MUTISIA TRIBE.

Series 3. LIGULIFLORÆ. Corollas all ligulate and fls. bisexual: juice milky..... 13. CICHORIUM TRIBE.

## II. Artificial Key to the Composite Tribes.

(Condensed from Engler & Prantl.)

- A. Plants without milky juice: corolla of disk-fls. not ligulate (except some of the Mutisia Tribe, recognized by the peculiar style and caudate anthers).
- B. Style below its point of branching neither thickened nor with a ring of long sweeping hairs.
- C. Anthers not caudate.
- D. Style-branches awl-shaped, acute, minutely hairy outside and often on style below, stigmatose over the whole inner face..... VERNONIA TRIBE.
- DD. Style-branches subterete, obtuse, covered with minute papillae, stigmatose in 2 lines near the base..... EUPATORIUM TRIBE.
- DDD. Style-branches flattened, with distinct though often short-terminal, usually short-hairy appendages, stigmatose in 2 lines..... ASTER TRIBE.

- DDDD. Style-branches flattened, stigmatose in 2 lines, very diverse in form (i. e., truncate or appendiculate, but with a distinct tendency toward a ring of long sweeping hairs somewhere above the fork (transitions frequent to the above 3 tribes).
- E. Pappus not capillary, but composed of scales, plumose bristles, or strong awns, or crown-like or wanting.
- F. Involucre bracts without scarious margins, rarely with narrow membranous margins (in some genera which may be separated by strongly developed scaly pappus from the Anthemis Tribe).
- G. Chaff present..... HELIANTHUS TRIBE.
- GG. Chaff absent..... HELENIUM TRIBE.
- FF. Involucre bracts scarious margined: pappus 0 or reduced, sometimes unilaterally developed..... ANTHEMIS TRIBE.
- EE. Pappus capillary, simple..... SENECIO TRIBE.
- DDDDD. Style-branches of the bisexual fls. (which are sterile) almost or quite wanting, rarely of normal size, not stigmatose.
- E. Plants more or less completely dioecious: chaff 0.
- F. Involucre bracts in 1 row, of equal length (often with tiny bracteoles at the base)..... Petasites.
- FF. Involucre bracts in many rows..... Baccharis.
- EE. Plants not dioecious: heads bisexual.
- F. Chaff 0.
- G. Achene of female fls. with pappus of coarse or fine bristles or hairs, sometimes plumose.
- H. Involucre bracts in several rows..... Some members of ASTER TRIBE.
- HH. Involucre bracts in 1 row, separate, with tiny bracteoles at base..... Tussilago.
- HHH. Involucre bracts in 1 row, connate at base..... Othonna and [Gamolepis]
- GG. Achene of female fls. with scaly pappus..... Gutierrezia.
- GGG. Achene of female fls. with no pappus.
- H. Lvs. opposite or radical..... Osteospermum.
- HH. Lvs. alternate..... Some members of CALENDULA TRIBE.
- FF. Chaff present.
- G. Involucre not scarious, nor woolly (see Milampodineæ and Ambrosiæ of the Helianthus Tribe).
- GG. Involucre scarious margined; inner bracts woolly..... Eriocapitatus.
- CC. Anthers caudate.
- D. Style-branches awl-shaped, acute, minutely hairy outside and often on style below, stigmatose on whole inner face..... Members of VERNONIA TRIBE.
- DD. Style-branches otherwise.
- E. Limb of corolla of bisexual fls. 5- (rarely 4-) toothed or lobed, rarely, in the Inula Tribe, slightly 2-lipped.
- F. Plants dioecious..... Antennaria.
- FF. Plants not dioecious.
- G. Heads with filiform female marginal fls., or fls. all alike. Some members of INULA TRIBE.
- GG. Heads with fls. of 2 sexes: corolla of female fls. (marginal) ligulate, rarely tubular, with broad regular or 2-lipped limb.
- H. Pappus present..... Some members of INULA TRIBE.
- HH. Pappus 0..... CALENDULA TRIBE.



- EE. Limb of corolla of bisexual fls.  
regular and deeply 5-divided  
or 2-lipped. . . . . **MUTISIA TRIBE.**
- BB. Style with sweeping hairs beginning  
at or below the point of forking,  
forming a ring; or style there thick-  
ened, or at least there different in  
color; style-branches often co-  
herent.
- C. Head with female or neutral ligu-  
late ray-fls. . . . . **ARCTOTIS TRIBE.**
- CC. Head of all bisexual fls. or with  
nonligulate neutral fls. or rarely  
with female ray-fls. . . . . **CYNARA TRIBE.**
- AA. Plants with milky juice; fls. in head  
all ligulate. . . . . **CICHORIUM TRIBE.**

### III. Regular Key to the Tribes.

#### 1. Vernonia Tribe.

- A. Genus anomalous with enlarged palmately  
quasiligulate outer corollas. . . . . 1. *Stokesia*.
- AA. Genus normal with tubular 5-lobed corollas. . . . . 2. *Vernonia*.

#### 2. Eupatorium Tribe.

- A. Anthers truncate at apex, not appendaged;  
achenes 5-angled, secondary ribs not  
prominent. . . . . 3. *Piqueria*.
- AA. Anthers appendaged.
- B. Achenes 5-ribbed, no secondary ribs visible.
- C. Pappus wholly of capillary bristles.
- D. Involucral bracts 4. . . . . 4. *Mikania*.
- DD. Involucral bracts more than 4. . . . . 5. *Eupatorium*.  
(Incl. *Conoclinium*.)
- CC. Pappus chaffy, awned, blunt or crown-  
shaped. . . . . 6. *Ageratum*.
- BB. Achenes 10-ribbed (rarely 7-8-ribbed),  
secondary ribs conspicuous.
- C. Involucral bracts not herbaceous, striate-  
nerved, conspicuously so when dry.
- D. Heads few-fld., corymbose. . . . . 7. *Adenostyles*.
- DD. Heads always paniculate. . . . . 8. *Brickellia*.
- CC. Involucral bracts somewhat herbaceous  
or partly colored, inconspicuously stri-  
ate if at all.
- D. The outer bracts successively shorter. . . . . 9. *Liatris*.
- DD. The bracts nearly all equal in length. . . . . 10. *Trilisa*.

#### 3. Inula Tribe.

- A. The fls. containing both stamens and pistil all  
sterile, only the unisexual fls. fertile; heads  
monoecious or dioecious.
- B. Pappus bristles, especially of fertile fls.,  
united at the base in a ring.
- C. Heads strictly dioecious, corymbose,  
rarely solitary; sterile pappus club-  
shaped. . . . . 11. *Antennaria*.
- CC. Heads containing 1 or both sexes, mono-  
ecious or dioecious, crowded in a small  
cluster or cyme surrounded by a long  
conspicuous woolly involucre. . . . . 12. *Leontopod-*  
*ium*.
- BB. Pappus bristles free; involucre rosette-like,  
very white-papery. . . . . 13. *Anaphalis*.
- AA. The fls. containing both stamens and style  
usually fertile.
- B. Heads with disk-fls. only.
- C. The heads compound; 1-fld. heads aggre-  
gated in an involucre cluster, often  
with petaloid appendages. . . . . 14. *Myrio-*  
*cephalus*.
- CC. The heads simple.
- D. Pappus 0. . . . . 15. *Humen*.
- DD. Pappus crown- or cup-shaped. . . . . 16. *Ammobium*.
- DDD. Pappus bristly.
- E. Achenes not beaked.
- F. Bristles often plumose at base. . . . . 17. *Helipterum*.
- FF. Bristles smooth, scarious, barked  
or plumose at apex. . . . . 18. *Helichry-*  
*sum*.
- EE. Achenes beaked. . . . . 19. *Waitzia*.
- BB. Heads composed of both ray- and disk-fls.
- C. Receptacle not chaffy.
- D. Stigmatic lines not confluent at apex. . . . . 20. *Podolepis*.
- DD. Stigmatic lines fusing at apex. . . . . 21. *Inula*.
- CC. Receptacle chaffy or bristly. . . . . 22. *Bupthal-*  
*um*.

#### 4. Cynara Tribe.

- A. Heads 1-fld., aggregated into larger involu-  
crate heads. . . . . 23. *Echinops*.
- AA. Heads several-fld.
- B. Fr. with basal areole.
- C. The fr. woolly, not margined.
- D. Pappus scales pointed or terminated  
by a simple awn. . . . . 24. *Xerantho-*  
*num*.

- DD. Pappus-scales plumose. . . . . 25. *Carlina*.
- CC. The fr. glabrous, marginal at summit.
- D. Receptacle bristly.
- E. Filaments glabrous; involucre bracts  
hooked. . . . . 26. *Arctium*.
- EE. Filaments warty, hairy, or pectinate-  
ciliate.
- F. The receptacle not fleshy.
- G. Pappus-bristles not plumose. . . . . 27. *Carduus*.
- GG. Pappus-bristles plumose. . . . . 28. *Cirsium*.
- FF. The receptacle fleshy. . . . . 29. *Cynara*.
- DD. Receptacle not bristly. . . . . 30. *Onopordon*.
- BB. Fr. with oblique lateral areole.
- C. Heads not involucre with lvs.
- D. Involucral-bracts without appendages. . . . . 31. *Serratula*.
- DD. Involucral-bracts with dry, scarious or  
thorny appendages. . . . . 32. *Centaurea*.
- CC. Heads surrounded by an involucre of  
thorny lvs.
- D. Pappus simple, of bristles, scales or 0. . . . . 33. *Carthamus*.
- DD. Pappus of 2 unequally long rows of  
bristles. . . . . 34. *Cnicus*.

#### 5. Aster Tribe.

- A. Heads dioecious and composed wholly of disk-  
fls. . . . . 35. *Baccharis*.
- AA. Heads not dioecious.
- B. Color of fls. yellow.
- C. Rays absent. . . . . 36. *Bigelovia*.
- CC. Rays present.
- D. The pappus composed of long paleæ,  
which are sometimes reduced to a  
crown. . . . . 37. *Gutierrezia*.
- DD. The pappus not as in D.
- E. Pappus-bristles few (4-8).
- F. Involucral bracts in 8 series,  
leathery or scarious at apex. . . . . 38. *Grindelia*.
- FF. Involucral bracts in 2-3 series,  
scarious at margins. . . . . 39. *Pentstemon*.
- EE. Pappus-bristles copious, in 2-8 series,  
sometimes few in ray-fls.
- F. Bristles of 2 kinds, the inner  
series capillary, outer very short  
and setulose or squamellate. . . . . 40. *Chrysopsis*.
- FF. Bristles mostly alike.
- G. Rays usually wanting. . . . . 41. *Linosyris*.
- GG. Rays present.
- H. The bristles broad at base,  
aristate. . . . . 42. *Xanthisma*.
- HH. The bristles capillary.
- I. Heads usually many-fld.
- J. Achenes many-nerved. . . . . 43. *Aplopappus*.
- JJ. Achenes few-nerved. . . . . 44. *Hazardia*.
- II. Heads usually few-fld.
- J. Bristles rudimentary,  
shorter than achene. . . . . 45. *Brachycheta*.
- JJ. Bristles longer than  
achene. . . . . 46. *Solidago*.
- BB. Color of ray fls. at least not yellow.
- C. The pappus 0, or forming a more-or-less  
conspicuous ring of short bristles or  
hairs, uniform in all fls.
- D. Bracts dry or scarious at margin. . . . . 47. *Brachycome*.
- DD. Bracts herbaceous. . . . . 48. *Bellis*.
- CC. The pappus composed of numerous bri-  
stles in 1 or more series, uniform in all fls.
- D. Involucre with outer bracts partly  
leafy, inner bracts membranous or  
scarious. . . . . 49. *Callistephus*.
- DD. Involucral bracts all nearly alike.
- E. Bracts in about 2 series.
- F. Achenes usually small. . . . . 50. *Erigeron*.
- FF. Achenes larger, longer; pappus  
more copious. . . . . 51. *Vittadinia*.
- EE. Bracts usually in several series,  
sometimes 2 series in Aster and  
*Felicia*.
- F. Plants woody, resinous.
- G. Achenes cylindrical. . . . . 52. *Olearia*.
- GG. Achenes compressed. . . . . 53. *Felicia*.
- FF. Plant herbaceous.
- G. Involucral bracts coriaceous. . . . . 54. *Sericocar-*  
*pus*.
- GG. Involucral bracts membranous  
or herbaceous. . . . . 55. *Aster*.
- CCC. The pappus anomalous or absent from the  
rays.
- D. Pappus-bristles shortly plumose; style-  
branches broad. . . . . 56. *Chariesis*.
- DD. Pappus-bristles in 1 series, unequal,  
rigid, thickened or dilated toward  
the base. . . . . 57. *Townsendia*.
- DDD. Pappus of the ray composed of very  
short paleæ; disk-pappus of copious  
slender bristles in 1-2 series. . . . . 58. *Heteropap-*  
*pus*.
- DDDD. Pappus-bristles very short, usually  
accompanied by 2-4 awns not longer  
than the achene. . . . . 59. *Boltonia*.

6. *Helianthus* Tribe.

Subtribe 1. MELAMPODIEÆ. Rays pistillate; disk-fls. staminate: achenes usually with coriaceous or thicker pericarp: style mostly entire; receptacle chaffy throughout; pappus none.

- A. Involucre of the many-fl. heads broad; inner bracts concave, embracing and half inclosing the thick, turgid, obovoid achenes. . . . . 60. *Polymnia*.
- AA. Involucre broad, of plane or barely concave bracts; innermost subtending obcompressed achenes, but not inclosing nor embracing them.
- B. Rays, or rather their ovaries and achenes, in more than 1 series. . . . . 61. *Silphium*.
- BB. Rays and achenes in a single series.
- C. Heads nearly discoid or rays short. . . . . 62. *Parthenium*.
- CC. Heads conspicuously radiate, mostly of 5 fertile and rather numerous sterile fls. . . . . 63. *Chrysogonum*.

Subtribe 2. AMBROISEÆ. Pistillate fls. apetalous, or with corolla reduced to a tube or ring around base of 2-parted style; staminate fls. with 4-5-lobed corolla; anthers slightly united or free; style abortive, hairy only at the somewhat enlarged and depressed summit.

- A. Herbs: heads of 2 kinds, the fertile with a bur-like involucre. . . . . 64. *Ambrosia*.
- AA. Shrubs: heads all alike. . . . . 65. *Iva*.

Subtribe 3. ZINNIEÆ. Rays pistillate; the tube absent or very short, persistent on achene and at length papery; disk-fls. bisexual, rarely sterile, subtended or embraced by chaffy bracts: lvs. opposite.

- A. Receptacle flattish. . . . . 66. *Sanvitalia*.
- AA. Receptacle conical, cylindrical or elongated.
- B. Achenes, at least inner ones, 1-3-awned. . . . . 67. *Zinnia*.
- BB. Achenes without pappus. . . . . 68. *Heliopsis*.

Subtribe 4. VERBESINÆ. Rays pistillate, or neutral, becoming papery and persistent; disk-fls. bisexual; anthers often blackish: achenes various, but those of disk never obcompressed; pappus various.

- A. Chaff of receptacle permanently investing achenes as an accessory covering. . . . . 69. *Sclerocarpus*.
- AA. Chaff of receptacle concave or complicate, loosely embracing or subtending the disk-achenes, mostly persistent.
- B. Rays sometimes absent. Certain species of. . . . . 70. *Spilanthes*.
- BB. Rays usually present.
- C. Receptacle high, from conical to columnar or subulate, at least in fr.
- D. The rays, if present, pistillate. . . . . 70. *Spilanthes*.
- DD. The rays sterile.
- E. Color of rays rose or rose-purple. . . . . 71. *Echinacea*.
- EE. Color of rays yellow or partly brown-purple (sometimes wholly so).
- F. Achenes 4-angled, prismatic. . . . . 72. *Rudbeckia*.
- FF. Achenes short and broad, compressed. . . . . 73. *Lepachys*.
- CC. Receptacle low, flat to convex, rarely becoming conical.
- D. Achenes not winged nor very flat, when flattened not margined nor sharp-edged.
- E. Rays pistillate. . . . . 74. *Balsamorhiza*.
- EE. Rays sterile.
- F. Achenes pubescent. . . . . 75. *Viguiera*.
- FF. Achenes glabrous. . . . . 76. *Helianthus*.
- DD. Achenes of the ray or margin often triquetrous, of the disk either flat-compressed and margined or thin-edged, or if turgid some of them winged.
- E. Rays neutral.
- F. Pappus 0, or an awn or its rudiment answering to each margin of the wingless achene. . . . . 77. *Encelia*.
- FF. Pappus of delicate squamellæ between the 2 chaffy teeth or awns which surmount the 2 acute margins of the achene. . . . . 78. *Helianthella*.
- FFF. Pappus of 2 slender-subulate naked awns, at length divergent, sometimes with 2 or 3 intermediate awns. . . . . 79. *Actinomeris*.
- EE. Rays pistillate, rarely neutral in Verbesina.
- F. Pappus of  $\infty$  distinct squamellæ. . . . . 80. *Pascalica*.
- FF. Pappus of dilated awns or 2 awn-like paleæ on the angles of the achene, with 2 small intermediate squamellæ on each side. . . . . 81. *Podachnium*.
- FFF. Pappus of 2 awns, sometimes 1-3 or 0, and no intermediate squamellæ. . . . . 82. *Verbesina*.

Subtribe 5. COREOPSIDÆ. Rays pistillate or neutral; disk-fls. fertile; receptacle chaffy; chaff flat or hardly concave: achenes more or less dorsally compressed, often 2-awned.

- A. Involucral bracts distinct, the outer herbaceous, inner somewhat like paleæ. . . . . 83. *Guizotia*.
- AA. Involucre double; inner bracts membranous, subequal, connate at base or often higher; outer bracts few and small or minute.
- B. Plants are all climbers with pistillate rays, achenes much enlarging and sterile disk-fls. with undivided style. . . . . 84. *Hidalgoo*.
- BB. Plants not climbing; rays usually sterile.
- C. Style-branches with long hairy appendages. . . . . 85. *Dahlia*.
- CC. Style-branches truncate, penicillate or with short appendages.
- D. Bracts of inner involucre united into a cup. . . . . 86. *Thelesperma*.
- DD. Bracts of involucre distinct, or united only at the common base.
- E. Achenes beaked, slender; rays purple or rose, in 1 species yellow; white vars. in cult.; awns mostly deciduous. . . . . 87. *Cosmos*.
- EE. Achenes not beaked; rays yellow or white.
- F. Tube of disk-fl. without ring at top.
- G. Lvs. or divisions entire. . . . . 88. *Coreopsis*.
- GG. Lvs. or divisions serrate. . . . . 89. *Bidens*.
- FF. Tube of disk-fls. with a ring near the top. . . . . 90. *Leptosyne*.

Subtribe 6. GALINOGÆ. Heads rayless and homogamous (in Marshallia). Pappus of  $\infty$  distinct paleæ. . . . . 91. *Marshallia*.

Subtribe 7. MADIEÆ. Rays pistillate, each subtended by an involucral bract which partly or completely incloses its achene; disk-fls. with both stamens and styles, but some or all sterile: glandular, viscid and heavy-scented herbs.

- A. Achenes laterally compressed. . . . . 92. *Madia*.
- AA. Achenes not laterally compressed. . . . . 93. *Layia*.

7. *Helenium* Tribe.

- A. Involucral bracts united nearly throughout into an oblong cup or tube. . . . . 94. *Tagetes*.  
(See also *Lasthenia*.)
- AA. Involucral bracts hardly at all imbricated; when broad, nearly equal or in 1 series.
- B. Receptacle mostly high-conical, and acute, beset after the achenes have fallen by projecting points (as if pedicels on which they were inserted).
- C. The involucre a single series of bracts connate by their edges into a 5-15-toothed green cup. . . . . 95. *Lasthenia*.
- CC. The involucre of loose, distinct bracts. . . . . 96. *Baria*.  
(Also *Actinolepis coronaria*.)
- BB. Receptacle flat or convex, rarely obtusely conical: achenes from linear to obpyramidal, rarely 5-angled. (See also BBB.)
- C. Herbage mostly woolly: involucral bracts erect, not membranous. . . . . 97. *Eriophyllum*.
- CC. Herbage usually not woolly.
- D. Disk-fls. deeply 5-cleft: involucral bracts mostly appressed. . . . . 98. *Polypterus*.
- DD. Disk-fls. with long and narrow throat and 5 short lobes or teeth.
- E. Heads solitary. . . . . 99. *Hulsea*.
- EE. Heads paniculate or corymbose.
- F. Plants tomentose herbs, the lvs. dissected.
- G. Involucral bracts free, narrow. . . . . 100. *Chænactis*.
- GG. Involucral bracts connected at the base, broad and obtuse. . . . . 101. *Bahia*.
- FF. Plants not tomentose, the lvs. not dissected. . . . . 102. *Pericome*.
- BBB. Receptacle from convex to oblong: achenes short, obpyramidal or top-shaped, 5-10-ribbed or angled, mostly silky hairy: disk-fls. all fertile.
- C. The receptacle destitute of awn-like fimbriæ among the fls.
- D. Involucre erect or nearly so. . . . . 103. *Actinella*.
- DD. Involucre spreading or soon reflexed. . . . . 104. *Helenium*.
- CC. The receptacle beset with bristle-like or awl-shaped or rarely dentiform fimbriæ among the fls. . . . . 105. *Gaillardia*.

3. *Anthemis* Tribe.

- A. Receptacle chaffy.
- B. Heads usually discoid.
- C. Shrubs with small, closely clustered lvs. . . . . 106. *Eriocaphala*.
- CC. Herbs, or sometimes slightly shrubby.
- D. Corolla with a hood-like appendage at base. . . . . 107. *Santolina*.
- DD. Corolla without such appendage. . . . . 108. *Onos*.



- BB. Heads usually radiate.  
 c. Achene compressed, with 2 narrow margins.....109. *Achillea*.  
 CC. Achenes 4-5-cornered or  $\infty$ -ribbed.  
 D. The heads peduncled at tips of branches.....110. *Anthemis*.  
 DD. The heads sessile in forks, surrounded by 5-6 dissected floral lvs.....111. *Cladanthus*  
 AA. Receptacle naked or alveolate-fimbriate.  
 B. Involucral bracts in many series.  
 c. Rays present.....112. *Chrysanthemum*.  
 (Consult also *Pyrethrum*).  
 CC. Rays absent.....113. *Tanacetum*.  
 BB. Involucral bracts in 1 or 2 or few series.  
 c. Rays present.....114. *Matricaria*  
 CC. Rays absent or inconspicuous.  
 D. Involucre top-shaped.....115. *Centa*.  
 DD. Involucre ovoid or broadly bell-shaped.....116. *Artemisia*.

## 9. Senecio Tribe.

- A. Involucral bracts in 1 series and connate at the base or beyond the middle in a cup; no outer bracts; style-branches of the fertile bisexual fls. truncate at apex, usually penicillate.  
 B. Style undivided; disk-fls. sterile.....117. *Othonna*.  
 BB. Style bifid; disk-fls. all or some fertile.....118. *Gamolepis*.  
 AA. Involucral bracts in 1 or 2 series, not connate in a cup but free, at least finally.  
 B. Style-branches of hermaphrodite fertile fls. roundish obtuse or at least not truncate and wholly without appendage or hairiness at summit.  
 c. Heads composed entirely of bisexual and fertile fls., homogamous, discoid.....119. *Cacaliopsis*.  
 CC. Heads submonocleous or subdioecious, the fls. containing both stamens and pistils, sterile.  
 D. The heads radiate, yellow.....120. *Tussilago*.  
 DD. The heads discoid, purplish or white.  
 E. Style of hermaphrodite fls. undivided; heads several.....121. *Petasites*.  
 EE. Style branched; heads 2.....122. *Homogyne*.  
 BB. Style-branches (of hermaphrodite fls.) either truncate or capitate at summit, which is either penicillate, hairy or naked and not rarely bears a short conical or flattened appendage.  
 c. Bracts of involucre herbaceous, acuminate.  
 D. Receptacle flat.....123. *Arnica*.  
 DD. Receptacle hemispherical.....124. *Doronicum*.  
 CC. Bracts of involucre narrow, strict, usually ribbed or keeled.  
 D. Apex of style usually truncate and penicillate.  
 E. Involucral bracts numerous.  
 F. Achenes subterete.....125. *Senecio*.  
 FF. Achenes dorsally compressed.....126. *Cineraria*.  
 EE. Involucral bracts few, 4-5; heads homogamous.....127. *Tetradymia*.  
 DD. Apex of style with long, subulate hairy appendages; heads homogamous.....128. *Gynura*.  
 DDD. Apex of style with appendages short and obtuse, or long and acutish; heads homogamous.....129. *Emilia*.

## 10. Calendula Tribe.

- A. Achenes or the rays thick, hard and bony; those of the disk usually all empty.....130. *Osteospermum*.  
 AA. Achenes straight, those of the rays usually triquetrous; disk-achenes often flattish or 2-winged.....131. *Dimorphotheca*.  
 AAA. Achenes incurved, heteromorphous.....132. *Calendula*.

## 11. Arctotis Tribe.

- A. Involucral bracts free, the inner ones broadly scarious, at least at the apex.  
 B. Herbs glabrous or pubescent: receptacle chaffy.....133. *Urtica*.  
 BB. Herbs tomentose: receptacle naked or alveolate.  
 c. Achenes usually villous, crowned by hyaline palea which are often convolute.....134. *Arctotis*.  
 CC. Achenes glabrous, with or without a crown of minute palea.....135. *Venidium*.  
 AA. Involucral bracts grown together at the base; lvs. not spinescent; alveoli short.....136. *Gazania*.

## 12. Mutisia Tribe.

- A. Rays in 1-2 series, 2-lipped.....137. *Gerbera*.  
 AA. Rays in 2-3 series, the outer always strap-shaped.....138. *Chaptalia*.

## 13. Cichorium Tribe.

- A. Pappus 0. or of 2-3 long bristles, which soon fall away.....139. *Scolymus*.  
 AA. Pappus paleaceous or partly so, or aristiform, or plumose.  
 B. Involucre of equal bracts and no short calyculate ones at base.  
 c. Achenes long-beaked.....140. *Tragopogon*.  
 CC. Achenes truncate.....141. *Krigia*.  
 BB. Involucre either calyculate or imbricate, i. e., principal bracts equal and some short ones at base, or less unequal bracts in 2 or more series.  
 c. Achenes (at least inner ones) tapering into a beak.  
 D. Receptacle with membranous chaff.....142. *Hypochaeris*.  
 DD. Receptacle naked.....143. *Leontodon*.  
 CC. Achenes usually short, with summit truncate or only a trifle contracted below apex.  
 D. Receptacle chaffy.....144. *Catananche*.  
 DD. Receptacle not chaffy.  
 E. Fls. normally blue.....145. *Cichorium*.  
 EE. Fls. yellow.....146. *Scorzonera*.  
 AAA. Pappus of capillary bristles that are scabrous, rarely barbellulate, never plumose nor paleaceous-dilated: receptacle naked (except in 1 species of *Troximon*).  
 B. Achenes flattened: pappus of copious fine soft capillary bristles.  
 c. The achenes distinctly beaked.....147. *Lactuca*.  
 CC. The achenes beakless.....148. *Sonchus*.  
 BB. Achenes not flattened: pappus persistent or bristles tardily falling (except 1 or 2 species of *Crepis*).  
 c. Beak distinct and slender (except in 1 or 2 species of *Troximon*).  
 D. The achenes 10-ribbed or 10-nerved, not muricate.....149. *Troximon*.  
 DD. The achenes 4-5-ribbed or angled, muricate.....150. *Taraxacum*.  
 CC. Beak 0, or achene merely narrow at apex.  
 D. Fls. whitish or cream-color to violet or rose-red.....151. *Prenanthes*.  
 DD. Fls. mostly yellow, sometimes orange-red or white.  
 E. Pappus of rather rigid, scabrous, fragile bristles which are usually rather dirty or neutral-colored.....152. *Hieracium*.  
 EE. Pappus of copious white and usually soft capillary bristles.....153. *Crepis*.

The following genera (and others) also are briefly treated: *Amellus*, *Asterinosyris*, *Bellium*, *Cacalia*, *Calimeris*, *Celmisia*, *Chamaemelum*, *Cotula*, *Cryptostemma*, *Erlangea*, *Euryps*, *Gymnolomia*, *Haplocarpha*, *Kuhnia*, *Leptocarpha*, *Montanoa*, *Oldenburgeria*, *Pertusa*, *Psilostrophe*, *Pteronia*, *Saussurea*, *Tithonia*, *Toipis*, *Tricholepis*, *Wedelia* and *Zaluzania*.

## 107. CAMPANULACEÆ.

- A. Fls. irregular, rarely nearly regular; anthers united.  
 B. Corolla open down to the base on one side.... 1. *Lobelia*.  
 BB. Corolla with a closed tube.  
 c. Stamens in a tube free from the corolla.... 2. *Downingia*.  
 CC. Stamens more or less adnate to the corolla up to near the throat, then monadelphous and free or farther adnate on one side only..... 3. *Palmerella*.  
 CCC. Stamens affixed at top of corolla-tube or above the middle: caps. 2-valved at apex..... 4. *Isotoma*.  
 CCCC. Stamens affixed at base of corolla-tube.  
 D. Fr. an indehiscent berry..... 5. *Centropogon*.  
 DD. Fr. a caps. 2-valved at apex..... 6. *Siphocampylus*.  
 AA. Fls. regular or nearly so; anthers usually separate.  
 B. Fr. an indehiscent, fleshy berry.  
 c. Ovary inferior..... 7. *Canarina*.  
 CC. Ovary superior as to calyx but not corolla. 8. *Campanula*.  
 BB. Fr. a caps.  
 c. Caps. dehiscing loculicidally by apical valves.  
 D. Corolla 5-parted nearly to base..... 9. *Jasione*.  
 DD. Corolla broadly bell-shaped, 5-lobed..... 10. *Platycodon*.  
 DDD. Corolla narrowly (or not broadly) bell-shaped or tubular.  
 E. Calyx-tube adnate, hemispherical..... 11. *Codonopsis*.  
 EE. Calyx-tube free, long-campanulate or inflated..... 12. *Cyananthus*.  
 CC. Caps. closed at apex, dehiscing laterally between the ribs by small lids or small solitary valves.  
 D. Corolla 5-cut-lobed, or -parted.  
 E. Ovary linear or narrowly oblong..... 13. *Specularia*.

- EE. Ovary hemispherical or top-shaped.  
 F. Anthers connate in a tube. .... 14. *Symphyan-*  
 FF. Anthers not connate in a tube. .... [dra].  
 G. Style girt at base by an epigynous fleshy disk, which is cup-shaped or tubular. .... 15. *Adenophora*  
 GG. Style without such disk.  
 H. Corolla 5-parted to the base; lobes narrow, either long-cohering above or rotate-spreading. .... 16. *Phyteuma*.  
 HH. Corolla 5-cut shortly or to the middle, rarely farther, bell-shaped, tubular, funnel-shaped or subrotate. .... 17. *Campanula*.  
 DD. Corolla narrowly tubular, shortly 3-cut at apex. .... 18. *Trachelium*.  
 DDD. Corolla usually 7-10-cut, rarely 5-cut.  
 E. Number of lobes 5-9, usually 7; fls. bell-shaped. .... 19. *Ostrowskia*.  
 EE. Number of lobes 8-10; lobes narrow and spreading. .... 20. *Michauxia*  
 Githopsis, Leptocodon and Lightfootia are also mentioned in the Cyclopedia.

## 108. MONOTROPACEÆ.

in cultivation. .... *Sarcodes*.

## 109. CLETHRACEÆ.

The only genus. .... *Clethra*.

## 110. PYROLACEÆ.

- A. Style very short, obconical: sts. leafy. .... 1. *Chimaphila*.  
 AA. Style mostly elongated; scape naked or leafy only at base.  
 B. Fls. solitary. .... 2. *Moneses*.  
 BB. Fls. racemose. .... 3. *Pyrola*.

## 111. ERICACEÆ (Inc. Vacciniaceæ).

Subfamily 1. VACCINIEÆ. Ovary inferior: fr. a berry or drupe.

Subfamily 2. ERICINEÆ. Ovary superior: fr. a caps., except  
 n Tribe 1 of Subfamily 2.

- Fr. fleshy, a berry or drupe. .... 1. ARBUTUS TRIBE.  
 Fr. a loculicidal caps., chiefly 5-celled; corolla deciduous. .... 2. ANDROMEDA TRIBE  
 Fr. a caps., with loculicidal or sometimes septicidal dehiscent and 4 or 5 cells; corolla marcescent persistent. .... 3. ERICA TRIBE.  
 Fr. a septicidal caps.: corolla deciduous. .... 4. RHODODENDRON [TRIBE].

## Subfamily 1. VACCINIEÆ.

- A. Corolla tubular or cylindric; filaments connate or free.  
 B. Filaments connate or cohering; anthers produced into a single long beak.  
 C. Stamens shorter than corolla. .... 1. *Macleana*.  
 CC. Stamens equaling or exceeding the corolla.  
 BB. Filaments distinct; anthers ending in 2 long beaks. .... 3. *Agapetes*.  
 AA. Corolla campanulate, urceolate or rotate; filaments usually free.  
 B. The ovary wholly inferior.  
 C. Ovary 10-celled, 10-ovuled. .... 4. *Gaylussacia*.  
 CC. Ovary 4 5-celled, or by false partitions from the back of these cells, 8-10-celled; ovules numerous. .... 5. *Vaccinium*.  
 BB. The ovary at first a third to half superior. .... 6. *Chiogenes*.

## Subfamily 2. ERICINEÆ.

## 1. Arbutus Tribe.

- A. The anthers have a pair of awns on the back.  
 B. Ovary-cell many-ovuled. .... 7. *Arbutus*.  
 BB. Ovary-cells 1-ovuled.  
 C. Nutlets coalescent: lvs. persistent, entire. .... 8. *Arctostaphylos*.  
 CC. Nutlets distinct: lvs. deciduous, serrate. .... 9. *Arctous*.  
 AA. The anthers awnless on back. .... 10. *Pernettya*.

## 2. Andromeda Tribe.

- A. Anther-cells opening through their whole length, not appendaged; stigma 5-lobed, the lobes adnate to a surrounding ring or cup. .... 11. *Epigæa*.

- AA. Anthers opening only at the top; stigma usually entire.  
 B. Calyx becoming fleshy in fr., forming a berry and inclosing the small caps. .... 12. *Gaultheria*.  
 BB. Calyx unchanged and dry under the caps.  
 C. Sepals or calyx-lobes valvate or open in the bud, never overlapping.  
 D. The anthers destitute of appendages or awns. .... 13. *Lyonia*.  
 DD. The anthers awned.  
 E. The anthers short and obtuse, with 2 pores topped by slender, ascending awns; corolla urn-shaped. .... 14. *Andromeda*.  
 EE. Anthers lanceolate, produced into 2 small tubes, each surmounted by a pair of slender, ascending awns; corolla bell-shaped. .... 15. *Zenobia*.  
 EEE. Anthers with 2 spreading or deflexed awns or teeth, on the back of the filament or at its junction with the anther. .... 16. *Pieris*.  
 CC. Sepals or calyx-lobes imbricated, at least in the early bud.  
 D. Lvs. heath-like, small, thick or needle-like, mostly overlapping: anther fixed near apex. .... 17. *Cassiope*.  
 DD. Lvs. not heath-like, usually larger, flat, broad and leathery.  
 E. Corolla cylindraceous to conical-urceolate; anthers fixed near base.  
 F. Seeds imbricated in 2 rows. .... 18. *Chama-daphne*.  
 FF. Seeds pendulous or in all directions. .... 19. *Leucothoe*.  
 FFF. Seeds all ascending or erect. .... 20. *Oxydendrum*.  
 EE. Corolla bell-shaped or urn-shaped. .... 21. *Enkianthus*.

## 3. Erica Tribe.

- A. Anthers 2-awned on back at base. .... 22. *Calluna*.  
 AA. Anthers 2-parted, blunt or awned, usually cristate or lamellate at base. .... 23. *Erica*.  
 AAA. Anthers blunt on back, not cristate. .... 24. *Bruckenthalia*.

## 4. Rhododendron Tribe.

- A. Corolla polypetalous or nearly so.  
 B. Fls. in elongated racemes or panicles: lvs. deciduous.  
 C. Petals 4; stamens 8. .... 25. *Elliottia*.  
 CC. Petals 3; stamens 6. .... 26. *Tripetaleia*  
 BB. Fls. solitary; petals 5; stamens 10: lvs. deciduous. .... 27. *Cladothamnus*.  
 BBB. Fls. in umbel-like racemes; petals 5; stamens 5-10: lvs. evergreen.  
 C. Lvs. tomentose below: caps. 5-celled; seeds winged. .... 28. *Ledum*.  
 CC. Lvs. glabrous: caps. 2-3-celled; seeds angular. .... 29. *Leiophyllum*.  
 AA. Corolla gamopetalous.  
 B. Seeds compressed, winged: corolla slightly irregular; stamens 5-10.  
 C. Stamens usually exserted; anthers opening by a round terminal pore; corolla rotate, campanulate or funnelform. .... 30. *Rhododendron*.  
 CC. Stamens included; anthers opening by an oblique pore; corolla urceolate: lvs. deciduous. .... 31. *Menziesia*.  
 BB. Seeds subglobose or trigonous, not winged: corolla regular.  
 C. Stamens 10.  
 D. The corolla cup-shaped with 10 pouches receiving the anthers; fls. in corymbs or solitary. .... 32. *Kalmia*.  
 DD. The corolla rotate; fls. terminal, 1-3: lvs. oblong-elliptic, ciliate. .... 33. *Rhodothamnus*.  
 DDD. The corolla urceolate or campanulate; fls. terminal, solitary or in umbels: lvs. heath-like. .... 34. *Phyllodoce*.  
 CC. Stamens 5 or 8.  
 D. Fls. 5-merous, in umbels, 2-5; corolla broadly funnelform: lvs. elliptic, opposite, smooth. .... 35. *Loiseleuria*  
 DD. Fls. 4-merous: lvs. alternate.  
 E. Corolla rotate, 4-parted; fls. 2-10, in loose racemes: lvs. heath-like. .... 36. *Bryanthus*.  
 EE. Corolla campanulate-urceolate with short 4-toothed limb; fls. in loose racemes: lvs. tomentose below. .... 37. *Dabæcia*.

The genus *Pentaptergyium* is included in the work.

## 112. EPACRIDACEÆ.

Style inserted in the intruded vertex of the ovary; stamens epipetalous; anthers 1-celled; corolla-lobes quincuncially imbricate; bracts numerous, passing into sepals. .... *Epacris*.  
 The recent genus *Rupicola* is also mentioned in the work.



## 113. DIAPENSIACEÆ.

- A. Corolla persistent; staminodes 0.  
 B. Fls. sessile. .... 1. *Pyxidanthera*.  
 BB. Fls. pedunculate. .... 2. *Diapensia*.  
 AA. Corolla deciduous; staminodes 5.  
 B. Staminodes small, scale-like, separate; corolla-lobes crenate. .... 3. *Shortia*.  
 BB. Staminodes long, linear, separate; corolla-lobes fimbriate. .... 4. *Schizocodon*.  
 BBB. Staminodes spatulate, connate with stamens; corolla-segms. entire. .... 5. *Galax*.

## 114. PLUMBAGINACEÆ.

- A. Calyx-limb usually spreading, scarious and colored.  
 B. Lvs. usually needle-like; styles distinct at angles of ovary; stigmas sub-capitate. .... 1. *Acantholimon*.  
 BB. Lvs. flat; styles as above; stigmas capitate, oblong or linear; infl. cymose or dense or scape 1- to few-fl'd. .... 2. *Statice*.  
 BBB. Lvs. flat or linear-subulate; styles shortly subconnate at vertex of ovary; stigmas linear; scape 1-headed. .... 3. *Armeria*.  
 AA. Calyx-lobes or teeth erect with merely scarious sinuses.  
 B. Stamens free; calyx glandular. .... 4. *Plumbago*.  
 BB. Stamens adnate to middle of corolla; calyx not glandular. .... 5. *Cerastium*.

## 115. PRIMULACEÆ.

- A. Corolla-lobes imbricated in quincunx fashion.  
 B. Plants aquatic; ovules anatropous; umbilicus basal. .... 1. *Hottonia*.  
 BB. Plants terrestrial; ovules semi-anatropous; umbilicus ventral.  
 C. Caps. dehisces by a lid at top. .... 2. *Soldanella*.  
 CC. Caps. dehisces by valves.  
 D. The corolla-lobes bent back. .... 3. *Dodecatheon*.  
 DD. The corolla-lobes spreading or ascending.  
 E. Stamens affixed to base of corolla; anthers long-acuminate. .... 4. *Cortusa*.  
 EE. Stamens affixed to corolla-tube; anthers obtuse.  
 F. Corolla-tube usually longer than calyx.  
 G. Caps. many-seeded. .... 5. *Primula*.  
 GG. Caps. 1-2-seeded. .... 6. *Douglasia*.  
 FF. Corolla-tube as long as calyx or shorter; caps. few or many-seeded. .... 7. *Androsace*.  
 AA. Corolla-lobes convolute in the bud; ovules semi-anatropous; umbilicus ventral.  
 B. Caps. circumscissile. .... 8. *Anagallis*.  
 BB. Caps. longitudinally dehiscent by valves.  
 C. Lobes of corolla bent back. .... 9. *Cyclamen*.  
 CC. Lobes of corolla not bent back.  
 D. Corolla-lobes 5-6; testa of seed with a firm epidermis. .... 10. *Lysimachia*.  
 EE. Staminodes 5, each corolla-lobe curved around its stamen. .... 11. *Steironema*.  
 EEE. Staminodes 5, tooth-like; corolla-lobes not encircling stamens. .... 12. *Naumburgia*.  
 DD. Corolla-lobes usually 7; testa of seed with a lax epidermis. .... 13. *Trientalis*.

The genus *Glaux* may be met with occasionally in cultivation.

## 116. MYRSINACEÆ.

- A. Staminodes 5; corolla gamopetalous.  
 B. Corolla cylindrical, shortly 5-lobed; fr. many-seeded. .... 1. *Theophrasta*.  
 BB. Corolla subrotate, deeply 5-parted; fr. 1- to many-seeded. .... 2. *Clavija*.  
 BBB. Corolla rotate-campanulate, deeply 5-cut; fr. few-seeded. .... 3. *Jacquinia*.  
 AA. Staminodes 0; corolla gamopetalous or poly-petalous; fr. 1-seeded.  
 B. Corolla imbricated; fls. fascicled, lateral or axillary. .... 4. *Myrsine*.  
 BB. Corolla convolute; panicles terminal or terminal and axillary. .... 5. *Ardisia*.

The genus *Mæsa* is also accounted for.

## 117. SYMPLOCACEÆ.

- The only genus. .... *Symplocos*.

## 118. STYRACACEÆ.

- A. Fr. superior, globular or ovoid, not ribbed nor winged. .... 1. *Styrax*.  
 AA. Fr. inferior, elongated ribbed, or winged.  
 B. Infl. paniced, many-fl'd., drooping, sub-terminal. .... 2. *Pterostyrax*.  
 BB. Infl. of few-fl'd. fascicles, often lateral. .... 3. *Halesia*.

## 119. SAPOTACEÆ.

- A. Corolla-lobes, calyx-segms., stamens and staminodes (when present) isomerous.  
 B. Staminodes 0; seeds usually albuminous; fls. 5-merous, rarely 6-7-merous. .... 1. *Chrysophyllum*.  
 BB. Staminodes small, usually affixed higher than stamens, sometimes few or 0; seeds not albuminous; fls. 4-5-merous. .... 2. *Lucuma*.  
 BBB. Staminodes alternate with stamens, rarely affixed higher; seeds albuminous. .... 3. *Sideroxylon*.  
 AA. Corolla-lobes and calyx-segms. isomerous; stamens twice as many or more. .... 4. *Isanandra*.  
 AAA. Corolla-lobes usually 2 or 3 times as many as calyx-segms.  
 B. Calyx-segms. 1 series. .... 5. *Bumelia*.  
 BB. Calyx-segms. 2 series. .... 6. *Mimusops*.

The genus *Pouteria* is now described in this family.

## 120. EBENACEÆ.

- A. The fls. usually hermaphrodite; stamens in 1 series. .... 1. *Royena*.  
 AA. The fls. dioecious.  
 B. Fls. usually 3-merous; stamens 3- $\infty$ , commonly 9; ovary 3- or 6-celled. .... 2. *Maba*.  
 BB. Fls. usually 4-5-merous; stamens 4-8, usually in 2 series; ovary 4- or 8-celled. .... 3. *Diospyros*.

## 121. OLEACEÆ.

- Fr. didymous or septically divisible into two; corolla-lobes strongly imbricate; ovules laterally affixed near base; seeds erect, without endosperm; radicle inferior. .... 1. JASMINE TRIBE.  
 Fr. terete or compressed parallel to the septum, loculicidally dehiscent; ovules pendulous from apex of cells; seeds winged, pendulous; radicle superior. .... 2. LILAC TRIBE.  
 Fr. entire, dry, indehiscent, winged, a samara, compressed contrary to the septum; ovules twin, pendulous from apex of cell; seeds pendulous with endosperm; radicle superior. .... 3. ASH TRIBE.  
 Fr. fleshy and indehiscent, a drupe or rarely a berry, not lobed; ovules twin, laterally affixed near the apex; seeds solitary, suspended or pendulous, with endosperm; radicle superior. .... 4. OLIVE TRIBE.

## 1. Jasmine Tribe.

- Fr. fleshy, indehiscent, didymous or by abortion simple. .... 1. *Jasminum*.

## 2. Lilac Tribe.

- A. Corolla-lobes imbricate.  
 B. Ovules 3-4 in a cell; lvs. pinnate and fls. white; corolla-lobes shorter than tube. .... 2. *Nathusia*.  
 BB. Ovules 4-10 in a cell; lvs. entire or 3-foliate and fls. yellow; lobes many times longer than tube. .... 3. *Forsythia*.  
 AA. Corolla-lobes induplicate-valvate; tube long or short; ovules 2 in a cell; seeds albuminous. .... 4. *Syringa*.

## 3. Ash Tribe.

- A. Lvs. usually pinnate; fr. elongate, with a terminal wing, generally 1-seeded by abortion. .... 5. *Frazinus*.  
 AA. Lvs. undivided; fr. ovate or orbiculate, surrounded by a wing, usually 2-celled and 2-seeded. .... 6. *Fontanesia*.

## 4. Olive Tribe.

- A. Corolla of nearly distinct petals which are long and linear. .... 7. *Chionanthus*.  
 AA. Corolla-lobes imbricate, broad and obtuse. .... 8. *Phillyrea*.  
 B. Endocarp of drupe thinly crustaceous. .... 9. *Osmanthus*.  
 BB. Endocarp of drupe hard and somewhat woody.  
 AAA. Corolla-lobes induplicate-valvate.

- B. Fr. a drupe; endocarp hard, thick or thin:  
infl. axillary, rarely terminal.....10. *Olea*.  
BB. Fr. a berry, hardly drupaceous; endocarp  
membranous or thinly coriaceous; pan-  
icles terminal.....11. *Ligustrum*.

## 122. LOGANIACEÆ.

- A. Style 2-fid, branches linear, 2-fid..... 1. *Gelsemium*.  
AA. Style simple.  
B. Corolla-lobes valvate.  
C. Fr. a circumscissile caps..... 2. *Spigelia*.  
CC. Fr. an indehiscent drupe or berry..... 3. *Strychnos*.  
BB. Corolla-lobes imbricate.  
C. Anthers exerted..... 4. *Chilianthus*.  
CC. Anthers included..... 5. *Buddleia*.  
The genus *Logania* may afford cultivated plants now and then.

## 123. GENTIANACEÆ.

- A. Lvs. alternate or radical.  
B. Fr. indehiscent..... 1. *Nymphoides*.  
BB. Fr. dehiscent.  
C. Caps. usually 4-valved at apex..... 2. *Villarsia*.  
CC. Caps. irregularly sub-2-valved at apex.... 3. *Menyanthes*.  
AA. Lvs. opposite.  
B. Ovary perfectly 2-celled; placentæ solitary  
in each cell, often thick, adnate to septum;  
liberated by dehiscence of caps..... 4. *Exacum*.  
BB. Ovary 1-celled; placentiferous margins of  
carpels more or less intruded within or  
even touching but not connate in the mid-  
dle of the cell, spuriously 2-celled.  
C. Style often deciduous; anthers usually  
erect.  
D. Anthers spirally twisted finally..... 5. *Erythraea*.  
DD. Anthers finally recurved at apex..... 6. *Sabbatia*.  
CC. Style usually persistent; anthers versa-  
tile, finally recurved..... 7. *Lisianthus*.  
BBB. Ovary 1-celled; margins of carpels rarely  
intruded; ovules and seeds affixed at  
each side of the suture in 1 series or more  
or less extended over the parietal surface;  
placentæ adnate, very thin.  
C. Corolla has 1-2 pits at base of each lobe.  
D. Style short or scarcely any..... 8. *Swertia*.  
DD. Style subulate..... 9. *Frasera*.  
CC. Corolla has no such pits.....10. *Gentiana*.  
The genus *Chironia* may also be expected in cultivation.

## 124. ASCLEPIADACEÆ.

Subfamily 1. PERIPLOCEÆ. Pollen granular, loosely aggre-  
gated in 2 masses in each anther-cell.

Character of subfamily..... 1. PERIPLOCA TRIBE.

Subfamily 2. EUASCLEPIADEÆ. Pollen waxy, the masses  
solitary in each anther-cell.

- Anthers tipped by a membrane, which is  
inflexed or sometimes erect, and usually  
hyaline, rarely opaque or petal-like;  
pollen-masses suspended, attached in  
pairs (1 in each adjacent cell of different  
anthers) to the corpuscle or gland..... 2. CYNANCHUM TRIBE.  
Anthers usually tipped by an inflexed or  
suberect membrane, which is hyaline,  
rarely opaque; pollinia solitary in each  
cell, erect or very small..... 3. MARS DENIA  
[TRIBE].  
Anthers obtuse at apex, not appendaged  
or rarely the connective produced; pol-  
linia solitary in the cells, erect..... 4. CEROPEGIA TRIBE.  
Anthers like those of the Ceropegieæ or  
more incumbent above the top of the  
stigma or subimmersed; sts. thick and  
fleshy, leafless or with a few lvs. at top..... 5. STAPELIA TRIBE.  
Anthers broad at the top, without ap-  
pendages or more or less membranace-  
ous on the margins, the cells somewhat  
transversely dehiscent, attached  
nearly or quite on the margin of the  
stigma-disk; pollinia horizontal or  
essentially so..... 6. GONOLOBUS TRIBE.

### 1. Periploca Tribe.

- A. Scales of corona distant from staminal tube.  
B. Corolla-tube short; scales linear or club-  
shaped..... 1. *Cryptolepis*.  
BB. Corolla large, funnel-shaped; scales acumi-  
nate or 2-fid..... 2. *Cryptostegia*.  
AA. Scales of corona close to stamens.  
B. Corolla-lobes valvate..... 3. *Chlorocodon*.  
BB. Corolla-lobes imbricate..... 4. *Periploca*.

## 2. Cynanchum Tribe.

- A. The outer or single crown either simple and  
composed of 5 scales or ring-shaped, adnate  
to the corolla and not the staminal tube, or  
rarely adherent to both.  
B. Stigma depressed..... 5. *Macrosepius*.  
BB. Stigma umbonate or 2-beaked at apex;  
corona-scales attached at middle (or  
below) of corolla-tube..... 6. *Physianthus*.  
BBB. Stigma plane or umbonate; corona annular,  
adnate to corolla..... 7. *Philibertia*.  
AA. The crown of 5 scales affixed to base of  
corolla and staminal tube; caudicles of pol-  
linia appendaged with an erect fuscous  
tooth..... 8. *Orypetalum*.  
AAA. The crown of 5 scales which are distinct,  
affixed or adnate to the staminal tube or  
the back of the anthers.  
B. Scales concave or hooded with an acute  
ligula inside..... 9. *Asclepias*.  
BB. Scales fleshy, narrow, adnate to stamen-  
tube, but free and recurved at base..... 10. *Calotropis*.  
BBB. Scales (5 outer ones) carinate-complicate  
at base of staminal tube; the 5 scales at  
the apex of the long staminal tube, short,  
obtusely spreading, alternate with anthers..... 11. *Podostigma*.  
AAAA. The outer or single crown affixed to the  
staminal tube, ring- or cup-shaped, entire,  
lobed or parted.  
B. Corona villous inside..... 12. *Morrenia*.  
BB. Corona with 5 scales or ligulae inside..... 13. *Cynanchum*.  
BBB. Corona naked inside..... 14. *Vincetori-*  
cum  
BBBB. Corona of 5 short procecded opposite anthers  
and 10 ligulae alternate with anthers in  
pairs..... 15. *Rothrockia*.

## 3. Marsdenia Tribe.

- A. Corolla-lobes strictly valvate..... 16. *Hoya*.  
AA. Corolla-lobes usually overlapping dextrorsely.  
B. Fls. not pure white, urn- or salver-shaped,  
small or medium-sized..... 17. *Marsdenia*.  
BB. Fls. white, salver- or funnel-shaped, large.... 18. *Stephanotis*.

## 4. Ceropegia Tribe.

Corona double, affixed to staminal tube..... 19. *Ceropegia*.

## 5. Stapelia Tribe.

Corona double, outer spreading, inner of 5 scales. 20. *Stapelia*.

## 6. Gonolobus Tribe.

Crown cup-shaped or annular, entire or lobed.... 21. *Gonolobus*.

Additional genera described in Asclepiadaceæ are: *Caralluma*,  
*Duvalia*, *Echidnopsis*, *Gomphocarpus*, *Hoodia*, *Huernia*, *Micho-*  
*litia*, *Pectinaria*, *Piarranthus*, *Raphionacme*, *Sphaerocodon* and  
*Trichocaulon*.

## 125. APOCYNACEÆ.

- A. Anther-cells not appendaged at base.  
B. Ovary entire (*Carissa* Tribe); fls. 5-merous.  
C. Fr. a 2-valved caps.; ovary 1-celled..... 1. *Allamanda*.  
CC. Fr. a berry, indehiscent; ovary 2-celled;  
cells 1-4-ovuled.  
D. Ovules laterally affixed; cymes ter-  
minal, few-fid; spines axillary..... 2. *Carissa*.  
DD. Ovules erect from base; cymes axillary,  
dense; spines 0..... 3. *Acokanthera*.  
BB. Ovaries 2 to several; style 1 (*Plumeria* Tribe).  
C. Calyx with several glands inside or a ring  
of hairs.  
D. Carpels 2-ovuled..... 4. *Thevetia*.  
DD. Carpels many-ovuled..... 5. *Taberna-*  
montana  
CC. Calyx without glands inside.  
D. Carpels 2-ovuled.  
E. Disk 2-scaled..... 6. *Kopsia*.  
EE. Disk cup-shaped or annular..... 7. *Rauwolfia*.  
DD. Carpels 6- to many-ovuled.  
E. Ovules in 2 series.  
F. Disk 0.  
G. Seeds truncate..... 8. *Amsonia*.  
GG. Seeds winged..... 9. *Gonioma*.  
FF. Disk of 2 scales..... 10. *Vinca*.  
EE. Ovules in many series.  
F. Stamens near base of tube..... 11. *Plumeria*.  
FF. Stamens above middle of tube..... 12. *Alistonia*.  
AA. Anther-cells produced at base, (Echites  
Tribe.)  
B. The cone of anthers more or less exerted  
at apex.  
C. Throat of corolla with 5 scales..... 13. *Prestonia*.  
CC. Throat without scales..... 14. *Vallisneria*.  
BB. The anthers included.  
C. Lvs. usually in whorls of 3..... 15. *Nerium*.



- cc. Lvs. opposite.  
 d. Corolla bell-shaped, with 5 squamellae alternating with stamens.....16. *Apocymum*.  
 dd. Corolla salver-shaped or funnel-shaped, the throat without scales.  
 e. Disk of 2 scales.....17. *Dipladenia*.  
 ee. Disk many-toothed or crenulate.....18. *Odontadenia*.  
 eee. Disk of 5 lobes or scales, often truncate in *Trachelospermum*.  
 f. Fls. salver-shaped.  
 g. Infl. lax corymbose cymes.....19. *Trachelospermum*.  
 gg. Infl. racemose; rarely shortly dichotamous.....20. *Echites*.  
 ff. Fls. funnel-shaped.  
 g. In cymes.....21. *Beaumontia*.  
 gg. In racemes.....22. *Mandevilla*.

Other genera treated are: *Hunteria*, *Landolphia*, *Pachypodium*, *Parsonsia*, *Pleiocarpa* and *Strophanthus*.

## 126. POLEMONIACEÆ.

- a. Caps. deeply loculicidal: herbs or sub-shrubs.  
 b. Stamens unequally affixed to corolla-tube; not declinate.  
 c. Lvs. mostly opposite, entire.....1. *Phlox*.  
 cc. Lvs. mostly alternate, usually incised or pinnatifid.....2. *Collomia*.  
 bb. Stamens equally affixed to tube or throat.  
 c. The stamens not declinate.....3. *Gilia*.  
 cc. The stamens declinate.  
 d. Filaments pilose-appendaged at base... 4. *Polemonium*.  
 dd. Filaments not appendaged.....5. *Læselia*.  
 aa. Caps. shortly loculicidal at apex; seeds broadly winged: trees or shrubs.....6. *Cantua*.  
 aaa. Caps. deeply septicidal: tall climbers.....7. *Cobaea*.

## 127. HYDROPHYLLACEÆ.

- a. Styles 2, distinct from base; corolla-lobes imbricate.....1. *Wigandia*.  
 aa. Styles 2-cut, rarely undivided.  
 b. Corolla-lobes usually convolute.  
 c. Stamens exserted.....2. *Hydrophyllum*.  
 cc. Stamens included.....3. *Nemophila*.  
 bb. Corolla-lobes imbricate.  
 c. Fls. marcescent, bell-shaped.....4. *Emmenanthe*.  
 cc. Fls. deciduous.  
 d. The peduncles 1-fid.....5. *Hesperochiron*.  
 dd. The fls. cymose or in 1-sided racemes... 6. *Phacelia*.

## 128. BORAGINACEÆ.

- a. Ovary undivided (or only laterally 4-lobed) and surmounted by the style.  
 b. Style twice bifid; stigmas not annular; cotyledons plaited or corrugated.....1. **CORDIA TRIBE.**  
 bb. Style once bifid or 2-parted (the divisions sometimes coalescent to the top); stigmas more or less capitate; cotyledons plane.....2. **EHRETIA TRIBE.**  
 bbb. Style entire, sometimes wanting; stigma shield- or ring-shaped, forming a complete ring surmounted usually by a tip or appendage which is entire or 2-lobed and varies from hemispherical to subulate.....3. **HELIOTROPE TRIBE.**  
 aa. Ovary 4-parted (rarely 2-parted) from above into 1-celled, 1-ovuled divisions surrounding the base of the undivided (rarely 2-lobed) style; stigma not annular.....4. **BORAGE TRIBE.**

## 1. Cordia Tribe.

Calyx tubular or bell-shaped, merely toothed or lobed.....1. *Cordia*.

## 2. Ehretia Tribe.

Calyx 5-parted; style 2-fid.....2. *Ehretia*.

## 3. Heliotrope Tribe.

- a. Plants sarmentose or twining.....3. *Tournefortia*.  
 aa. Plants are herbs or sub-shrubs.....4. *Heliotropium*.

## 4. Borage Tribe.

- a. Gynobase elevated.  
 b. Apex of nutlets not projecting much beyond scar.  
 c. Nutlets divergent or divaricate (either radiately or in pairs), extended outward or backward much beyond the insertion (which is by a roundish or oblong scar); gynobase little elevated or broadly conical.  
 d. Stamens included.  
 e. Nutlets covered with small cups or cavities.....5. *Omphalodes*.  
 ee. Nutlets covered with small warts or barbed bristles.....6. *Cynoglossum*.  
 dd. Stamens exserted.  
 e. Corolla-tube longer than spreading lobes.....7. *Lindelofia*.  
 ee. Corolla tubular; lobes short, erect or somewhat spreading.....8. *Solanthus*.  
 cc. Nutlets adnate by the inner face or keel to an elevated, conical or columnar gynobase, forming a more or less globose or pyramidal fruit.....9. *Myosotidium*.  
 bb. Apex of nutlets projecting conspicuously beyond scar.  
 c. Pedicels persistent.  
 d. Nutlets keeled toward apex.....10. *Plagiobotrys*.  
 dd. Nutlets not keeled.....11. *Oreocarya*.  
 cc. Pedicels deciduous.....12. *Cryptanthus*.  
 aa. Gynobase flat or nearly so.  
 b. Scar excavated or often girt by a ring.  
 c. Throat of corolla has 5 scales inside.  
 d. Filaments appendaged with a scale....13. *Borago*.  
 dd. Filaments not appendaged.  
 e. Corolla-lobes very short and sub-erect.....14. *Symphytum*.  
 ee. Corolla-lobes spreading.....15. *Anchusa*.  
 cc. Throat naked or pilose.....16. *Pulmonaria*.  
 bb. Scar flat, either small at the inner angle or oblique.  
 c. Racemes without bracts (rarely a few bracts at base); anthers obtuse at apex.  
 d. Throat of corolla scaly.....17. *Myosotis*.  
 dd. Throat almost naked.....18. *Mertensia*.  
 cc. Racemes bracted.  
 d. Anthers obtuse at apex or hardly mucronate.  
 e. Lobes of corolla erect.....19. *Onosmodium*.  
 ee. Lobes of corolla spreading.....20. *Lithospermum*.  
 ff. Corolla-tube slender; throat naked.....21. *Arnebia*.  
 fff. Corolla tubular or salver-form; throat naked, lobes usually unequal.....22. *Echium*.  
 dd. Anthers linear, often acuminate, arrow-shaped at base.  
 e. Nutlets distinct.....23. *Onosma*.  
 ee. Nutlets connate in pairs.....24. *Cerinthe*.

## 129. CONVULVULACEÆ.

- a. Corolla-lobes small, imbricate: plants parasitic, leafless; sts. thread-like, not green....1. *Cuscuta*.  
 aa. Corolla large, plicate or induplicate in aestivation.  
 b. Fr. berry-like or harder, indehiscent: style undivided.  
 c. The ovary 4-celled, 4-ovuled.....2. *Argyriaea*.  
 cc. The ovary 2-celled, 4-ovuled.....3. *Leptostoma*.  
 bb. Fr. a 2-4-valved caps. with a thin or hard pericarp, or indehiscent with a thin pericarp; styles 2 and distinct or the style entire or divided.  
 c. Stigma capitate; style entire or 2-parted; ovary 2-celled, 4-ovuled.....4. *Porana*.  
 cc. Stigma thick, globose, often twin; ovary 2-4-celled, 4-ovuled.  
 d. Stamens and style included within the corolla-tube.....5. *Ipomæa*.  
 dd. Stamens and style exserted.  
 e. Plant a night-bloomer; corolla contorted in bud.....6. *Calonyction*.  
 ee. Plant a day-bloomer; corolla not contorted.....7. *Quamoclit*.  
 ccc. Stigma capitate; ovary 2-celled.....8. *Breweria*.  
 cccc. Stigmas 2, linear, filiform or thickish.....9. *Convolvulus*.  
 (Except *Calystegia* section, see also *Rhodorhiza*.)  
 ccccc. Stigmas 2, flat, ovate or oblong.....10. *Jacquemonia*.  
 (Also *Calystegia* section of *Convolvulus*.)

## 130. SOLANACEÆ.

- a. Stamens didynamous, the fifth (and sometimes also one of the pairs) smaller, abortive or missing.  
 B. Number of perfect stamens usually 5.  
 c. The stamens affixed at middle of tube or lower..... 1. *Petunia*.  
 cc. The stamens affixed at apex of tube..... 2. *Nierembergia*.  
 BB. Number of perfect stamens usually 4 or 2.  
 c. Corolla-tube cylindrical; limb oblique; perfect stamens 2..... 3. *Schizanthus*.  
 cc. Corolla obliquely funnel-shaped; perfect stamens 4, didynamous..... 4. *Salpiglossis*.  
 CCC. Corolla-tube cylindrical, straight; anthers of the 2 short stamens dimidiate, of the longer ones 2-celled..... 5. *Browallia*.  
 CCCC. Corolla-tube twisted; anthers as in *Browallia*..... 6. *Streptosolen*.  
 CCCCC. Corolla-tube long, not twisted; slightly widened at apex; 4 perfect anthers with confluent cells..... 7. *Brunfelsia*.  
 AA. Stamens all perfect not didynamous, normally 5.  
 B. Seeds little, if at all, flattened.  
 c. Fr. a few-seeded berry..... 8. *Cestrum*.  
 CC. Fr. a many-seeded caps.  
 D. Corolla with a narrow tube and short spreading lobes..... 9. *Fabiana*.  
 DD. Corolla funnel- or salver-shaped; limb equal or oblique..... 10. *Nicotiana*.  
 BB. Seeds flattened.  
 c. Fr. a caps.  
 D. Corolla-lobes plicate.  
 E. Caps. 4-celled, and 4-valved (sometimes indehiscent)..... 11. *Datura*.  
 EE. Caps. circumscissile above the middle..... 12. *Scopolia*.  
 DD. Corolla-lobes imbricate..... 13. *Hyoscyamus*.  
 CC. Fr. berry-like, or at least indehiscent.  
 D. Limb of corolla subequally plicate or divided into valvate or induplicate lobes.  
 E. Anthers longer than filament, connivent connate in a cylinder or cone, acuminate at apex or dehiscent by 2 apical pores.  
 F. Connective variously thickened on back..... 14. *Cyphomandra*.  
 FF. Connective slender or obsolete.  
 G. The anthers acuminate, hollow at tip, dehiscing by a longitudinal crack..... 15. *Lycopersicon*.  
 GG. The anthers opening by an apical pore which is sometimes continued into a longitudinal crack..... 16. *Solanum*.  
 EE. Anthers free, with parallel cells, and dehiscing by a longitudinal crack.  
 F. Stamens affixed above middle of tube..... 17. *Salpichroa*.  
 FF. Stamens affixed near the base of tube.  
 G. Corolla nearly rotate or broadly bell-shaped.  
 H. Fruiting calyx hardly enlarged..... 18. *Capsicum*.  
 HH. Fruiting calyx inflated or bladdery.  
 I. Calyx cut shortly or to middle..... 19. *Physalis*.  
 II. Calyx parted to base..... 20. *Nicandra*.  
 GG. Corolla tubular or narrowly funnel-shaped..... 21. *Iochroma*.  
 DD. Limb of corolla more or less imbricate, flat and distinct or connected by induplicate sinuser.  
 E. The lobes imbricated from the base, not plicate.  
 F. Plants woody.  
 G. Berry with 4 stones, each 1-2-seeded..... 22. *Grabowskia*.  
 GG. Berry with 2 cells, each 1-∞-seeded..... 23. *Lycium*.  
 FF. Plants herbaceous..... 24. *Atropa*.  
 EE. The sinuses of the corolla induplicate between the lobes.  
 F. Calyx long and tubular..... 25. *Solanum*.  
 FF. Calyx leafy, 5-fid, increasing in f. .... 26. *Mandragora*.

## 131. NOLANACEÆ.

Single genus..... *Nolana*.

## 132. SCROPHULARIACEÆ.

**Series 1. PSEUDOSOLANACEÆ.** Lvs. all alternate; infl. simple, centripetal; corolla hardly if at all bilabiate; the 2 posterior lobes external in the bud.

- A. Corolla-tube short, somewhat bell-shaped: American species..... 1. *Leucophyllum* [TRIBE].  
 AA. Corolla subrotate: Old World species... 2. *Verbascum* [TRIBE].  
**Series 2. ANTIRRHINIDÆÆ.** Lvs. prevaillingly opposite, at least the lower: infl. simple or compound, partially centrifugal, i.e., the peduncle cymosely few- to several-fid.; posterior lip or lobes of corolla generally external in the bud.  
 A. Corolla bilabiate; lips inflated, concave. 3. *Calceolaria* [TRIBE].  
 AA. Corolla bilabiate or nearly regular; lips nearly plane.  
 B. Corolla saccate or spurred.  
 c. Tube wanting..... 4. *Hemimeris* [TRIBE].  
 cc. Tube present..... 5. *Antirrhinum* [TRIBE].  
 BB. Corolla-tube not saccate nor spurred.  
 c. Infl. centrifugal, cymose, usually compound, rarely sub-simple.... 6. *Chelone* [TRIBE].  
 cc. Infl. centripetal.  
 d. Anthers 1-celled..... 7. *Manulea* [TRIBE].  
 dd. Anthers 2-celled..... 8. *Gratiola* [TRIBE].

**Series 3. RHINANTHIDÆÆ.** Lvs. various; infl. simple or compound; corolla-lobes variously imbricated, the anterior or lateral ones usually exterior.

- A. Anther-cells contiguous at apex and usually confluent: plants not parasitic. 9. *Digitalis* [TRIBE].  
 AA. Anther-cells everywhere distinct: plants often root-parasitic.  
 B. Corolla-lobes all flat, usually spreading..... 10. *Gerardia* [TRIBE].  
 BB. Corolla with posterior lip erect, concave or galeate; anterior lip often spreading..... 11. *Euphrasia* [TRIBE].

## 1. Leucophyllum Tribe.

Corolla-lobes 5, subequal, spreading..... 1. *Leucophyllum*.

## 2. Verbascum Tribe.

- A. Stamens 5..... 2. *Verbascum*.  
 AA. Stamens 4..... 3. *Celsia*.

## 3. Calceolaria Tribe.

The only genus..... 4. *Calceolaria*.

## 4. Hemimeris Tribe.

- A. Corolla more or less rotate, resupinate, the grooves inconspicuous or obsolete..... 5. *Alonsoa*.  
 AA. Corolla spread out flat, swollen or saccate under anterior lip..... 6. *Angelonia*.  
 AAA. Corolla flat or concave, with 2 basal spurs or pouches..... 7. *Diascia*.  
 AAAA. Corolla-tube short with 1 spur or sac on the anterior side..... 8. *Nemesia*.

## 5. Antirrhinum Tribe.

- A. Throat has a prominent palate.  
 B. Corolla spurred..... 9. *Linaria*.  
 BB. Corolla saccate or gibbous at base..... 10. *Antirrhinum*.  
 AA. Throat has no palate.  
 B. Caps. opens by 2 apical pores which are sometimes confluent..... 11. *Anarrhinum*.  
 BB. Caps. opens by transverse holes or irregularly.  
 c. Calyx ample, membranous..... 12. *Rhodochiton*.  
 cc. Calyx smaller, herbaceous..... 13. *Maurandia*.

## 6. Chelone Tribe.

- A. Staminode often elongated.  
 B. Caps. loculicidally dehiscent..... 14. *Tetranema*.  
 BB. Caps. septicidally dehiscent.  
 c. Fls. bilabiate.  
 D. Anterior lip with middle lobe folded upon itself and inclosing the stamens..... 15. *Collinsia*.  
 DD. Anterior lip of 3 flat spreading lobes.  
 E. Seeds winged..... 16. *Chelone*.  
 EE. Seed not winged..... 17. *Pentstemon*.  
 cc. Fls. with all the lobes flat, spreading and subequal..... 18. *Russelia*.  
 AA. Staminode usually in the form of a scale at apex of corolla-tube..... 19. *Scrophularia*.  
 AAA. Staminode small, minute or 0.  
 B. Stamens usually exerted.  
 c. Calyx 5-parted; caps. tardily dehiscent..... 20. *Phygellus*.  
 cc. Calyx cup-shaped; berry indehiscent..... 21. *Halleria*.  
 BB. Stamens included; calyx 5-cut.  
 c. Fr. an indehiscent berry..... 22. *Teedia*.  
 cc. Fr. a loculicidal caps..... 23. *Paulownia*.

## 7. Manulea Tribe.

- A. Calyx bilabiate or 2-parted..... 24. *Zaluzianskya*.  
 AA. Calyx 5-parted..... 25. *Chænostoma*.



8. *Gratiola* Tribe.

- A. Perfect stamens 2.....26. *Gratiola*.  
 A A. Perfect stamens 4.  
 B. Stamens all affixed inside corolla-tube.  
 cc. Calyx bell-shaped, 5-parted.....27. *Mazus*.  
 cc. Calyx tubular, 5-toothed and angled.....28. *Mimulus*.  
 BB. Stamens partly inside corolla-tube, partly in throat, 2 affixed in each place.....29. *Torenia*.

9. *Digitalis* Tribe.

- A. Caps. opens by loculicidal valves.  
 B. Herbs creeping.....30. *Sibthorpia*.  
 BB. Herbs upright.....31. *Rehmannia*.  
 BBB. Herbs thick-rhizomatous, the lvs. nearly or quite radical.....32. *Wulfenia*.  
 A A. Caps. opens by septicidal valves.  
 B. Lvs. alternate.  
 c. Corolla declinate, tube swollen, or bell-shaped; posterior lip spreading.....33. *Digitalis*.  
 cc. Corolla-tube slender, spreading.....34. *Erinus*.  
 BB. Lvs. opposite.....35. *Oursia*.  
 A A. Caps. 4-valved or loculicidally 2-valved.  
 B. Lvs. all alternate or radical.....36. *Synthyris*.  
 BB. Lvs. (at least lower ones) opposite.....37. *Veronica*.

10. *Gerardia* Tribe.

- Calyx-lobes shorter than tube.....38. *Gerardia*.

11. *Euphrasia* Tribe.

- A. The anther-cells equal.....39. *Pedicularis*.  
 A A. The outer anther-cell fixed by the middle; inner one pendulous or deficient.  
 B. Calyx laterally compressed, split on anterior side or both.....40. *Castilleja*.  
 BB. Calyx 4-cut.....41. *Orthocarpus*.

Other genera to be looked for are: *Bowkeria*, *Craterostigma*, *Herpustis*, *Lindenbergia*, *Seymeria*.

## 133. LENTIBULARIACEÆ.

- A. Posterior lip of corolla erect; calyx 2-parted or deeply 2-lobed.....1. *Utricularia*.  
 A A. Posterior lip of corolla spreading; calyx 4-5-parted.....2. *Pinguicula*.

## 134. BIGNONIACEÆ.

- A. Ovary 2-celled: caps. dehiscent: lvs. mostly opposite.  
 B. Valves opening parallel with septum.  
 c. Lvs. 2-3-foliate: shrubs, climbing with tendrils.  
 D. Tendrils filiform, simple.  
 E. Disk present.  
 F. Caps. smooth or slightly warty, broadly linear; calyx with black gland.....1. *Adenocalymma*.  
 FF. Caps. rough, broad: disk crenate; calyx not glandular, with 5 subulate teeth.....2. *Clytostoma*.  
 EE. Disk warty; calyx with 5 short teeth or truncate: caps. linear.....3. *Cydista*.  
 DD. Tendrils 3-parted, filiform, slender.  
 E. Corolla straight or slightly curved, membranous: caps. narrow, smooth.  
 F. Lobes of corolla imbricate; stamens inclosed: tendrils twice or thrice 3-parted.....4. *Anisostichus*.  
 (See under Bignonia.)  
 FF. Lobes valvate; stamens exserted: tendrils simply 3-parted.....5. *Pyrostegia*.  
 EE. Corolla strongly curved; calyx leathery, tomentose.  
 F. Stamens inclosed; fls. white.  
 G. Ovary warty: caps. broad, rough, not curved: branches angular.....6. *Pithecolitium*.  
 GG. Ovary smooth: caps. oblong, curved, with a convex and a concave valve: branches terete.....7. *Diactis*.  
 FF. Stamens exserted; fls. red; ovary tomentose.....8. *Phædranthus*.  
 DDD. Tendrils 3-parted, the ramifications hooked, claw-like.  
 E. Calyx truncate or lobed; disk simple.....9. *Bignonia*.  
 EE. Calyx splitting on one side; disk double.....10. *Macfadyenia*.  
 CC. Lvs. 2-3-pinnate: upright tree.....11. *Orozylon*.  
 BB. Valves opening at right angles to septum: upright plants or climbing without tendrils.

- c. Habit climbing (upright in some forms of *Campsis*): lvs. pinnate.  
 D. Stamens exserted: fls. serrate.....12. *Tecomaria*.  
 DD. Stamens inclosed.  
 E. Climbing by rootlets: fls. serrate: corolla campanulate-funnelform.....13. *Campsis*.  
 EE. Climbing without rootlets: fls. entire.  
 F. Corolla club-shaped, straight, upright; fls. in racemes.....14. *Campsidium*.  
 FF. Corolla campanulate-funnelform; fls. in panicles.....15. *Pandorea*.  
 CC. Habit upright: herbs, with alternate lvs.: caps. folliculately dehiscent.  
 D. Seeds with membranous wing: lvs. simple or compound.....16. *Incarvillea*.  
 DD. Seeds with fringed hairs, lvs. pinnate.....17. *Amphicome*.  
 CCC. Habit upright: trees or shrubs with usually opposite lvs.  
 D. Lvs. simple or digitate.  
 E. Seeds fringed with hairs: lvs. simple, entire.  
 F. Fertile stamens 4: lvs. linear, alternate.....18. *Chilopsis*.  
 FF. Fertile stamens 2: lvs. cordate, opposite.....19. *Catalpa*.  
 EE. Seeds winged: lvs. simple or digitate.....20. *Tabebuia*.  
 DD. Lvs. pinnate, rarely simple and serrate.  
 E. Septum flat.  
 F. Calyx campanulate, truncate, toothed or lobed.  
 G. Staminate not elongated.  
 H. Anthers with enlarged leafy connective; calyx regularly 5-toothed: shrubs: fls. serrate; lvs. rarely simple.....21. *Tecoma*.  
 HH. Anthers without enlarged connective; calyx irregularly 2-5-lobed: tree: fls. usually entire.....22. *Heterophragma*.  
 GG. Staminate much elongated and enlarged at the apex; calyx small; fls. in large terminal panicles: lvs. 1-2-pinnate with numerous fls.....23. *Jacaranda*.  
 FF. Calyx spathe-like, splitting on one side; corolla broadly campanulate.....24. *Spathodea*.  
 EE. Septum thick, spongy.  
 F. Seeds in deep impressions of the septum: calyx truncate or indistinctly toothed: lvs. usually bipinnate.....25. *Radermachia*.  
 FF. Seeds in shallow impressions of the septum: calyx 3-5-lobed: lvs. pinnate.....26. *Stereospermum*.  
 A A. Ovary 1-celled.  
 B. Fr. a dehiscent caps.; corolla tubular, narrowed at the mouth: lvs. opposite, pinnate: climbing with tendrils.....27. *Ecrcromocarpus*.  
 BB. Fr. indehiscent: corolla campanulate or campanulate-funnelform; trees or shrubs, with alternate lvs.  
 C. Lvs. simple or 3-foliate.  
 D. Calyx spathe-like, splitting on one side; corolla regular; fls. on the old wood.....28. *Parmentiera*.  
 DD. Calyx campanulate, irregularly lobed; corolla very irregular; fls. at the end of the branches.....29. *Crescentia*.  
 CC. Lvs. pinnate: corolla irregular.....30. *Kigelia*.

The genus *Colea* is also more or less in cultivation within our limits.

## 135. GESNERIACEÆ.

- A. Ovary more or less inferior: fr. capsular.  
 B. Disk 0.....1. *Niphaea*.  
 BB. Disk annular.  
 cc. Fls. smallish, pallid or white.....2. *Dicentra*.  
 CC. Fls. largish, variously colored.  
 D. Corolla-tube broadly swollen or bell-shaped; calyx-lobes usually membranous or leafy.....3. *Gloxinia*.  
 (Of botanists, not of florists.)  
 DD. Corolla-tube cylindrical or broadened above; calyx-lobes narrow or short.  
 E. The fls. axillary.....4. *Achimenes*.  
 (Consult also *Scheeria*.)  
 EE. The fls. alternate in a terminal, leafless raceme.....5. *Nagelia*.  
 BBB. Disk of 5 distinct or but slightly united glands, these equal or unequal.  
 c. Caps. inferior to the middle or higher.  
 D. Anther-cells confluent at apex.....6. *Sinningia*.  
 (Gloxinia of florists.)  
 DD. Anther-cells distinct.....7. *Isoloma*.  
 CC. Caps. shortly immersed at base, almost superior.....8. *Gesneria*.

- AA. Ovary wholly superior: fr. capsular or baccate, unknown in *Saintpaulia*.  
 B. Anther-cells distinct and parallel.  
 C. Disk with a large posterior gland, otherwise small or wanting.  
 D. Filaments free among themselves. .... 9. *Episcia*.  
 DD. Filaments connate into a sheath which is split on the posterior side.  
 E. Anthers separate. .... 10. *Alloplectus*.  
 EE. Anthers connate cross-like. .... 11. *Columnnea*.  
 CC. Disk annular, elevated, almost cup-shaped.  
 D. Perfect stamens 2. .... 12. *Agalmylea*.  
 DD. Perfect stamens 4. .... 13. *Trichosporum*.  
 CCC. Disk obsolete. .... 14. *Mitraria*.  
 BB. Anther-cells divaricate or diverging, rarely sub-parallel.  
 C. Disk 0.  
 D. Anthers free. .... 15. *Ramonda*.  
 DD. Anthers cohering in a tube extending beyond the cells. .... 16. *Conandron*.  
 CC. Disk reduced to a posterior gland. .... 17. *Codonanthe*.  
 CCC. Disk a ring (rarely dimidiate in *Chirita*).  
 E. Lvs. cauline, opposite.  
 F. Stamens 4. .... 18. *Besleria*.  
 FF. Stamens 2. .... 19. *Chirita*.  
 EE. Lvs. basal (rarely opposite in *Streptocarpus*).  
 F. Stamens 4. .... 20. *Habertia*.  
 FF. Stamens 2. .... 21. *Streptocarpus*.  
 GG. Corolla-tube long. .... 21. *Streptocarpus*.  
 GG. Corolla-tube short. .... 22. *Saintpaulia*.  
 Additional genera described are: *Acanthonema*, *Boea*, *Corytholoma*, *Cyrtandra*, *Klugia*, *Lysionotus*, *Rhabdothamnus* and *Roettlera*.

## 136. MARTYNIACEÆ.

- A. Corolla-tubes swollen above the short base. .... 1. *Martynia*.  
 AA. Corolla-tube very long, slender and cylindrical with a bell-shaped throat. .... 2. *Craniolaria*.

## 137. PEDALIACEÆ.

- A. Caps. truncate at apex, the angles awned or horned. .... 1. *Ceratotheca*.  
 AA. Caps. obtuse or acuminate, unarned. .... 2. *Sesamum*.

## 138. ACANTHACEÆ.

- A. Corolla expanded into a single obovate lip.  
 B. Calyx of normal texture; posterior segms. 3-5-nerved. .... 1. *Blepharis*.  
 BB. Calyx usually cartilaginous; posterior segm. 3-5-nerved. .... 2. *Acanthus*.  
 AA. Corolla with subequal limb, or 2-lipped.  
 B. The corolla contorted.  
 C. Ovary with 2 collateral ovules in each cell, or by abortion 1. .... 3. *Thunbergia*.  
 CC. Ovary with 2 to many ovules in each cell, in 1 series or alternately placed one above another.  
 D. Filaments connate in pairs at the base.  
 E. Caps. subterete. .... 4. *Ruellia*.  
 EE. Caps. compressed parallel to the septum. .... 5. *Dædalacanthus*.  
 DD. Filaments equidistant or subconnate at the base in pairs; calyx-lobes obtuse. .... 6. *Sanchezia*.  
 DDD. Filaments crowded or connate at the base on the posterior wall of the tube or 2 posterior filaments affixed a little higher.  
 E. Calyx ample, membranous or colored. .... 7. *Whitfieldia*.  
 EE. Calyx-segms. linear, not colored.  
 F. Ovules 2 in each cell. .... 8. *Strobilanthes*.  
 FF. Ovules 3 to many in each cell. .... 9. *Hemigraphis*.  
 BB. The corolla not contorted.  
 C. Corolla of 5 flat lobes, not bilabiate.  
 D. Stamens 4.  
 E. The corolla-lobes variously imbricated, lateral ones usually outer.  
 F. Anthers all 2-celled. .... 10. *Barleria*.  
 FF. Anthers all 1-celled. .... 11. *Crossandra*.  
 EE. The anterior corolla-lobe outside, posterior one inside.  
 F. Anthers all 1-celled. .... 12. *Stenandrium*.  
 FF. Anthers all 2-celled (in *Chameranthemum*, the posterior anthers sometimes 1-celled).  
 G. Tube swollen into a long or broad throat. .... 13. *Asystasia*.

- GG. Tube long, slender, scarcely swollen at apex. .... 14. *Chameranthemum*.  
 DD. Stamens 2: ovules in each cell 2. .... 15. *Erantheimum*.  
 CC. Corolla bilabiate or sub-equally 4-cut.  
 D. Ovules in each cell 3 or more. .... 16. *Phlogocanthus*.  
 DD. Ovules in each cell 2.  
 E. Fls. with 2 or 4 bracts longer than calyx. .... 17. *Peristrophe*.  
 EE. Fls. without such bracts.  
 F. Stamens 4, anthers all 1-celled. .... 18. *Aphelandra*.  
 FF. Stamens 2, anthers 2-celled.  
 G. Anther-cells unlike, one larger or affixed higher. (In *Jacobinia* cells often subequal.)  
 H. The lower anther cell usually spurred. .... 19. *Justicia*.  
 HH. The anther-cells not spurred, sometimes equally mucronate at base.  
 I. The corolla with short tube and ample lips. .... 20. *Adhatoda*.  
 II. The corolla-tube usually long and narrow. .... 21. *Jacobinia*.  
 GG. Anther-cells equal.  
 H. Staminodes at base of filaments small.  
 I. Corolla-tube swollen above; posterior lip incurved, anterior spreading, 3-cut. .... 22. *Graptophyllum*.  
 II. Corolla-tube elongated; limb sub-bilabiate, 4-lobed. .... 23. *Thysanocanthus*.  
 HH. Staminodes 0.  
 I. Veins of lvs. white or colored. .... 24. *Fittonia*.  
 II. Veins of lvs. green.  
 J. Calyx-segms. linear or bristle-like. .... 25. *Schaueria*.  
 JJ. Calyx small; lobes acute or acuminate. .... 26. *Anisacanthus*.

The following genera are also treated: *Anisotes*, *Beloperone*, *Dianthera*, *Dicliptera*, *Duvernoia*, *Dyschoriste*, *Lepidagathis*, *Micanthus*, *Pseuderanthemum*, *Rungia* and *Warpuria*.

## 139. GLOBULARIACEÆ, or SELAGINACEÆ.

- A. Calyx 5-cut; the 2 posterior lobes of the corolla narrow or connate or deficient. .... 1. *Globularia*.  
 AA. Calyx cut down one side; posterior lobes of corolla 4. .... 2. *Hebenstreitlia*.

## 140. PHRYMACEÆ.

The only genus. .... *Phryma*.

## 141. MYOPORACEÆ.

Corolla more or less bell-shaped, rarely funnel-shaped, with a subregular limb; ovary 2- or more-celled; cells 1-ovuled, rarely 2-celled and 2-ovuled. .... *Myoporum*.

## 142. VERBENACEÆ.

- A. Infl. centripetal.  
 B. Fls. sessile in the spike.  
 C. Nutlets 2, or by abortion 1, 1-seeded.  
 D. Fr. a juicy berry. .... 1. *Lantana*.  
 DD. Fr. drupaceous; calyx 2-4-cut or toothed. .... 2. *Lippia*.  
 DDD. Fr. dry; calyx 5-toothed. .... 3. *Stachytarpheta*.  
 CC. Nutlets or cells of fr. 4, or by abortion fewer, 1-seeded. .... 4. *Verbena*.  
 BB. Fls. pedicelled.  
 C. Nutlets 1-seeded.  
 D. Number of nutlets 4. .... 5. *Amasonia*.  
 DD. Number of nutlets 2 or 1. .... 6. *Petræa*.  
 CC. Nutlets 2-seeded, in pyrenes 2-5, 2-locellate. .... 7. *Duranta*.  
 AA. Infl. centrifugal.  
 B. Fr. drupe-like, entire or 4-lobed, exocarp usually pulpy or fleshy, the endocarp entire or 4-celled, often separating into 4 nutlets.  
 C. Corolla regular; stamens as many as petals. .... 8. *Callicarpa*.  
 CC. Corolla-limb oblique, with anterior lobe produced, or sub-bilabiate; stamens 4, didynamous or arched under posterior lobes.  
 D. Drupe with one 4-celled stone.  
 E. Corolla-tube cylindrical, short. .... 9. *Vitex*.



- EE. Corolla-tube strongly dilated above. .10. *Gmelina*.  
 DD. Drupe 4-parted, with 4 stones, or by reduction 1-stoned (this 1-celled).  
 E. Fertile stamens 2. .11. *Oxera*.  
 EE. Fertile stamens 4. .12. *Clerodendron*.  
 BB. Fr. dry, subcapsular; exocarp with 4 valves involute at the margin from the base up, which carry off the nutlets and leave no central column. .13. *Caryopteris*.  
 Other genera in cultivation in North America are *Avicennia*, *Citharexylum*, *Congea*, *Diostea*, *Faradaya*, *Premna*.

## 143. LABIATÆ.

## I. Summary of Tribes.

Ignoring exceptions.

- A. The nutlets fleshy or drupe-like, affixed to a small basal or oblong introrsely oblique areole; ovary 4-lobed. 1. PRASIA TRIBE.  
 AA. The nutlets dry or hard.  
 B. Ovary shortly, rarely deeply 4-lobed; nutlets wrinkled or netted, affixed to an obliquely introrse or lateral, usually large, areole.  
 C. Seeds, when known, with endosperm; corolla with an ample throat and broad lobes. .2. PROSTANTHERA TRIBE.  
 CC. Seeds without endosperm; corolla various. .3. AJUGA TRIBE.  
 BB. Ovary 4-parted to the base; nutlets affixed to a small basal or slightly oblique areole.  
 C. Stamens declinate; perfect ones 4, rarely 2; anthers 1-celled by confluent. .4. OCIMUM TRIBE.  
 D. Subtribe 1. EUOCIMEÆ. Areole basal; stamens usually exerted; anterior corolla-lobe usually unlike the others.  
 DD. Subtribe 2. LAVANDULEÆ. Areole extrorsely oblique; stamens included; corolla-lobes equal or the anterior lobe with the lateral ones forming the anterior lip.  
 CC. Stamens ascending, or in the Stachys Tribe sometimes included. (Consult also CCC.)  
 D. Perfect stamens 2; anther-cells linear, separate, solitary or confluent. .5. MONARDA TRIBE.  
 DD. Perfect stamens 4, rarely 2 in the Nepeta Tribe.  
 E. Calyx usually 15-nerved; posterior stamens longer than the anterior. .6. NEPETA TRIBE.  
 EE. Calyx 5- or 10-nerved; posterior stamens shorter than anterior; posterior lip of corolla erect, usually concave or fornicate, anterior spreading, 3-cut. .7. STACHYS TRIBE.  
 F. Subtribe 1. SCUTELLARIEÆ. Calyx bilabiate or at length 2-parted, the mouth closed after anthesis.  
 FF. Calyx not bilabiate.  
 G. Subtribe 2. MELITTEÆ. Corolla-tube long-exserted; calyx broad, of 5 short teeth or 3-4 broad lobes.  
 GG. Corolla-tube included or slightly exerted, rarely long-exserted; calyx tubular or bell-shaped, 5-10-toothed.  
 H. Subtribe 3. MARRUBIEÆ. Stamens included.  
 HH. Subtribe 4. LAMIEÆ. Stamens exerted.  
 CCC. Stamens straight, diverging or ascending; perfect ones 4 or 2; calyx 5-, 10-, or 13-nerved, rarely 15-nerved; corolla-lobes usually flat. .8. SATUREIA TRIBE.  
 D. Subtribe 1. POGOSTEMONÆ. Anthers 1-celled, subglobose; stamens distinct, straight.  
 DD. Anthers 2-celled, at least the younger ones.  
 E. Subtribe 2. MENTHOIDEÆ. Calyx usually 5- or 10-nerved; stamens distant or divaricate.

- EE. Subtribe 3. MELISSEÆ. Calyx usually 13-nerved; stamens ascending, at least at the base.

## II. Key to the Tribes.

## 1. Prasias Tribe.

Not in cultivation.

## 2. Prostanthera Tribe.

- A. Calyx bilabiate; lips entire or anterior emarginate. .1. *Prostanthera*.  
 AA. Calyx equal, 5-toothed. .2. *Westringia*.

## 3. Ajuga Tribe.

- A. Corolla-tube slender, lobes 5, subequal, spreading. .3. *Trichostema*.  
 AA. Corolla-tube, quasi 1-lipped, the posterior lobes and small lateral ones declinate at the contracted base of the very large anterior lobe, or rarely erect. .4. *Teucrium*.  
 AAA. Corolla-tube short or exerted, the posterior lip short, erect, 2-cut, anterior much longer and its middle lobe largest. .5. *Ajuga*.

## 4. Ocimum Tribe.

- A. Subtribe 1. EUOCIMEÆ.  
 B. Anterior lobe of corolla hardly longer than the others, often narrower, declinate, flat or slightly concave.  
 C. Fruiting calyx deflexed. .6. *Ocimum*.  
 CC. Fruiting calyx scarcely enlarging, often declinate. .7. *Moschosma*.  
 BB. Anterior lobe of corolla longer than others, concave or boat-shaped.  
 C. Filaments connate at the base in a tube. .8. *Coleus*.  
 CC. Filaments free. .9. *Plectranthus*.  
 AA. Subtribe 2. LAVANDULEÆ. Sole genus. .10. *Lavandula*.

## 5. Monarda Tribe.

- A. Calyx tubular. .11. *Monarda*.  
 AA. Calyx bilabiate.  
 B. Fertile anther-cells 2: upper lip of corolla 4-lobed. .12. *Perowskia*.  
 BB. Fertile anther-cells 1: upper lip of corolla entire or bifid.  
 C. Connective continuous with filament and not indicated unless by a slender reflexed tooth. .13. *Rosmarinus*.  
 CC. Connective articulated to the filament but not produced or very shortly acuminate. .14. *Audibertia*.  
 CCC. Connective elongated, versatile on the short filament, its sterile end continued beyond the articulation and either dilated or bearing an abortive rudiment of the second anther-cell. .15. *Salvia*.

## 6. Nepeta Tribe.

- A. Calyx bilabiate or with the posterior tooth much wider than the others. .16. *Dracocephalum*.  
 AA. Calyx tubular, mouth straight or oblique.  
 B. Stamens erect or divergent; anther-cells parallel or at length divergent. .17. *Lophanthus*.  
 BB. Stamens ascending or straightish; anther-cells parallel. .18. *Cedronella*.  
 BBB. Stamens ascending and parallel or in a few species rather lax and distant; anther-cells divergent or divaricate. .19. *Nepeta*.

## 7. Stachys Tribe.

## Subtribe 1. Scutellarieæ.

- A. The calyx-lip entire. .20. *Scutellaria*.  
 AA. The posterior calyx-lip 3-toothed, anterior 2-fid. .21. *Brunella*.

## Subtribe 2. Melitteæ.

- A. Anther-cells parallel; calyx subequally 5-toothed. .22. *Physostegia*.  
 AA. Anther-cells divergent; calyx 3-lobed. .23. *Melittis*.

## Subtribe 3. Marrubieæ.

- Calyx 5-10-toothed; corolla-tube included; anther-cells at length confluent. .24. *Marrubium*.

Subtribe 4. *Lamieæ*.

- A. The posterior lip of corolla often short or flat, glabrous or pubescent.....25. *Colquhounia*.  
 AA. The posterior lip concave or fornicate, rarely flattish, usually villous.  
 B. Teeth of calyx 6-13, rarely 5.  
 cc. Calyx very broad at apex.....26. *Moluccella*.  
 cc. Calyx long-tubular.....27. *Leonotis*.  
 BB. Teeth of calyx 5.  
 c. Stamens often cast to one side after anthesis.....28. *Stachys*.  
 cc. Stamens often hairy on the back of the anthers.....29. *Lamium*.  
 CCC. Stamens often have the posterior filaments appendaged at the base.....30. *Phlomis*.

8. *Satureia* Tribe.Subtribe 1. *Pogostemonæ*.

- Calyx, 5-toothed; corolla 4-cut; anterior lobes usually wider spreading.....31. *Pogostemon*.

Subtribe 2. *Menthoideæ*.

- A. Whorls spicate or racemose, not axillary.  
 B. Calyx equal, erect, often elongated in fr.; whorls many-fld.....32. *Elsholtzia*.  
 BB. Calyx subequal in anthesis, but declinate and bilabiate in fr.; whorls 2-fld.  
 c. Nutlets smooth.....33. *Collinsonia*.  
 cc. Nutlets netted-veined.....34. *Perilla*.  
 AA. Whorls axillary (or, in a few species of *Mentha*, crowded in a dense terminal spike).  
 B. Perfect stamens 4.....35. *Mentha*.  
 BB. Perfect stamens 2.....36. *Cunila*.  
 AAA. Whorls in dense heads surrounded by involucre bracts.  
 B. Corolla sub-bilabiate; whorls densely many-fld.  
 c. Lobes of corolla ovate; heads often corymbose-panicled.....37. *Pycnanthemum*.  
 cc. Lobes of corolla oblong or linear; heads globose, solitary.....38. *Monardella*.  
 BB. Corolla bilabiate; whorls 2-fld., rarely more; heads solitary, crowded or corymbose-panicled.....39. *Origanum*.  
 AAAA. Whorls few-fld., axillary or the upper ones spicate; calyx-throat closed by villous hairs.40. *Thymus*.  
 AAAA. Whorls axillary or the highest spicate; calyx open-bell-shaped, equal.  
 B. Calyx 10-nerved; stamens ascending.....41. *Satureia*.  
 BB. Calyx 15-nerved; stamens divergent.....42. *Hyssopus*.

Subtribe 3. *Melisseæ*.

- A. Posterior lip of corolla concave, sickle-shape or galeate.....43. *Acanthomintha*.  
 AA. Posterior lip of corolla flattish or slightly concave.  
 B. Calyx distinctly 2-lipped.  
 c. Corolla-tube straight or slightly curved.....44. *Satureia* § *Calamintha*.  
 cc. Corolla-tube below the middle recurved-ascending.....45. *Melissa*.  
 BB. Calyx equal or sub-bilabiate.  
 c. Perfect stamens 4.....46. *Micromeria*.  
 cc. Perfect stamens 2.....47. *Hedeoma*.  
 Other genera treated are: *Eremostachys*, *Galeopsis*, *Pyclostachys*, *Sideritis*, *Synandra* and *Tinnea*.

144. *PLANTAGINACEÆ*.

- One genus in cultivation..... *Plantago*.

145. *NYCTAGINACEÆ*.

- A. Fls. involucrete.  
 B. Stigma with a small head; anthers didynamous.....1. *Mirabilis*.  
 BB. Stigma linear; anthers not didynamous.....2. *Abronia*.  
 AA. Fls. not involucrete, but bracted.  
 B. Bracts large, colored.....3. *Bougainvillea*.  
 BB. Bracts very small.....4. *Pisonia*.

146. *AMARANTACEÆ*.

- A. Anthers 2-celled.  
 B. Ovary 2-ovuled.  
 c. Fr. a utricle.....1. *Celosia*.  
 cc. Fr. berry-like.....2. *Deeringia*.  
 BB. Ovary 1-ovuled.  
 c. Ovule erect, with a short funiculus.

- D. Segms. of perianth stellate in fr.: fls. in terminal racemes: shrubs.....3. *Bosea*.  
 DD. Segms. of perianth upright in fr.: fls. in clusters or panicles: herbs.....4. *Amarantus*.  
 CC. Ovule suspended from the apex of an elongated funiculus.  
 D. Perianth-segms. scarious at apex, connate at base.....5. *Trichinium*.  
 DD. Perianth-segms. hyaline, membranous or somewhat papery, lanate.....6. *Erva*.  
 AA. Anthers 1-celled.  
 B. Fls. minute in glomerules or little-spiked along the sparse branches of the panicle.....7. *Iresine*.  
 BB. Fls. in heads or spikes rarely panicled.  
 C. Stigmas 2.  
 D. Perianth-segms. free or connate at base.8. *Gomphrena*.  
 DD. Perianth-tube 5-cut, cristate or winged in fr.....9. *Frælichia*.  
 CC. Stigma simple.  
 D. Staminal tube short or long, with 5 anther-bearing awl-shaped laciniae and 5 antherless laciniae interposed.....10. *Telanthera*.  
 DD. Staminal tubes with no antherless laciniae interposed.....11. *Pfiaffia*.

147. *CHENOPODIACEÆ*.

- A. Fls. with 4 bractlets, 2 of which are adnate to the perianth at the base, or higher.  
 B. Embryo spiral: filaments straight in the bud.1. *Basella*.  
 BB. Embryo semi-annular: filaments recurved at apex or lower in the bud.....2. *Boussingaultia*.  
 AA. Fls. with bractlets not adnate to perianth.  
 B. Embryo spiral: endosperm scant or 0.....3. *Salsola*.  
 BB. Embryo ring-shaped or horseshoe-shaped: endosperm copious. (*Salicornia* has conduplicate embryo and no endosperm.)  
 C. St. and branches articulated: fls. immersed in caves in the superposed joints: no foliage-lvs.....4. *Salicornia*.  
 CC. St. not articulated.  
 D. Perianths heteromorphous; staminate without bracts, 3-5-lobed or parted; pistillate usually 0: fls. with 2 bractlets accrescent in fr. free or connate into a sack, and no perianth.  
 E. Pistillate fls. without perianth, 3-4-toothed.....5. *Spinacia*.  
 EE. Pistillate fls. with ample bracts which enlarge in fr.; perianth 0.....6. *Atriplex*.  
 DD. Perianths homomorphous, i.e., not of two different forms in the same plant.  
 E. Fls. hermaphrodite and feminine, solitary or glomerate: seed horizontal; embryo annular, albumen scant.....7. *Kochia*.  
 EE. Fls. glomerate, hermaphrodite or unisexual: seed erect, inverse or horizontal; embryo annual or horse-shoe-shaped.  
 F. Perianth-tube surrounded by a wing, stamens 5: seed horizontal, bony.....8. *Cycloloma*.  
 FF. Perianth 5-parted, usually unchanged in fr.: stamens 1-5: seed erect or horizontal, bony or leathery.....9. *Chenopodium*.  
 FFF. Perianth 5-lobed, hardened at the base in fr.: seed horizontal, leathery.....10. *Beta*.

The genus *Ullucus*, allied to *Basella*, is also described briefly

148. *PHYTOLACCACEÆ*.

- A. Ovary superior.  
 B. Carpel 1.....1. *Rivina*.  
 BB. Carpels 2-∞, united into a berry.....2. *Phytolacca*.  
 BBB. Carpels 1 or 2, united, the fr. with scales at top.....3. *Petiveria*.  
 AA. Ovary semi-inferior: fr. inferior.....4. *Agdestis*.

149. *POLYGONACEÆ*.

- A. The fls. fascicled in the axils or at the nodes of infl. (In the first 3 genera sometimes along the rachis of infl.)  
 B. Endosperm 3-6-lobed with longitudinal grooves and usually ruminate.  
 C. Fruiting perianth fleshy or berry-like at the base or everywhere, the nut included or exserted at the apex.....1. *Muehlenbeckia*.  
 CC. Fruiting perianth with fleshy or berry-like tube, including the nut and often adnate to it, crowned by the unchanged connivent or marcescent limb.....2. *Coccoloba*.



- ccc. Fruiting perianth enlarged, membranous or scarious, colored, outer segms. larger and broadly cordate, inner ones oblong. . . . . 3. *Antigonon*.
- cccc. Fruiting perianth developing wings on the 3 outer parts. . . . . 4. *Triplaris*.
- bb. Endosperm equable, entire. . . . .
- c. Perianth 5-merous, rarely 4-merous; styles usually filiform and stigmas usually capitate.
- d. Pistil 2-3-merous; stamens usually 6-8; shrubs, often spinescent. . . . . 5. *Atraphaxis*.
- dd. Pistil 3-merous: stamens 8 or fewer; herbaceous, rarely suffruticose.
- e. Nut entirely or nearly covered by the fruiting perianth. . . . . 6. *Polygonum*.
- ee. Nut much longer than the fruiting perianth. . . . . 7. *Fagopyrum*.
- cc. Perianth 6-merous, rarely 4-merous.
- d. Stamens 9, rarely 6; fruiting perianth unchanged: nut 3-winged. . . . . 8. *Rheum*.
- dd. Stamens 6, rarely 9; inner segms. of fruiting perianth much enlarged, erect and including the 3-angled nut. . . . . 9. *Rumex*.
- aa. The fls. in infl. dichotomously or umbellately branched, the floral lvs. or bracts connate below the branches into one 3-cut bract, or free and 3-∞ in number. . . . . 10. *Eriogonum*.

## 150. NEPENTHACEÆ.

The only genus. . . . . *Nepenthes*.

## 151. ARISTOLOCHACEÆ.

- a. Perianth persistent, 3-lobed above ovary; regular stamens 12 surrounding the style in 2 series; anthers free. . . . . 1. *Asarum*.
- aa. Perianth deciduous, irregular, polymorphous; anthers 6-∞, adnate in 1 series to a stylar column. . . . . 2. *Aristolochia*.

## 152. SAURURACEÆ.

- a. Stamens 3. . . . . 1. *Houttuynia*.
- aa. Stamens 5-8.
- b. Carpels connate. . . . . 2. *Anemopsis*.
- bb. Carpels distinct. . . . . 3. *Saururus*.

## 153. PIPERACEÆ.

- a. Stamens 2-6; anther-cells usually distinct; stigmas 3-4, rarely 2 or 5. . . . . 1. *Piper*.
- aa. Stamens 2, anther-cells confluent into one 2-valved anther; stigma terminal or lateral, penicillate or undivided. . . . . 2. *Peperomia*.

## 154. CHLORANTHACEÆ.

In cultivation. . . . . *Chloranthus*.

## 155. MYRISTICACEÆ.

Sole genus. . . . . *Myristica*.

## 156. MONIMIACEÆ.

- a. Stamens numerous; anther-cells dehiscing in a 2-valved fashion by a longitudinal crack. . . . . 1. *Peumus*.
- aa. Stamens 6-12; anther-cells dehiscing above. . . . . 2. *Laurelia*.

## 157. LAURACEÆ.

- a. Anthers 2-locellate, valves laterally dehiscent or quickly deciduous. . . . . 1. *Hernandia*.
- aa. Anthers extrorsely locellate, valves dehiscent upwards.
- b. The whole perianth persisting under the fr., appressed or slightly spreading; perianth sometimes deciduous from the base. . . . . 2. *Persea*.
- bb. The perianth-segms. at length transversely cut, leaving the fruiting tube bell-shaped or expanded and 6-toothed. . . . . 3. *Cinnamo-* [mum]

- bbb. The perianth-segms. deciduous from base, fruiting tube flattened or disk-shaped and entire or truncate. . . . . 4. *Cinnamo-* [mum] § [Camphora]
- aaa. Anthers introrsely locellate; valves dehiscing upward.
- b. Fls. in a short, lax raceme, accompanied by small and narrow bracts. . . . . 5. *Sassafras*.
- bb. Fls. umbellate, capitate or rarely solitary; umbels or heads before anthesis included in a 4-6-bracted involucre.
- c. Locellæ of anther 4. . . . . 6. *Umbellul-* [aria]
- cc. Locellæ 2.
- d. Stamens usually 9; fls. dioecious. . . . . 7. *Benzoin*.
- dd. Stamens usually 12-20; fls. polygamous 8. *Laurus*.
- The genus *Litsea* is sparingly in cultivation.

## 158. THYMELÆACEÆ.

- a. Stamens fewer than the corolla-lobes. . . . . 1. *Pimelea*.
- aa. Stamens twice as many as corolla-lobes.
- b. Disk 0 or a very short ring.
- c. Perianth-tube cylindrical; limb spreading. . . . . 2. *Daphne*.
- cc. Perianth much swollen above, obliquely truncate; limb not spreading. . . . . 3. *Dirca*.
- bb. Disk more or less lobed or oblique.
- c. Fls. 5-merous; disk cup-shaped. . . . . 4. *Dais*.
- cc. Fls. 4-merous.
- d. The disk annular; lobes very short. . . . . 5. *Edgeworthia*.
- dd. The disk 4-cut or 2-cut. . . . . 6. *Wikstrœmia*.
- The genera *Gnidia*, *Lagetta*, and *Thymelæa* will also be found in the book.

## 159. PROTEACEÆ.

**Series 1.** Fr. an indehiscent nut or drupe; fls. usually solitary with a bract under each one.

- a. Fls. dioecious by abortion, regular. . . . . 1. *Lewaden-* [dron]
- aa. Fls. hermaphrodite, irregular. . . . . 2. *Protea*.

**Series 2.** Fr. follicular, capsular or rarely indehiscent and subdrupaceous; fls. usually in pairs along the rachis with only 1 bract for each pair.

- a. Ovules 2, collateral.
- b. Fls. racemose or fascicled; involucre none or inconspicuous; bracts deciduous.
- c. The ovules pendulous, orthotropous.
- d. Fr. scarcely or tardily dehiscing; pericarp thick, fleshy or hard; seeds with thick, often unequal cotyledons.
- e. Perianth-limb recurved. . . . . 3. *Guevina*.
- ee. Perianth straight. . . . . 4. *Macadamia*.
- dd. Fr. follicular or obliquely 2-valved; seeds compressed, margined or winged. . . . . 5. *Roupala*.
- cc. The ovules laterally affixed or ascending.
- d. Seeds with or without a narrow wing. . . . . 6. *Grevillea*.
- dd. Seeds samara-like; wing oblong, terminal. . . . . 7. *Hakea*.
- bb. Fls. in dense bracted spikes or cones. . . . . 8. *Banksia*.
- aa. Ovules 4 or more.
- b. Fls. umbellate: seeds winged below. . . . . 9. *Stenocarpus*.
- bb. Fls. in dense racemes: seeds samara-like, with an oblong terminal wing. . . . . 10. *Telopea*.
- bbb. Fls. twin, in short or long racemes: seeds samara-like with a terminal truncate wing. . . . . 11. *Lomatia*.

## 160. ELÆAGNACEÆ.

- a. Lvs. alternate: stamens 4.
- b. Fls. hermaphrodite. . . . . 1. *Elæagnus*.
- bb. Fls. unisexual, usually dioecious. . . . . 2. *Hippophaë*.
- aa. Lvs. opposite: stamens 8. . . . . 3. *Shepherdia*.

## 161. LORANTHACEÆ.

- a. Perianth double. . . . . 1. *Loranthus*.
- aa. Perianth single or simple. . . . . 2. *Phoraden-* [dron]
- Viscum is also of general interest.

## 162. SANTALACEÆ.

- a. Plant herbaceous, low. . . . . 1. *Comandra*.
- aa. Plant woody, shrubs or trees.
- b. Fls. perfect. . . . . 2. *Santalum*.
- bb. Fls. dioecious or polygamous.
- c. Lvs. alternate. . . . . 3. *Pyralia*.
- cc. Lvs. opposite. . . . . 4. *Buckleya*.

## 163. PLATANACEÆ.

Sole genus..... *Platanus*.

## 164. MORACEÆ.

- A. Anthers reversed on the bud with inflexed filaments.  
 B. The male fls. spicate, racemose or capitate; female globose, capitate.  
 C. Female perianth dentate..... 1. *Broussonetia*.  
 CC. Female perianth deeply 4-fid..... 2. *Maclura*.  
 BB. The fls. of either sex spicate; spikes short and dense or long and lax..... 3. *Morus*.  
 BBB. The fls. crowded on fleshy receptacle..... 4. *Dorstenia*.  
 AA. Anthers erect from the beginning.  
 B. Plants, trees or shrubs; fls. usually on a fleshy receptacle.  
 C. The receptacle fleshy, globose or ovoid, clearly inclosing the numerous fls., but with a small mouth which is bracteate introrsely; the mouth is closed in fr..... 5. *Ficus*.  
 CC. The receptacle androgynous, male fls. numerous, females solitary in the center of the receptacle..... 6. *Brosimum*.  
 CCC. The receptacle unisexual, with an involucre of numerous bracts overlapping in series..... 7. *Antiaris*.  
 CCCC. The fl.-clusters unisexual, with or without 3-4 bracts at the base, in heads, spikes, rarely in racemes or the female 1-fld.  
 D. Stamens 4..... 8. *Cudrania*.  
 DD. Stamens 1..... 9. *Artocarpus*.  
 BB. Plants, herbs; fls. not on a fleshy receptacle.  
 C. St. climbing; lvs. opposite; embryo spirally involute..... 10. *Humulus*.  
 CC. St. not climbing; lvs. alternate or the lowest opposite; embryo curved..... 11. *Cannabis*.

Coussapoa is also briefly treated.

## 165. URTICACEÆ.

- A. Hairs stinging.  
 B. Achene straight..... 1. *Urtica*.  
 BB. Achene oblique..... 2. *Urea*.  
 AA. Hairs harmless.  
 B. Perianth of the female fl. 3-5-parted.  
 C. Lvs. opposite; stamens 4, rarely 2-3..... 3. *Pilea*.  
 CC. Lvs. alternate, distichous, oblique at base; stamens 5, rarely 4..... 4. *Pellionia*.  
 BB. Perianth of the female fl. tubular, inclosing the achene, not adnate; lvs. opposite or alternate; fls. in clusters or panicles..... 5. *Boehmeria*.  
 BBB. Perianth of the female fl. tubular adnate to the achene; lvs. alternate, tomentose below; fls. in globular heads often forming cymes..... 6. *Debregeasia*.

Helxine, Parietaria, and Pipturus are described.

## 166. ULMACEÆ.

- A. Fr. drupaceous; fls. on the young growth.  
 B. Cotyledons very broad.  
 C. Sepals connate; style excentric..... 1. *Zelkova*.  
 CC. Sepals distinct or nearly so; style central.  
 D. Fr. globose, not winged..... 2. *Celtis*.  
 DD. Fr. winged..... 3. *Pteroceltis*.  
 BB. Cotyledons narrow.  
 C. Fertile fls. perfect; fls. in cymes..... 4. *Trema*.  
 CC. Fertile fls. unisexual, solitary, staminate in cymes before the lvs..... 5. *Aphananthe*.  
 AA. Fr. not drupaceous, winged or mucicate; fls. on last year's branches.  
 B. Fr. stalked, surrounded by a broad wing..... 6. *Ulmus*.  
 BB. Fr. not winged, everywhere somewhat fleshy and mucicate..... 7. *Planera*.

## 167. JUGLANDACEÆ.

- A. The fls. of either sex in erect spikes, imbricate-bractate..... 1. *Platycarya*.  
 AA. The staminate fls. in pendulous catkins; pistillate fls. spicate or subsolitary.  
 B. In germinating, cotyledons are borne above ground and remain green..... 2. *Pterocarya*.  
 BB. In germinating, cotyledons remain inside the nut.  
 C. Husk at length splitting into segms.; nut smooth or angled..... 3. *Carya*.  
 CC. Husk indehiscent; nut wrinkled or sculptured..... 4. *Juglans*.

## 168. LEITNERIACEÆ.

The only genus..... *Leitneria*.

## 169. MYRICACEÆ.

- A. Lvs. serrate or entire, not stipulate; ovary subtended by 2-4 bractlets..... 1. *Myrica*.  
 AA. Lvs. pinnatifid, stipulate; ovary subtended by 8 linear, persistent bractlets..... 2. *Comptonia*.

## 170. CASUARINACEÆ.

Sole genus..... *Casuarina*.

## 171. EUPHORBIACEÆ.

- A. Ovules 2 in each cell of ovary; plant without milky juice (or red juice in *Bischofia*).  
 B. Lvs. alternate, simple (sometimes opposite in *Poranthera*).  
 C. Calyx of staminate fls. imbricate.  
 D. Petals present, at least in staminate fls.  
 E. Plant a shrub with broad, glabrous or somewhat hairy lvs.; ovary 3-celled..... 1. *Andrachne*.  
 EE. Plant a tree, with scaly herbage; ovary 1-celled..... 2. *Ætioxicon*.  
 EEE. Plant a heath-like sub-shrub; lvs. narrow, with recurved margin..... 3. *Poranthera*.  
 DD. Petals 0.  
 E. Fls. single or in axillary clusters.  
 F. Styles slender or only broadened at apex.  
 G. Rudimentary pistil present in staminate fls.; disk present; lvs. entire.  
 H. Seed grooved on inner face; disk of pistillate fl. lobed..... 4. *Plugges*.  
 HH. Seed not grooved; disk entire..... 5. *Securinega*.  
 GG. Rudimentary pistil absent.  
 H. Disk present..... 6. *Phyllanthus*.  
 HH. Disk absent, at least from pistillate fls.  
 I. Fr. a caps..... 7. *Glochidion*.  
 II. Fr. more or less fleshy.  
 J. The styles 2-parted..... 8. *Breynia*.  
 JJ. The styles almost entire..... 9. *Sauropus*.  
 FF. Styles broad, spreading.  
 G. Stamens arising from a disk.  
 H. Staminate fls. with rudimentary pistil..... 10. *Drypetes*.  
 HH. Staminate fls. without rudimentary pistil..... 11. *Hemicyclia*.  
 GG. Stamens 2-4, without disk..... 12. *Putranjiva*.  
 EE. Fls. in elongated catkin-like or branched infl., dioecious; lvs. large, broad and plane.  
 F. Ovary 1-celled; stamens 2-5..... 13. *Antidesma*.  
 FF. Ovary 2-5-celled.  
 G. Staminate fls. with rudimentary pistil..... 14. *Baccaurea*.  
 GG. Staminate fls. without rudimentary pistil..... 15. *Daphniphyllum*.  
 CC. Calyx of staminate fls. valvate; petals small..... 16. *Lebidieropsis*.  
 BB. Lvs. alternate, compound..... 17. *Bischofia*.  
 BBB. Lvs. opposite, compound..... 18. *Olafieldia*.  
 BBBB. Lvs. whorled, simple..... 19. *Hyænanche*.  
 AA. Ovules 1 in each cell of the ovary.  
 B. Fls. produced singly or in ordinary infl.  
 C. Stamens incurved in the bud; pubescence stellate or scaly; juice not milky..... 20. *Croton*.  
 CC. Stamens erect in the bud.  
 D. Juice not milky (see also *Codiaeum* and relatives); calyx valvate; lvs. simple.  
 E. Staminate fls. with petals; herbs..... 21. *Chrozophora*.  
 EE. Staminate fls. apetalous.  
 F. Stamens much branched; herbs with lvs. palmately veined and peltate..... 22. *Ricinus*.  
 FF. Stamens not branched.  
 G. Lvs. opposite; styles free (see also *Mallotus*).  
 H. The stamens as many as 50..... 23. *Trewia*.  
 HH. The stamens 8-20..... 24. *Mercurialis*.  
 GG. Lvs. alternate, or rarely opposite.  
 H. Plant a thorny shrub; stamens 8-15..... 25. *Adelia*.  
 HH. Plant with holly-like spiny margined lvs.; stamens 3-8..... 26. *Alchornea*.



- HHH. Plant unarmed or with stinging hairs.  
 I. Styles free or united only at base.  
 J. Anther-cells spherical to oblong.  
 K. Anthers 2-celled.....27. *Mallotus*.  
 KK. Anthers 3-4-celled: lvs. usually peltate.....28. *Macaranga*.  
 JJ. Anther-cells elongated, often vermiform.....29. *Acalypha*.  
 II. Styles united above the base: st. often climbing.  
 J. Infl. without conspicuous involucre.  
 K. Number of stamens usually 3; styles free at apex.....30. *Tragia*.  
 KK. Number of stamens 8-30; styles united to the apex into a swollen column.....31. *Plukenetia*.  
 JJ. Infl. subtended by a conspicuous involucre.....32. *Dalechampia*.  
 DD. Juice almost always more or less milky (chief exceptions in *Cluytia* and relatives).  
 E. The fls. with petals, at least the staminate.  
 F. Calyx valvate.  
 G. Lvs. simple, palmate.....33. *Aleurites*.  
 GG. Lvs. compound.....34. *Joannesia*.  
 FF. Calyx imbricate.  
 G. Petals free from one another.  
 H. The stamens in 2 or more whorls.  
 I. Number of stamens about 10: lvs. usually palmately veined.....35. *Jatropha*.  
 II. Number of stamens 15-30 or more: lvs. pinnately veined: styles entire.....36. *Codizum*.  
 HH. The stamens in 1 whorl, usually about 3-5.....37. *Cluytia*.  
 GG. Petals connate: lvs. usually palmately veined.  
 H. Some of the filaments united: lvs. simple.....35. *Jatropha*.  
 HH. Filaments free: lvs. compound.....38. *Ricinodendron*.  
 EE. The fls. apetalous.  
 F. Sepals valvate or slightly imbricate in some.  
 G. Lvs. trifoliate.....39. *Hevea*.  
 GG. Lvs. simple, pinnately veined.  
 H. Number of stamens 3: lvs. spiny margined.....40. *Pachystroma*.  
 HH. Number of stamens 1: lvs. not spiny.....41. *Ophthalmolobon*.  
 FF. Sepals or lobes of calyx, if any, imbricate: lvs. simple.  
 G. Number of stamens usually 10 or more (5-50).  
 H. Staminate calyx with 5 sepals connate, at least at base: lvs. usually palmately veined: st. erect.  
 I. Herbage with stinging hairs.....35. *Jatropha*.  
 II. Herbage usually glabrous.....42. *Manihot*.  
 HH. Staminate calyx 3-5-lobed: lvs. pinnately veined: st. climbing or trailing.....43. *Mabea*.  
 HHH. Staminate calyx of 1 or 2 sepals.....44. *Homalium*.  
 HHHH. Staminate calyx cupulate, truncate or dentate: lvs. broad, hairy.....45. *Hura*.  
 GG. Number of stamens 1-5.  
 H. Staminate calyx with 4-5 free sepals: st. climbing.....46. *Omphalia*.  
 HH. Staminate calyx with 2-3 sepals, free or connate at base.  
 I. Infl. usually terminal: seed carunculate.....47. *Sebastiania*.  
 II. Infl. usually axillary: seed not carunculate.....48. *Ezocaccaria*.  
 HHH. Staminate calyx with connate sepals, 1-3-lobed.  
 I. The stamens 2-3.  
 J. Stamens free.  
 K. Base of caps. persistent as a pointed piece.....49. *Sapium*.  
 KK. Base of caps. not persistent, only a 3-parted central column remaining.....50. *Stillingia*.  
 JJ. Stamens united.  
 K. Pistil 4-celled.....51. *Maprounia*.  
 KK. Pistil 6-9-celled.....52. *Hippomane*.  
 II. The stamens 1.  
 J. Infl. terminal.....51. *Maprounia*.  
 JJ. Infl. lateral or axillary.....41. *Ophthalmolobon*.  
 HHHH. Staminate calyx 0, or rarely 1-2 minute scales.....53. *Colliguaya*.  
 BB. Fls. in cyathia (see explanation under Euphorbia).  
 C. Cyathia regular or nearly so.  
 D. Involucral glands free from one another, alternate with lobes of involucre.....54. *Euphorbia*.  
 DD. Involucral glands united into a ring around the lobes.....55. *Synadenium*.  
 CC. Cyathia decidedly irregular.....56. *Pedilanthus*.
- ### 172. BUXACEÆ.
- A. Cells of ovary with 2 ovules each; stamens 4.  
 B. Lvs. alternate.  
 C. Evergreen shrubs: lvs. entire.....1. *Sarcococca*.  
 CC. Evergreen herbs: lvs. dentate.....2. *Pachysandra*.  
 BB. Lvs. opposite.....3. *Buzus*.  
 AA. Cells of ovary with 1 ovule each; stamens numerous: lvs. opposite.....4. *Simmondsia*.
- ### 173. BETULACEÆ.
- A. Staminate fls. with 4 perianth-segms. or by abortion fewer (Birch Tribe).  
 B. Stamens 2.....1. *Betula*.  
 BB. Stamens 4.....2. *Alnus*.  
 AA. Staminate fls. with no perianth (Hazel Tribe).  
 B. Nut large, inclosed by a leafy involucre: staminate fls. with 2 bractlets; pistillate fls. 2-4, capitate.....3. *Corylus*.  
 BB. Nut small, subtended by or inclosed in a large bractlet; staminate fls. with no bractlets; pistillate catkins spike-like.  
 C. Fruiting bractlet flat, 3-cleft and incised.....4. *Carpinus*.  
 CC. Fruiting bractlet bladder-like, closed, membranous.....5. *Ostrya*.
- ### 174. FAGACEÆ.
- A. Ovary of pistillate fls. 6-celled; spikes of either sex erect and strict: fruiting involucre or bur densely covered with strong prickles.....1. *Castanea*.  
 AA. Ovary of pistillate fls. 3-celled, rarely 4- or 5-celled in some species of *Quercus*.  
 B. Staminate fls. 1-3 in a cluster: lvs. usually small.....2. *Nothofagus*.  
 BB. Staminate fls. in loose, roundish pendulous heads: lvs. generally large.....3. *Fagus*.  
 BBB. Staminate fls. in pendulous catkins or the spikes of either sex erect and strict.  
 C. Involucre of numerous scales forming a cup in fr. and subtending the acorn.....4. *Quercus*.  
 CC. Involucre in fr. armed with clusters of prickles or tubercles, wholly including the fr., perfectly closed or at length split irregularly.....5. *Castanopsis*.
- ### 175. SALICACEÆ.
- A. Lvs. usually narrow: disk composed of 1 or 2 glands which are distinct or barely connate at base.....1. *Salix*.  
 AA. Lvs. usually broad: disk cyathiform, often oblique or cup-shaped, entire or lobed.....2. *Populus*.
- ### 176. EMPETRACEÆ.
- A. Fls. axillary, solitary; stamens 3; pistil 6-9-merous.....1. *Empetrum*.  
 AA. Fls. axillary in 2's or 3's; stamens 2; pistil 2-merous.....2. *Ceratiola*.  
 AAA. Fls. subcapitate; stamens usually 3; pistil 3-merous.....3. *Corema*.
- ### 177. GINKGOACEÆ.
- Ovule-bearing blade, long-stalked, shortly 2-∞ cut at apex, the lobes dilated into a ring or short cup adnate to the seed: anther-cells 2, pendulous: lvs. fan-shaped.....*Ginkgo*.

## 178. GNETACEÆ.

Leafless shrubs with jointed branches and scales opposite the nodes connate into a little sheath. . . *Ephedra*.

The very curious genus *Welwitschia* may be found in botanical collections.

## 179. TAXACEÆ.

- A. Anthers 2-celled; tropical or subtropical trees and shrubs.
- B. Scales of pistillate aments few, adnate to peduncle and with it usually fleshy; lvs. linear to ovate, rarely scale-like. . . . . 1. *Podocarpus*.
- BB. Scales of pistillate aments short, broad and somewhat fleshy, imbricate; lvs. minute and scale-like; branchlets flattened and lf.-like. . . . . 2. *Phyllocladus*.
- AA. Anthers 3-8-celled; lvs. linear; hardy or nearly hardy trees and shrubs.
- B. Pistillate fls. consisting of several decussate 2-ovuled carpicles; lvs. with 2 glaucous lines below broader than the 3 green lines. . . . . 3. *Cephalotaxus*.
- BB. Pistillate fls. reduced to 1 ovule.
- C. Carpicles at maturity inclosing the seed and adnate to it; anthers 4-celled, cells free; lvs. with 2 glaucous lines below narrower than the green lines. . . . . 4. *Torreya*.
- CC. Carpicles at maturity partly inclosing the seed, not adnate to it; anthers 6-8-celled, cells connate; lvs. pale green below. . . . . 5. *Taxus*.

## 180. PINACEÆ.

- A. Lvs. spirally arranged.
- B. Carpicles simple; ovule 1, reversed; cone-scales with 1 seed. . . . . 1. ARAUCARIA TRIBE.
- BB. Carpicles divided into scale and bract, sometimes connate.
- C. Ovules 2, reversed; scale and bract always distinct; cone-scales with 2 usually winged seeds. . . . . 2. ABIES TRIBE.
- CC. Ovules 2-8, axillary and upright or on the scale and at least finally reversed; cone-scales with 2-8 seeds. . . . . 3. TAXODIUM TRIBE.
- AA. Lvs. opposite or whorled, often scale-like; ovules upright. . . . . 4. CUPRESSUS TRIBE.

## 1. Araucaria Tribe.

- A. Seeds free from the scale, with 1 or 2 wings; lvs. broad, generally elliptic, more or less distichous and rather remote. . . . . 1. *Agathis*.
- AA. Seeds adnate to the winged or wingless scale; lvs. large, scale-like or needle-shaped, spirally arranged, crowded. . . . . 2. *Araucaria*.

## 2. Abies Tribe.

- A. Foliage deciduous, partly fascicled.
- B. Male fls. solitary in a leafless scaly bud; connective not produced beyond anther-cells nor scarcely prominent; cones reflexed; scales persistent. . . . . 3. *Larix*.
- BB. Male fls. clustered, pendulous; cone-scales deciduous. . . . . 4. *Pseudolarix*.
- AA. Foliage evergreen.
- B. Connective of anthers usually produced into a scale-like appendage.
- C. Male fls. subsapicate at base of new shoots; cone-scales persistent; lvs. in clusters of 2-5, rarely solitary. . . . . 5. *Pinus*.
- CC. Male fls. solitary in the cluster of lvs. which terminate short branchlets; cone-scales finally deciduous; lvs. partly fascicled as in the larch. . . . . 6. *Cedrus*.
- CCC. Male fls. solitary in the axils; cones reflexed; scales persistent; lvs. solitary, 4-angled or flattened and glaucous above, green on the back. . . . . 7. *Picea*.
- BB. Connective of anthers simply umbonate beyond the cells or hardly prominent; male fls. solitary in axils; lvs. solitary, usually flattened, glaucous or paler below.
- C. Cones reflexed; scales persistent.
- D. Subtending bract conspicuous. . . . . 8. *Pseudotsuga*.
- DD. Subtending bract small. . . . . 9. *Tsuga*.
- CC. Cones erect.
- D. Scales persistent; seeds about as long as scales; bracts much shorter than scales; lvs. flattened, keeled above, pale below. . . . . 10. *Keteleeria*.

DD. Scales deciduous; seeds shorter than scales; bracts shorter or longer; lvs. flattened and grooved above, usually glaucous below, rarely 4-angled. . . . . 11. *Abies*.

## 3. Taxodium Tribe.

- A. Lvs. connate into pairs, arranged in whorls; ovule-bearing blade finally much increased and hardened, making the greater part of the woody cone. . . . . 12. *Sciadopitys*.
- AA. Lvs. solitary, scattered.
- B. Scales of cone flat.
- C. Carpicles entire at apex; anther-cells 2-4; seeds surrounded by a narrow wing; lvs. lanceolate flat, rather large, glaucous below. . . . . 13. *Cunninghamia*.
- CC. Carpicles toothed at the apex; anther-cells 4-5; seeds 2-3-angled; lvs. awl-shaped, curved. . . . . 14. *Cryptomeria*.
- BB. Scales peltate.
- C. Seeds usually 5, narrowly winged; lvs. scale-like or linear, persistent. . . . . 15. *Sequoia*.
- CC. Seeds 2, angular; lvs. linear, deciduous with the branchlets. . . . . 16. *Taxodium*.

## 4. Cupressus Tribe.

- A. Fr. a cone.
- B. Cone-scales all fertile, 4-8, forming apparently 1 whorl; lvs. usually scale-like, opposite or in whorls of 3 or 4, rarely alternate on sterile branches. . . . . 17. *Callitris*.
- BB. Cone-scales fertile at middle of cone and sterile at top and base. . . . . 18. *Fitzroya*.
- BBB. Cone-scales partly fertile, partly empty, arranged in opposite pairs; lvs. scale-like, opposite only on juvenile branches, sometimes needle-shaped.
- C. Scales of cone imbricate.
- D. Seeds 4-5; pairs of scales 3-4 (excluding the upper connate pair). . . . . 19. *Thujaopsis*.
- DD. Seeds 2.
- E. Pairs of scales 4, the upper pair fertile. . . . . 20. *Libocedrus*.
- EE. Pairs of scales 6-8; the 2 upper pairs fertile. . . . . 21. *Thuja*.
- CC. Scales of cone peltate.
- D. Number of seeds 2; cones small.
- E. Wings of seeds very large, unequal. . . . . 22. *Fokienia*.
- EE. Wings of seeds narrow, equal. . . . . 23. *Chamaecyparis*.
- DD. Number of seeds many; cones usually rather large and woody. . . . . 24. *Cupressus*.
- AA. Fr. fleshy, indehiscent berry or drupe, with 2-6 fertile scales; lvs. scale-like, opposite or needle-shaped and usually in 3's. . . . . 25. *Juniperus*.

Consult also the genus *Athrotaxis*, allied to *Cephalotaxus* and *Sequoia*.

## 181. CYCADACEÆ.

- A. Lf.-segms. circinally involute in veneration; female cones proliferous after anthesis; scales elongate, the margins bearing 2 to many ovules. . . . . 1. *Cycas*.
- AA. Lf.-segms. straight in veneration; female cones deciduous after anthesis; scales peltate.
- B. Cone-scales superposed in vertical series.
- C. Shield of the scales transversely 2-horned at apex. . . . . 2. *Ceratozamia*.
- CC. Shield of the scales truncate, not horned at apex. . . . . 3. *Zamia*.
- BB. Cone-scales overlapping in alternating series.
- C. The lf.-segms. ribbed and nerved; nerves spreading on either side of midrib, very numerous, simple or forked. . . . . 4. *Stangeria*.
- CC. The lf.-segms. with parallel, longitudinal nerves.
- D. Shield of cone-scales flat, erect, ovate-cordate. . . . . 5. *Dioon*.
- DD. Shield thickened, ascending, usually prolonged into an erect, acuminate blade. . . . . 6. *Macrozamia*.
- DDD. Shield thickened truncate, decurved at apex. . . . . 7. *Encephalartos*.

The genera *Bowenia* and *Microcycas* are also included.

## 182. HYDROCHARITACEÆ.

- A. St. elongated, submerged, everywhere leafy; lvs. short; spathes small, sessile in axils; placenta little prominent in ovary. . . . . 1. *Elodea*.
- AA. St. very short, sometimes emitting creeping or floating stolons; lvs. crowded, immersed, sessile, elongated; spathes pedunculate; placenta hardly prominent. . . . . 2. *Vallisneria*.



- AAA. St. very short; lvs. crowded, some sessile and submerged, others (except in *Stratiotes*) long-stalked, with a floating blade: spathes peduncled; placenta of 2 lamellæ, strongly intruded, dividing the ovary more or less perfectly into 6 cells.
- B. Styles 3; stamens 3-9..... 3. *Limnobia*.
- BB. Styles 6, 2-fid.
- C. Stamens with 6 2-fid filaments, of which 3 have 2 anthers and 3 have 1 anther.... 4. *Hydrocharis*.
- CC. Stamens 11-15..... 5. *Stratiotes*.

## 183. ORCHIDACEÆ.\*

## I. Summary of Tribes.

- A. Fertile stamens 2, with a broad shield-shaped sterile one (staminodium) .. 1. *CYPRIPEDIUM* [TRIBE.
- AA. Fertile stamen 1, with no staminodium.
- B. Anther persistent; pollinia with basal appendages.
- C. The anther erect.
- D. Stigma flat, unappendaged..... 2. *SERAPIAS* TRIBE.
- DD. Stigma with appendages..... 3. *HABENARIA* TRIBE.
- CC. The anthers placed obliquely..... 4. *SATYRIUM* TRIBE.
- BB. Anther usually readily deciduous; pollinia not appendaged or with terminal ones.
- C. Infl. terminal.
- D. Lf.-buds convolute.
- E. Lf.-blade not jointed to stalk.
- F. The anther commonly much exceeding the beak of the column which is not distinctly cut.
- G. Lip without hypochil, usually spurless.
- H. St. short, with only 1 or 2 lvs..... 5. *POGONIA* TRIBE.
- HH. St. long, with many lvs..... 6. *VANILLA* TRIBE.
- GG. Lip with distinct hypochil, which is often spurred..... 7. *CEPHALANTHERA* [TRIBE.
- FF. The anther commonly about as long as the beak of the column which usually bears a sharp cut or groove.
- G. Pollinia waxy or powdery, not divided.
- H. Lip turned down..... 8. *SPIRANTHES* TRIBE.
- HH. Lip turned up ..... 9. *CRANICHIS* TRIBE.
- GG. Pollinia divided into distinct masses..... 10. *PHYSURUS* TRIBE.
- EE. Lf.-blade distinctly jointed to the petiole.
- F. Pollinia 8: st. slender: fls. usually with spurs or chins..... 11. *THUNIA* TRIBE.
- FF. Pollinia 4: st. a short pseudobulb: fls. without spurs or chins..... 12. *CÆLOGYNE* TRIBE.
- DD. Lf.-buds conduplicate.
- E. Sepals and petals about equally developed, the lip usually very conspicuous.
- F. Lvs. usually not jointed: column footless..... 13. *LIPARIS* TRIBE.
- G. Nerves of lvs. 1.
- H. Pollinia 2-4, with very short stalks..... 14. *POLYSTACHYA* [TRIBE.
- HH. Pollinia 4-8, with distinct caudicles.
- I. Column-foot forming a chin with the lateral sepals or a short sac with the lip..... 15. *PONERA* TRIBE.
- II. Column footless..... 16. *CATTLEYA* TRIBE.
- GG. Nerves of lvs. several..... 17. *SOBRALIA* TRIBE.
- EE. Sepals much more developed than the petals and lip..... 18. *PLEUROTHALLIS* [TRIBE.
- CC. Infl. lateral, or on separate shoot.
- D. Lf.-buds convolute.
- E. St. slender or gradually swollen.
- F. Pollinia with caudicles but without stalks..... 19. *PHAJUS* TRIBE.
- FF. Pollinia without caudicles but with stalks.
- G. Lip jointed to column-foot or forming a spur with it..... 20. *CYRTOPODIUM* [TRIBE.

- GG. Lip not jointed, often with a distinct hypochil. 21. *CATASETUM* TRIBE.
- EE. St. a short distinct pseudobulb.
- F. Lip jointed to the column-foot.
- G. Callus-ridges lengthwise. 22. *LYCASTE* TRIBE.
- GG. Callus-ridges transverse. 23. *ZYGOPETALUM* [TRIBE.
- FF. Lip continuous with column-foot..... 24. *GONGORA* TRIBE.
- DD. Lf.-buds conduplicate.
- E. St. terminating its growth in 1 year.
- F. Lip movably jointed to foot of column.
- G. Lvs. not strap-shaped: pollinia unappendaged or with either caudicles or stipes, but not with both.
- H. Flowering st. arising from near the apex of the slender st. or from the pseudobulb. 25. *DENDROBIUM* [TRIBE.
- HH. Flowering st. arising under the pseudobulb or at the base of the st.
- I. Pollinia without appendages..... 26. *BULBOPHYLLUM* [TRIBE.
- II. Pollinia with distinct stalks.
- J. Pseudobulbs usually present: flowering st. arising lower than new growth..... 27. *MAXILLARIA* [TRIBE.
- JJ. Pseudobulbs usually wanting: flowering st. arising higher than new growth..... 28. *HUNTLEYA* TRIBE.
- GG. Lvs. strap-shaped: pollinia with broad caudicles and stipes..... 29. *CYMBIDIUM* TRIBE.
- FF. Lip immovably united to foot of column.
- G. Fls. with spurs..... 30. *IONOPSIS* TRIBE.
- GG. Fls. without spurs.
- H. The fls. narrow, not open..... 31. *ADA* TRIBE.
- HH. The fls. wide, open.
- I. Lip enrolled around the column..... 32. *TRICHOPILIA* [TRIBE.
- II. Lip not enrolled.
- J. The lip united to column to the middle..... 33. *ASPASIA* TRIBE.
- JJ. The lip united only to the base of the column..... 34. *ODONTOGLOSSUM* [TRIBE.
- EE. St. increasing in length from year to year..... 35. *AERIDES* TRIBE.

## II. Key to the Tribes.

1. *Cypripedium* Tribe.

- A. Fl. persistent, withering on the ovary: lf.-buds convolute..... 1. *Cypripedium* [tribum
- AA. Fl. soon deciduous: lf.-buds conduplicate.
- B. Ovary 3-celled, the placenta central; mouth of lip with broad returned margin... 2. *Phragmoped-* [tribum
- BB. Ovary 1-celled, the placenta parietal; mouth of lip usually with no broad returned margins..... 3. *Paphi-* [pedilum

2. *Serapias* Tribe.

- A. Lip spurred.
- B. Sepals free..... 4. *Orchis*.
- BB. Sepals united into an arching hood..... 5. *Galeorchis*.
- AA. Lip spurless.
- B. Pollinia glands in a single sac..... 6. *Serapias*.
- BB. Pollinia glands separate, in 2 distinct sacs... 7. *Ophrys*.

3. *Habenaria* Tribe.

- A. Lip adnate to column at base; stigma broad... 8. *Cynorchis*.
- AA. Lip free; stigma slender..... 9. *Habenaria*.

4. *Satyrion* Tribe

- Dorsal sepal helmet-shaped..... 10. *Disa*.

\*For explanation of orchid flowers and of terms, see the article *Orchids*.

5. *Pogonia* Tribe.

- A. Fls. on a scape with a terminal whorl of lf.-like bracts.....11. *Isotria*.  
 AA. Fls. on a leafy st.  
 c. Lip crested.....12. *Pogonia*.  
 BB. Lip not crested.....13. *Triphora*.

6. *Vanilla* Tribe.

- Sts. rooting at nodes.....14. *Vanilla*.

7. *Cephalanthera* Tribe.

- A. Fls. with a chin; lip long.....15. *Cephalanthera*.  
 AA. Fls. chinless; lip round.....16. *Epipactis*.

8. *Spiranthes* Tribe.

- A. Dorsal sepal forming a hood with the petals.  
 B. Infl. 1-sided; fls. without a chin.....17. *Spiranthes*.  
 BB. Infl. not 1-sided; fls. with a chin.....18. *Stenorrhynchus*.  
 AA. Sepals and petals spreading.....19. *Listera*.

9. *Cranichis* Tribe.

- Lip and petals inserted upon the elongated column.....20. *Ponthieva*.

10. *Physurus* Tribe.

- A. Lip with a distinct spur.  
 B. Lvs. green; lip concave above the spur.....21. *Physurus*.  
 BB. Lvs. usually variegated; lip with a long fimbriate claw.....22. *Anætochilus*.  
 AA. Lip spurless or nearly so.  
 B. Column straight; fls. symmetric.  
 C. The lip not clawed.....23. *Goodyera*.  
 CC. The lip clawed.....24. *Dossinia*.  
 BB. Column twisted; fls. not symmetric.  
 C. The column with 2 upright appendages in front.....25. *Macodes*.  
 CC. The column without appendages.....26. *Hæmaria*.

11. *Thunia* Tribe.

- A. Fls. without chin.  
 B. Sts. without basal pseudobulbs.....27. *Thunia*.  
 BB. Sts. with basal pseudobulbs.....28. *Bletilla*.  
 AA. Fls. with a distinct chin, formed of lateral sepals and column-foot.....29. *Trichosma*.

12. *Cœlogyne* Tribe.

- A. Base of lip with sac-like hollow.  
 B. Column short; winged above; sepals flat.....30. *Pholidota*.  
 BB. Column slender; sepals sac-like, concave.....31. *Neogyne*.  
 AA. Base of lip flat.  
 B. Column slender, without horns.  
 C. Lvs. and pseudobulbs perennial.....32. *Cœlogyne*.  
 CC. Lvs. and pseudobulbs annual.....33. *Pleione*.  
 BB. Column short, with 2 horns.....34. *Platykinis*.

13. *Liparis* Tribe.

- A. Lvs. green; fls. without chin.  
 B. Lip shoe-shaped.....35. *Calypso*.  
 BB. Lip not shoe-shaped.  
 C. Column short; lip turned upward.....36. *Microstylis*.  
 CC. Column slender; lip turned downward.....37. *Liparis*.  
 AA. Lvs. wanting; fls. with chin.....38. *Corallorhiza*.

14. *Polystachya* Tribe.

- A. Lip spurred.  
 B. Plant tuberous; spur slender.....39. *Tipularia*.  
 BB. Plant not tuberous; spur funnel-shaped.....40. *Galeandra*.  
 AA. Lip not spurred.  
 B. The lip 3-lobed.  
 C. Column short; chin distinct.....41. *Polystachya*.  
 CC. Column slender, curved; chin indistinct.....42. *Ansellia*.  
 BB. The lip entire.....43. *Neobenthamia*.

15. *Ponera* Tribe.

- A. Lip normal.  
 B. St. slender, leafy; no pseudobulbs; pollinia 4.....44. *Isorchilus*.  
 BB. St. a pseudobulb; pollinia 8.....45. *Cælia*.  
 AA. Lip forming a beaker-like cavity, with the column, or the former hollow at base.  
 B. Young shoots at the apex of the old.....46. *Hexisea*.  
 BB. Young shoots from base of old.  
 C. Fls. in dense spikes; pollinia 8.....47. *Arpophytum*.  
 CC. Fls. in short clusters; pollinia 4.....48. *Hartwegia*.

16. *Cattleya* Tribe.

- A. Anther not toothed, nor in an excavation.  
 B. Pollinia 4.  
 C. Lip adnate to the column, at least at its base.  
 D. Ovary produced into a hollow neck.....49. *Broughtonia*.  
 DD. Ovary not so produced.....50. *Epiden-drum*.  
 CC. Lip free.  
 D. The lip flat, with 2 elevations on upper side.....51. *Diacrium*.  
 DD. The lip enrolled about column, with no elevations.....52. *Cattleya*.  
 BB. Pollinia 5-7, some of them often abortive.....53. *Laelio-burgkia*.  
 BBB. Pollinia 8.  
 C. Stigma pitted upon the front of the column, anther inclined.  
 D. Base of lip gradually merging into blade.  
 E. Lip distinctly surrounding the column; sepals and petals not wavy.....54. *Lælia*.  
 EE. Lip not as above; sepals and petals distinctly wavy.....55. *Schomburgkia*.  
 DD. Base of lip tightly encompassing column, suddenly broadened into the broad blade.....56. *Brassavola*.  
 CC. Stigma running up on 2 extensions of the column-apex; anther erect.....57. *Sophrontitis*.  
 AA. Anther 2-toothed below, in an excavation in the column.....58. *Leptotes*.

17. *Sobralia* Tribe.

- A. St. many-lvd., not bulbous at base; lip not bearded.....59. *Sobralia*.  
 AA. St. 1- or 2-lvd., bulbous at base; lip bearded.....60. *Calopogon*.

18. *Pleurothallis* Tribe.

- A. Lip turned upward; lateral sepals united into a boat-shaped hood.....61. *Scaphosepalum*.  
 AA. Lip turned down.  
 B. Sepals united.....62. *Masdevallia*.  
 BB. Sepals free, or the lateral only united.  
 C. Dorsal sepal and petals attenuated into a club-shaped apex.....63. *Restrepia*.  
 CC. Dorsal sepal and petals not as above.....64. *Pleurothallis*.

19. *Phajus* Tribe.

- A. Lvs. not articulated to petiole.  
 B. Lip free, encompassing the column.....65. *Phajus*.  
 BB. Lip adnate to column, the blade spreading.....66. *Calanthe*.  
 AA. Lvs. articulated to petiole.  
 B. Sepals and petals spreading.  
 C. Lip with its base tightly inclosing the column, the blade spreading.....67. *Limnæodes*.  
 CC. Lip not inclosing column.  
 D. Fls. with distinct chin.....68. *Chysis*.  
 DD. Fls. without chin.  
 E. Pollinia 8.  
 F. Middle lobe of lip not clawed.....69. *Bletia*.  
 FF. Middle lobe of lip clawed.....70. *Spathoglottis*.  
 EE. Pollinia 4.....71. *Apectrum*.  
 BB. Sepals and petals erect.....72. *Acanthophippium*.

20. *Cyrtopodium* Tribe.

- A. Fls. spurred or with sac-like base.  
 B. Sepals narrower and less colored than petals.....73. *Lissochilus*.  
 BB. Sepals and petals alike or nearly so.....74. *Eulophia*.  
 AA. Fls. not spurred nor saccate.  
 B. Lip only inserted on column-foot.....75. *Cyrtopodium*.  
 BB. Lip and lateral sepals inserted on column-foot.  
 C. Chin distinct, rectangular.....76. *Warrea*.  
 CC. Chin indistinct, round.....77. *Eulophiella*.

21. *Catasetum* Tribe.

- A. Fls. perfect; column twisted.....78. *Mormodes*.  
 AA. Fls. of 2 or 3 forms; column not twisted.  
 B. Column stout, straight; fls. with antennæ.....79. *Catasetum*.  
 BB. Column slender, curved; fls. without antennæ.....80. *Cynoches*.

22. *Lycaste* Tribe.

- A. Pollinia upon a single stalk.  
 B. Fls. globose.....81. *Anguloa*.  
 BB. Fls. with spreading sepals and petals.  
 C. Stalk of pollinia long and narrow; fls. 1 to few.  
 D. Infl. of a single erect fl.; lip turned down.....82. *Lycaste*.



- DD. Infl. of 2 to few drooping fls.; lip turned upwards..... 83. *Paphinia*.  
 CC. Stalk of pollinia short; fls. many..... 84. *Bateman-*  
*inia*.  
 AA. Pollinia upon 2 separate stalks..... 85. *Bifrenaria*.

## 23. Zygopetalum Tribe.

- A. Lip clawed distinctly..... 86. *Colax*.  
 AA. Lip not distinctly clawed..... [lum].  
 B. The lip with horseshoe-shaped callus..... 87. *Zygopeta-*  
 BB. The lip with few longitudinal lamellæ..... 88. *Eriopsis*.

## 24. Gongora Tribe.

- A. Lip turned downwards.  
 B. Fls. with sepals and petals erect or incurved.  
 C. Hypochil separated from column by a strong stricture; no pleuridia..... 89. *Lacæna*.  
 CC. Hypochil united with column by a broad base; pleuridia present.  
 D. Epichil movably attached to hypochil; pollinia with short stalk at most..... 90. *Peristeria*.  
 DD. Epichil immovably attached to hypochil; pollinia with elongated stalk..... 91. *Acineta*.  
 BB. Fls. with sepals and petals spreading or reflexed.  
 C. Lateral sepals much larger than the dorsal sepal and petals..... 92. *Coryanthes*.  
 CC. Sepals and petals nearly alike.  
 D. Hypochil concave; epichil flat.  
 E. Pollinia 2..... 93. *Stanhopea*.  
 EE. Pollinia 4..... 94. *Aganisia*.  
 DD. Hypochil not concave..... 95. *Houlletia*.  
 AA. Lip turned upwards..... 96. *Gongora*.

## 25. Dendrobium Tribe.

- A. Sts. many-jointed; rhizome short.  
 B. Lip without callus, or with lamellate or elevated lines..... 97. *Dendro-*  
 BB. Lip with basal callus; joints of st. long-fila-  
 mentose..... [bium].  
 98. *Inobulbon*.  
 AA. Sts. 1- or rarely 2-jointed; rhizome long-creeping..... 99. *Sarcopod-*  
 [ium].

## 26. Bulbophyllum Tribe.

- A. Lateral sepals with their outer margins adhering, except at the free base..... [lum].  
 AA. Lateral sepals free..... 100. *Cirrhopeta-*  
 101. *Bulbophyl-*  
 [lum].

## 27. Maxillaria Tribe.

- A. Lip without claw, movable; lvs. normal..... 102. *Maxillaria*.  
 AA. Lip clawed, or adnate to column-base; lvs. whip-shaped..... 103. *Scuticaria*.

## 28. Huntleya Tribe.

- A. Pseudobulbs distinct..... 104. *Promenæa*.  
 AA. Pseudobulbs wanting or rudimentary.  
 B. Lip entire..... 105. *Chondror-*  
 BB. Lip lobed..... [rhyncha].  
 C. Callus of lip fringed..... 106. *Huntleya*.  
 CC. Callus not fringed.  
 D. Column boat-shaped, concave..... 107. *Bollea*.  
 DD. Column slender, not concave.  
 E. Claw very short; callus free in front and resting upon the lip..... 108. *Warszewicz-*  
 [ella].  
 EE. Claw distinct; callus not free in front..... 109. *Pescatorea*.

## 29. Cymbidium Tribe.

- A. Lvs. many; sts. elongated..... 110. *Grammat-*  
 AA. Lvs. few; sts. short..... [ophyllum].  
 B. Sts. concealed by the lf.-sheaths.  
 C. Pollinia pear-shaped, upon a quadrate stalk; st. not bulbous..... 111. *Cyperor-*  
 CC. Pollinia round, upon a stalk much broader [chis].  
 than high; st. bulbous..... 112. *Cymbid-*  
 [ium].  
 BB. Sts. naked; lvs. only at its apex..... 113. *Gram-*  
 [mangis].

## 30. Ionopsis Tribe.

- A. Sepals free..... 114. *Trichocen-*  
 AA. Sepals, the lateral ones, united, at least below..... [trum].  
 B. The lip spurred..... 115. *Rodri-*  
 BB. The sepals spurred..... [guesia].  
 C. Spur short..... 116. *Ionopsis*.  
 CC. Spur long and slender..... 117. *Comparet-*  
 [tia].

## 31. Ada Tribe.

- A. Lvs. flat.  
 B. Sepals free..... 118. *Ada*.  
 BB. Lateral sepals united..... 119. *Mesos-*  
 [pinidium].  
 AA. Lvs. cylindric..... 120. *Quekettia*.

## 32. Trichopilia Tribe.

- Lip rolled around the column..... 121. *Trichopilia*.

## 33. Aspasia Tribe.

- A. Middle lobe of lip broad..... 122. *Aspasia*.  
 AA. Middle lobe of lip narrow..... 123. *Cochlidia*.

## 34. Odontoglossum Tribe.

- A. Lip surrounding column with 2 longitudinal calluses; blade reflexed..... 124. *Gomeza*.  
 AA. Lip not as above.  
 B. Base of lip parallel to column and sometimes adnate to it..... 125. *Odontoglos-*  
 BB. Lip spreading from base of column..... [sum].  
 C. Lateral sepals united entirely; lip like dorsal sepal..... 126. *Palum-*  
 CC. Lateral sepals free or only partly united; lip unlike dorsal sepal..... [bina].  
 D. Sepals and petals long and much attenuated; lip entire or fiddle-shaped..... 127. *Brassia*.  
 DD. Sepals and petals not much attenuated.  
 E. The lip entire, flat, broad..... 128. *Miltonia*.  
 EE. The lip mostly 3-lobed, with warts or a cushion at base..... 129. *Oncidium*.

## 35. Aerides Tribe.

- A. Lip movably joined to column.  
 B. Middle lobe of spurless lip flat..... 130. *Renan-*  
 [thera].  
 BB. Middle lobe of spurred lip compressed..... 131. *Arach-*  
 AA. Lip immovably united with column..... [nantha].  
 B. Spurless.  
 C. Column without a foot.  
 D. Summit of lip laterally compressed..... 132. *Vandopsis*.  
 DD. Summit of lip not compressed..... 133. *Luisia*.  
 CC. Column with a foot, the lateral sepals attached to it..... 134. *Phalænop-*  
 BB. Spurred..... [sis].  
 C. Column without a foot.  
 D. Pollinia upon a single stalk.  
 E. Spur appendaged.  
 F. With a longitudinal septum..... 135. *Sarcanthus*.  
 FF. With the mouth covered with a plate..... 136. *Cleisos-*  
 EE. Spur not appendaged..... [toma].  
 F. Stalk of the pollinia filiform.  
 G. Fls. firm; lip turned downwards..... 137. *Saccola-*  
 GG. Fls. fragile; lip turned upwards..... 138. *Acampe*.  
 FF. Stalk of the pollinia broadened upwards or throughout.  
 G. Spur short and broad..... 139. *Vanda*.  
 GG. Spur long and slender..... 140. *Angræcum*.  
 DD. Pollinia on 2 separate stalks, or these united by the gland.  
 E. Stalks membranous, the pollinia attached to the face.  
 F. Plants leafy; lip entire..... 141. *Macrolec-*  
 FF. Plants without lvs.; lip 3-lobed..... 142. *Polyrrhiza*.  
 EE. Stalks slender.  
 F. Column bent toward the dorsal sepal..... 143. *Listro-*  
 FF. Column straight..... [stachys].  
 CC. Column with a foot, the lateral sepals attached to it..... 144. *Mystaci-*  
 D. Spur curved upwards against the lip-blade..... 145. *Aërides*.  
 DD. Spur straight or reflexed.  
 E. Lip 3-lobed..... 146. *Camarotis*.  
 EE. Lip entire..... 147. *Rhyn-*  
 [chostylis].

Other orchid genera entered are: Acriopsis, Arethusa, Bromheadia, Collabium, Corysanthes, Cryptophoranthus, Cryptostylis, Diuris, Eria, Eriochilus, Geodorum, Govenia, Holothrix, Ione, Lapanthes, Lueddemannia, Megacalinum, Monomeria, Moorea, Neolaucha, Neottia, Nervilia, Neuwiedia, Notylia, Oberonia, Octomeria, Ornithidium, Ornithocephalus, Ornithochilus, Panisea, Physisiphon, Platylepis, Polycynis, Pterostylis, Sarcophilus, Satyrium, Scaphyglottis, Schlimmia, Sievekingia, Sigmatostalix, Solenidium, Staurophilus, Stelis, Stenia, Tainia, Thecostele, Thelymitra, Trichoglottis, Trigoniidium, Xylobium, and many bi- and tri-generic hybrids.

## 184. DIOSCOREACEÆ.

- A. Fr. globose and berry-like, indehiscent..... 1. *Tamus*.  
 AA. Fr. capsular, winged.  
 B. Caps. 1-carpeled by abortion..... 2. *Rajania*.  
 BB. Caps. 3-carpeled or lobed, winged above..... 3. *Testudi-*  
 BBB. Caps. 3-carpeled or lobed, winged below or all around, or rarely not at all..... 4. *Dioscorea*.

## 185. TACCACEÆ.

In cultivation..... *Tacca*.

## 186. IRIDACEÆ.

- A. Fls. never more than 1 to a spathe, spicate, not fugitive.  
 B. Style-branches simple, not bifid.  
 C. Stamens equilateral; perianth regular.  
 D. The style short; branches long and subulate.  
 E. Rootstock not bulbous; roots in dense tufts, fibrous, some fleshy.... 1. *Schizostylis*.  
 EE. Rootstock bulbous..... 2. *Hesperantha*.  
 DD. The style longer; branches shorter and more or less broadened.  
 E. The spathe-valves oblong, green or brownish upwards..... 3. *Geissorhiza*.  
 EE. The spathe-valves scarious or hyaline, cut or 3-parted at apex..... 4. *Dierama*.  
 EEE. The outer spathe-valve short, emarginate, membranous or papery..... 5. *Ixia*.  
 CC. Stamens unilateral and arched.  
 D. Foliage very hairy and plaited..... 6. *Babiana*.  
 DD. Foliage not hairy and plaited.  
 E. Perianth-limb irregular.  
 F. Tube funnel-shaped; spathe-valves lanceolate..... 7. *Gladiolus*.  
 FF. Tube cylindrical in lower half, suddenly dilated at the middle, spathe-valves oblong-lanceolate.. 8. *Antholyza*.  
 EE. Perianth-limb subregular.  
 F. Fls. small; no tube; segms. very acuminate..... 9. *Melast[æ]rula*.  
 FF. Fls. larger; tube present; segms. more or less oblong.  
 G. Spathe valves large, green, lanceolate..... 10. *Acidanthera*.  
 GG. Spathe-valves small, oblong.  
 H. Caps. inflated, globose..... 11. *Crocsmia*.  
 HH. Caps. small, oblong..... 12. *Tritonia*.  
 GGG. Spathe-valves scarious and deeply lacerated..... 13. *Sparaxis*.  
 BB. Style-branches bifid; stamens unilateral.  
 C. Tube broadly funnel-shaped, with stamens inserted below the throat..... 14. *Freesia*.  
 CC. Tube slender with stamens inserted at the throat..... 15. *Lapeyrouisia*.  
 CCC. Tube broadly funnel-shaped above the middle where the stamens are inserted.. 16. *Watsonia*.  
 AA. Fls. usually more than 1 to a spathe, stalked, often fugitive and opening one after another.  
 B. Style-branches opposite stamens and outer perianth-segms.  
 C. Stigmas transverse; style-branches have crests that overtop anthers.  
 D. Inner perianth-segms. not convolute.  
 E. Ovary 1-celled, with 3 parietal placentæ; rootstock digitate..... 17. *Herm[odactylus]*.  
 EE. Ovary 3-celled.  
 F. Perianth-tube usually present; filaments free; rootstock usually a rhizome, sometimes a bulb. 18. *Iris*.  
 FF. Perianth without a tube; filaments monadelphous; rootstock usually a tunicated corm..... 19. *Moræa*.  
 DD. Inner perianth-segms. convolute.  
 E. Style-crests petaloid; lvs. in 2-ranked rosette, not plaited; peduncle flattened; rootstock not bulbous. 20. *Marica*.  
 EE. Style-crests large, spur-like or flattened; lvs. superposed, plaited; st. terete; rootstock bulbous..... 21. *Cypella*.  
 (See also *Phalocallis*.)  
 CC. Stigmas terminal; style-branches do not overtop anthers.  
 D. Perianth without any tube; inner segms small, not convolute; style-branches bifid at tip..... 22. *Herbertia*.  
 DD. Perianth-segms. connivent in a cup, without any spreading blade..... 23. *Hydrotænia*.  
 DDD. Perianth-segms. connivent in a cup, then spreading, at least the outer ones.  
 E. Style-branches with 2 petal-like stigmatose crests..... 24. *Homeria*.  
 EE. Style-branches bifid.  
 F. Ditto penicillate, i.e., shaped like an artist's brush, a dense tuft of hairs..... 25. *Ferraria*.  
 FF. Ditto not penicillate.  
 G. Inner segms. very small; outer with a large, reflexed blade.... 26. *Rigidella*.  
 GG. Inner and outer segms. dissimilar, various..... 27. *Tigridia*.  
 BB. Style-branches alternate with anthers.  
 C. Rootstock not a bulb or corm.

- D. Spathes essentially 1-fld.  
 E. Peduncle short, hidden; perianth with a long tube and ascending segms..... 28. *Crocus*.  
 EE. Peduncle long; perianth-segms. much longer than the short tube..... 29. *Romulea*.  
 DD. Spathes usually with more than 1 fl..... 30. *Nemastylis*.  
 CC. Rootstock not a bulb or corm; spathes usually more than 1-fld.  
 D. Perianth-segms. unequal.  
 E. Inner segms. shorter, connivent; upper stamen imperfect..... 31. *Diplarrhena*.  
 EE. Inner segms. obovate-cuneate; outer oblong, usually shorter; stamens all perfect..... 32. *Libertia*.  
 DD. Perianth-segms. subequal.  
 E. Style-branches flattened and emarginate at apex; infl. a lax corymb.... 33. *Belemcanda*.  
 EE. Style-branches subulate.  
 F. Pedicels short; clusters panicled... 34. *Orthosanthus*.  
 FF. Pedicels long; clusters terminal, single or fascicled..... 35. *Sisyrinchium*.

Other genera described are: *Aristea*, *Cipura*, *Eleutherine* and *Ennealophus*.

## 187. AMARYLLIDACEÆ.

- A. Subterranean axis a bulb; scapose; infl. umbelloid and involucrate, or solitary..... 1. AMARYLLIS TRIBE.  
 AA. Subterranean axis a rhizome; st. leafy, at least at base.  
 B. Plants with large, thick, fleshy, rosette-like lvs.; infl. racemose or paniculate..... 2. AGAVE TRIBE.  
 BB. Plants with ordinary lvs. of small size; infl. various.  
 C. Lf.-blades inverted, upper face downward; infl. an involucrate umbel..... 3. ALSTROEMERIA TRIBE.  
 CC. Lf.-blades normal, linear; infl. not umbelloid.  
 D. Plant hairy or glabrous, scapose; infl. spicate or racemose..... 4. HYPOXIS TRIBE.  
 DD. Plant glabrous, with leafy sts.; infl. loose, racemose or solitary; anther opening by apical pore..... 5. CONANTHERA TRIBE.  
 DDD. Plant densely woolly with leafy sts.; infl. scorpioid; lvs. capitate..... 6. CONOSTYLIS TRIBE.

## 1. Amaryllis Tribe.

Subtribe 1. CORONATÆ. Fl. furnished with a crown between the perianth and stamens, which is not to be confused with a staminal cup formed by the growing together of filaments.

1. *Narcissus*.

Subtribe 2. AMARYLLIDÆ GENUINÆ. Corona 0, and filaments not united into a staminal cup.

- A. Anthers erect; filaments inserted at or near the base of anthers.  
 B. Stamens epigynous; filaments short.  
 C. The perianth-segms. all alike..... 2. *Leucojum*.  
 CC. The inner segms. different, permanently connivent..... 3. *Galanthus*.  
 BB. Stamens perigynous.  
 C. Fls. solitary..... 4. *Cooperia*.  
 CC. Fls. umbellate..... 5. *Chlidanthus*.  
 AA. Anthers dorsifixed, versatile.  
 B. Ovules many, superposed; testa black.  
 C. Fls. solitary; spathe tubular in the lower half.  
 D. The fl. gaping, horizontal, bright red, 3 lower segms. convolute..... 6. *Sprekelia*.  
 DD. The fls. regular, erect or suberect.  
 E. Seeds globose; fls. yellow; peduncle short or long..... 7. *Sternbergia*.  
 EE. Seeds flat; peduncle long..... 8. *Zephyranthes*.  
 CC. Fls. umbellate; spathe 2-4-valved, and pedicels subtended by filiform bracteoles.  
 D. Perianth-tube short or almost 0, rarely long in *Hippeastrum*.  
 E. Peduncle solid; seeds few in a cell.... 9. *Lycoris*.  
 EE. Peduncle hollow.  
 F. Fl. often furnished with minute scales or a distinct neck at the throat; seeds many in a cell..... 10. *Hippeastrum*.  
 FF. Fl. with a sort of corolla, which is funnel-shaped, and deeply cut, the divisions emarginate..... 11. *Placea*.  
 DD. Perianth-tube long.  
 E. Tube broadly funnel-shaped, pulvinate at throat..... 12. *Vallota*.  
 EE. Tube 2-3 times longer than segms., naked at throat..... 13. *Cyrtanthus*.



- BB. Ovules 2, basal, collateral; testa pale. . . . . 14. *Griffinia*.  
 BBB. Ovules 2 or few, collateral or fasciated from the center of the placenta.  
 c. Fr. baccate.  
 d. Bulb imperfect; ovules several. . . . . 15. *Clivia*.  
 dd. Bulb large, tunicated; ovules 2. . . . . 16. *Hæmanthus*.  
 cc. Fr. capsular. . . . . 17. *Buphane*.  
 BBBB. Ovules few or many, superposed; seeds few, turgid, testa green.  
 c. Fr. indehiscent or bursting irregularly.  
 d. Perianth-tube long. . . . . 18. *Crinum*.  
 dd. Perianth-tube short.  
 e. Segms. broad. . . . . 19. *Amaryllis*.  
 ee. Segms. narrow. . . . . 20. *Ammoch-*  
 cc. Fr. a 3-valved caps. . . . . [aris].  
 d. Caps. top-shaped, acutely angled. . . . . 21. *Brunsvigia*.  
 dd. Caps. globose, obtusely angled. . . . . 22. *Nerine*.

Subtribe 3. **PANCRAEÆ.** Corona 0, but stamens appendaged toward base and often united into a distinct cup,

- A. Ovules superposed, many or few.  
 B. Lvs. broad, petioled.  
 c. Perianth white.  
 d. Ovary globose.  
 e. Filaments with a large tooth on each side of the anthers. . . . . 23. *Calliph-*  
 [ruria].  
 ee. Filaments united in a distinct cup. . . . . 24. *Eucharis*.  
 dd. Ovary 3-lobed; hybrid. . . . . 25. *Urceoch-*  
 cc. Perianth colored. . . . . [aris].  
 d. The perianth-tube cylindrical, suddenly dilated. . . . . 26. *Urceolina*.  
 dd. The perianth subcylindrical; segms. long or short. . . . . 27. *Phædran-*  
 BB. Lvs. linear or ligulate, sessile. . . . . [arisa].  
 c. Perianth colored, subcylindrical; tube long; filaments united in an entire or toothed cup. . . . . 28. *Stenomesson*.  
 cc. Perianth white; tube funnel-shaped; staminal cup large. . . . . 29. *Pancratium*.  
 AA. Ovules collateral, basal, 2-6. . . . . 30. *Hymeno-*  
 AAA. Ovules medial, 2-3. . . . . [callis].  
 B. Perianth funnel-shaped; segms. narrow. . . . . 31. *Vagaria*.  
 BB. Perianth with a slender tube and broad segms. . . . . 32. *Eurycles*.

## 2. Agave Tribe.

- A. Lvs. thick, fleshy, usually spiny at edge and point.  
 B. Perianth funnel-shaped; filaments normal. . . . . 33. *Agave*.  
 BB. Perianth rotate; filaments swollen on one side at base. . . . . 34. *Furcraea*.  
 AA. Lvs. comparatively thin, not spiny at edge or point.  
 B. Segms. short.  
 c. Fls. white, in a lax, simple spike; tube long, curved, subcylindrical. . . . . 35. *Polyanthes*.  
 cc. Fls. greenish brown in a lax raceme; tube abruptly curved and dilated at middle. . . . . 36. *Prochny-*  
 ccc. Fls. red or white, laxly spicate or racemose; tube curved, subcylindrical. . . . . [anthes].  
 37. *Bravoa*.  
 BB. Segms. long; tube scarcely any.  
 c. Fls. greenish red, in a simple or panicked raceme; segms. oblanceolate. . . . . 38. *Beschor-*  
 cc. Fls. bright red, in a capitulum or thyrsoid [neria].  
 panicle; segms. narrow, falcate. . . . . 39. *Doryanthes*.

## 3. Alstrœmeria Tribe.

- A. Rootstock bulbous; perianth-segms. subequal. 40. *Ixiolirion*.  
 AA. Rootstock 0; 3 outer perianth-segms. different from 3 inner.  
 B. Inner segms. unequal: st. erect. . . . . 41. *Alstrœmeria*.  
 BB. Inner segms. equal: st. with runners or stolons. . . . . 42. *Bomarea*.

## 4. Hypoxis Tribe.

- A. Ovary often produced into a long slender beak simulating a perianth-tube: fr. succulent, indehiscent. . . . . 43. *Curculigo*.  
 AA. Ovary not beaked: fr. a caps. usually circumscissile at apex. . . . . 44. *Hypoxis*.

## 5. Conanthera Tribe.

- Stamens, 3 only, fertile. . . . . 45. *Tecophilæa*.

## 6. Conostylis Tribe.

- Fls. irregular. . . . . 46. *Anigozan-*  
 [thos].

Also in cultivation: *Anoiganthus*, *Callipsyche*, *Cummingia*, *Cyanella*, *Gethyllis*.

## 188. VELLOZIACEÆ.

- A. Perianth-tube more or less extended beyond the ovary. . . . . 1. *Barbacenia*.  
 AA. Perianth-tube practically none. . . . . 2. *Vellozia*.

## 189. MUSACEÆ.

- A. Calyx tubular, later split-spathaceous. . . . . 1. *Musa*.  
 AA. Calyx of free sepals (lateral ones sometimes adnate to corolla in *Heliconia*).  
 B. Fr. a caps. loculicidally 3-valved; seeds  $\infty$ .  
 c. Petals 2, lateral connate. . . . . 2. *Strelitzia*.  
 cc. Petals separate. . . . . 3. *Ravenala*.  
 BB. Fr. indehiscent or separating into berries, the cells 1-seeded. . . . . 4. *Heliconia*.

## 190. ZINGIBERACEÆ.

- A. Ovary 1-celled, with 3 parietal placentæ. . . . . 1. *Globo.*  
 AA. Ovary perfectly 3-celled, or at least 3 celled much above the middle; placentæ axile.  
 B. Lateral staminodes ample and petal-like.  
 c. Connective not appendaged at the base.  
 d. Filament short; bracts 1-f. . . . . 2. *Kaempferia*.  
 dd. Filament long; bracts 1-co-fid. . . . . 3. *Hedychium*.  
 cc. Connective appendaged at the base.  
 d. Spur 2-fid; lateral staminodes narrowed at base. . . . . 4. *Roscoea*.  
 dd. Spurs 2; lateral staminodes connate with the petaloid filament. . . . . 5. *Curcuma*.  
 BB. Lateral staminodes small, tooth-like or 0, rarely longer, narrow and adnate to labellum.  
 c. Filament short or very short.  
 d. Infl. cone-like.  
 e. Anther-cells divergent at apex; connective either short or produced beyond cells into an entire or 3-lobed crest. . . . . 6. *Amomum*.  
 ee. Anther-cells contiguous; connective produced beyond the cells into a long, linear appendage. . . . . 7. *Zingiber*.  
 dd. Infl. not cone-like.  
 e. Connective not produced beyond cells.  
 f. Anther-cells contiguous to apex. . . . . 8. *Eleteria*.  
 ff. Anther-cells separate. . . . . 9. *Renealm.*  
 ee. Connective produced beyond cells into a long lanceolate, concave appendage. . . . . 10. *Burbridgea*.  
 cc. Filament elongated (in *Costus* petal-like).  
 d. Infl. cone-like. . . . . 11. *Costus*.  
 dd. Infl. not cone-like. . . . . 12. *Alpinia*.

Also in cultivation: *Bamburanta*, *Brachychilus*, *Cautleya*, *Rhynchanthus*.

## 191. MARANTACEÆ.

- A. Ovary 1-celled after a fashion, the other cells being minute and empty.  
 B. Bracts narrow, convolute, inclosing the rachis. . . . . 1. *Maranta*.  
 BB. Bracts and bractlets usually colored, spreading, long persistent. . . . . 2. *Stromanth.*  
 BBB. Bracts spreading, deciduous. . . . . 3. *Thalia*.  
 AA. Ovary usually 3-celled and 3-ovuled.  
 B. Corolla-tube usually short. . . . . 4. *Phrynium*.  
 BB. Corolla-tube usually slender and longer. . . . . 5. *Calathea*.  
 Ctenanthe is also briefly treated.

## 192. CANNACEÆ.

Sole genus. . . . . *Canna*.

## 193. BROMELIACEÆ.

(Following Mez in DC. Monog. Phaner. vol. 9.)

- A. Fr. a berry, indehiscent; ovary inferior; seeds not winged nor plumed.  
 B. Pollen-grains entire, not provided with pores or a longitudinal membranous fold.  
 c. Calyx without a tube or cup. . . . . 1. *Bromelia*.  
 cc. Calyx with a tube or cup. . . . . 2. *Cryptanthus*.  
 BB. Pollen-grains furnished with pores.  
 c. Infl. immersed in a central bowl of lvs. and surrounded by an involucre formed from the reduced inmost lvs. and usually colored.

- d. Petals without ligules, connate, at least toward base.  
 e. The infl. simple..... 3. *Aregelia*.  
 ee. The infl. compound..... 4. *Nidularium*.  
 dd. Petals with ligules, free..... 5. *Canistrum*.  
 cc. Infl. not surrounded by a distinct involucre: st. or scape tall.  
 d. Petals furnished with 2 ligules inside.  
 e. Berries connate among themselves and also to the bracts and axis.... 6. *Ananas*.  
 ee. Berries free.  
 f. Sepals with long awns, or, if awnless, the ovules with very long tails..... 7. *Echmea*.  
 (See also *Echinostachys*.)  
 ff. Sepals without awns or only obscurely awned: ovules obtuse.. 8. *Quesnelia*.  
 dd. Petals not provided with ligules inside.  
 e. Fls. very flat and crowded into dense cones..... 9. *Hohenbergia*.  
 ee. Fls. more or less loosely spicate on the branches of the infl..... 10. *Streptocalyx*.  
 bbe. Pollen-grains furnished with a longitudinal membranous groove..... 11. *Billbergia*.  
 aa. Fr. a dehiscent caps: ovary superior or nearly so.  
 b. Seeds winged, or appendaged: pollen grooved.  
 c. Ovary semi-superior..... 12. *Pitcairnia*.  
 cc. Ovary superior.  
 d. Fls. of 2 forms and dioecious..... 13. *Hechtia*.  
 dd. Fls. all the same form.  
 e. Petals free to the very base..... 14. *Puya*.  
 ee. Petals coalesced toward the base..... 15. *Dyckia*.  
 bb. Seed with a long, plumose appendage: ovary superior.  
 c. Petals free.  
 d. The petals ligulate inside..... 16. *Vriesea*.  
 dd. The petals not ligulate inside..... 17. *Tillandsia*.  
 cc. Petals connate or intimately confluent. 18. *Guzmania*.  
 (See also *Massangea*.)  
 Catopsis and Neoglaziovia are also in cultivation.

## 194. LILIACEÆ.

## I. Summary of Tribes.

Ignoring many exceptions.

**Series 1.** Anthers introrsely dehiscent: fr. usually berry-like: plant not bulbous, usually scaly at the base of the st. and leafy above, sometimes with a scaly scape.

- a. Stigma not broadly petlate.  
 b. Ovules orthotropous or hemianatropous: "foliage" abnormal, in the *Smilax* Tribe 3-5-nerved but with netted veinlets; in the *Asparagus* Tribe li-shaped or needle-like "phylloclades" are present.  
 c. Anthers abnormal, the inner valve of each cell being so narrow that the open anther seems to be 1-celled: st. sarmentose or scandent..... 1. *SMILAX* TRIBE.  
 cc. Anthers normally 2-celled, or cells confluent at apex: st. branched or scandent..... 2. *ASPARAGUS* TRIBE.  
 bb. Ovules anatropous, rarely hemianatropous in the *Luzuriaga* Tribe.  
 c. St. shrubby and branched, or scandent..... 3. *LUZURIAGA* TRIBE.  
 cc. St. herbaceous, unbranched or sparingly branched; leafy above.. 4. *SOLOMON'S SEAL* [TRIBE].  
 ccc. Stemless herbs with lvs. clustered on the rhizome and often inclosed (together with the lateral leafless scape) by sheathing scales at the base..... 5. *LILY-OF-THE-VALLEY* TRIBE.  
 aa. Stigma usually very broadly petlate: lvs. on the rhizome few, ample: scape very short and 1-fid. or bearing a dense spike at apex..... 6. *ASPIDISTRA* TRIBE.

**Series 2.** Anthers introrsely dehiscent: fr. loculicidally dehiscent, rarely indehiscent or berry-like: lvs. on a rhizome, or densely crowded at the apex of a caudex, or forming a bulb at the base of the scape.

- a. Anthers with a pit on the back into which the filament intrudes.  
 b. Lvs. linear or membranous, crowded on a short rhizome: perianth cylindrical, funnel-shaped, or bell-shaped..... 7. *LEMON-LILY* OR [HEMEROCALLIS] TRIBE.  
 bb. Lvs. usually thick, fleshy or rigid, sometimes spiny: rhizome hard, often extended above ground into a woody caudex: perianth-segms. connivent or connate into a tube or sometimes with spreading tips.... 8. *ALOE* TRIBE.

- aa. Anthers not pitted (sometimes slightly pitted in the *Asphodel* Tribe): lvs. not thick, and fleshy as in a century plant.  
 b. Rootstock, if any, rhizomatous; rhizome usually short, often very short in *Asphodel* Tribe, sometimes produced into a woody caudex in *Dracæna* Tribe (see also bb).  
 c. Seeds fleshy: perianth marcescent. 9. *OPHIPOGON* [TRIBE].  
 cc. Seeds not fleshy.  
 d. Perianth tubular-bellshaped, connate, persistent; infl. racemose..... 10. *ALETIS* TRIBE.  
 dd. Perianth shaped like a bell or cylinder, rarely a funnel, the segms. usually distinct, deciduous; infl. often panicked..... 11. *DRACÆNA* TRIBE.  
 ddd. Perianth-segms. usually distinct and spreading, deciduous; infl. sparingly branched, if at all..... 12. *ASPHODEL* TRIBE.  
 bb. Rootstock bulbous as a rule: in the *Onion* Tribe sometimes a corm and rarely a very short rhizome; bulb usually tunicated, but in the *Tulip* Tribe often scaly.  
 c. Stemless plants with the infl. terminal on a leafy scape.  
 d. Infl. an umbel with an involucre of at least 2 bracts..... 13. *ONION* TRIBE.  
 dd. Infl. a raceme, or rarely a spike..... 14. *SQUILL* TRIBE.  
 cc. St. leafy, or at least with 1 lf.: fls. few or in a lax raceme..... 15. *TULIP* TRIBE.

**Series 3.** Anthers usually introrsely affixed but extrorsely dehiscent (the whole *Colchicum* Tribe exceptional): fr. usually a septicidal caps., rarely loculicidal or in the *Medeola* Tribe an indehiscent berry. Plants fibrous-rooted, rarely cormous or bulbous.

- a. Fr. a berry: plant not bulbous: lvs. few, subradical or whorled on the st..... 16. *MEDEOLA* OR [CUCUMBER-ROOT] TRIBE.  
 aa. Fr. a caps. rarely, in the *Bellwort* Tribe, a berry.  
 b. Anthers introrsely dehiscent. The only tribe in Series 3 with a cormous rootstock..... 17. *COLCHICUM* OR [AUTUMN CROCUS] TRIBE.  
 bb. Anthers extrorsely dehiscent, rarely otherwise in the *Narthecium* Tribe: plants not bulbous except sometimes in *False Hellebore* Tribe.  
 c. St. lvs. smaller than the radical lvs. which are either crowded or petiolate), sometimes very small or 0: caps. septicidal or loculicidal..... 18. *NARTHECIUM* [TRIBE].  
 cc. St. leafy, herbaceous or high climbing: lvs. alternate, sessile or clasping, without sheath..... 19. *BELLWORT* OR [UVULARIA] TRIBE.  
 ccc. St. usually tall, leafy or hardly so beyond the radical lvs.: plants not bulbous or bulbous: anthers with confluent cells, roundish-petlate after dehiscence..... 20. *FALSE HELLEBORE* [OR *VERATRUM* TRIBE].

## II. Key to the Tribes.

1. *Smilax* Tribe.

- a. Perianth 6-parted..... 1. *Smilax*.  
 aa. Perianth undivided; mouth minutely toothed.. 2. *Hetero-* [smilax].

2. *Asparagus* Tribe.

- a. Filaments connate into a little urn, with the anthers sessile at the mouth of the urn.  
 b. Anthers 3; fls. clustered on the middle of the face of the phylloclade..... 3. *Ruscus*.  
 bb. Anthers 6; fls. clustered on the margins, or rarely at the middle of the phylloclade.... 4. *Semele*.  
 bbb. Anthers 6; fls. terminal in short racemes.... 5. *Danaë*.  
 aa. Filaments free..... 6. *Asparagus*.

3. *Luzuriaga* Tribe.

- a. Fls. large or rather large, solitary or few; perianth-segms. erect; ovary 1-celled with 3 parietal placentæ.  
 b. Lvs. 3-5-nerved; perianth-segms. of about equal length..... 7. *Lapageria*.  
 bb. Lvs. 1-nerved: outer perianth-segms. much smaller than inner..... 8. *Philesia*.  
 aa. Fls. small; perianth-segms. spreading; ovary 3-celled: lvs. with  $\infty$  slender nerves.  
 b. The fls. clustered in the axils..... 9. *Eustrephus*.  
 bb. The fls. mostly terminating the branches.... 10. *Gettono-* [plesium].



## 4. Solomon's Seal Tribe.

- A. Fls. 1-2 in the axils, rarely more, usually nodding.  
 B. Perianth-tube cylindrical; lobes short; style undivided, with a small stigma. . . . . 11. *Polygonatum*.  
 BB. Perianth-tube 0; segms. spreading above or from the base; style shortly or more deeply 3-fid. . . . . 12. *Streptopus*.  
 AA. Fls. in a terminal raceme or panicle.  
 B. Floral parts in 3's. . . . . 13. *Smilacina*.  
 BB. Floral parts in 2's. . . . . 14. *Maintheum*.

## 5. Lily-of-the-Valley Tribe.

- A. Fls. racemose, nodding; perianth subglobose; lobes shorter than tube. . . . . 15. *Convallaria*.  
 AA. Fls. spicate, far apart; perianth-tube cylindrical; lobes recurved-spreading. . . . . 16. *Reineckia*.

## 6. Aspidistra Tribe.

- A. Fls. 4-merous; stigma very large, roundish-peltate, undivided. . . . . 17. *Aspidistra*.  
 AA. Fls. 3-merous; stigma broadly peltate, 3-lobed. 18. *Rohdea*.

## 7. Lemon-Lily, or Hemerocallis Tribe.

- A. Fls. erect; stamens affixed at apex of tube: lvs. long and narrow.  
 B. Perianth funnel-shaped, the cylindrical tube shorter than the lobes; panicles few-fld. . . . . 19. *Hemerocallis*.  
 BB. Perianth with subincurved segms. loosely connivent above the top-shaped tube; panicles much branched. . . . . 20. *Phormium*.  
 AA. Fls. pendulous.  
 B. Stamens affixed at middle of tube: lvs. long and narrow; perianth-tube swollen above; lobes short. . . . . 21. *Blandfordia*.  
 BB. Stamens often hypogynous.  
 C. Lvs. petioled, usually broad: fls. racemose; perianth funnel-shaped; tube short or long. . . . . 22. *Funkia*.  
 CC. Lvs. long and narrow: fls. spicate; perianth a long narrow tube with short lobes. . . . . 23. *Kniphofia*.

## 8. Aloe Tribe.

- A. Perianth-segms. strongly connate into a tube which is swollen at the base; segms. free at apex; stamens included in tube. . . . . 24. *Gasteria*.  
 AA. Perianth-segms. coherent or connivent to the very apex in a tube, or barely spreading at the very apex; stamens usually exserted. . . . . 25. *Aloe*.  
 AAA. Perianth-segms. coherent or connivent, stellate-spreading at apex; stamens a little shorter than perianth. . . . . 26. *Apicra*.  
 AAAA. Perianth usually incurved, the segms. cohering or connivent, at the apex recurved and spreading somewhat as if 2-lipped; stamens not exceeding perianth. . . . . 27. *Haworthia*.  
 AAAAA. Perianth of Aloe, but stamens a little shorter than the perianth. . . . . 28. *Lomatophyllum*.

## 9. Ophiopogon Tribe.

- A. Perianth-tube long and slender; filaments normal. . . . . 29. *Sansevieria*.  
 AA. Perianth more or less erect or spreading above the ovary; filaments shorter than the linear anthers; style longish. . . . . 30. *Ophiopogon*.  
 AAA. Perianth spreading from base of ovary; filaments about as long as the oblong anthers. . . . . 31. *Liriope*.

## 10. Aletris Tribe.

- One genus cultivated. . . . . 32. *Aletris*.

## 11. Dracæna Tribe.

- A. Ovary 1-celled; cells 3-ovuled. . . . . 33. *Dasyllirion*.  
 AA. Ovary 3-celled.  
 B. Cells 1-ovuled. . . . . 34. *Dracæna*.  
 BB. Cells 2-ovuled. . . . . 35. *Nolina*.  
 BBB. Cells  $\infty$ -ovuled.  
 C. Fls. racemose. . . . . 36. *Hesperocallis*.  
 CC. Fls. paniced.  
 D. Anthers small, sessile on a club-shaped filament; perianth subglobose or bell-shaped; segms. hardly connate at base. . . . . 37. *Yucca*.  
 DD. Anthers dorsifixed on normal or flattened filaments; perianth cylindrical or narrowly bell-shaped, with a short tube. . . . . 38. *Cordylina*.

## 12. Asphodel Tribe.

## Summary of Subtribes.

- A. Anthers dorsifixed, versatile.  
 B. Subtribe 1. EUASPHODELEÆ. Plant not bulbous: lvs. crowded at base of st.; cauline lvs. smaller, when present.  
 BB. Subtribe 2. LOMANDREÆ. Plant not bulbous: lvs. grass-like: fls. in spikes.  
 BBB. Subtribe 3. CHLOROGALEÆ. Plant bulbous: lvs. few.  
 AA. Anthers erect, affixed at or near the base.  
 B. Subtribe 4. BOWIÆ. Lvs. few, from a thick tuber or fleshy bulb, quickly vanishing before or at anthesis.  
 BB. Lvs. numerous, crowded at base of st. or sometimes in Subtribe 5 arranged along st.  
 C. Subtribe 5. ANTHERICEÆ. Lvs. not 2-ranked.  
 CC. Subtribe 6. DIANELLEÆ. Lvs. 2-ranked.

## Subtribe 1. Euasphodeleæ.

- A. Ovules 2 in a cell.  
 B. St. or scape leafless.  
 C. Anthers pitted where the filament is inserted; fls. yellow. . . . . 39. *Asphodelus*.  
 CC. Anthers not pitted. . . . . 40. *Bulbinella*.  
 (Consult *Chrysobactron*.)  
 BB. St. more or less leafy: fls. usually white. . . . . 41. *Asphodeline*.  
 AA. Ovules  $\infty$  in a cell.  
 B. Anthers pitted; filaments glabrous. . . . . 42. *Paradisæa*.  
 BB. Anthers not pitted; filaments long bearded. . . . . 43. *Bulbine*.

## Subtribe 2. Lomandreæ.

- In cultivation . . . . . 44. *Xanthorrhæa*.

## Subtribe 3. Chlorogaleæ.

- A. Perianth-segms. 3-nerved. . . . . 45. *Chlorogalum*.  
 AA. Perianth-segms. 1-nerved. . . . . 46. *Hastingsia*.

## Subtribe 4. Bowieæ.

- Lvs. linear, vanishing before anthesis: bulb tuber-like. . . . . 47. *Bowiea*.

## Subtribe 5. Anthericæ.

- A. Infl. clustered down among the radical lvs. on a very short st. . . . . 48. *Leucocrinum*.  
 AA. Infl. on a scape, simple or with few branches, racemose or spicate.  
 B. Stamens finally as long as the perianth or longer; raceme long, simple and dense. . . . . 49. *Eremurus*.  
 BB. Stamens shorter than perianth.  
 C. Caps. with hardly prominent angles. . . . . 50. *Anthericum*.  
 CC. Caps. 3-cornered or 3-winged. . . . . 51. *Chlorophytum*.

## Subtribe 6. Dianelleæ.

- Filaments fleshy or thickened at apex or middle. . . . . 52. *Dianella*.

## 13. Onion Tribe.

- A. Rootstock a short rhizome, with clusters of root-fibers. . . . . 53. *Agapanthus*.  
 AA. Rootstock a tunicated bulb or corm.  
 B. Perianth salver-shaped or urn-shaped.  
 C. Stamens 6; perianth-tube cylindrical.  
 D. Tube often crowned at throat with 3-6 scales; stamens included inside the tube in 2 series. . . . . 54. *Tristagma*.  
 DD. Tube constricted at the mouth by a scarcely noticeable ring; stamens exserted at mouth of tube; filaments very short. . . . . 55. *Milla*.  
 CC. Stamens 3, affixed at throat.  
 D. Perianth-tube subglobose, constricted at mouth; stamens alternate with a like number of staminodes. . . . . 56. *Stropholirion*.  
 DD. Perianth-tube broadly cylindrical, shortly 6-saccate at base; stamens with a like number of staminodes connate into a spurious corona behind the anthers. . . . . 57. *Brevoortia*.  
 BB. Perianth funnel-shaped or bell-shaped; lobes as long as the tube or longer.  
 C. Filaments connate into a tube; stamens 6, affixed to throat.  
 D. Tube about as long as lobes. . . . . 58. *Androstephium*.  
 DD. Tube much shorter than lobes. . . . . 59. *Bessera*.  
 CC. Filaments free, normal or very short; perfect stamens 6 or 3, affixed to throat or tube.  
 D. Pedicels articulated at apex. . . . . 60. *Brodiaea*.

- DD. Pedicels not articulated at apex.....61. *Triteleia*.  
 BBB. Perianth wheel-shaped or bell-shaped; segms. connate at the base into a ring or cup.  
 C. Rootstock a fibrous-tunicated corm.  
 D. Filaments dilated at base into truncate scales surrounding ovary.....62. *Bloomeria*.  
 DD. Filaments slightly dilated below the middle.....63. *Muilla*.  
 CC. Rootstock a tunicated bulb.  
 D. Alliacous odor absent; perianth-segms. connate at base or to the middle.....64. *Nothoscordum*.  
 DD. Alliacous odor nearly if not quite always present; perianth-segms. distinct or barely united at base in a ring.....65. *Allium*.

## 14. Squill Tribe.

- A. Perianth-segms. distinct, or united only at the very base.  
 B. Seeds strongly compressed; ovules numerous.  
 C. The outer segms. of the persistent perianth spreading, the inner a little shorter, erect, connivent at apex and variously crested.....66. *Albuca*.  
 CC. The segms. of the deciduous perianth subequal, connivent into a bell, or spreading.....67. *Urginea*.  
 BB. Seeds obovoid or globose, not flattened or angled; ovules 2-∞ in a cell.  
 C. Infl. a long dense raceme, bearded at the apex by empty bracts, which may be herbaceous or colored.....68. *Eucomis*.  
 CC. Infl. not as in C.  
 D. Nerves of perianth-segms 1.....69. *Scilla*.  
 DD. Nerves of perianth-segms 3-∞.....70. *Camassia*.  
 DDD. Nerves of perianth segms. obscure.....71. *Ornithogalum*.  
 AA. Perianth-segms. united into a tube or bell.  
 B. Ovules ∞, usually numerous.  
 C. Seeds strongly compressed or angled.  
 D. The outer lobes spreading; inner ones erect and shorter.....72. *Dipcadi*.  
 DD. The lobes all spreading and subequal, or the inner ones a little wider.....73. *Galtonia*.  
 CC. Seeds obovoid or globose.....74. *Lachenalia*.  
 BB. Ovules 2-6 in a cell, rarely more; seeds not flattened or angled.  
 C. Lobes very short, tooth-like, much shorter than tube.  
 D. Perianth cylindrical.....75. *Veltheimia*.  
 DD. Perianth urn-shaped, constricted at throat.....76. *Muscari*.  
 CC. Lobes considerably longer than the bell-shaped tube; fls. few, in a lax raceme.  
 D. Filaments erect, not connate, all or only alternate ones dilated and petal-like.....77. *Chionodoxa*.  
 DD. Filaments connate into a sort of cup which is produced beyond the anthers into a cone.....78. *Puschkinia*.  
 CCC. Lobes shorter than the tube or about as long, sometimes a trifle longer; filaments normal or dilated at base.....79. *Hyacinthus*.

## 15. Tulip Tribe.

- A. Caps. septicidally dehiscent or 3-parted: fls. erect or pendulous; outer perianth-segms. usually narrower or smaller; inner ones pitted.....80. *Calochortus*.  
 (Consult also *Cyclobothra*.)  
 AA. Caps. loculicidally dehiscent.  
 B. Anthers dorsifixed, versatile; fls. nodding or pendulous, rarely erect; claw of segms. usually furnished with a nectariferous groove.....81. *Lilium*.  
 BB. Anthers basifixed, erect; filament usually intruded.  
 C. Fls. usually erect; perianth bell-shaped or somewhat funnel-shaped; segms. often spotted near the base, not pitted.....82. *Tulipa*.  
 CC. Fls. nodding or pendulous.  
 D. Perianth bell-shaped; segms. usually furnished with a pit or nectar-bearing spot above the base.....83. *Fritillaria*.  
 DD. Perianth-segms. narrow, recurved or reflected from the middle or almost from the base.....84. *Erythronium*.

## 16. Medeola, or Cucumber-Root Tribe.

- A. Foliage at base of st.; lvs. few, stalked or contracted into a sheath; fls. in a long-peduncled umbel, rarely solitary.....85. *Clintonia*.  
 AA. Foliage whorled at top of st.  
 B. Lvs. 3; fl. solitary, 3-merous.....86. *Trillium*.  
 BB. Lvs. 4-∞; fls. solitary, 4-∞-merous.....87. *Paris*.  
 AAA. Foliage whorled at middle of st. with 3 smaller lvs. at the top surrounding the umbel.....88. *Medeola*.

## 17. Colchicum, or Autumn-Crocus Tribe.

- A. Perianth-tube entire; styles 3, distinct from the base.....89. *Colchicum*.  
 AA. Perianth-segms. with distinct claws, connivent into a tube.  
 B. Styles 3, distinct from base.....90. *Merendera*.  
 BB. Style entire inside the tube, 3-fid at apex....91. *Bulbocodium*.

## 18. Narthecium Tribe.

- A. Caps. loculicidally dehiscent.  
 B. Style undivided.....92. *Narthecium*.  
 BB. Styles 3.....93. *Zerophyllum*.  
 AA. Caps. septicidally dehiscent or parted.  
 B. Fls. few at apex of scape; style undivided....94. *Heloniopsis*.  
 BB. Fls. in a dense raceme; styles 3, very short..95. *Helonias*.

## 19. Bellwort, or Uvularia Tribe.

- A. Fr. an indehiscent berry.....96. *Disporum*.  
 AA. Fr. a septicidal caps.....97. *Tricyrtis*.  
 B. Fr. (when known) a loculicidal caps.  
 B. Fls. terminal, pendulous.  
 C. Lvs. perfoliate: seeds covered by a thin white aril.....98. *Uvularia*.  
 CC. Lvs. sessile: seeds have a swollen, spongy, brown ridge.....99. *Oakesia*.  
 BB. Fls. axillary, or long-pedicelled in the axils.  
 C. Plants are climbers.  
 D. Perianth-segms. spreading, usually wavy or crisped.....100. *Gloriosa*.  
 DD. Perianth-segms. distinct, suberect, more or less connivent and bell-shaped.....101. *Littonia*.  
 CC. Plants not climbers: perianth urn-shaped; lobes very short.....102. *Sandersonia*.

## 20. False Hellebore or Veratrum Tribe.

- A. Seeds membranous-winged nearly all the way around: sts. leafy.  
 B. Lvs. narrow or long-stalked; perianth-segms. distinctly clawed.....103. *Melanthium*.  
 BB. Lvs. usually broad, plaited, veiny, contracted into a sheath, not distinctly stalked; perianth-segms. a trifle contracted at the base.....104. *Veratrum*.  
 AA. Seeds narrow, angled, hardly winged: lvs. radical or crowded at base of st., linear or rarely sublanceolate.  
 B. Stamens much shorter than perianth; perianth more or less bell-shaped.....105. *Stenanthium*.  
 BB. Stamens a little shorter than perianth; perianth flattened out.....106. *Zygadenus*.

Other genera described are: *Acrospira*, *Alectorurus*, *Androcymbium*, *Arthropodium*, *Astelia*, *Chamaelirium*, *Dipidax*, *Drimia*, *Leucocoryne*, *Massonia*, *Oligobotrya*, *Peliosanthes*, *Thysanotus*, *Tonellia*, *Tupistra*, and *Tulbaghia*.

## 195. PONTEDERIACEÆ.

- A. Perianth funnel-shaped.  
 B. Ovary by abortion 1-celled, 1-ovuled.....1. *Pontederia*.  
 BB. Ovary 3-celled, many-ovuled.....2. *Eichhornia*.  
 AA. Perianth salver-shaped.....3. *Heteranthera*.

## 196. COMMELINACEÆ.

- A. Fr. indehiscent.  
 B. Pericarp hard and brittle.....1. *Polia*.  
 BB. Pericarp succulent or fleshy.....2. *Palisota*.  
 AA. Frs. loculicidally dehiscent.  
 B. Fls. with 3 perfect stamens, and 3 or fewer staminodes.  
 C. Anther-cells parallel and contiguous.  
 D. Ovary 3-celled; 2 anterior cells 1-2-ovuled; posterior 1-ovuled, empty or wanting.....3. *Commelina*.  
 DD. Ovary 2-3-celled; cells usually 2-∞-ovuled.....4. *Aneilema*.  
 CC. Anthers, with variously petaloid connective cells spirally twisted into numerous gyres.....5. *Cochlosoma*.  
 BB. Fls. with 6 stamens, rarely 5, all perfect; no staminodes.  
 C. Anther-cells dehiscing by a terminal pore.....6. *Dichorisandra*.  
 CC. Anthers otherwise dehiscent.  
 D. Connective transversely or divaricately 2-lobed.....7. *Zebrina*.  
 DD. Connective not 2-lobed as in D.  
 E. Ovary-cells 2-5-ovuled.



- F. Cymes fascicle-formed, with the very short rachis contracted into a receptacle, sessile inside the base of the complicate floral lvs. or variously paniculate..... 8. *Tradescantia*.  
 FF. Cyme terminal, pedunculate with 2-3 longish branches secund-fid. from base..... 9. *Tinantia*.  
 EE. Ovary cells 1-ovuled..... 10. *Rhæo*.

## 197. JUNCACEÆ.

- A. Ovary 1-celled, or more or less perfectly 3-celled; placentæ or cells  $\infty$ -ovuled..... 1. *Juncus*.  
 AA. Ovary 3-celled; cells 2- or few-ovuled..... 2. *Prionium*.

## 198. PALMACEÆ.

- A. If-segms. infolded in vernation; spadices interfoliaceous.  
 B. Fls. diœcious.  
 C. Lvs. pinnatisect; segms. acuminate; spathe solitary; ovary of 3 distinct carpels, only 1 maturing; seed deeply grooved ventrally umbilicate, embryo dorsal..... 1. PHŒNIX TRIBE.  
 CC. Lvs. plaited in a fan-shaped fashion, roundish, semi-orbicular or wedge-shaped, split: spathes numerous; ovary entire or 3-lobed, 3-celled, with erect ovules; seeds with a mere dot of a hilum: raphe ventral..... 2. CORYPHA TRIBE.  
 BB. Fls. usually hermaphrodite: lvs. much like those of Corypha Tribe; spathes numerous; ovary entire, 3-lobed, with ascending ovules; seeds with diffused hilum..... 3. BORASSUS TRIBE.  
 EA. Lf-segms. folded back in vernation.  
 B. Seeds adherent to the endocarp; hilum diffused; embryo opposite pore; spadices interfoliaceous; fls. usually monœcious in the same spadix, the lower ones in 3's with the middle one pistillate..... 4. COCOS TRIBE.  
 BB. Seed umbilicate.  
 C. Raphe dorsal; embryo ventral; spadices terminal or axillary; fls. polygamo-monoœcious..... 5. LEPIDOCARYA TRIBE.  
 CC. Raphe ventral; embryo dorsal... 6. ARECA TRIBE.

## 1. Phœnix Tribe.

- The only genus..... 1. *Phœnix*.

## 2. Corypha Tribe.

- A. Style or stigma basilar in fr.; endosperm equable.  
 B. The style short; embryo terminal. Palms fruit once and die..... 2. *Corypha*.  
 BB. The style elongated.  
 C. Embryo dorsal..... 3. *Sabal* [(*Inodes*).]  
 CC. Embryo sub-basilar..... 4. *Washingtonia*.  
 AA. Style or stigma terminal in fruit.  
 B. Perianth of imbricate petals or corolla-segms.  
 C. Fls. polygamo-diœcious; stigmas sessile, distinct; embryo dorsal..... 5. *Chamærops*.  
 DD. Endosperm equable..... 6. *Rhapidophyllum*.  
 CC. Fls. hermaphrodite; styles long, distinct.  
 D. Filaments free..... 7. *Acanthorhiza*.  
 DD. Filaments connate into a tube..... 8. *Trithrinax*.  
 BB. Perianth of valvate petals or corolla-lobes (see also BBB).  
 C. Fls. diœcious; corolla 3-toothed; anthers extrorsely dehiscent..... 9. *Rhapis*.  
 CC. Fls. polygamo-monoœcious; carpels distinct; stigmas distinct, sessile; endosperm equable, ventrally grooved; embryo dorsal..... 10. *Trachycarpus*.  
 CCC. Fls. hermaphrodite.  
 D. Embryo dorsal; endosperm equable: carpels slightly cohering or in *Livistona* sometimes distinct.  
 E. Spadix-branches not sheathed style single, short, 3-cornered..... 11. *Brahea*.  
 EE. Spadix rachis sheathed; carpels 3-cornered; style single, thread-like..... 12. *Licuala*.  
 EEE. Spadix-branches naked or lower ones bracted; carpels globose; styles short, distinct or cohering..... 13. *Livistona*.  
 DD. Embryo, sub-basilar: rachis of spadix sheathed.

- E. Endosperm ruminant: carpels 3, distinct at base; style single, short, 3-grooved..... 14. *Copernicia*.  
 EE. Endosperm equable.  
 F. Corolla-tube  $\infty$  persistent; segms. deciduous; ovary 3-cornered or 3 lobed, narrowed into a style..... 15. *Pritchardia*.  
 FF. Corolla otherwise.  
 G. Carpels free at base; style single, slender, elongated..... 16. *Serenæa*.  
 GG. Carpels slightly cohering; style single, short, 3-grooved..... 17. *Erythea*.

- BBB. Perianth minute 6-fid or obsolete..... 18. *Thrinax* (and *Coccothrinax*).

## 3. Borassus Tribe.

- A. Stamens 6.  
 B. Fls. numerous in the cavities of the spadix..... 19. *Borassus*.  
 BB. Fls. solitary in the cavities..... 20. *Hyphæne*.  
 AA. Stamens numerous.  
 B. Fls. numerous in cavities..... 21. *Lodoicea*.  
 BB. Fls. solitary in cavities..... 22. *Latania*.

## 4. Cocos Tribe.

- A. Palms armed with prickles: fr. 1-seeded; endocarp 3-porous at or above the middle.  
 B. Pistillate fls. with petals united for a considerable distance; staminate fls. smaller: endocarp bony.  
 C. Staminate fls. not immersed in spadix: lf-segms. acuminate..... 23. *Bactris*.  
 CC. Staminate fls. immersed in cavities of spadix: lf-segms. premorse..... 24. *Astrocaryum*.  
 BB. Pistillate fls. with petals connate only at base.  
 C. Staminate fls. immersed; anthers large, inserted: lf-segms. acuminate..... 25. *Acrocomia*.  
 CC. Staminate fls. not immersed; anthers included: lf-segms. wedge-shaped, premorse..... 26. *Martinezia*.  
 AA. Palms unarmed.  
 B. Endocarp 3-porous above middle: fr. 1-3-seeded..... 27. *Elæis*.  
 BB. Endocarp bony and, except in *Jubæa*, 3-6-porous toward base: fr. 1- $\infty$ -seeded.  
 C. Spadix simple..... 28. *Diplolathium*.  
 CC. Spadix simply branched.  
 D. Number of stamens 6: fr. 1-seeded (in *Scheelea* sometimes 2-3-seeded).  
 E. Petals minute, much smaller than exerted stamens of staminate fls..... 29. *Mazilia*.  
 EE. Petals lanceolate; stamens included..... 30. *Cocos*.  
 EEE. Petals shaped like a long club, or cylindrical; stamens shorter..... 31. *Scheelea*.  
 DD. Number of stamens 10-24 or more; petals of staminate fls. lanceolate; stamens included; anther-cells connate.  
 E. Fr. 2-6-seeded..... 32. *Attalea*.  
 EE. Fr. 1-seeded; the endocarp 3-porous at the middle or a little lower..... 33. *Jubæa*.

## 5. Lepidocarya Tribe.

- A. Lvs. fan-shaped; ovary perfectly 3-celled..... 34. *Mauritia*.  
 AA. Lvs. equally pinnatisect; ovary imperfectly 3-celled; spadices axillary.  
 B. Palms fruit once and die..... 35. *Plectocomia*.  
 BB. Palms fruit more than once; usually climbers.  
 C. Spathes solitary, deciduous: lf-segms. rhombic; nerves fan-shaped..... 36. *Ceratolobus*.  
 CC. Spathes numerous, persistent; lf-segms. acuminate; nerves parallel.  
 D. Spadices contracted; spathes cymbiform, beaked, long-persistent, the 2 lower ones forming an involucre for the others..... 37. *Dæmonorops*.  
 DD. Spadices diffused, or, if contracted, the spathes are flat and persistent only during anthesis..... 38. *Calamus*.

## 6. Areca Tribe.

## Key to Subtribes;

- A. Petals of the pistillate fls. valvate throughout nearly their whole length; spadices interfoliaceous; spathes 2 or more; ovary entire, 3-celled..... 1. *CARYOTIDEÆ*.  
 AA. Petals of the pistillate fls. overlapping or valvate only at apex, very rarely valvate throughout.  
 B. Spadices infralioleaceous.  
 C. Stigmas terminal in fr.; ovary entire, 1-celled.  
 D. Staminate fls. unsymmetrical; sepals usually small and not imbricate..... 2. *EUARECEÆ*.

- DD. Staminate fls. symmetrical; sepals usually roundish and widely overlapping. . . . . 3. *PTYCHOSPERMEÆ*.
- CC. Stigmas usually excentric or lateral on ovary, entire or 3-lobed; lf-segms. acuminate. . . . . 4. *ONCOSPERMEÆ*.
- DD. Spathes 2; ovary entire. . . . . 5. *IRIARTEÆ*.
- EE. Ovary deeply 3-lobed, with large stigmas; spadices club-shaped. . . . . 6. *WETTINIEÆ*.
- BB. Spadices nearly always interfoliateous. . . . . 7. *LINOSPADICEÆ*.
- C. Stigmas terminal on fr., rarely basal. . . . . 8. *CEROXYLEÆ*.
- D. Ovary 1-celled; spadix simple, with monœcious fls. immersed in cavities. . . . . 9. *MALORTIEÆ*.
- DD. Ovary 3-celled, imperfectly so in Subtribe 8. . . . . 10. *IGUANUREÆ*.
- E. Fr. globose; spadix paniculately branched, the fls. dioecious and pedicelled. . . . . 11. *CHAMÆDORÆÆ*.
- EE. Fr. elongated; spadix subdigitately branched, the fls. monœcious and not immersed. . . . . 12. *GEONOMEÆ*.
- CC. Stigmas lateral or basal on fr., rarely terminal; ovary entire. . . . . 13. *CARYOTIDEÆ*.
- D. Fls. not immersed in cavities. . . . . 14. *CARYOTIDEÆ*.
- E. Spathes 2; all the fls. or the lower ones in 3's; ovary 1-3-celled. . . . . 15. *CARYOTIDEÆ*.
- EE. Spathes numerous; ovary 3-celled; spadices inter- and infrafoliateous; fls. usually dioecious, without bracts or bractlets; perianth rather fleshy or leathery. . . . . 16. *CARYOTIDEÆ*.
- DD. Fls. immersed in cavities, monœcious or dioecious, compressed; perianth glumaceous; style often elongated, terminal or lateral. . . . . 17. *CARYOTIDEÆ*.
- Subtribe 1. Caryotideæ.
- A. Lvs. bipinnatisect; endosperm ruminate; staminate fls. with 3 sepals and stamens. . . . . 39. *Caryota*.
- AA. Lvs. pinnatisect; endosperm equable. . . . . 40. *Wallichia*.
- B. Stamens 6; calyx of staminate fls. tubular, truncate. . . . . 41. *Didymosperma*.
- BB. Stamens ∞. . . . . 42. *Arenga*.
- C. Calyx of staminate fls. cup-shaped, 3-lobed. . . . . 43. *Arenga*.
- CC. Calyx of staminate fls. of 3 sepals. . . . . 44. *Arenga*.
- Subtribe 2. Euareceæ.
- A. Ovule basal, erect. . . . . 45. *Kentia*.
- B. Endosperm ruminate. . . . . 46. *Hydriastele*.
- C. Stamens 3 or 6; staminate fls. minute, numerous, solitary or in pairs, on branches of spadix; pistillate fls. much larger, solitary toward base of branches. . . . . 47. *Veitchia*.
- CC. Stamens numerous; fls. in 3's, the middle one pistillate, arranged in 2, 4 or 6 ranks. . . . . 48. *Nenga*.
- BB. Endosperm equable; stamens 6; fls. in 3's, the middle one pistillate, arranged in 4 ranks. . . . . 49. *Kentia*.
- AA. Ovule parietal, more or less pendulous. . . . . 50. *Archontophoenix*.
- B. Fls. arranged in 4 ranks on branches of spadix. . . . . 51. *Rhopalostylis*.
- BB. Fls. arranged spirally on branches of spadix. (All "sepals" mentioned under BB refer to sepals of staminate fls. except when otherwise stated.) . . . . . 52. *Dictyosperma*.
- C. Pistillate fls. much larger than staminate; sepals papery, connate at base. . . . . 53. *Hedyscepe*.
- CC. Pistillate fls. not larger than staminate. . . . . 54. *Dictyosperma*.
- D. Length of sepals far surpassing petals; sepals narrow. . . . . 55. *Dictyosperma*.
- DD. Length of sepals not exceeding petals. . . . . 56. *Dictyosperma*.
- E. The sepals overlapping. . . . . 57. *Dictyosperma*.
- F. Sepals triangular-orbicular; stamens numerous; filaments short. . . . . 58. *Dictyosperma*.
- FF. Sepals small, keeled; stamens 9-24; filaments inflexed at apex. . . . . 59. *Dictyosperma*.
- EE. The sepals not overlapping. . . . . 60. *Dictyosperma*.
- F. Filaments inflexed at apex. . . . . 61. *Dictyosperma*.
- G. Sepals awl-shaped or lanceolate; stamens 6-12; pistillate fls. with short petals valvate at apex. . . . . 62. *Dictyosperma*.
- GG. Sepals small, acute; stamens 6; pistillate fls. with petals a little longer than the sepals. . . . . 63. *Dictyosperma*.

- FF. Filaments normal; sepals narrowly lanceolate; stamens 9-12; pistillate fls. with petals like the sepals. . . . . 53. *Hedyscepe*.

## Subtribe 3. Ptychospermeæ.

- A. Endosperm ruminate. . . . . 54. *Ptychosperma*.
- B. Stamens 20-30. . . . . 55. *Rhopaloblaste*.
- BB. Stamens 6. . . . . 56. *Drymophlaeus*.
- AA. Endosperm equable. . . . . 57. *Drymophlaeus*.
- B. Lf-segms. obliquely premorse; stamens numerous. . . . . 58. *Drymophlaeus*.
- BB. Lf-segms. narrowed at apex, or in *Cyrtostachys* entire or sometimes obliquely 2-toothed. . . . . 59. *Cyrtostachys*.
- C. Stamens 6-15; pericarp slightly fibrous, smooth inside. . . . . 60. *Cyrtostachys*.
- CC. Stamens 6; pericarp thick, granular, fibrous inside. . . . . 61. *Cyrtostachys*.

## Subtribe 4. Oncospermeæ.

- A. Staminate fls. symmetrical; sepals broad and much overlapping; stigmas on fr. excentric or lateral, or in *Cyphosperma* subterminal. . . . . 62. *Cyphosperma*.
- B. Perianth of pistillate fls. enlarged after anthesis. . . . . 63. *Cyphosperma*.
- C. Pericarp grumose and fibrous. . . . . 64. *Cyphosperma*.
- CC. Pericarp thin, leathery or bony. . . . . 65. *Cyphosperma*.
- BB. Perianth not changed after anthesis. . . . . 66. *Cyphosperma*.
- AA. Staminate fls. unsymmetrical; sepals small or narrow, not imbricate or only slightly so; stigmas lateral on fr. or basal. . . . . 67. *Cyphosperma*.
- B. Petals of pistillate fls. connate at base, valvate above. . . . . 68. *Cyphosperma*.
- C. Calyx of staminate fls. united at base. . . . . 69. *Cyphosperma*.
- CC. Calyx with 3 distinct sepals. . . . . 70. *Cyphosperma*.
- BB. Petals free. . . . . 71. *Cyphosperma*.
- C. Anthers erect. . . . . 72. *Cyphosperma*.
- CC. Anthers versatile. . . . . 73. *Cyphosperma*.
- D. Fr. globose; palms unarmed. . . . . 74. *Cyphosperma*.
- DD. Fr. minute; palms spiny. . . . . 75. *Cyphosperma*.

## Subtribe 5. Iriarteæ.

- Stamens 9-15; stigmas terminal or nearly so in fr.; lf-segms. turned in every direction. . . . . 67. *Iriarteæ*.

## Subtribe 6. Wettinieæ.

- No representatives known to be cultivated in America.

## Subtribe 7. Linospadiceæ.

- A. Anthers basifixed, erect. . . . . 68. *Bacularia*.
- B. Stamens 6, 10, or 12; pistillate fls. have ∞ staminodes; lf-segms. premorse. . . . . 69. *Howea*.
- BB. Stamens very numerous; pistillate fls. have no staminodes; lf-segms. acuminate. . . . . 70. *Linospadix*.
- AA. Anthers dorsifixed, versatile; staminodes in pistillate fls. 6-9; lf-segms. acuminate. . . . . 71. *Linospadix*.

## Subtribe 8. Ceroxyleæ.

- Stamens 9-15; fr. with basal stigmas. . . . . 71. *Ceroxylon*.

## Subtribe 9. Malortieæ.

- Not cultivated in America.

## Subtribe 10. Iguanureæ.

- A. Stigmas excentric or lateral on fr. . . . . 72. *Heterospathes*.
- AA. Stigmas basal or nearly so on fr. . . . . 73. *Stevensonia*.
- B. Stamens 15-20; ovary 1-celled; palm armed. . . . . 74. *Verschoffia*.
- BB. Stamens 6, with didymous anthers. . . . . 75. *Dypsis*.
- C. Ovary 1-celled; palm unarmed. . . . . 76. *Dypsis*.
- CC. Ovary 3-celled; palm unarmed. . . . . 77. *Dypsis*.

## Subtribe 11. Chamædoreæ.

- A. Fls. dioecious or monœcious in different spadices, spirally arranged. . . . . 76. *Chamædorea*.
- AA. Fls. monœcious in the same spadix. . . . . 77. *Chamædorea*.
- B. The fls. arranged in elongated heaps or clusters. . . . . 78. *Gaussia*.
- C. Infl. from among the lvs. . . . . 79. *Hyophorbe*.
- CC. Infl. from below the lvs. . . . . 80. *Roscheria*.
- BB. The fls. sparse, solitary or in pairs. . . . . 81. *Roscheria*.



## Subtribe 12. Geonomeæ.

- A. Base of the ovary included in the disk.  
 B. Anthers arrow-shaped.....80. *Calyptrone*.  
 BB. Anthers with long separate pendulous cells.....81. *Geonoma*.  
 AA. Disk 0: many-stemmed palms of India.....82. *Bentinckia*.

## Imperfectly Known Genera of Palms.

83. *Balaka* is a member of the Areca Tribe and probably belongs between *Ptychosperma* and *Drymophloeus*, differing from those genera as indicated in the article *Balaka*.  
 84. *Bismarckia* is a member of the Borassus Tribe.  
 85. *Chrysalidocarpus* is a well-known member of the Areca Tribe of doubtful affinity.  
 86. *Exorrhiza* is a member of the Areca Tribe, Subtribe Euareceæ.  
 87. *Nipa* is a member of the Areca Tribe but of uncertain affinity. Its nearest horticultural relative is *Phoenix*.  
 88. *Phytelephas* is a well-known member of the Areca Tribe but of doubtful affinity.  
 89. *Pseudophoenix* is a member of the Areca Tribe which probably belongs in the Subtribe Chamædoreæ, near *Hyophorbe*.  
 90. *Ptychoraphis* is a member of the Areca Tribe which probably comes after *Ptychosperma*.  
 91. *Ranevea* is known only in the juvenile state and is conjectured to be near to *Hyophorbe*.

The following genera are also treated: *Acoelorrhaphe*, *Cyphokentia*, *Desmoneus*, *Eremospatha*, *Hyospatha*, *Manicaria*, *Metroxylon*, *Microphœnix*, *Neonicholsonia*, *Enocarpus*, *Pigafetta*, *Ptychococcus*, *Synechanthus*, *Teyssmannia*, *Welfia* and *Zalacca*.

## 199. LEMNACEÆ.

- Floating plants with roots: fls. inserted on marginal cracks of the frond; stamens 1-2; anthers 2-celled.....*Lemna*.

## 200. PANDANACEÆ.

- A. Ovules solitary in carpels.....1. *Pandanus*.  
 AA. Ovules many in the locules.....2. *Freycinetia*.

## 201. CYCLANTHACEÆ.

- A. Plants with watery juice.....1. *Carludovica*.  
 AA. Plants with milky juice.....2. *Cyclanthus*.

## 202. TYPHACEÆ.

- The only genus.....*Typha*.

## 203. ARACEÆ.

- A. Perianth 0 (except female fls. of *Peltandra*).  
 B. Fls. monocious (in *Arisæma* sometimes dioecious).  
 C. Spadix appendaged (except in *Pistia*).  
 D. The male and female infl. contiguous with no neutral organs between: ovules anatroplus or semi-anatroplus.....1. *Amorphophallus*.  
 DD. The upper fls. males, lower ones females: ovules orthotroplus.  
 E. The spadix free from the spathe or adnate at the base.  
 F. Male fls. sparse: lvs. and fls. appear together.  
 G. Tube of spathe with connate margins; male fls. with 1 stamen; anthers horseshoe-shaped.....2. *Arisarum*.  
 GG. Tube of spathe convolute; fls. usually dioecious; males with 2-5 stamens.....3. *Arisæma*.  
 FF. Male fls. dense: lvs. often appear before fls.  
 G. Tube of spathe with connate margins.  
 H. Ovule solitary: lvs. entire.....4. *Biarum*.  
 HH. Ovules 2-4: lvs. pedatisect.....5. *Saurontum*.  
 GG. Tube of spathe convolute.  
 H. Ovules ∞, parietal, in 2 series.....6. *Arum*.  
 HH. Ovules few, inserted at base and apex of cell.  
 I. Male and female fls. remote; appendix of spadix hairy.....7. *Helicodieros*.  
 II. Male and female fls. contiguous.....8. *Dracunculus*.  
 EE. The spadix not appendaged, adnate to spathe on back: aquatic plant... 9. *Pistia*.

- EEE. The tube of spathe closed at mouth by dilation of spadix or else divided into 2 cells.  
 F. Tube closed at throat.....10. *Pinellia*.  
 FF. Tube 2-celled.....11. *Ambrosinia*.  
 CC. Spadix not appendaged (rarely with a naked appendage or endowed with neutral organs); upper fls. males, lower ones females.  
 D. Stamens connate in a prismatic or peltate body.  
 E. Plants are climbing shrubs.  
 F. Ovaries distinct, 2-10-celled.....12. *Philodendron*.  
 FF. Ovaries coherent, 1-2-celled.....13. *Syngonium*.  
 EE. Plants are herbs, not climbing.  
 F. The ovules orthotroplus or nearly so: micropyle superior.  
 G. Ovules numerous in 2 series on 3-5 parietal placentæ.....14. *Colocasia*.  
 GG. Ovules few, basal.....15. *Alocasia*.  
 GGG. Ovules 1 or few, subparietal: distinguished by ovary immersed in a carp and embryo not albuminous.....16. *Peltandra*.  
 FF. The ovules anatroplus or semi-anatroplus: micropyle inferior.  
 G. Ovaries distinct or slightly coherent.....17. *Caladium*.  
 GG. Ovaries distinct below, above thick, dilated and grown together.....18. *Xanthosoma*.  
 GGG. Ovary 2-5-celled.....19. *Dieffenbachia*.  
 DD. Stamens distinct.  
 E. Fr. not included by tube of spathe: the whole spathe deciduous, marcescent.  
 F. Ovule affixed to intruded placentæ: lvs. ovate.....20. *Aglaonema*.  
 FF. Ovule affixed near top of cell: lvs. broadly arrow-shaped.....21. *Nepenthes*.  
 EE. Fr. included by accrescent tube of spathe: blade of spathe marcescent, deciduous.....22. *Zantedeschia*.  
 EEE. Fr. included by spathe, blade of which is persistent.....23. *Homalomena*.  
 EEEE. Fr. girt by the top-shaped tube of spathe, which has a circumscissile, deciduous blade.....24. *Schismatoglottis*.  
 BB. Fls. hermaphrodite.  
 C. Plants marsh herbs.....25. *Calla*.  
 CC. Plants are scandent shrubs.  
 D. Ovules 2 in a cell, affixed to base of septum.....26. *Monstera*.  
 DD. Ovules solitary, basal.....27. *Scindapsus*.  
 DDD. Ovules numerous.....28. *Rhaphidophora*.  
 DDDD. Ovules 3 or 4 in a cell.....29. *Stenospermotrium*.  
 AA. Perianth of 4-8 distinct segms.; fls. all hermaphrodite.  
 B. Spadix flowering downward; spathe long, often twisted, long-persistent.....30. *Cyrtosperma*.  
 BB. Spadix flowering upward.  
 C. Spathe sheathing the very long pedunculate stipe of the spadix, with blade incomplete or 0.  
 D. Ovary 1-celled; ovules solitary, semi-anatroplus.....31. *Orontium*.  
 DD. Ovary 2-celled; ovules 1-2 in a cell, orthotroplus.....32. *Lysichiton*.  
 DDD. Ovary 1-2-celled; ovule 1 in each cell, suspended.....33. *Symplocarpus*.  
 DDDD. Ovary imperfectly 1-2-celled; ovule solitary, affixed to interior angle of cell.....34. *Dracontium*.  
 CC. Spathe provided with scale-like appendages in the tube, long-persistent: ovules semi-anatroplus or campylotroplus.....35. *Spathyema*.  
 CCC. Spathe leafy, accrescent, persistent, quite flattened out: ovules anatroplus.....36. *Spathiphyllum*.  
 CCCC. Spathe open, recurved or reflexed, accrescent, persistent: ovules various.....37. *Anthurium*.  
 CCCC. Spathe accrescent, persistent or obsolete: ovules anatroplus.....38. *Pothos*.  
 CCCCC. Spathe obsolete or obscure: ovules orthotroplus.....39. *Acorus*.

## Additional Key to the Araceæ.

The Araceæ are likely to be so difficult for the gardener that an additional key, based on other contrasts, is here inserted for his convenience.

- A. Plants free-swimming, aquatic.....*Pistia*.  
 AA. Plants not free-swimming aquatics, terrestrial or marsh plants.  
 B. Lvs. parallel-veined (see also *Calla* and *Acorus*).  
 C. Plant shrub-like or climbing: st. more or less aerial: stamens of staminate fl. separate.

- D. Blade of spathe deciduous; spathe constricted in middle, leaving a long tube when blade falls. .... *Schismato-glottis*.
- DD. Blade of spathe persistent, at least until ripening of spadix. .... *Homalomena*.  
*Philodendron*.
- CC. Plant with st. upright, aerial; stamens united into a synandrium.
- D. Pistillate fls. crowded, without staminodia; staminate fls. with only 2-3 separate stamens. .... *Aglaonema*.
- DD. Pistillate fls. with staminodia interspersed; staminate fls. with 3-4 united stamens. .... *Dieffenbachia*.
- CCC. Plant with st. subterranean.
- D. Seeds orthotropous or nearly so: the connate staminodia of the pistillate fl. forming an involucre around the gynoceum. .... *Peltandra*.
- DD. Seeds anatropous: staminodia of pistillate fls. separate. .... *Zantedeschia*.
- BB. Lvs. netted-veined (i.e. veins of 2nd, 3rd, and 4th order netted).
- C. Milk-tubes absent.
- D. Raphides absent (raphides are acicular crystals found in bundles in the plant-cell).
- E. Lvs. differentiated into petiole and blade: seeds anatropous.
- F. Seeds without endosperm. .... *Pothos*.  
*Anthurium*.
- FF. Seeds with endosperm. .... *Acorus*.
- EE. Lvs. without distinction into petiole and blade: seeds orthotropous. .... *Acorus*.
- DD. Raphides present in ground tissue of st. and lvs.
- E. Fls. without perianth; spathe deciduous before ripening of spadix: plants mostly climbing.
- F. Seeds with endosperm and axial embryo.
- G. Foliage-lvs. many on each shoot. .... *Stenospermation*.
- GG. Foliage-lvs. 1 on each shoot in addition to several bracts. .... *Raphidophora*.
- FF. Seeds without endosperm.
- G. Ovary 2-celled. .... *Monstera*.
- GG. Ovary 1-celled. .... *Scindapsus*.
- EE. Fls. with perianth; spathe not deciduous: sub-shrubs. .... *Spathiphyllum*.
- CC. Milk-tubes present in fibro-vascular bundles.
- D. The milk-tubes branched; veins of 2nd grade fusing into a collective vein between veins of 1st grade.
- E. Seeds with endosperm: st. not climbing.
- F. Ovary with basal placenta. .... *Alocasia*.
- FF. Ovary with parietal placenta. .... *Colocasia*.
- FFF. Ovary with broad, nearly central placenta.
- G. Style small. .... *Caladium*.
- GG. Style disk-like, projecting beyond ovary. .... *Xanthosoma*.
- EE. Seeds without endosperm: st. climbing. .... *Synгонium*.
- DD. The milk-tubes simple, straight; veins not as above.
- E. Perianth present; fls. bisexual.
- F. Lvs. not arrow-shaped.
- G. Ovary 2-celled; 2 ovules in each cell, suspended from middle of partition. .... *Lysichitum*.
- GG. Ovary 1-celled, 1-ovuled.
- H. Ovule from apex of cell: spadix short, nearly globose. .... *Symplocarpus*.
- HH. Ovule basal: spadix cylindrical. .... *Orontium*.
- FF. Lvs. arrow-shaped.
- G. Plants are shrubs with climbing or creeping sts.: petioles and sts. usually prickly or warty. .... *Cyrtosperma*.
- GG. Plants tuberous. .... *Dracontium*.
- EE. Perianth absent; fls. unisexual (bisexual in *Calla*).
- F. Fls. bisexual: lvs. not arrow-shaped. *Calla*.
- FF. Fls. unisexual: lvs. various.
- G. Spadix with a sterile terminal appendage, or with sterile wings: sts. various.
- H. Seeds without endosperm. .... *Amorphophallus*.
- HH. Seeds with endosperm.
- I. Appendage of spadix projecting much beyond the spathe, or included and free.
- J. Spadix with rudimentary fls. between the fertile staminate and fertile pistillate fls., or staminate infl. bordering immediately on the pistillate infl.
- K. Placenta parietal: lvs. arrow-shaped or lanceolate. .... *Arum*.
- KK. Placenta apical and basal: lvs. pedately divided.
- L. Fertile staminate infl. bordering immediately on the pistillate infl. .... *Dracunculus*.
- LL. Fertile staminate infl. separated from pistillate infl. by many rudimentary fls. .... *Helicodiceros*.
- KKK. Placenta basal.
- L. Lvs. pedately divided: seeds 2 or more. .... *Sauromatum*.
- LL. Lvs. ovate, lanceolate or linear: seeds mostly 1. .... *Biarum*.
- JJ. Spadix without rudimentary fls., but a space between the staminate and pistillate fls., or unisexual.
- K. Ovary with many ovules.
- L. Staminate fls. of 1 stamen: lvs. ovate or arrow-shaped: spadix bisexual. .... *Arisarum*.
- LL. Staminate fls. of 2-5 stamens: lvs. 3- or many-parted: spadix unisexual. .... *Arisæma*.
- KK. Ovary 1-ovuled: staminate and pistillate portions of spadix separated by a partition which reaches out from wall of spathe. .... *Pinellia*.
- II. Appendages of the spadix wing-like on the 2 sides, thus dividing the bilabiate spathe into 2 chambers, the anterior of which contains a staminate fl., the posterior a pistillate fl. .... *Ambrosinia*.
- GG. Spadix without such appendage or wings: sts. subterranean, creeping. .... *Nephtylis*.
- Other genera described are *Calloopsis*, *Cryptocoryne*, *Epipremnum*, *Gamogyne*, *Gymnostachys*, *Staurostigma*, *Typhonium* and *Typhonodorum*.

## 204. ALISMACEÆ.

- A. Carpels inserted in a whorl on a small receptacle. .... 1. *Alisma*.
- AA. Carpels densely crowded in many series on a large oblong or globose receptacle. .... 2. *Sagittaria*.

## 205. BUTOMACEÆ.

- A. Petals marcescent; stamens 9; carpels 6. .... 1. *Butomus*.
- AA. Petals deciduous; stamens numerous; carpels 15-20. .... 2. *Limnorchis*.

## 206. NAIADACEÆ.

- A. Fls. hermaphrodite, spicate; perianth 4-divided; stamens 2 or 4. .... 1. *Potamogeton*.
- AA. Fls. unisexual, axillary; perianth 0; stamens 1. .... 2. *Zannichellia*.

## 207. APONOGETONACEÆ.

- The only genus. .... *Aponogeton*.



## 208. CYPERACEÆ.

- A. Fls. strictly unisexual; female inclosed in a flask-shaped or bag-shaped scale or glume (perigynium)..... 1. *Carex*.
- AA. Fls. bisexual, rarely unisexual, not inclosed as above.
- B. With several (2 to many) of the lower scales empty.
- C. Spikelets few-fld. (usually 1-2, rarely, 3-6-fld.)..... 2. *Rhynchospora*.
- CC. Spikelets many-fld.
- D. St. leafy..... 3. *Hypolytrum*.
- DD. St. not leafy or only at base..... 4. *Mapania*.
- BB. With only 1 or 2 of the lower scales empty.
- C. Scales 2-ranked.
- D. Perianth 0..... 5. *Cyperus*.
- DD. Perianth of 8 setæ..... 6. *Dulichium*.
- CC. Scales many-ranked, overlapping.
- D. Perianth of 3-8, rarely 0, setæ.
- E. Style persistent, thickened and bulb-like at base..... 7. *Eleocharis*.
- EE. Style not or hardly thickened at base..... 8. *Scirpus*.
- DD. Perianth of many setæ, very long-exserted after anthesis, becoming wavy or cottony..... 9. *Eriophorum*.

## 209. GRAMINEÆ.

## I. Summary of the Tribes.

## Subfamily I. PANICOIDEÆ.

Spikelets 1-, rarely 2-fld.; the terminal fl. perfect, the lower staminate or neuter; rachilla articulated below the glumes, the more or less dorsally compressed spikelets falling from the pedicels entire, singly, in groups, or together with joints of an articulate rachis.

- A. Spikelets unisexual, the male and female spikelets in different infl. on the same plant or in different parts of the same infl.; awnless..... 1. INDIAN CORN [TRIBE, OR MAYDEÆ.
- AA. Spikelets perfect, sometimes with male or neutral ones intermixed.
- B. Lemma and palea hyaline, the glumes more or less indurated; spikelets in 2's or 3's on the usually articulate axis of a spike-like raceme, 1 sessile and perfect, usually awned, the other pedicelated and perfect, staminate or rudimentary..... 2. SORGHUM TRIBE, OR ANDROPOGONEÆ.
- BB. Lemma and palea more or less indurated, firmer in texture than the glumes; spikelets all perfect; first glume sometimes obsolete..... 3. MILLET TRIBE, OR PANICEÆ.

## Subfamily II. POACOIDEÆ.

Spikelets 1- to many-fld., the imperfect or rudimentary floret, if any, usually uppermost; rachilla usually articulated above the glumes which are persistent on the pedicel or rachis after the fall of the florets; when 2- to many-fld., a manifest internode of the rachis separating the florets, and articulated below them; spikelets more or less laterally compressed.

- A. Culms not woody and perennial.
- B. Infl. paniculate, the spikelets pedicelated, not sessile on opposite sides of a jointed flattened axis, forming spikes, nor sessile along one side of a slender continuous axis.
- C. Spikelets 1-fld., the rachilla sometimes continued as a minute bristle behind the palea (or in Phalaridæ a pair of rudimentary or male florets below the perfect one).
- D. Spikelets falling entire; glumes usually obsolete or nearly so... 4. RICE TRIBE, OR [ORYZÆÆ.
- DD. Spikelets persistent; glumes present.
- E. Floret with 2 minute scales (rudimentary lemmas) or 2 small male florets attached at the base and falling with it..... 5. CANARY-GRASS [TRIBE, OR PHALARIDÆÆ.
- EE. Floret with no scales attached below; glumes usually subequal; lemma awned or awnless..... 6. RED-TOP TRIBE, OR [AGROSTIDÆÆ.
- CC. Spikelets 2- to many-fld.
- D. Glumes longer than the first floret; spikelets 2- to several-fld.; 1 or more of the florets usually awned from the back or from between the teeth of a bifid apex..... [AVENÆÆ.
7. OAT TRIBE, OR
- DD. Glumes shorter than the first floret; spikelets 2- to many-fld.; awns when present terminal or nearly so..... 8. FESCUE TRIBE, OR [FESTUCÆÆ.
- BB. Infl. spicate.
- C. Spikelets sessile or subsessile in 1-sided spikes, 1- to few-fld.; spikes solitary, or digitately or racemously arranged..... 9. CHLORIS TRIBE, OR [CHLORIDÆÆ.
- CC. Spikelets sessile on opposite sides of a zigzag jointed channeled axis forming a spike; 1- to several-fld..... 10. BARLEY TRIBE, OR [HORDEÆÆ.
- AA. Culms woody, tree-like; fl.-blades articulated with the sheaths..... 11. BAMBOO TRIBE, OR [BAMBUSÆÆ.

## II. Key to the Tribes.

## 1. Indian Corn Tribe, or Maydeæ.

- A. Male spikelets in a terminal panicle; female spikelets in spikes or ears in the axils of the lvs.
- B. Female spikelets sunken in cavities of a jointed readily disarticulating axis..... 1. *Euchlæna*.
- BB. Female spikelets crowded in rows on a thickened continuous axis (the cob)..... 2. *Zea*.
- AA. Male and female spikelets in the same infl., the male at the end of the spikes.
- B. Spikes digitate, the axis of the female portion bony indurated, disarticulating with spikelets attached..... 2. *Tripsacum*.
- BB. Spikes paniculate, the female spikelets inclosed in ovoid pearly or grayish bead-like bodies, the male portion protruding from a small orifice of the bead..... 4. *Coix*.

## 2. Sorghum Tribe, or Andropogoneæ.

- A. Spikelets all alike, perfect.
- B. Axis of racemes continuous, the spikelets deciduous; panicle fan-shaped..... 5. *Miscanthus*.
- BB. Axis of racemes jointed, readily disarticulating with the spikelets attached.
- C. The spikelets awnless..... 6. *Saccharum*.
- CC. The spikelets awned..... 7. *Erianthus*.
- AA. Spikelets not all alike, the sessile perfect, the pedicelated male or neuter.
- B. Lower 1 or 2 pairs of spikelets unlike the upper pairs; racemes in pairs from boat-shaped sheaths on the ultimate branches of an elongated infl..... 8. *Cymbopogon*.
- BB. Lower pairs of spikelets like the upper.
- C. Infl. consisting of 1 to many racemes, these digitate or racemose along a short axis..... 9. *Andropogon*.
- CC. Infl. compound, paniculate.
- D. Racemes many-fld., linear, naked at base, numerous, arranged in whorls on an elongated axis..... 10. *Vetiveria*.
- DD. Racemes reduced to 2 or 3 spikelets, arranged in a compound panicle..... 11. *Holcus*.

## 3. Millet Tribe, or Paniceæ.

- A. Axis broad and corky, the spikelets sunken in its cavities..... 12. *Stenotaphrum*.
- AA. Axis not broad and corky, spikelets not sunken in its cavities.
- B. Spikelets not subtended or surrounded by bristles.
- C. Glumes and lemmas awnless, the apex of the palea inclosed in the enfolding lemma..... 13. *Panicum*.
- CC. Glumes or lemmas, or both, awned or awn-tipped.
- D. Second glume and sterile lemma tapering into an awn or point, coarsely hispid; palea free at the summit; spikelets crowded..... 14. *Echinochloa*.
- DD. Second glume and sterile lemma awned from a 2-lobed apex.
- E. Infl. of 1-sided racemes along a common axis; spikelets pubescent but not silky; palea inclosed at summit..... 15. *Opismenus*.
- EE. Infl. paniculate; spikelets covered with long silky hairs..... 16. *Tricholæna*.
- BB. Spikelets subtended or surrounded by bristles.
- C. Bristles persistent, not falling with the spikelets at maturity..... 17. *Setaria*.
- CC. Bristles falling attached to the spikelet..... 18. *Pennisetum*.

## 4. Rice Tribe, or Oryzæ.

- A. Spikelets unisexual, the female awned, erect at the summit of the panicle, the male awnless, nodding on the lower branches..... 19. *Zizania*.
- AA. Spikelets perfect, strongly flattened..... 20. *Oryza*.

## 5. Canary-Grass Tribe, or Phalarideæ.

- A. Glumes strongly compressed; sterile lemmas rudimentary.....21. *Phalaris*.  
 AA. Glumes not strongly compressed; sterile lemmas not rudimentary.  
 B. Sterile lemmas awned; glumes very unequal.....22. *Anthoxanthum*.  
 BB. Sterile lemmas awnless; glumes nearly equal.....23. *Hierochloë*.

## 6. Red-Top Tribe, or Agrostideæ.

- A. Lemma indurated, or at least firmer than the glumes.  
 B. Panicle spike-like; spikelets flattened, awnless.....24. *Ammophila*.  
 BB. Panicle not spike-like; spikelets not flattened, awned.  
 C. Floret oblong and with a sharp callus at base; awn stout, geniculate, twisted, persistent.....25. *Stipa*.  
 CC. Floret ovate, the callus blunt; awn slender, more or less deciduous.....26. *Oryzopsis*.  
 AA. Lemma of about the same texture as the glumes or more delicate.  
 B. Spikelets crowded in dense spike-like panicles or heads.  
 C. Heads oval, very woolly.....27. *Lagurus*.  
 CC. Heads cylindrical, not woolly.....28. *Phleum*.  
 BB. Spikelets not crowded in dense heads or spikes.  
 C. Lemma and palea much more delicate and shorter than the glumes, the palea shorter than the lemma, often wanting.....29. *Agrostis*.  
 CC. Lemma and palea of about the same texture as the glumes and as long or longer.  
 D. Rachilla not continued beyond the base of the floret; lemma awned from the tip or awnless.  
 E. The lemma awned or sharp-pointed, longer than the body of the awned or awnless glumes.....30. *Muehlenbergia*.  
 EE. The lemma not awned or sharp-pointed.  
 F. Nerves of lemma 1.....31. *Sporobolus*.  
 FF. Nerves of lemma 3-5.....32. *Calamovilfa*.  
 DD. Rachilla prolonged beyond the floret as a plumose bristle; lemmas awned on the back and silky hairy at base.....33. *Calamagrostis*.

## 7. Oat Tribe, or Aveneæ.

- A. Plants low, delicate; spikelets minute.....34. *Aira*.  
 AA. Plants 1 ft. or more high.  
 B. Articulation below the glumes, the spikelets falling entire from the pedicels.  
 C. Glumes much exceeding the 2 florets, the upper floret with a hook-like awn.....35. *Notholcus*.  
 CC. Glumes exceeded by the upper floret, both florets awnless.....36. *Sphenopholis*.  
 BB. Articulation above the glumes, these persistent after the fall of the florets.  
 C. Spikelets 1 in. or more long, nodding, in an open panicle; florets all alike.....37. *Avena*.  
 CC. Spikelets about  $\frac{1}{4}$  in. long, erect in a narrow panicle; lower floret staminate.....38. *Arrhenatherum*.

## 8. Fescue Tribe, or Festuceæ.

- A. Rachilla or lemma bearing long hairs as long as the lemma; tall reeds.  
 B. Spikelets unisexual; male and female spikelets on separate plants.  
 C. Lemmas much shorter than the glumes; sts. leafy throughout.....39. *Gynierium*.  
 CC. Lemmas with elongated delicate tips; lvs. crowded at the base.....40. *Cortaderia*.  
 BB. Spikelets perfect.  
 C. Lemmas hairy; rachilla naked.....41. *Arundo*.  
 CC. Lemmas naked; rachilla hairy.....42. *Phragmites*.  
 AA. Rachilla or lemma glabrous or hairy, but the hairs shorter than the lemmas.  
 B. Spikelets of 2 kinds, perfect and sterile, in the same panicle.  
 C. Fertile spikelets awnless, the sterile awned; panicle spike-like.....43. *Cynosurus*.  
 CC. Fertile spikelets awned, the sterile awnless; panicle 1-sided, the fascicled spikelets not ling.....44. *Lamarckia*.  
 BB. Spikelets all alike in the same infl.  
 C. Lemmas 1-3-nerved.  
 D. The spikelets subterete, loosely 2-4-fld.....45. *Molinia*.  
 DD. The spikelets compressed, densely, usually many-fld.  
 E. Florets membranaceous; spikelets in open panicles.....46. *Eragrostis*.  
 EE. Florets coriaceous; spikelets in rigid spike-like panicles.....47. *Desmazeria*.

## cc. Lemmas 5- to many-nerved.

- B. The spikelets with several sterile lemmas at the base, strongly flattened, in a large drooping panicle.....48. *Uniola*.  
 DD. The spikelets without sterile lemmas at the base.  
 E. Florets crowded, nearly horizontal; spikelets broad, cordate.....49. *Briza*.  
 EE. Florets not crowded; spikelets not broad and cordate.  
 F. Spikelets flattened, nearly sessile in dense clusters at the ends of the few panicle branches.....50. *Dactylis*.  
 FF. Spikelets not flattened.  
 G. Lemmas keeled, often bearing white cobwebby hairs at base.....51. *Poa*.  
 GG. Lemmas convex or keeled at the summit only, not hairy at base.  
 H. Nerves of lemma prominent, parallel; lemmas scarious at the summit.....52. *Glyceria*.  
 HH. Nerves of lemma not prominent, approaching each other at the apex; lemmas acute.  
 I. The lemmas entire, often awn-tipped.....53. *Festuca*.  
 II. The lemmas 2-toothed, usually awned just below the apex.....54. *Bromus*.

## 9. Chloris Tribe, or Chlorideæ.

- A. Spikes racemose along a common axis; spikelets falling entire.....55. *Spartina*.  
 AA. Spikes digitate at the summit of the culm.  
 B. Spikelets awnless.  
 C. The spikes slender; spikelets 1-fld.....56. *Cynodon*.  
 CC. The spikes stout; spikelets several-fld.....57. *Eleusine*.  
 BB. Spikelets awned.  
 C. Fertile lemma 1-awned.....58. *Chloris*.  
 CC. Fertile lemma 3-awned.....59. *Trichloris*.

## 10. Barley Tribe, or Hordeæ.

- A. Spikelets solitary at each joint of the axis.  
 B. Glume 1, except in terminal spikelet; spikelets placed with 1 edge to the axis.....60. *Lolium*.  
 BB. Glumes 2; spikelets placed with side to the axis.  
 C. Palea adherent to the grain; rachilla disarticulating, the florets separating.....61. *Agropyron*.  
 CC. Palea free from the grain, rachilla not disarticulating.  
 D. Shape of glumes very narrow, 1-nerved.....62. *Secale*.  
 DD. Shape of glumes ovate, 3- to many-nerved.....63. *Triticum*.  
 AA. Spikelets in clusters of 2 or 3 at each joint of the axis.  
 B. Lateral pair of each cluster pedicel, usually aborted, appearing like a cluster of awns.....64. *Horæum*.  
 BB. Lateral spikelets sessile, usually but 2 spikelets at a joint.....65. *Elymus*.

## 11. Bamboo Tribe, or Bambuseæ.

- A. Stamens 3; fr. a true caryopsis.  
 B. Spikelets 2- to many-fld.  
 C. Infl. fasciculate.....66. *Oxytenanthera*.  
 CC. Infl. racemose or paniculate, not leafy; sts. cylindrical; sheaths persistent.....67. *Arundinaria*.  
 CCC. Infl. spicate, leafy; sts. flattened on one side; sheaths early deciduous.....68. *Phyllostachys*.  
 BB. Spikelets 1-fld.....69. *Chusquea*.  
 AA. Stamens 6.  
 B. Pericarp thin, adnate to the seed, the fr. a true caryopsis.....70. *Bambusa*.  
 BB. Pericarp, crustaceous, separable from the seed, the fr. nut-like.....71. *Dendrocalamus*.

Other genera mentioned are: Cenchrus, Cephalostachyum, Cinna, Dactyloctenium, Deschampsia, Diandroyra, Distichlis, Imperata, Leptochloa, Melica, Melinis, Paspalum, Rottboellia and Trisetum.

## 210. LYCOPODIACEÆ.

One genus in cultivation..... *Lycopodium*.

## 211. SELAGINELLACEÆ.

One genus only..... *Selaginella*.



## 212. EUISETACEÆ.

- One genus only..... *Equisetum*.

## 213. OPHIOGLOSSACEÆ.

- A. Sporangia coherent, in 2 ranks, forming spikes: veins anastomosing..... 1. *Ophioglossum*.  
 AA. Sporangia free in compound spikes or panicles: veins free: lvs. mostly compound..... 2. *Botrychium*.

## 214. MARATTIACEÆ.

- A. Sori in double lines along the veins, not united..... 1. *Angiopteris*.  
 AA. Sori united in synangia.  
   B. Synangia oval, opening by a fissure..... 2. *Marattia*.  
   BB. Synangia elongate, each compartment opening by a terminal pore..... 3. *Danaea*.

## 215. HYMENOPHYLLACEÆ.

- A. Involucre 2-valved..... 1. *Hymenophyllum*.  
 AA. Involucre tubular or funnel-shaped..... 2. *Trichomanes*.

## 216. OSMUNDACEÆ.

- A. Sporangia borne in panicles formed either from certain pinnae or from whole lvs..... 1. *Osmunda*.  
 AA. Sporangia borne on the under surface of foliage lvs.  
   B. Ferns coarse with broad segms..... 2. *Todea*.  
   BB. Ferns finely cut, membranous..... 3. *Leptopteris*.

## 217. SCHIZÆACEÆ.

- A. Sporangia borne on under side of normal or altered lvs.  
   B. Lvs. twining; lfts. palmate or pinnate: sporangia borne singly under scale..... 1. *Lygodium*.  
 BB. Lvs. not twining.  
   C. Sporangia in sori on the under surface.... 2. *Mohria*.  
   CC. Sporangia in 2 ranks forming spikes..... 3. *Schizæa*.  
 AA. Sporangia borne in erect panicles formed on the elongate lowermost pinnae..... 4. *Anemia*.

## 218. POLYPODIACEÆ.

## I. Summary of Tribes.

- A. Indusium wanting or rudimentary (rarely developed in Monogramma).  
   B. Sporangium scattered in a stratum over the under surface of the lvs.: coarse ferns..... 1. ACROSTICHUM [TRIBE].  
 BB. Sporangium collected in round or linear sori.  
   C. Lvs. not jointed to the rootstock: sporangia in long lines following the veins..... 2. VITTARIA TRIBE.  
   CC. Lvs. not jointed to the rootstock: sori round. (See Phegopteris in Dryopteris Tribe.)  
   CCC. Lvs. jointed to the rootstock: sori mostly roundish..... 3. POLYPODIUM [TRIBE].  
 AA. Indusium present (exceptionally wanting in Phegopteris, Menisium, Notholena and Ceropteris).  
   B. Sori oblong or linear, at least twice as long as broad.  
   C. The sori marginal, covered with an indusium formed of the reflexed edge of the lf. (naked in Notholena, or naked and distributed along the veins in Ceropteris).... 4. PTERIS TRIBE.  
   CC. The sori dorsal, covered with a flap-like indusium..... 5. ASPLENIUM TRIBE.  
 BB. Sori roundish or at least less than twice as long as broad.  
   C. Indusia superior, attached by a central stalk or by a sinus (sori naked in Phegopteris and Menisium), normally dorsal: lvs. not jointed to the rootstock..... 6. DRYOPTERIS [TRIBE].  
   CC. Indusia extrorse or cup-shaped, normally marginal: lvs. jointed to the rootstock in most genera... 7. DAVALLIA TRIBE.

ccc. Indusia inferior, attached under the sorus and opening laterally or by splitting radially into lobes. 8. WOODSIA TRIBE.

## II. Key to the Tribes.

## 1. Acrostichum Tribe.

- A. Sporangia localized on definite areas of the lvs.: lvs. dimorphous, the sterile basal ones shield-like..... 1. *Platyceerium*.  
 AA. Sporangia covering entire lvs. or entire pinnae.  
   B. Lvs. simple..... 2. *Elaphoglossum*.  
   BB. Lvs. pinnate..... 3. *Acrostichum*.  
   BBB. Lvs. (sterile), dichotomously forked..... 4. *Rhipidopteris*.

## 2. Vittaria Tribe.

- A. Sori forming 1 or 2 continuous lines parallel to the midrib.  
   B. Sorus 1 or 2 lines..... 5. *Monogramma*.  
   BB. Sorus always 2 lines..... 6. *Vittaria*.  
 AA. Sori on lateral veins forming more or less interrupted lines..... 7. *Antrophyum*.

## 3. Polypodium Tribe.

- A. Lvs. distinctly dimorphous, compound, the sterile basal ones oak-like: plants large..... 8. *Drynaria*.  
 AA. Lvs. dimorphous, simple: plants very small.... 9. *Drymoglossum*.  
 AAA. Lvs. uniform.  
   B. Foliage covered underneath with stellate hairs..... 10. *Cyclophorus*.  
   BB. Foliage smooth or scaly, not stellate hairy.  
   C. Veins free..... 11. *Polypodium*.  
   CC. Veins anastomosing.  
     D. Corresponding veinlets from principal veins uniting and bearing a sorus at the end..... 12. *Goniophlebium*.  
     DD. Areole bearing 2 or more free veinlets extending outward, which bear a free sorus..... 13. *Phlebodium*.  
     DDD. Areoles containing free veinlets irregularly directed..... 14. *Phymatodes*.

## 4. Pteris Tribe.

- A. Sori dorsal, extending along all the veins, naked.  
   B. Veins copiously anastomosing.  
   C. Lvs. large, pinnate..... 15. *Coniogramma*.  
   CC. Lvs. smaller, palmate..... 16. *Hemionitis*.  
 BB. Veins free or only casually uniting.  
   C. Lvs. naked..... 17. *Anogramma*.  
   CC. Lvs. hairy..... 18. *Ceropteris*.  
 AA. Sori marginal, nominally covered with edge of lf.  
   B. The sori at the ends of veins unconnected at their apices.  
   C. Lvs. dimorphous.  
   D. Sori at the ends of veins only..... 19. *Cryptogramma*.  
   DD. Sori scattered the length of the veins... 20. *Onychium*.  
 CC. Lvs. uniform, smooth, on dark-colored stalks.  
   D. Veins free: lvs. pinnate..... 21. *Fellæa*.  
   DD. Veins usually anastomosing: lvs. palmate..... 22. *Doryopteris*.  
 CCC. Lvs. uniform, hairy, scaly or powdery.  
   D. Margins scarcely recurved..... 23. *Notholena*.  
   DD. Margins recurved to form a distinct indusium.  
   E. Indusia more or less continuous around the segm.  
     F. The lvs. pinnately divided..... 24. *Cheilanthes*.  
     FF. The lvs. palmately divided..... 25. *Adiantopsis*.  
   EE. Indusia in the form of more or less distant marginal lobes..... 26. *Hypolepis*.  
   BB. The sori inserted beneath the marginal indusium: stalks black or blackish..... 27. *Adiantum*.  
 BBB. The sori rising in a continuous line-like receptacle which joins the ends of the veins.  
   C. With an inner membranous indusium.... 28. *Pteridium*.  
   CC. With no inner indusium present.  
     D. Lvs. small, radiate-dichotomous..... 29. *Actinopteris*.  
     DD. Lvs. small, palmate: stalk black..... 30. *Cassiopea*.  
     DDD. Lvs. larger, pinnate..... 31. *Pteris*.

## 5. Asplenium Tribe.

- A. Sori parallel to the midrib.  
   B. Sterile lvs. with free veins: sori continuous... 32. *Blechnum*.

- BB. Sterile lvs. with anastomosing veins; sori interrupted.  
 c. The sori sunken in the lvs. . . . . 33. *Woodwardia*.  
 CC. The sori superficial in 1 or more rows. . . . . 34. *Doodia*.  
 AA. Sori partly parallel and partly oblique to the midrib; veins anastomosing. . . . . 35. *Camptosorus*.  
 AAA. Sori oblique to the midrib.  
 B. Veins free, united at the margins.  
 c. The sori double, extending along both sides of the vein. . . . . 36. *Diplazium*.  
 CC. The sori single on the veins.  
 D. Indusia opening toward each other, in pairs. . . . . 37. *Phyllitis*.  
 DD. Indusia all opening toward the end of pinnæ or segms. . . . . 38. *Asplenium*.  
 BB. Veins of lower (inner) series uniting; indusium extending both sides of veins. . . . . 39. *Callipteris*.

### 6. Dryopteris Tribe.

- A. Indusium present.  
 B. Veins free, or with a single row of areoles along the mid-veins.  
 c. Indusia on the ends of veins which project beyond the margin of the lf. . . . . 40. *Deparia*.  
 CC. Indusia dorsal.  
 D. The indusium cordate or reniform, attached by the sinus, sometimes wanting. . . . . 41. *Dryopteris*.  
 DD. The indusium orbicular, peltate, attached by a central stalk. . . . . 42. *Polystichum*.  
 DDD. The indusium oval, fixed to a central elongate receptacle. . . . . 43. *Didymochlæna*.  
 BB. Veins anastomosing.  
 c. The indusium cordate or reniform, attached by the sinus. . . . . 44. *Tectaria*.  
 CC. The indusium peltate, attached by a central stalk; veins forming small areoles. . . . . 45. *Cyrtomium*.  
 AA. Indusium wanting.  
 B. Veins free. . . . . 46. *Phegopteris*.  
 BB. Veins anastomosing.  
 c. The main veins joined by arches which bear the curved sori. . . . . 47. *Gymnopteris*.  
 CC. The sori round, attached dorsally.  
 D. Sori distinct at maturity. . . . . 48. *Meniscium*.  
 DD. Sori confluent at maturity. . . . . 49. *Leptochilus*.

### 7. Davallia Tribe.

- A. Indusium attached at base only.  
 B. Pinnæ jointed to the rachis; lvs. simply pinnate; indusium circular or reniform. . . . . 50. *Nephrolepis*.  
 BB. Pinnæ not jointed to the rachis; lvs. jointed to the rootstock.  
 c. The indusium thick, coriaceous. . . . . 51. *Humata*.  
 CC. The indusium membranous. . . . . 52. *Leucostegia*.  
 AA. Indusium attached at both base and sides.  
 B. Lvs. jointed to the scaly rootstocks.  
 c. Shape of indusium tubular. . . . . 53. *Davallia*.  
 CC. Shape of indusium broader than long, forming a boat-shaped cavity on the edge of the segm. . . . . 54. *Loxoscaphe*.  
 BB. Lvs. not jointed to the rootstocks.  
 c. Indusia near the end of unmodified lf.-lobes.  
 D. Sorus formed on receptacles containing vascular tissues. . . . . 55. *Microlepia*.  
 DD. Sorus not formed on a special receptacle. . . . . 56. *Odontosoria*.  
 CC. Indusium united with the modified lf.-lobe to form a complete cup. . . . . 57. *Dennstaedtia*.

### 8. Woodsia Tribe.

- A. Lvs. uniform, plane; veins free.  
 B. Indusium beneath the sorus, breaking up into linear lobes. . . . . 58. *Woodsia*.  
 BB. Indusium extrorse, opening laterally with a hood-like lobe. . . . . 59. *Cystopteris*.  
 AA. Lvs. dimorphous, the sporophylls closely rolled together.  
 B. Veins free; lvs. in crowns. . . . . 60. *Matteuccia*.  
 BB. Veins anastomosing; lvs. scattered. . . . . 61. *Onoclea*.  
 Brainea, Compteris, and Lonchitis are briefly described.

### 219. GLEICHENIACEÆ.

Single genus in cultivation. . . . . *Gleichenia*.

### 220. CYATHEACEÆ.

- A. Sori borne on the apex of the veins: indusium extrorse, formed of a more or less modified marginal tooth and an inner lid-like scale. . . . . 1. *DICKSONIA* TRIBE.  
 AA. Sori borne dorsally on the veins or at the fork: indusium inferior, or wholly wanting. . . . . 2. *CYATHEA* TRIBE.

#### 1. Dicksonia Tribe.

- A. Tooth of spore-bearing segm. scarcely modified, about the size of the inner scale. . . . . 1. *Dicksonia*.  
 AA. Tooth of the spore-bearing segm. strongly modified, coriaceous like the inner scale and usually larger. . . . . 2. *Cibotium*.

#### 2. Cyathea Tribe.

- A. Indusium present, inferior.  
 B. The indusium at first inclosing the globular sorus, remaining cup-shaped or irregularly splitting at maturity. . . . . 3. *Cyathea*.  
 BB. The indusium membranous, semi-circular, more fully inclosing the sorus. . . . . 4. *Hemitelia*.  
 AA. Indusium wanting. . . . . 5. *Alsophila*.  
 Thyrsopteris, of another tribe, may be expected in cultivation and is briefly accounted for in this work.

### 221. CERATOPTERIDACEÆ.

Habit aquatic: single genus. . . . . *Ceratopteris*

### 222. SALVINIACEÆ.

- A. Lvs. minute, numerous, closely imbricated: sporocarps of 2 kinds, the larger globose, the smaller ovoid. . . . . 1. *Azolla*.  
 AA. Lvs. larger, fewer, distinct: sporocarps uniform, globose. . . . . 2. *Salvinia*.

### 223. MARSILEACEÆ.

In cultivation . . . . . *Marsilea*.



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## NOTE

The foregoing index comprises only the names in the Key, not all those in the Cyclopædia. It is not intended that the Key shall include every small or incidental generic entry or paragraph in the volumes, for that would make it more involved and complicated. (See page 79.) At the end of some of the families the names of other genera are sometimes given, so far as these small entries were positively determined when the Key was made, for the purpose of aiding the student to a completer knowledge of the family or of advising him of entries that he might overlook. In the progress of the work, other minor or outlying or very recently introduced genera will undoubtedly be inserted, and such new definitions of genera may be made as will necessitate some shifting of names. All such additional entries will be accounted for, under their proper families, in the General Index at the close of Vol. VI.

## NAME-LIST

### ENGLISH EQUIVALENTS OF LATIN NAMES OF SPECIES

The technical or botanical name of a plant is a combination of two words,—the generic word, common to the entire group or genus; the specific or particular word, designating the given species: as *Briza maxima*, the large briza, *B. minor*, the small briza, and *B. media*, the intermediate briza. The second or species-word usually is an adjective descriptive of some feature of the plant, although it is sometimes geographical, as *Abies sibirica*, the Siberian abies, or commemorative, as *A. Fraseri*, Fraser's abies. Although the species-word is not always designative and is sometimes even inapplicable, nevertheless the student is aided if he knows what the word means in English translation; and the following list is inserted to supply this knowledge for characteristic Latin or Latinized descriptive adjectives (in some cases nouns in the genitive or in apposition) applied to the species of plants. These words are likely to be used in differing meanings in different genera and as applied by different authors; in many cases, they do not follow the usages of classical Latin: therefore a list of this kind cannot be exact or give all the meanings in which the words may be applied as specific names. The generic names (the first word in the combination) need not be listed here, for they are not adjectives of description but made-up substantives; and, moreover, their origins are explained at the entries in the text.

The species-adjective is made to agree with its genus in gender: thus the Latin adjective *aureus* (golden) takes the regular masculine termination in *Calochortus aureus*, because *Calochortus* is masculine; the feminine termination in *Albica aurea*; the neuter in *Acrostichum aureum*; in *Sorbus* it is feminine (*S. aurea*) even though the generic name is masculine in form, because most trees are feminine whatever the termination of the name. In the following list, for convenience most of the adjectives are printed in the masculine form. The leading exceptions are those that terminate in *-fer* and *-ger*, meaning "bearing," these being given in the feminine form.

The above examples illustrate prevailing terminations of species-words. Other adjectives have other forms, as *niger*, *nigra*, *nigrum* (black); *asper*, *aspera*, *asperum* (rough); *acaulis*, *acaulis* (stemless); the termination *-ensis* (belonging to, citizen of), as in *canadensis*, *canadense* (not *-um*). Commemorative personal species-names may be in the genitive or in the form of an adjective; as *Stanhopea Lindleyi*, Lindley's *stanhopea*; *Selenipedium Lindleyanum*, Lindleyan *selenipedium*. If the person's name ends in a hard consonant, the termination (under the recent Vienna code) is in double *i*, as *Canna Lambertii*. If for a woman, the termination is feminine, as *Acacia Wayæ*. Substantive names in apposition hold their own termination, and the word in such cases should begin with a capital letter, if it is a proper name or an old generic name, as *Hibiscus Sabdariffa*, *Artemisia Absinthium*, *Begonia Rex*. Such words are usually old generic names or prominent vernacular substantives, and they commonly record some historical connection of the plant.

In all the regular entries in the Cyclopædia the pronunciation is indicated (see explanation p. xii); but it is also indicated again in the following lists: when the emphatic syllable is indicated as ending in a vowel and with a grave accent, the vowel is pronounced long, as *acutifidus*, *pumilus*; when it ends in a consonant and is marked with an acute accent, the vowel is short, as *maximus*, *arvensis*. There are differences of practice in the pronouncing of many of the names in this list, but the list represents the method in this Cyclopædia; and if it should so happen that there are any inconsistencies between the list and the text, it is desired that the list shall hold.

Very many names are compounded from generic or subgeneric names, representing similarity or likeness to. These the reader will be able to recognize at once, and they need not be entered in this list. Examples are: *achilleaefolius*, achillea-leaved; *achilleoides*, achillea-like; *acrostichoides*, acrostichum-like; *bellidiflorus*, bellis-flowered; *lamiifolius*, lamium-leaved; *xiphoides*, xiphium-like; *tremuliformis*, tremula-formed or -shaped; *calciopsis*, calcaia-like; *atriplexis*, atriplex-like; *scillarix*, scilla-like.

The glossary, beginning page 160, will be helpful in giving other botanical equivalents and in accounting for other words that are sometimes applied as species-names.

**abbreviatus**: abbreviated, shortened.  
**abortivus**: aborted, parts failing.  
**abruptus**: abrupt, suddenly changing in shape or character.  
**abyssinus**: Abyssinian.  
**acaulis**: stemless.  
**acephalus**: headless.  
**acerbus**: acerb, harsh or sour (taste).  
**aceroides**: acer-like, maple-like.  
**aceroides**: needle-shaped.  
**aciculatus**: needle-like.  
**acidissimus**: exceedingly sour.  
**acidus**: acid, sour.  
**acinatus**: scimitar- or saber-shaped.  
**acris**: acrid, sharp.  
**aculeatus**: prickly.  
**acuminatus**: acuminate, long-pointed, tapering.  
**acutangulus**: acutely or sharply angled.  
**acutifidus**: acutely or sharply cut.  
**acutifolius**: acutely leaved, sharp-leaved.

**acutifolius**: acutely lobed.  
**acutipetalus**: petals acute or sharp (pointed).  
**acutus**: acute, sharp-pointed.  
**admirabilis**: admirable, noteworthy.  
**adnatus**: adnate, joined to.  
**adpressus**: pressed against.  
**adscendens**: ascending.  
**adsurgens**: rising to an erect position, ascending.  
**adunatus**: hooked.  
**advenus**: newly arrived, adventive.  
**ægyptiacus**: Egyptian.  
**æmulus**: emulative, imitating.  
**æneus**: brazen, bronze-colored.  
**æquinoctialis**: pertaining to the equinox.  
**æquipetalus**: equal-petaled.  
**æruginosus**: rusty, rust-colored.  
**æstivus**: summer.  
**æstivus**: summer.  
**æthiopicus**: Ethiopian, African.  
**affinis**: related (to another species).

**africanus**: African.  
**agavoides**: Agave-like.  
**ageratoides**: ageratum-like.  
**aggregatus**: aggregate, clustered.  
**agrorius**: of the fields.  
**agrestis**: of or pertaining to the fields.  
**aizoides**: aizoon-like (*Aizoon*, an evergreen or tenacious plant).  
**alatus**: winged.  
**albescens**: whitish, becoming white.  
**albicans**: whitish.  
**albicaulis**: white-stemmed.  
**albidus**: white.  
**albiflorus**: white-flowered.  
**albifrons**: white-fronched, white-herbaged.  
**albispinus**: white-spined.  
**albicinctus**: white-girdled, white-crowned.  
**albospicatus**: white-spiked.  
**albus**: white.  
**albicornis**: elk-horned.



alép picus: of Aleppo (in Syria).  
 alià ceus: of the alliums, garlic-like.  
 aloi des: aloe-like.  
 alpés tris: alpine.  
 alpi nus: alpine.  
 altà icus: of the Altai Mts. (S. Siberia).  
 altér nans: alternating.  
 altér nus: alternating, alternate.  
 âl tifróns: tall-fronded or -herbaged.  
 altis simus: very tall, tallest.  
 âl tus: tall.  
 amáb ilis: lovely.  
 amà rus: bitter.  
 ambíg uus: ambiguous, doubtful.  
 amelloi des: amellus-like.  
 americà nus: American.  
 amethýs tinus: amethystine, violet-colored.  
 amœ nus: charming, pleasing.  
 amphib ius: amphibious, growing both in water and on land.  
 amplexicàù lis: stem-clasping.  
 amphis simus: most or very ample.  
 âm plus: ample, large, extended.  
 amurén sis: of the Amur River region (E. Siberia).  
 amygdál inus: pertaining to or like amygdalus.  
 anacân thus: without spines.  
 anatól icus: of Anatolia (Asia Minor).  
 ân ceps: two-headed, two-edged.  
 andíc olus: native of the Andes.  
 andi nus: Andine, Andian, pertaining to the Andes.  
 andróg ynus: with both staminate and pistillate flowers in one cluster.  
 anfractuò sus: twisted.  
 ân glicus: English, pertaining to England.  
 angui nus: snaky, pertaining to serpents.  
 angulà ris: angular, angled.  
 angulà tus: angular, angled.  
 angulò sus: angular, angled.  
 angús tus: narrow.  
 annòt inus: year-old.  
 annulà ris: annular, ringed.  
 annulà tus: annular.  
 ân nuus: annual, living but one year.  
 anóm alus: anomalous, out of the ordinary or usual.  
 antillà ris: of the Antilles (W. Indies).  
 antíp odum: of the antipodes.  
 antiquò rum: of the ancients.  
 anti quus: ancient.  
 apenni nus: pertaining to the Apennines (Italy).  
 apér tus: uncovered, bare.  
 apét alus: without petals.  
 apýl lus: leafless.  
 apiculà tus: apiculate, tipped with a point.  
 appendiculà tus: appendaged, bearing an extension or additional part or process.  
 applanà tus: flattened.  
 applicà tus: joined, attached.  
 âp terus: wingless.  
 aquát icus, aquát ilis: aquatic.  
 â queus: aqueous, watery.  
 aquil nus: aquiline, pertaining to the eagle.  
 aráb icus: Arabian.  
 arachnoi des: spider-like, cobwebby.  
 arborés cens: becoming tree-like, woody.

arbò reus: tree-like.  
 ârc ticus: arctic.  
 arcuà tus: bow-like, bowed.  
 arenà rius: of sand or sandy places.  
 areolà tus: areolate, pitted.  
 argentà tus: silvery, silvered.  
 argén tus: silvery.  
 argophýl lus: silver-leaved.  
 argù tus: sharp-toothed.  
 argyræ us: silvery.  
 âr idus: arid.  
 arietì nus: like a ram's head.  
 aristà tus: aristate, bearded.  
 aristò tus: bearded.  
 armà tus: armed (as with thorns).  
 aromát icus: aromatic.  
 arrect us: raised up, erect.  
 articulà tus: articulated, jointed.  
 arundinà ceus: reed-like.  
 arvén sis: pertaining to cultivated fields.  
 ascén dens: ascending.  
 asiát icus: Asian.  
 ás per: rough.  
 asperà tus: rough.  
 aspericàù lis: rough-stemmed.  
 aspér rimus: very rough.  
 assím ilis: similar, like to.  
 assúr gens: assurgent, clambering.  
 â ter: coal-black.  
 atlánt icus: Atlantic, growing in Atlantic regions.  
 atrà tus: blackened.  
 atropurpù reus: dark purple.  
 atrór ubens: dark red.  
 atrosanguín eus: dark blood-red.  
 atróv irens: dark green.  
 attenuà tus: attenuated, produced to a point.  
 ât ticus: pertaining to Attica or Athens, Greek.  
 augustís simus: very notable.  
 augúst us: august, notable, majestic.  
 aurantí acus: orange-red.  
 aurè olus: golden.  
 àu reus: golden.  
 auriculà tus: auricled, eared.  
 australièn sis: belonging to Australia.  
 austrà lis: southern.  
 austri acus: Austrian.  
 autumnà lis: autumnal.  
 axillà ris: axillary, borne in the axils, pertaining to the axils.  
 azù reus: azure, sky-blue.

baccà tus: berried.  
 baccíf era: berry-bearing.  
 baleár icus: Balearian, of the Balearic Islands.  
 balsà meus: balsamic, balsam-like, with balsam odor.  
 balsamíf era: balsam-bearing.  
 bambusoi des: bambusa-like, bamboo-like.  
 banát icus: of Banat (S. Hungary).  
 barbadén sis: of Barbadoes.  
 bár barus: foreign, from a strange country.  
 barbà tus: barbed, bearded.  
 barbíg era: bearing barbs or beards.  
 basilà ris: pertaining to the base or bottom.  
 bél lus: handsome.  
 benedic tus: blessed.  
 benghalén sis: of Bengal (E. India).  
 betuloi des: Betula-like, birch-like.

bicarinà tus: twice-keeled, with two keels.  
 bic olor: two-colored.  
 bicór nis: two-horned.  
 bicornù tus: two-horned.  
 bidentà tus: two-toothed.  
 bién nis: biennial, living only two years.  
 bif idus: twice cut, in two parts.  
 biflò rus: two-flowered.  
 bifurcà tus: twice-forked.  
 bigib bus: with two swellings or projections.  
 bigiù mis: two-glumed.  
 bij ugus: yoked two together, joined, fastened together.  
 bíl obus: two-lobed.  
 binà tus: twin, double, two-and-two.  
 binér vis: two-nerved.  
 binoculà ris: binocular, two-eyed, two-spotted.  
 biparti tus: two-parted.  
 bipét alus: two-petaled.  
 bipinnatíf idus: bipinnatifid, twice pinnately cut.  
 bipinnà tus: bipinnate, twice pinnate.  
 bipunctà tus: two-spotted.  
 biséc tus: cut in two parts.  
 bispinò sus: two-spined.  
 biternà tus: twice ternate.  
 blán dus: bland, mild.  
 bô nus: good.  
 borbón icus: of Bourbonne (in N. E. France).  
 boreà lis: northern.  
 botryoi des: cluster-like, grape-like.  
 brachià tus: brachiate, branched at right angles.  
 brachýp odus: short-stalked.  
 bracteà tus: bracteate, bearing bracts.  
 bracteò sus: bract-bearing.  
 brevicàù lis: short-stemmed.  
 brév ifrons: short-fronded, short-leaved.  
 brév ipes: short-footed, as with short pedicel or petiole.  
 breviròs tris: short-beaked.  
 brè vis: short.  
 brevisè tus: short-bristled.  
 brevis pathus: short-spated.  
 brevis simus: very short, shortest.  
 brilliantís simus: most brilliant, very brilliant.  
 brún neus: deep brown.  
 bucéph alus: ox-headed.  
 bufò nius: pertaining to the toad.  
 bulbíf era: bulb-bearing.  
 bulbò sus: bulbous.  
 bullà tus: inflated, swelling, puckered, bullate.  
 byzanti nus: Byzantine (of the Constantinople region).

cæulés cens: becoming or turning dark blue.  
 cærù leus: cerulean, dark blue.  
 cæ sius: bluish gray.  
 cæspitò sus: caespitose, tufted, growing in low dense clumps.  
 cáf fer, caffra: Kafir.  
 caláb ricus: from Calabria (in S. Italy).  
 calathi nus: basket-like.  
 calcarà tus: spurred, with spurs.  
 calcà reus, of or pertaining to lime.  
 callò sus: thick-skinned, with callosities.

**calvus**: bald, hairless.  
**calycinus**: calyx-like.  
**calyculatus**: calyx-like, calyx-bearing, fruit inclosed in a calyx.  
**cámbricus**: Cambrian, Welsh.  
**campanulatus**: campanulate, bell-shaped.  
**campes tris**: of the fields or plains.  
**canadensis**: Canadian.  
**canaliculatus**: channeled, grooved.  
**canariensis**: of the Canary Isls.  
**candidans**: white, hoary, particularly white-hairy or white-woolly.  
**candidissimus**: very white-hairy or hoary.  
**cantabricus**: from Cantabria (in Spain).  
**candidus**: white, white-hairy, shining.  
**canescens**: gray-pubescent.  
**caneus**: ash-colored, hoary.  
**capensis**: of the Cape (of Good Hope).  
**capillaris**: hair-like.  
**capreolatus**: winding, twining.  
**capsularis**: capsular.  
**cardinalis**: cardinal.  
**carinata**: keeled.  
**carneus**: flesh-colored.  
**carnosus**: fleshy.  
**carolinensis**: Carolinian, pertaining to North or South Carolina, or indefinitely to the Carolinas.  
**carpathicus**: of the Carpathian region (Europe).  
**cartilagineus**: like cartilage.  
**caryophyllaceus**: clove-like; perhaps also pertaining to the pink family.  
**cashmeria nus**: of Cashmere (Asia).  
**catharticus**: cathartic.  
**cathayanus**: of Cathay (China).  
**caucasicus**: belonging to the Caucasus (mountain region between the Black and Caspian Seas).  
**caudatus**: caudate, tailed.  
**caulescens**: caulescent, having a stem or stems.  
**cauliflorus**: stem-flowered.  
**cenisus**: of Mt. Cenis (between France and Italy).  
**cephalatus**: headed, bearing heads.  
**cerasiflorus**: cherry-formed.  
**cerefolius**: wax-leaved.  
**ceriferus**: wax-bearing.  
**ceruus**: bending forward, inclined, drooping, nodding.  
**ceylanicus**: of Ceylon; same as *zeylanicus*.  
**chalcedonicus**: of Chalcedon (on the Bosphorus).  
**chilensis**: belonging to Chile.  
**chinensis**: belonging to China.  
**chloranthus**: green-flowered.  
**chrysanthus**: golden-flowered.  
**chrysocarpus**: golden-fruited.  
**chrysophyllus**: golden-leaved.  
**chrysotomus**: golden-mouthed, golden-throated.  
**ciliaris**: ciliate, fringed with hairs on the margin.  
**ciliatus**: ciliate, hairy fringed.  
**cilicicus**: of Cilicia (in S. E. Asia Minor).  
**cinctus**: girded, girdled.  
**cinereus**: ash-colored.  
**cinnabarinus**: cinnabar-red.  
**cinnamomeus**: cinnamon-brown.  
**circinatus**: circinate, coiled.

**cirrhus**: tendrilled.  
**citratus**: citrus-like.  
**citrinus**: citron-colored or -like.  
**clandestinus**: concealed.  
**clavatus**: clavate, club-shaped.  
**clematideus**: pertaining to or like clematis.  
**clypeatus**: with a shield.  
**cocciferus**: berry-bearing.  
**coccineus**: scarlet.  
**cochlearis**: spoon-like.  
**cochlearatus**: spoon-like.  
**coelestis**: sky-blue.  
**celestis**: celestial, sky-blue.  
**collinus**: pertaining to a hill.  
**coloratus**: colored (other than green).  
**coma tus**: with coma or hair.  
**communis**: common, general, gregarious.  
**commutatus**: changed or changing.  
**comatus**: with long hair.  
**compactus**: compact, dense.  
**complexus**: circled, embraced.  
**complicatus**: complicate; page 162.  
**compressus**: compressed.  
**compositus**: adorned, ornamented.  
**concavus**: concave, hollowed out.  
**concinus**: neat, well made.  
**concolor**: colored similarly.  
**condensus**: condensed, crowded.  
**confertus**: crowded.  
**confertus**: similar, like to.  
**confusus**: confused, uncertain (as to characteristics).  
**congestus**: congested, brought together.  
**conglomeratus**: conglomerate, crowded together.  
**coniferus**: cone-bearing.  
**conjungatus**: connected, joined together.  
**conoides**: conoid, cone-like.  
**consolidus**: consolidated, solid, stable.  
**conspicuus**: conspicuous, marked.  
**constrictus**: constricted.  
**contiguus**: contiguous, near together.  
**contortus**: contorted, twisted.  
**contractus**: contracted.  
**coralliflorus**: coral-flowered.  
**corallinus**: coral-red.  
**cordatus**: cordate, heart-shaped.  
**cordifolius**: cordate-leaved, heart-leaved.  
**coriaceus**: leathery.  
**corniculatus**: horned.  
**cornigerus**: horn-bearing.  
**cornutus**: horned.  
**coronarius**: used for or belonging to garlands.  
**coronatus**: crowned.  
**corrugatus**: corrugated, wrinkled.  
**corsicus**: Corsican (island in the Mediterranean).  
**corticatus**: heavily furnished with bark.  
**coruscans**: vibrating, glittering.  
**corymbiferus**: corymb-bearing.  
**corymbosus**: corymbose.  
**costatus**: costate, ribbed.  
**crassicaulis**: thick-stemmed.  
**crassifolius**: thick-leaved.  
**crasipes**: thick-footed or -stalked.  
**crassus**: thick, fleshy.  
**crenatus**: crenate, scalloped.  
**crenulatus**: crenulate, somewhat scalloped.

**crepidatus**: sandaled, slippereq.  
**crepitans**: rattling, rustling.  
**cretaceus**: cretaceous, pertaining to chalk.  
**creticus**: of Crete (island in Eastern Mediterranean).  
**crinitus**: hairy, provided with hair.  
**crispus**: crisped, curled.  
**cristatus**: cristate, crested.  
**crocatus**: saffron-yellow.  
**croceus**: saffron-colored, yellow.  
**cruciatus**: cruciate, cross-like.  
**cruciferus**: cross-bearing.  
**cruentus**: bloody.  
**crystalinus**: crystalline.  
**cubensis**: Cuban.  
**cucullatus**: hooded.  
**cultratus**: cultrate, knife-shaped.  
**cuneatus**: cuneate, wedge-shaped.  
**cuneifolius**: wedge-leaved.  
**cuneiformis**: wedge-formed.  
**cupreus**: copper-like or -colored.  
**curvatus**: curved.  
**cuspidatus**: cuspidate, with a cusp or sharp stiff point.  
**cyaneus**: blue.  
**cylindricus**: cylindrical.  
**cylin dricus**: cylindrical.  
**cymbiflorus**: boat-formed.  
**cymosus**: cymed, having a cyme or cymes.  
**cypreus**: copper-like; see *cupreus*.  
**dactyliferus**: finger-bearing.  
**dahuricus**, **davuricus**: Of Dahuria or Dauria (in Trans-Baikal Siberia, near the frontier of China).  
**dalmaticus**: Dalmatian (on eastern side of the Adriatic).  
**damascenus**: of Damascus.  
**dasycarpus**: thick-fruited.  
**dealbatus**: whitened, white-washed.  
**debilis**: weak, frail.  
**decandrus**: ten-stamened.  
**decapetalus**: ten-petaled.  
**deciduus**: deciduous, with parts falling.  
**decepiens**: deceptive.  
**declinatus**: declined, bent downward.  
**decolorans**: discoloring, staining.  
**decompositus**: decompound, more than once compound or divided.  
**decorans**: adorning.  
**decorus**: elegant, comely, becoming.  
**decumbens**: decumbent, reclining at the base but the top or tips upright.  
**decurrens**: decurrent, as a leaf extending down the stem.  
**deflexus**: deflexed, bent abruptly downward.  
**deformis**: misshapen, deformed.  
**delicatus**: chosen.  
**delicatissimus**: most or very delicate.  
**delicatus**: delicate, tender.  
**deliciosus**: delicious.  
**deltoides**: deltoid, triangular.  
**demissus**: low, weak.  
**dendroides**: tree-like.  
**densiflorus**: densely flowered.  
**densus**: dense.  
**dentatus**: toothed.  
**denticulatus**: denticulate, slightly toothed.  
**dentosus**: toothed.  
**denudatus**: denuded, naked.



**depauperà tus:** depauperate, starved, dwarfed.  
**depén dens:** hanging down.  
**deprés sus:** depressed.  
**deús tus:** burned.  
**devastà tor:** (feminine *devastatrix*): devastating, laying waste.  
**diacàn thus:** two-spined.  
**diadè ma:** a diadem, crown.  
**dián drus:** with two stamens.  
**diàph anus:** diaphanous, very thin, transparent.  
**dichôt omus:** forked, two-branched equally.  
**dich rois:** of two colors.  
**dicóc cus:** with two berries.  
**díd ymus:** in a pair, as of anthers.  
**diffór mis:** of differing forms.  
**diffù sus:** diffuse, spreading.  
**digità tus:** digitate, compound in form like the fingers.  
**dilatà tus:** dilated, expanded.  
**dilà tus:** dilated, spread out.  
**dimidià tus:** halved, in two equal parts.  
**dimór phus:** dimorphous, two-formed.  
**dì odon:** with two teeth.  
**dioi cus:** dicecious.  
**dipét alus:** two-petaled.  
**diphýl lus:** two-leaved.  
**dipsà ceus:** of the teasel or Dipsacus.  
**discoíd eus:** discoid, rayless.  
**dís color:** of two or of different colors.  
**dís par:** dissimilar, unlike.  
**disséc tus:** dissected, deeply cut.  
**dissím ilis:** dissimilar, unlike.  
**dissitiflò rus:** remotely or loosely flowered.  
**distà chyus:** two-spiked.  
**dís tans:** distant, separate, remote.  
**dís tichus:** two-ranked, with leaves or flowers in ranks on opposite sides of stem.  
**dis tylus:** two-styled.  
**diúr nus:** day-flowering.  
**divaricà tus:** divaricate, spreading, widely divergent.  
**divér gens:** diverging, wide-spreading.  
**diversiflò rus:** diversely flowered, variable-flowered.  
**diversiflò lius:** variable-leaved.  
**divi sus:** divided, separated.  
**dodecán drus:** twelve-stamened.  
**dolabrifór mis:** hatchet- or ax-shaped.  
**dolò sus:** deceitful.  
**domés ticus:** domestic, domesticated.  
**drupà ceus:** drupe-like.  
**drupif era:** drupe-bearing.  
**dù bius:** dubious, doubtful.  
**dúl cis:** sweet.  
**dumetò rum:** of bushes or hedges.  
**dumò sus:** bushy.  
**dù plex:** double.  
**duplicà tus:** duplicate, double.  
**duráb ilis:** durable, lasting.  
**durác inus:** hard-berried.  
**duriús culus:** somewhat hard or rough.

**ebenà ceus:** ebony-like.  
**ebractea tus:** bractless.  
**ebúr neus:** ivory-white.  
**echinà tus:** bristly, prickly.  
**echinocáp pus:** prickly-fruited.  
**echinosér alus:** prickly-sepaled.  
**ecornù tus:** hornless.

**edù lis:** edible.  
**effù sus:** very loose-spreading.  
**elás ticus:** elastic.  
**elà tior:** taller.  
**elà tus:** tall.  
**él egans:** elegant.  
**elegantis simus:** most elegant, very elegant.  
**elephán tum:** of the elephants.  
**ellíp ticus:** elliptical.  
**elongà tus:** elongated, lengthened.  
**emarginà tus:** emarginate, with a shallow notch at the apex.  
**emét icus:** emetic.  
**ém inens:** eminent, prominent.  
**enneaphýl lus:** nine-leaved.  
**ensà tus:** sword-shaped.  
**ensiflò lius:** sword-leaved.  
**ensifór mis:** sword-formed or -shaped.  
**entomóph ilus:** insect-loving.  
**equés tris:** pertaining to the horse.  
**equi nus:** of horses.  
**eréc tus:** erect, upright.  
**erian thus:** woolly-flowered.  
**ericoi des:** erica-like, heath-like.  
**eriocár pus:** woolly-fruited.  
**eriocéph alus:** woolly-headed.  
**erò sus:** erose, jagged, as if gnawed.  
**errát icus:** erratic, unusual, sporadic.  
**erubés cens:** blushing.  
**erythrocar pus:** red-fruited.  
**erythroceph alus:** red-headed.  
**erythròp odus:** red-footed, red-stalked.  
**erythròp terus:** red-winged.  
**esculén tus:** esculent, edible.  
**estrià tus:** without stripes.  
**etuberò sus:** without tubers.  
**europæ us:** European.  
**exaltà tus:** exalted, very tall.  
**excavà tus:** excavated, hollowed out.  
**excél lens:** excellent, excelling.  
**excél sus:** tall.  
**exci sus:** excised, cut away.  
**exig uus:** little, small, poor.  
**exim ius:** distinguished, out of the ordinary.  
**exitò sus:** pernicious, destructive.  
**exolè tus:** mature, fully grown, dying away.  
**exòt icus:** exotic, from another country.  
**expán sus:** expanded.  
**exsculp tus:** dug out, carved out.  
**exsér tus:** exerted, protruding from.  
**exsúr gens:** rising up, standing up.  
**extén sus:** extended.  
**exù dans:** exuding.

**fabà ceus:** faba-like, bean-like.  
**falcà tus:** falcate, sickle-shaped or scythe-shaped.  
**falciflò lius:** falcate-leaved.  
**falcifór mis:** sickle-formed.  
**fál lax:** deceptive.  
**farinà ceus:** containing farina or starch, or like flour; perhaps also farinose.  
**farinif era:** farina-bearing.  
**farinò sus:** farinose, mealy, powdery.  
**fascià tus:** fasciate, abnormally flattened and broadened.  
**fasciculà ris:** fascicled, clustered, brought together.  
**fasciculà tus:** fascicled.  
**fascinà tor:** fascinating, charming.

**fastigià tus:** fastigiate, branches erect and close together.  
**fastuò sus:** proud.  
**febrif ugus:** febrifuge, fever-dispelling.  
**fenestrà lis:** with window-like openings.  
**fè rox:** ferocious; very thorny.  
**fér reus:** pertaining to iron.  
**ferrugin eus:** rusty, of the color of iron rust.  
**fér tilis:** fertile, fruitful.  
**festi vus:** festive, gay, bright.  
**fibrò sus:** fibrous, bearing prominent fibers.  
**ficoid eus:** fig-like.  
**filamentò sus:** filamentous, composed of threads or bearing threads.  
**filicà tus:** fern-like, ferny.  
**filiciflò lius:** fern-leaved.  
**filici nus:** fern-like.  
**filicoi des:** fern-like.  
**filif era:** bearing filaments or threads.  
**filiflò lius:** thread-leaved, with leaves cut into thread-like divisions.  
**filifór mis:** filiform, thread-like.  
**fil ipes:** with stalks thread-like.  
**fimbrià tus:** fimbriated, fringed.  
**firmà tus:** firm, made firm.  
**fír mus:** firm, strong.  
**fissiflò lius:** split-leaved.  
**fís silis:** fissile, cleft or split.  
**fís sus:** cleft, split.  
**fistulò sus:** fistular, hollow-cylindrical.  
**flabellà tus:** flabellate, with fan-like parts.  
**flabellifór mis:** fan-formed.  
**flác cidus:** flaccid, soft.  
**flagellà ris:** flagellate, whip-like.  
**flagellà tus:** whip-like.  
**flagellifór mis:** whip-formed.  
**flagél lum:** a scourge or flail.  
**flám meus:** flame-colored.  
**flavés cens:** yellowish, becoming yellow or yellowish.  
**flavic omus:** yellow-wooled or -haired.  
**fláv idus:** yellow, yellowish.  
**flavispi nus:** yellow-spined.  
**flavís simus:** very yellow, deep yellow.  
**flà vus:** yellow.  
**fléx ilis:** flexible, pliant.  
**flexuò sus:** flexuose, tortuous, zig-zag.  
**flocçò sus:** woolly.  
**flò re-ál bo:** with white flowers.  
**florenti nus:** Florentine.  
**flò re-plè no:** with full or double flowers.  
**floribún dus:** free-flowering, blooming profusely.  
**flór idus:** flowering, full of flowers.  
**flù itans:** floating.  
**fluviat ilis:** pertaining to a river.  
**fém ina:** female.  
**fœniculà ceus:** fennel-like.  
**fœtidis simus:** very fetid.  
**fœt idus:** fetid, bad-smelling.  
**folià tus:** with leaves.  
**foliolà tus:** with leaflets.  
**foliò sus:** leafy, full of leaves.  
**folliculà ris:** bearing follicles, follicled.  
**forficà tus:** shear-shaped.  
**formicæfór mis:** ant-shaped, ant-like.  
**formosis simus:** most or very beautiful.  
**formò sus:** beautiful, handsome.

**foveà tus:** pitted.  
**frág ilis:** fragile, brittle.  
**frà grans:** fragrant, odorous.  
**fragrantis simus:** very fragrant.  
**fraxín eus:** fraxinous, like *Fraxinus* or ash trees.  
**fríg idus:** cold, of cold regions.  
**frondò sus:** fronded, leafy.  
**fructif era:** fruit-bearing, fruitful.  
**fructig enus:** fruitful.  
**frutés cens:** shrubby, bushy.  
**fruticò sus:** fruticose, shrubby, bushy.  
**fucà tus:** painted, dyed.  
**fù gax:** swift.  
**fúl gens:** shining, glistening.  
**fulg idus:** fulgid, shining.  
**fuliginò sus:** black-painted or -colored, sooty.  
**fulvès cens:** fulvous or becoming fulvous.  
**fúlvus:** fulvous, tawny, orange-gray-yellow.  
**funà lis:** of a rope or cord.  
**fù nebris:** funereal.  
**fungò sus:** fungous, pertaining to a fungus, spongy.  
**funiculà tus:** of a slender rope or cord; with a funicle (stalk of an ovule or seed).  
**fúr cans:** forked.  
**furcà tus:** furcate, forked.  
**fús cus:** fuscous, brown, dusky.  
**fusifór mis:** spindle-shaped.  
**galericulà tus:** helmet-like.  
**gál licus:** of Gaul or France; also pertaining to a cock or rooster.  
**gandavén sis:** belonging to Ghent, Belgium.  
**gargán icus:** belonging to Gargano (Eastern Italy).  
**gél idus:** ice-cold.  
**geminà tus:** twin.  
**geminiflò rus:** twin-flowered.  
**gemmà tus:** gemmed, jewelled; also bearing buds.  
**gemmaf era:** bud-bearing.  
**genevén sis:** belonging to Geneva.  
**geniculà tus:** jointed, kned.  
**geoi des:** of the earth.  
**geomét ricus:** geometrical, in a pattern.  
**germán icus:** German, of Germany.  
**gibberò sus:** humped, hunchbacked.  
**gibbiflò rus:** gibbous-flowered.  
**gibbò sus:** swollen on one side.  
**gib bus:** gibbous, swollen on one side.  
**gigantè us:** gigantic, very large.  
**gigánt icus:** gigantic.  
**gi gas:** of giants, immense.  
**glabél lus:** smoothish.  
**glà ber:** glabrous, smooth.  
**glabér rimus:** most smooth, smoothest.  
**glabrà tus:** somewhat glabrous or smooth.  
**glabrés cens:** smoothish, or becoming so.  
**glacià lis:** icy, frozen.  
**gladià tus:** sword-like.  
**glandulif era:** gland-bearing.  
**glandulò sus:** glandular.  
**glastiflò lius:** with leaves like the dyer's woad (*Isatis*, once called *Glastum*).  
**glaucés cens:** glaucescent, becoming glaucous.

**glauciflò lius:** glaucous-leaved.  
**glaucophýl lus:** glaucous-leaved.  
**glau cus:** glaucous, with a bloom, grayish.  
**globò sus:** globose, spherical, nearly or quite globular.  
**globulà ris:** of a little ball or sphere.  
**globulif era:** globule-bearing, globe-bearing.  
**globulò sus:** globuled, like a little ball.  
**glomerà tus:** glomerate, clustered.  
**gloriò sus:** glorious, superb.  
**glumà ceus:** glumed, with glumes or glume-like structures.  
**glutinò sus:** glutinous, gluey, sticky.  
**gongylò des:** roundish.  
**gracilén tus:** slender.  
**grác ilis:** graceful, slender.  
**gracil limus:** graceful, very slender.  
**grà cus:** of Greece, Greek.  
**gramín eus:** grassy, grass-like.  
**graminiflò lius:** grass-leaved.  
**grán diceps:** large-headed.  
**grandicús pis:** with large cusps or points.  
**grandidentà tus:** large- or big-toothed.  
**grandiflò rus:** large-flowered.  
**grandiflò lius:** large-leaved.  
**grandifór mis:** on a large scale, of a big kind.  
**grandipunctà tus:** with large spots.  
**grán dis:** large, big.  
**granulà tus:** granulate, covered with minute grains.  
**granulò sus:** granulate, granulose.  
**grátis simus:** very pleasing or agreeable.  
**grà tus:** pleasing, agreeable.  
**gravè olens:** heavy-scented.  
**grœnlând icus:** of Greenland.  
**guianén sis:** of Guiana (South America).  
**guineén sis:** of Guinea (Africa).  
**gummif era:** gum-bearing.  
**guttà tus:** spotted, speckled.  
**gymnocár pus:** naked-fruited.  
**gy rans:** gyrating, revolving in a circle.

**hæmán thus:** blood-red-flowered.  
**hamà tus:** hooked.  
**hamò sus:** hooked.  
**harpophýl lus:** sickle-leaved.  
**hastà tus:** hastate, spear-shaped.  
**hastif era:** spear-bearing.  
**hastí lis:** of a javelin or spear.  
**hebecár pus:** pubescent-fruited.  
**hederà ceus:** of the ivy (*Hedera*).  
**helían thus:** sunflower.  
**helvét icus:** Swiss, of *Helvetia* (Switzerland).  
**hél volus:** pale yellow.  
**hemisphær icus:** hemispherical.  
**heptaphýl lus:** seven-leaved.  
**herbà ceus:** herbaceous, dying to the ground and not woody.  
**herbariò rum:** of the herbaria.  
**heteracán thus:** various-spined.  
**heterán thus:** various-flowered, variable in flowers.  
**heterocár pus:** various-fruited.  
**hetér odon:** various-toothed.  
**heteroglòs sus:** various-tongued.  
**heteromór phus:** various in form.  
**heterophýl lus:** various-leaved, with leaves of more than one shape.  
**hexagonóp terus:** six-angled-winged.

**hexagò nus:** hexagonal, six-angled.  
**hexapét alus:** six-petaled.  
**hi ans:** open, gaping.  
**hibernà lis:** of or pertaining to winter.  
**hibér nicus:** Hibernian, of or pertaining to Ireland.  
**hieroglýph icus:** hieroglyphic, marked as if with signs.  
**himalà icus:** Himalayan.  
**hirci nus:** of a goat, with a goat's odor.  
**hirsutis simus:** very hairy, most hairy.  
**hirsù tulus:** somewhat hirsute or hairy.  
**hirsù tus:** hirsute, hairy.  
**hirtél lus:** somewhat hairy.  
**hirtiflò rus:** hairy-flowered.  
**hír tipes:** hairy-stalked or -stemmed.  
**hír tus:** hairy.  
**hispán icus:** Spanish, of Spain.  
**hispidis simus:** most or very bristly.  
**hispid ulus:** somewhat hispid or bristly.  
**hís pidus:** hispid, bristly.  
**histrión icus:** histrionic, pertaining to the stage or to actors.  
**holoseríc eus:** woolly-silky.  
**horizontà lis:** horizontal.  
**hór ridus:** provided with spines or barbs, prickly.  
**hortén sis:** belonging to the hortus or garden.  
**hortic olus:** a little garden; of the garden.  
**hortò rum:** of gardens.  
**hortulà nus:** pertaining to a garden.  
**humiflò sus:** sprawling on the ground.  
**hù milis:** low-growing, dwarf.  
**hyacínth inus:** hyacinthine, sapphire-colored.  
**hyacinthoi des:** like the hyacinth.  
**hyál inus:** transparent, translucent.  
**hýb ridus:** hybrid, mixed, mongrel.  
**hyemà lis:** of winter; also *hiemalis*.  
**hygromét ricus:** hygrometric, taking up water.  
**hymenán thus:** membranaceous-flowered.  
**hymenò des:** membrane-like.  
**hyperbò reus:** far northern.  
**hypocraterifór mis:** salver-shaped, flower with a slender cylindrical tube and flat spreading limb.  
**hypogæ us:** underground, subterranean.  
**hypoglaù cus:** glaucous beneath.  
**hypoleù cus:** whitish, pale.  
**hypophýl lus:** under the leaf.  
**hýs trix:** porcupine-like, bristly.  
**ián thinus:** violet, violet-blue.  
**ibér icus:** of Iberia (the Spanish peninsula).  
**icosán drus:** twenty-stamened.  
**igné cens:** fiery.  
**íg neus:** fiery.  
**iliciflò lius:** ilex-leaved, holly-leaved.  
**illustrà tus:** pictured.  
**illús tris:** bright, brilliant, lustrous.  
**illýr icus:** of Illyria (*Grecian Peninsula*).  
**imbér bis:** without beards or spines.  
**im bricans:** imbricating.  
**imbricà tus:** imbricated, lapping over, shingled.  
**immaculà tus:** immaculate, spotless.



**immér sus:** immersed, under water.  
**imperâ tor:** commanding, imperious.  
**imperiâ lis:** imperial, kingly.  
**impléx us:** implicated, interwoven.  
**imprês sus:** impressed, sunken in.  
**inæqualifô lius:** unequal-leaved.  
**inæquâ lis:** unequal.  
**inæquilât erus:** unequal-sided.  
**incâ nus:** hoary.  
**incarnâ tus:** flesh-colored.  
**incér tus:** uncertain, doubtful.  
**incisifô lius:** cut-leaved.  
**inci sus:** incised, cut.  
**inclinâ tus:** inclined, bent downward.  
**incomparâb ilis:** incomparable, excelling.  
**incômp tus:** rude, unadorned, not attractive.  
**inconspíc uus:** inconspicuous, not prominent.  
**incurvâ tus:** incurved, bent inward.  
**incúr vus:** incurved.  
**indentâ tus:** indented, dented  
**în dicus:** Indian, of India or the East Indies.  
**indivî sus:** undivided.  
**inér mis:** unarmed, without thorns or spines.  
**infectô rius:** used for dying, pertaining to dyes.  
**infês tus:** dangerous, unsafe.  
**inflâ tus:** inflated, swollen up.  
**infortunâ tus:** unfortunate.  
**infrâc tus:** broken.  
**infundibulifôr mis:** funnel-shaped, trumpet-shaped.  
**infundib ulum:** a funnel.  
**inodô sus:** without odor, scentless.  
**inornâ tus:** without ornament, not showy.  
**în quians:** polluting, discoloring.  
**inscrip tus:** inscribed, written on.  
**insig nis:** remarkable, distinguished, marked.  
**insitî ius:** grafted.  
**intâc tus:** intact, untouched.  
**în teger:** entire.  
**intégér rimus:** very entire.  
**integrifô lius:** entire-leaved.  
**interjéc tus:** interjected, put between.  
**intermê dius:** intermediate.  
**interrûp tus:** interrupted.  
**intertéx tus:** interwoven, intertwined.  
**intricâ tus:** intricate, entangled.  
**intrôr sus:** introrse, turned inward.  
**intumés cens:** swollen, puffed up, tumid.  
**întybâ ceus:** pertaining to chicory (Intybus).  
**inver sus:** inverse, turned over, upside down.  
**invis sus:** unseen, overlooked.  
**involucrâ tus:** involucred, with an involucre.  
**involut sus:** involute, rolled inward.  
**ionân thus:** with flowers like the violet.  
**ionóp terus:** with wings like the violet.  
**iridês cens:** iridescent, changing color at different angles.  
**iridiflô rus:** iris-flowered.  
**irregulâ ris:** irregular.  
**isân drus:** with equal stamens.  
**isopét alus:** equal-petaled.  
**isophýl lus:** equal-leaved.  
**ital icus:** Italian.

**jamaicén sis:** of Jamaica.  
**japón icus:** Japanese, of Japan.  
**jasmin eus:** jasmine-like.  
**jasminiflô rus:** jasmine-flowered.  
**javân icus:** Javan, of Java.  
**jubâ tus:** crested, with a mane.  
**jucún dus:** agreeable, pleasing.  
**jugô sus:** joined, yoked.  
**jún ceus:** Juncus-like, rush-like.

**kashmiriâ nus:** of Cashmere or Kashmere.  
**kewén sis:** belonging to Kew (Kew Gardens, England).  
**koraiâ nus:** of Corea; also *coreanus*.

**labiâ tus:** labiate, lipped.  
**labiô sus:** lipped.  
**lâch ryma:** a tear.  
**laciniâ tus:** laciniate, torn, cut or slashed into narrow lobes.  
**lacinio sus:** laciniöse, laciniate.  
**lactâ tus:** milky.  
**lâc teus:** milk-white.  
**lactíc olor:** milk-colored.  
**lactíf era:** milk-bearing, milky-juiced.  
**lactiflô rus:** flowers milk-colored.  
**lacunô sus:** with holes or pits.  
**lacús tris:** pertaining to lakes.  
**ladanif era:** ladanum-bearing.  
**lâtev irens:** light green, vivid green.  
**lâe tus:** bright, vivid.  
**lævicaû lis:** smooth-stemmed.  
**lævigâ tus:** smooth.  
**læv ipes:** smooth-footed, smooth-stalked.  
**lâe vis:** smooth.  
**lævîus culus:** smoothish, somewhat smooth.  
**lanâ tus:** woolly.  
**lanceolâ tus:** lanceolate.  
**lân ceus:** lance-like.  
**lancifô lius:** lance-leaved.  
**lanig era:** wool-bearing.  
**lanuginô sus:** woolly, downy.  
**lappâ ceus:** pertaining to a globular hooked bur; Lappa-like.  
**lappón icus:** of Lapland.  
**laricifô lius:** larch-leaved.  
**laric inus:** Larix-like, larch-like.  
**lasiocâr pus:** rough-fruited, rough-hairy.  
**lasiopét alus:** with petals rough-hairy.  
**lateriflô rus:** lateral-flowered, with flowers on the side.  
**laterit ius:** brick-red.  
**latifô lius:** broad-leaved.  
**lât ifrons:** broad-fronded, broad-herbaged, broad-leaved.  
**latimaculâ tus:** broad-spotted.  
**lât ipes:** broad-footed, broad-stalked.  
**lâtis simus:** broadest, very broad.  
**lâ tus:** broad, wide.  
**laurifô lius:** laurel-leaved.  
**lauri nus:** laurel-like.  
**lavandulâ ceus:** lavender-like.  
**laxiflô rus:** loose-flowered.  
**laxifô lius:** loose-leaved.  
**lâx us:** lax, open, loose.  
**leian thus:** smooth-flowered.  
**leiccât pus:** smooth-fruited.  
**leiophýl lus:** smooth-leaved.  
**lenticulâ ris:** lenticular, lens-shaped.  
**iên tus:** pliant, tenacious, tough.  
**leontoglôs sus:** lion-tongued or -throated.

**leopardi nus:** leopard-spotted.  
**lepidophýl lus:** scaly-leaved.  
**leprô sus:** of leprosy, scurfy.  
**leptocaû lis:** thin-stemmed, slender-stemmed.  
**leptôc ladus:** thin-stemmed or -branched.  
**leptól epis:** thin-scaled.  
**leptophýl lus:** thin- or slender-leaved.  
**leptosép alus:** thin-sepaled.  
**lêp topus:** thin- or slender-stalked.  
**leucân thus:** white-flowered.  
**leucôb otry:** with white clusters.  
**leucocéph alus:** white-headed.  
**leuconeû rus:** white-nerved.  
**leucophýl lus:** white-leaved.  
**leucorhi zus:** white-rooted.  
**libîr nicus:** of Liburnia (west of Adriatic).  
**lignô sus:** woody.  
**ligulâ ris:** ligulate, strap-shaped.  
**lilâc inus:** lilac.  
**liliiflô rus:** lily-flowered.  
**limbâ tus:** bordered.  
**limô sus:** of muddy or marshy places.  
**linariifô lius:** linaria-leaved.  
**linearifô lius:** linear-leaved.  
**linearil obus:** linear-lobed.  
**lineâ ris:** linear.  
**lineâ tus:** lined, with lines or stripes.  
**lingulâ tus:** tongue-shaped.  
**linifô lius:** linum-leaved, flax-leaved.  
**linophýl lus:** flax-leaved.  
**lithospér mus:** with seeds stone-like.  
**littorâ lis:** of the seashore.  
**liv idus:** livid, bluish.  
**lobâ tus:** lobed.  
**lobulâ ris:** lobed.  
**loliâ ceus:** Lolium-like (Lolium comprises the rye-grasses).  
**longebractea tus:** long-bracted.  
**longepedunculâ tus:** long-pedunculate.  
**longicaudâ tus:** long-tailed.  
**longiflô rus:** long-flowered.  
**longifô lius:** long-leaved.  
**longihamâ tus:** long-hooked.  
**longilaminâ tus:** with long laminæ or plates.  
**longil obus:** long-lobed.  
**longimucronâ tus:** long-mucronate.  
**lông ipes:** long-footed, long-stalked.  
**longipét alus:** long-petaled.  
**longipinnâ tus:** long-pinnate.  
**longiracemô sus:** long-racemed.  
**longiscâ pus:** long-scaped.  
**longisép alus:** long-sepaled.  
**longis pathus:** long-spathed.  
**longispi nus:** long-spined.  
**longis simus:** longest, very long.  
**longis tylus:** long-stalked.  
**lôn gus:** long.  
**lorifô lius:** strap-leaved.  
**lû cidus:** lucid, bright, shining, clear.  
**ludovicîa nus:** of Louisiana.  
**lugdunén sis:** belonging to the region of Lyons.  
**lunâ tus:** lunate, moon-shaped, moon-like, crescent-shaped.  
**lunulâ tus:** somewhat moon-shaped.  
**lupuli nus:** Lupulus-like, hop-like.  
**lû ridus:** lurid, wan, sallow, pale yellow.  
**lutê olus:** yellowish.  
**lutes cens:** yellowish, becoming yellow.

**lù teus:** yellow.  
**luxù rians:** luxuriant, thrifty.  
**lyrà tus:** lyrate, pinnatifid with large terminal lobe.

**macilén tus:** lean, meager.  
**macrán drus:** with large anthers.  
**macrán thus:** large-flowered.  
**macrób otrys:** large-clustered.  
**macrocár pus:** large-fruited.  
**macrocéph alus:** large-headed.  
**macrodac tylus:** large-fingered.  
**macrodon tus:** large-toothed.  
**macropét alus:** with large petals.  
**macrophyl lus:** large-leaved.  
**macropléc tron:** large-spurred.  
**macróp odus:** large-footed or -stalked.  
**macróp terus:** large-winged.  
**macrospà dix:** with large spadix.  
**macrostà chyus:** large-spiked.  
**macrostè gius:** large-decked.  
**macrostè mus:** with large filaments.  
**macrós tylus:** large-styled.  
**macroù rus:** large-tailed.  
**maculà tus:** spotted.  
**maculò sus:** spotted.

**mæsi acus:** of Moesia, ancient name of Bulgaria and Servia.

**magellán icus:** Straits of Magellan region.

**magnif icus:** magnificent, eminent, distinguished.

**majà lis:** of May, Maytime.

**majést icus:** majestic.

**mà jor, mà jus:** greater, larger.

**malabár icus:** of Malabar (in British India).

**malifór mis:** apple-formed.

**malvâ ceus:** Malva-like, mallow-like.

**mammò tus:** breasted, with breasts.

**manicâ tus:** manicate, long-sleeved, covered densely as with thick hairs so that the covering can be removed as such.

**marcés cens:** withering but not falling.

**már cidus:** withering but not falling off.

**margaritâ ceus:** pearly, of pearls.

**marginâ lis:** marginal, marked in some way along the margins or edges.

**marginâ tus:** margined.

**marginél lus:** somewhat margined.

**marilánd icus:** of the Maryland region; also written *marylandicus*.

**marít imus:** maritime, of the sea.

**marmorâ tus:** marbled, mottled.

**marmò reus:** marbled.

**marmorophyl lus:** leaves marbled.

**maroccâ nus:** of Morocco.

**mâs:** male.

**masculâ tus:** masculine.

**mâs culus:** male, masculine.

**matronâ lis:** pertaining to matrons.

**mauritán icus:** of Mauretania (N. Africa).

**maxillâ ris:** maxillary, of the jaw.

**mâx imus:** largest.

**mediterrâ neus:** of the Mediterranean region.

**mè dius:** medium, intermediate.

**medullâ ris:** of the marrow or center or pith.

**megalân thus:** large-flowered.

**megaphyl lus:** large-leaved.

**megapotâm icus:** of the large river.

**megarrhi zus:** large-rooted.

**megaspér mus:** large-seeded.

**megastâ chyus:** large-spiked.

**megastig mus:** with large stigma.

**melanân thus:** black-flowered.

**melanchól icus:** melancholy, hanging or drooping.

**melanocaù lon:** black-stemmed.

**melanocóc cus:** black-berried.

**melanoleù cus:** black-and-white.

**melanóx ylon:** black-wooded.

**meleâ gris:** like a guinea-fowl, speckled.

**mél leus:** pertaining to honey.

**mellif era:** honey-bearing.

**melofór mis:** melon-shaped.

**membranâ ceus:** membranaceous, membranous, thin and more or less translucent.

**meniscifò lius:** crescent-leaved.

**mesoleù cus:** mixed with white.

**metál licus:** metallic (color or luster).

**mexicâ nus:** Mexican, of Mexico.

**mì cans:** glittering, sparkling, mica-like.

**micrán thus:** small-flowered.

**microcár pus:** small-fruited.

**míc rodon:** small-toothed.

**microglòs sus:** small-tongued.

**micròl epis:** small-scaled.

**micróm eris:** small-numbered, of small number of parts.

**micropé. alus:** small-petaled.

**microphyl lus:** small-leaved.

**micróp terus:** small-winged.

**microsép alus:** small-sepaled.

**microstè mus:** of small filaments or stemlets.

**milità ris:** military.

**millefoliâ tus:** thousand-leaved.

**millefò lius:** thousand-leaved, leaves or parts very many.

**mì mus:** mimic.

**mì nax:** threatening, forbidding.

**miniâ tus:** cinnabar-red.

**mín imus:** least, smallest.

**mì nor, mì nus:** smaller.

**minutis simus:** very or most minute.

**minù tus:** minute, very small.

**mirâb ilis:** marvellous, extraordinary, wonderful.

**mistassín icus:** of Lake Mistassini, (Quebec).

**mì tis:** mild, gentle.

**mitrà tus:** turbaned.

**míx tus:** mixed.

**modés tus:** modest.

**molдав icus:** of Moldavia (in Rumania).

**mól lis:** soft, soft-hairy.

**mollis simus:** very soft-hairy.

**moluccâ nus:** of the Moluccas (East Indies).

**monadél phus:** in one group or bundle.

**mongól icus:** of Mongolia.

**monilif era:** bearing a necklace.

**monacân thus:** once-spined.

**monocéph alus:** single-headed.

**monóg ynus:** of one pistil.

**monoi cus:** monocious.

**monopét alus:** one-petaled.

**monophyl lus:** one-leaved.

**monóp terus:** one-winged.

**monopyrè nus:** bearing one stone or pyrene.

**monosép alus:** one-sepaled.

**monospér mus:** one-seeded.

**monostâ chyus:** single-spiked.

**monspelién sis:** of Montpellier.

**monspessulâ nus:** of Montpellier.

**monstrò sus:** monstrous, wholly abnormal or deformed, teratological.

**montâ nus:** pertaining to mountains or mountainous regions.

**montevideén sis:** of Montevideo (Uruguay).

**montic olus:** native of mountains.

**moschâ tus:** musky, musk-scented.

**mucronâ tus:** mucronate, tipped with a short sharp point or mucro.

**mucronulâ tus:** with a small mucro or point.

**multibracteâ tus:** many-bracted.

**multicaù lis:** many-stemmed, with numerous stems.

**múl ticeps:** many-headed, many branched.

**multic olor:** many-colored.

**multif idus:** multifid, many times parted.

**multiflò rus:** many-flowered.

**multifurcâ tus:** much-forked, many times forked.

**multifj ugus:** many in a yoke, many times joined.

**multinér vis:** many-nerved.

**múl tipleus:** many-folded.

**multiradiâ tus:** many-radiate, with numerous rays.

**multiséc tus:** many times cut, much cut or dissected.

**mún dulus:** trim, neat.

**muni tus:** defended, fortified.

**murâ lis:** of walls, growing on walls.

**muricâ tus:** muricate, roughed by means of hard points.

**muscip ula:** a mouse-trap.

**mutâb ilis:** changeable, variable, mutant.

**mutâ tus:** changeable.

**mù ticus:** blunt, pointless.

**mutilâ tus:** mutilated.

**myriacân thus:** numberless spined, very many-spined.

**myriocár pus:** very many-fruited.

**myrmecoph ilus:** ant-loving.

**myrtifò lius:** myrtle-leaved.

**nâ nus:** dwarf.

**napifór mis:** turnip-shaped.

**narbonén sis:** of Narbonne (ancient region or province of S. France).

**nâ tans:** floating, swimming.

**naviculâ ris:** pertaining to a ship.

**neapolitâ nus:** Neapolitan.

**nebulò sus:** nebulous, clouded, indefinite, obscure.

**negléc tus:** neglected, overlooked.

**memorâ lis:** of groves or woods.

**memorò sus:** of groves or woods and shady places.

**nepalén sis:** of Nepal (Himalayan region).

**neriifò lius:** nerium-leaved, oleander-leaved.

**nervò sus:** nerved.

**nevadén sis:** of the Sierra Nevadas (in Spain or N. America).

**nfc titans:** blinking, moving.

**nì dus:** nest.

**nì ger:** black.



**nigrà tus:** blackish.  
**nigrés cens:** blackish, becoming black.  
**níg ricans:** black.  
**nigricór nis:** black-horned.  
**níg ripes:** black-footed or -stalked.  
**nilót ica:** of the Nile.  
**nì tens:** shining.  
**nít idus:** shining.  
**nivà lis:** snowy, pertaining to snow.  
**nív eus:** snowy.  
**nivò sus:** snowy, full of snow.  
**nobil ior:** more noble.  
**nób ilis:** noble, famous, renowned.  
**nobilis simus:** most or very noble.  
**nodiflò rus:** with flowers at nodes.  
**nodò sus:** with nodes, jointed.  
**nonscrip tus:** undescribed.  
**nootkatén sis:** of Nootka (Nootka Sound is by Vancouver Island).  
**notà tus:** marked.  
**nò væ-án gliæ:** of New England.  
**nò væ-cæsarè æ:** of New Jersey.  
**nò væ-zealánd iæ:** of New Zealand.  
**noveboracén sis:** of New York.  
**nò vi-bél gii:** of New Belgium or New Netherlands (i. e., New York).  
**nubic olus:** dwelling among clouds.  
**nucif era:** nut-bearing.  
**nudà tus:** nude, stripped.  
**nudicaù lis:** naked-stemmed.  
**nudiflò rus:** naked-flowered.  
**nù dus:** nude, naked.  
**numismà tus:** pertaining to money, coin-like.  
**nù tans:** nodding.  
**nyctic alus:** night-blooming.

**obcón icus:** inversely conical.  
**obcordà tus:** obcordate, inversely cordate.  
**obè sus:** obese, fat.  
**obfuscà tus:** clouded, confused.  
**oblí quus:** oblique, unequal and slanting.  
**obliterà tus:** obliterated, erased, not apparent.  
**oblongà tus:** oblong.  
**oblongiflò lius:** oblong-leaved.  
**oblón gus:** oblong.  
**obovà tus:** obovate, inverted ovate.  
**obscù rus:** obscure, hidden.  
**obsolè tus:** obsolete, rudimentary.  
**obtusà tus:** obtuse, blunt.  
**obtusiflò lius:** blunt-leaved.  
**obtusil obus:** blunt-lobed.  
**obtù tus:** obtuse, blunt, rounded.  
**occidentà lis:** occidental, western.  
**océan icus:** oceanic; perhaps of Oceanica.  
**ocellà tus:** eyeleted, with small eyes.  
**ochreà tus:** with an ochrea or boot-sheath.  
**ochroleù cus:** yellowish white.  
**octán drus:** with eight anthers.  
**octopét alus:** eight-petaled.  
**octophyl lus:** eight-leaved.  
**oculà tus:** eyed, with eye-like marks.  
**odonti tes:** tooth.  
**odontochi lus:** with toothed lip or margin.  
**odoratís simus:** most or very odorous, very fragrant.  
**odorà tus:** odorous, fragrant.  
**odò rus:** odorous, fragrant.  
**officinà lis:** officinal, medicinal, recognized in the pharmacopea.

**officinà rum:** of the apothecaries.  
**oleæfò lius:** Olea- or olive-leaved.  
**oleif era:** oil-bearing.  
**olerà ceus:** oleraceous, vegetable-garden herb used in cooking.  
**oligán thus:** few-flowered.  
**oligocár pus:** few-fruited.  
**oligospér mus:** few-seeded.  
**olitò rius:** pertaining to vegetable-gardens or -gardeners.  
**olivà ceus:** olive-like, olive-colored.  
**olivæfór mis:** olive-shaped.  
**olým picus:** of Olympus or Mt. Olympus (in Greece).  
**omniv orus:** omnivorous, of all kinds of food.  
**opà cus:** opaque, shaded.  
**operculà tus:** with a lid.  
**oppositiflò rus:** opposite-flowered.  
**oppositiflò lius:** opposite-leaved.  
**opuliflò rus:** flowers of Opulus (a Viburnum).  
**orbiculà ris:** round.  
**orbiculà tus:** round.  
**orchid eus:** orchid-like.  
**orchioi des:** orchid-like.  
**oregà nus:** of Oregon.  
**orgyà lis:** length of the arms extended, about 6 feet.  
**orientà lis:** oriental, eastern.  
**ornatis simus:** most showy or ornate.  
**ornà tus:** ornate, adorned.  
**ornithocéph alus:** like a bird's head.  
**ornithóp odus:** like a bird's foot.  
**ornithorhyn chus:** shaped like a bird's beak.  
**orthocár pus:** straight-fruited.  
**orthochi lus:** straight-lipped.  
**orthópt erus:** straight-winged.  
**ovaliflò lius:** oval-leaved.  
**ovà lis:** oval.  
**ovatiflò lius:** ovate-leaved.  
**ovà tus:** ovate.  
**ovif era:** egg-bearing.  
**ovig era:** egg-bearing.  
**ovi nus:** pertaining to sheep.  
**oxyacán thus:** sharp-thorned or -spined.  
**oxygò nus:** sharp-angled.  
**oxyphyl lus:** sharp-leaved.  
**oxysép alus:** with sharp sepals.

**pachyán thus:** thick-flowered.  
**pachyneù rus:** thick-nerved.  
**pachýp terus:** thick-winged.  
**pacif icus:** of the Pacific, of regions bordering the Pacific Ocean.  
**palæsti nus:** of Palestine.  
**paleà ceus:** with palea (bracts in grass flowers), or palea-like, chaffy.  
**pál lens:** pale.  
**pallés cens:** palish, becoming pale.  
**pallià tus:** palliated, cloaked.  
**pallidiflò rus:** pale-flowered.  
**pallidiflò lius:** pale-leaved.  
**pallidispl nus:** pale-spined.  
**pál lidus:** pale.  
**palliflā vens:** pale yellow.  
**palmatif idus:** palmately cut.  
**palmà tus:** palmate, divided or lobed like the hand.  
**paludò nus:** of marshes, marsh-loving.  
**pálús tris:** marsh-loving.  
**pandurà tus:** fiddle-shaped.  
**paniculà tus:** paniculate.  
**paniculif era:** panicle-bearing.

**pannón icus:** of Pannonia (Roman province on the Danube, now western Hungary).  
**pannò sus:** ragged, tattered.  
**papaverà ceus:** Papaver-like, poppy-like.  
**papilionà ceus:** butterfly-like, the form of the pea flower.  
**papillò sus:** papillate, with minute nipple-like projections or protuberances.  
**papyrà ceus:** papery.  
**papyrif era:** paper-bearing.  
**paradisi acus:** of parks or gardens.  
**paradox us:** paradoxical, strange.  
**parasit icus:** parasitical, of a parasite.  
**pardali nus:** leopard-like, spotted.  
**pardi nus:** leopard-spotted.  
**partì tus:** parted.  
**parviflò rus:** small-flowered.  
**parviflò lius:** small-leaved.  
**parvis simus:** smallest, very small.  
**pár vulus:** very small, very slight.  
**pár vus:** small.  
**patagón icus:** of Patagonia.  
**patellà ris:** circular, disk-shaped, like a knee-pan.  
**pà tens:** spreading.  
**pát ulus:** spreading.  
**pauciflò rus:** few-flowered.  
**pauciflò lius:** few-leaved.  
**paupér culus:** poor.  
**pavoni nus:** peacock-like.  
**pectinà ceus:** pectinate.  
**pectinà tus:** pectinate, comb-like, pin-natifid with very narrow close divisions or parts.  
**pectinif era:** comb-bearing.  
**pectorà lis:** shaped like a breast-bone.  
**pedà tus:** footed, of the foot or feet; also pedate, like a bird's foot, being palmately divided and the side parts 2-cleft.  
**pedemontà nus:** of Piedmont (northern Italy).  
**pedunculà ris:** peduncled, stalked.  
**pedunculà tus:** peduncled.  
**pedunculò sus:** with many peduncles.  
**pellù cidus:** pellucid, with translucent dots.  
**peltà tus:** peltate.  
**peltiflò lius:** peltate-leaved.  
**pelvifór mis:** pelvis-shaped.  
**penduliflò rus:** pendulous-flowered.  
**penduli nus:** somewhat pendulous.  
**pén dulus:** pendulous, hanging.  
**penicillà tus:** hair penciled, like a little brush; pinnate.  
**pennà tus:** feathered, as the veins or lobes standing off at right angles from a midrib; pinnate.  
**penninér vis:** feather-veined.  
**pennsylván icus:** of Pennsylvania.  
**pentagò nus:** five-angled.  
**pentág ynus:** of five pistils.  
**pentán drus:** of five stamens.  
**pentán thus:** five-flowered.  
**pentaphyl lus:** five-leaved.  
**perbél lus:** very beautiful.  
**peregrí nus:** exotic, foreign, from a strange country.  
**perén nans:** perennial.  
**perén nis:** perennial, living three or more years.  
**perfolià tus:** perfoliate, with leaf surrounding the stem.

perforà tus: perforated, with holes.  
 permix tus: much mixed or confused.  
 persicafò lius: peach-leaved.  
 pér sicus: of Persia; also the peach.  
 perspíc uus: clear, transparent.  
 pertù sus: thrust through, forced through, perforated.  
 peruvia nus: Peruvian, of Peru.  
 petaloíð eus: petal-like.  
 petiolà ris: petioled, with a leaf-stalk.  
 petiolà tus: petioled.  
 petræ us: rock-loving.  
 phlogifò rus: flame-flowered.  
 phœnic eus: purple-red.  
 phryg ius: of Phrygia (in Asia Minor).  
 phyllomani acus: running wildly to leaves, leafy.  
 picturà tus: painted-leaved, pictured, variegated.  
 pic tus: painted.  
 pilif era: bearing soft hairs.  
 pilosius culus: somewhat or slightly pilose.  
 pilò sus: pilose, shaggy, with soft hairs.  
 pilulif era: globule-bearing.  
 pinetò rum: of pine forests.  
 pín eus: of the pine.  
 pinifò lius: pine-leaved.  
 pinnatif idus: pinnatifid, pinnately cleft.  
 pinnát ifrons: pinnate-fronded or -foliated.  
 pinnatinér vis: pinnate-nerved.  
 pinnà tus: pinnate, with leaflets on the sides of a main leaf axis.  
 pisif era: Pisum-bearing, pea-bearing.  
 pisocár pus: pea-fruited.  
 placà tus: quiet, calm.  
 planifò rus: plane-flowered, flat-flowered.  
 planifò lius: flat-leaved.  
 plantagín eus: plantain-like.  
 plà nus: plane, flat.  
 platanoi des: Platanus-like, plane-tree-like.  
 platycán thus: broad-spined.  
 platycár pus: broad-fruited.  
 platyladus: broad-branched.  
 platyglòs sus: broad-tongued.  
 platyphýl ius: broad-leaved.  
 plenis simus: very full or double.  
 plè nus: full, used to designate doubleness in flowers (as in *flore-pleno*).  
 pleurós tachys: side-spiked.  
 plicà tus: plicate, plaited, folded lengthwise.  
 plumà rius: plumed.  
 plumà tus: plumed.  
 plúm beus: of lead.  
 plumò sus: feathery.  
 poculifór mis: deep cup-shaped.  
 podocár pus: with stalked fruit.  
 poët icus: pertaining to poets.  
 polifò lius: Polium-leaved, white-leaved.  
 poli tus: polished.  
 polyacán thus: many-spined.  
 polyán drus: of many stamens.  
 polyán thus: many-flowered.  
 polycéph alus: many-headed.  
 polydác tylus: many-fingered.  
 polyg amus: polygamous, having both perfect and imperfect flowers.

polymór phus: of many forms, variable.  
 polypét alus: many-petaled.  
 polyphýl ius: many-leaved.  
 polyspér mus: many-seeded.  
 polystà chys: many-spiked.  
 polystic tus: many-dotted.  
 pomà ceus: pome-like, resembling the apple or pear.  
 pomeridià nus: afternoon.  
 ponderò sus: ponderous, heavy, weighty.  
 pón ticus: of Pontus (in Asia Minor).  
 populifò lius: populus-leaved, poplar-leaved.  
 popúl neus: pertaining to poplars.  
 porci nus: pertaining to swine.  
 porrifò lius: Porrum- or leek-leaved.  
 præal tus: very tall.  
 præ cox: precocious, premature, very early.  
 præ stans: distinguished, excelling.  
 prætex tus: bordered.  
 prasinà tus: greenish.  
 prasi nus: grass-green.  
 pratén sis: of meadows.  
 precatò rius: praying, prayerful.  
 primúl inus: primrose-like.  
 prin ceps: princely, first.  
 prismát icus: prismatic, prism-shaped.  
 proboscíd eus: proboscis-like.  
 procè rus: tall.  
 procúm bens: procumbent, lying on the ground.  
 procúr rens: extended.  
 prodúc tus: produced, lengthened.  
 profú sus: profuse.  
 prolif era: producing offshoots, bearing abnormal supernumerary parts.  
 prolif icus: prolific, fruitful.  
 propén dens: hanging down.  
 propín quus: related, near to.  
 prostrà tus: prostrate, lying flat.  
 protrù sus: protruding.  
 provincià lis: provincial; or of Provence, southern France.  
 pruinà tus: pruinose.  
 pruinò sus: pruinose, with a hoary or frost-like bloom.  
 prunifò lius: plum-leaved.  
 prù riens: itching.  
 pseud- pseudo-: in combinations means *false, not genuine, not the true or the typical*, as *Pseudotsuga*, *false tsuga*.  
 psittaci nus: of the parrot.  
 pù bens: downy.  
 pubér ulus: puberulous, somewhat pubescent.  
 pubés cens: pubescent, downy.  
 pudí cus: bashful, retiring, shrinking.  
 pulchél ius: pretty, beautiful.  
 púl cher: handsome, beautiful.  
 pulchér rimus: very handsome.  
 púl lus: dark colored, dusky, almost black.  
 pulverulén tus: powdered, dust-covered.  
 pulvinà tus: cushioned, cushion-like.  
 pù milus: dwarf.  
 punctatis simus: most spotted, very spotted.  
 punctà tus: punctate, dotted.  
 pún gens: piercing, sharp-pointed.  
 punic eus: reddish purple.  
 purpurà ceus: purple.

purpurás cens: purplish, becoming purple.  
 purpurà tus: purple.  
 purpù reus: purple.  
 pusíl lus: very small, insignificant.  
 pycnacán thus: densely spined.  
 pycnán thus: densely flowered.  
 pygmæ us: pigmy.  
 pyramidà lis: pyramidal.  
 pyrenà icus: of the Pyrenees.  
 pyrifò lius: pear-leaved.  
 pyrifór mis: Pyrus-formed, pear-shaped.  
 quadrangulà ris: quadrangular, four-angled.  
 quadrangulà tus: four-angled.  
 quadrà tus: in four or fours, squared.  
 quadric olor: of four colors.  
 quadridentà tus: four-toothed.  
 quadrif idus: four-cut.  
 quadrifò lius: four-leaved.  
 quadripartì tus: four-parted.  
 quadrivál vis: four-valved.  
 quercifò lius: Quercus-leaved, oak-leaved.  
 quercì nus: of Quercus the oak.  
 quina nus: quinate, in fives.  
 quinquéc olor: five-colored.  
 quinquéfò rus: five-flowered.  
 quinquéfò lius: five-leaved.  
 quinqueloculà ris: five-loculed, of five cells or compartments.  
 quinquenér vis: five-nerved.  
 quinquepunctà tus: five-spotted.  
 racemifò rus: raceme-flowered.  
 racemò sus: racemose, flowers in racemes.  
 radià tus: radiate, rayed.  
 radì cans: rooting.  
 radicò sus: many-rooted.  
 radì cum: of roots.  
 radiò sus: radiate, with many rays.  
 ramentà ceus: bearing a hair-like covering.  
 ramifò rus: with branching inflorescence.  
 ramosis simus: most- or much-branched.  
 ramò sus: branched.  
 ranif era: bearing frogs.  
 rapà ceus: pertaining to rape or turnips.  
 rarifò rus: scattered-flowered, with flowers loose or few.  
 rà rus: rare, uncommon.  
 raù cus: hoarse, raw.  
 reclinà tus: reclined, bent back.  
 réc tus: straight, upright.  
 recurvâ tus: recurved.  
 recurvifò lius: recurved-leaved.  
 recúr vus: recurved, curved back.  
 redivì vus: restored, brought to life.  
 reduplicà tus: duplicated again, doubled again, redoubled.  
 refléx us: reflexed, bent back.  
 refrác tus: broken, broken in pieces.  
 refúl gens: brightly shining, reflecting light or color.  
 regà lis: regal, royal.  
 Regì na: Queen.  
 rè gius: regal, royal, kingly, pertaining to a king.  
 religió sus: used for religious purposes, venerated.



**remò tus:** remote, with parts distant.  
**renifór mis:** reniform, kidney-shaped.  
**repán dus:** repand, with margin wavy.  
**rè pens:** repent, creeping.  
**rép tans:** creeping.  
**reséc tus:** cut off, curtailed, pruned.  
**resinò sus:** resin-bearing, full of resin.  
**reticulà tus:** reticulate, netted. net-veined.  
**retór tus:** twisted back.  
**retrofléx us:** reflexed.  
**retù sus:** retuse, notched slightly at a rounded apex.  
**revér sus:** reversed, end-for-end.  
**revolù tus:** revolute, rolled backward from the margins.  
**Réx:** king.  
**rhamnifò lius:** Rhamnus-leaved, buckthorn-leaved.  
**rhizophýl lus:** root-leaved, acaulescent.  
**rhodán thus:** rose-flowered.  
**rhodochi lus:** rose-lipped or -margined.  
**rhodocínc tus:** rose-girdled.  
**rhodoneù rus:** red-nerved.  
**rhombóid eus:** rhomboidal.  
**ricinifò lius:** Ricinus-leaved, with leaves of castor-oil plant.  
**rigíd ulus:** somewhat stiff or rigid.  
**ríg idus:** rigid, stiff.  
**rín gens:** ringent, gaping, open-mouthed.  
**ripà rius:** of river banks.  
**rivà lis:** pertaining to brooks.  
**rivulà ris:** brook-loving.  
**robús tus:** robust, stout.  
**rosà ceus:** rose-like.  
**rosæfìò rus:** rose-flowered.  
**rò seus:** rose, rosy.  
**rostrà tus:** rostrate, beaked.  
**rosulà ris:** rosulate, in rosettes.  
**rotà tus:** rotate, wheel-shaped.  
**rotundifò lius:** round-leaved.  
**rotún dus:** rotund, round.  
**rubél lus:** reddish.  
**rù bens:** red, ruddy.  
**rù ber:** red, ruddy.  
**rubér rimus:** very red.  
**rubés cens:** reddish, becoming red.  
**rubiaëfò lius:** rubus- or bramble-leaved.  
**rubicún dus:** rubicund, red.  
**rubiginò sus:** rusty.  
**rubricaù lis:** red-stemmed.  
**rubrifò lius:** red-leaved.  
**rubronér vis:** red-veined.  
**rufés cens:** reddish, becoming red.  
**rufinér vis:** red-nerved.  
**rù fus:** red, reddish.  
**rugò sus:** rugose, wrinkled.  
**runcinà tus:** runcinate, retrorsely or backwardly incised or toothed.  
**rupés tris:** rock-loving.  
**rupic olus:** growing on cliffs or ledges.  
**rús ticus:** rustic, belonging to the country.  
**ruthén icus:** Ruthenian, Russian.  
**rù tilans:** red, becoming red.

**saccà tus:** saccate, bag-like.  
**saccharà tus:** containing sugar, sweet.  
**saccharif era:** sugar-bearing  
**sacchari nus:** saccharine.  
**sác charum:** sugar.  
**saccif era:** bag-bearing.

**sachalinén sis:** of Saghalien Isl. (N. Japan).  
**sagittà lis:** of the arrow, sagittate.  
**sagittà tus:** sagittate, arrow-like.  
**sagittifò lius:** arrow-leaved.  
**salicifò lius:** salix-leaved, willow-leaved.  
**salíc inus:** willow-like.  
**salíg nus:** of the willow.  
**sali nus:** salty.  
**sambù cinus:** sambucus- or elder-like.  
**sánc tus:** holy.  
**sandwicén sis:** of the Sandwich or Hawaiian Isls.  
**sanguín eus:** bloody, blood-red.  
**sáp idus:** savory, pleasing to taste.  
**sapién tum:** of the wise men or authors.  
**saponà ceus:** soapy.  
**sarcò des:** flesh-like.  
**sarmát icus:** of Sarmatia (an ancient territory in S. Russia and Poland).  
**sarmentò sus:** sarmentose, bearing runners.  
**sati nus:** cultivated.  
**saurocéph alus:** lizard-headed.  
**saxát ilis:** found among rocks.  
**saxic olus:** growing among rocks.  
**saxò sus:** full of rocks.  
**scà ber:** scabrous, rough.  
**scabrél lus:** somewhat scabrous.  
**scán dens:** scandent, climbing.  
**scapò sus:** with scapes.  
**scép trum:** of a scepter.  
**schizoneù rus:** cut-nerved.  
**schizopét alus:** cut-petaled.  
**schizophýl lus:** cut-leaved.  
**scholà ris:** pertaining to a school.  
**sclerocár pus:** hard-fruited.  
**sclerophýl lus:** hard-leaved.  
**scót ica:** Scotch, of Scotland.  
**scúlp tus:** carved.  
**scutellà ris:** salver- or dish-shaped.  
**scù tum:** a shield.  
**sebif era:** tallow-bearing.  
**sebò sus:** full of tallow or grease.  
**sechellà rus:** of the Seychelles (Indian Ocean).  
**secún dus:** secund, side-flowering.  
**securig era:** axe-bearing.  
**ség etum:** of cornfields.  
**semialà tus:** semi-winged, half or somewhat winged.  
**semicaudà tus:** semi- or partially tailed.  
**semicylín dricus:** semi- or somewhat cylindrical.  
**semipinnà tus:** half or imperfectly pinnate.  
**semperflò rens:** ever flowering.  
**sempér virens:** ever green.  
**seni lis:** senile, old, white-haired.  
**sensib ilis:** endowed with feeling, sensitive.  
**sensiti vus:** sensitive.  
**sepià rius:** pertaining to hedges.  
**sè pium:** of hedges or fences.  
**septangulà ris:** seven-angled.  
**septém lobus:** seven-lobed.  
**septempunctà tus:** seven-spotted.  
**septentrionà lis:** northern, belonging to the North.  
**sepúl tus:** sepulchered, interred.  
**seric eus:** silky.  
**serót inus:** late, late-flowering or late-ripening.

**sér pens:** creeping, crawling.  
**serpenti nus:** of snakes, serpentine, looping or waving.  
**serratifò lius:** serrate-leaved, saw-edge-leaved.  
**serrà tus:** serrate, saw-toothed.  
**serrulà tus:** serrulate, somewhat serrate.  
**sesquipedà lis:** one foot and a half long or high.  
**sessiflò rus:** sessile-flowered, without pedicel.  
**sessiflò lius:** sessile-leaved, without petiole.  
**sessilifò lius:** sessile-leaved.  
**sés silis:** sessile, stalkless, sitting.  
**setà ceus:** setaceous, bristle-like.  
**setig era:** bristly, bristle-bearing.  
**setò sus:** setose, full of bristles.  
**setulò sus:** full of small bristles.  
**sibír icus:** of Siberia.  
**signà tus:** marked, designated, attested.  
**sikkimén sis:** of Sikkim or Sikkim (N. India).  
**silíc eus:** pertaining to or growing in sand.  
**siliculò sus:** bearing silicles.  
**silvát icus:** pertaining to woods, sylvan; sometimes *sylvaticus*.  
**silvès tris:** pertaining to woods.  
**sím plex:** simple, unbranched.  
**simpliciaù lis:** simple-stemmed.  
**simplicifò lius:** simple-leaved.  
**simplicis simus:** simplest, very unbranched.  
**sím ulans:** similar to, resembling.  
**sinén sis:** Chinese, of China.  
**sín icus:** Chinese.  
**sinuà tus:** sinuate, wavy-margined.  
**sinuò sus:** sinuate.  
**sithén sis:** belonging to Sitka, Alaskan.  
**smarág dinus:** of emerald.  
**smilác inus:** of smilax.  
**sobolíf era:** bearing creeping rooting stems or shoots.  
**socià lis:** sociable, companionable.  
**socotrà nus:** of the Island of Socotra (south of Arabia).  
**solà ris:** solar, of the sun.  
**sól idus:** solid, dense, not hollow.  
**somníf era:** sleep-producing.  
**sór didus:** dirty, unclean, foul.  
**spadic eus:** with a spadix.  
**sparsiflò rus:** sparsely or few-flowered.  
**sparsiflò lius:** sparsely or few-leaved.  
**spár sus:** sparse, scattered, few.  
**spár teus:** pertaining to the broom.  
**spathà ceus:** with a spathe.  
**spathulà tus:** spatulate, spoon-shaped, narrowed toward the base from a rounded top.  
**speciosis simus:** very showy.  
**speciò sus:** showy, good-looking.  
**spectáb ilis:** spectacular, worth seeing, remarkable, showy.  
**spectán dus:** showy.  
**spéc trum:** an image, apparition.  
**sphacelà tus:** dead, withered, diseased.  
**sphær icus:** spherical.  
**sphærocár pus:** spherical-fruited.  
**sphærocéph alus:** spherical-headed.  
**sphæroid eus:** sphere-like.  
**sphærostà chyus:** spherical-spiked.

**spicâ tus:** spicate, with spikes.  
**spicig era:** spike-bearing.  
**spinosis simus:** most or very spiny.  
**spinô sus:** full of spines.  
**spinulif era:** bearing small spines.  
**spinulô sus:** somewhat or weakly spiny.  
**spirâ lis:** spiral.  
**spirêl lus:** a spiral, little spiral.  
**splên dens:** splendid.  
**splendîs simus:** very splendid.  
**splên didus:** splendid.  
**spumâ rius:** frothing, of froth or spume.  
**spû rius:** spurious, false, bastard.  
**squâ lens:** daubed, filthy.  
**squâl idus:** squalid, filthy.  
**squamâ tus:** squamate, with squamæ or small scale-like leaves or bracts.  
**squamô sus:** squamate, full of scales.  
**squarrô sus:** squarrose, with parts spreading or even recurved at ends.  
**stamin eus:** bearing prominent stamens.  
**stâns:** standing, erect, upright.  
**stauracân thus:** with spines cross-shaped.  
**stellâ ris:** starry.  
**stellâ tus:** stellate, starry.  
**stellulâ tus:** of little stars.  
**stenocéph alus:** narrow-headed.  
**stenóg ynus:** with a narrow stigma.  
**stenopét alus:** narrow-petaled.  
**stenophyl lus:** narrow-leaved.  
**stenóp terus:** narrow-winged.  
**stér ilis:** sterile, infertile.  
**stigmât icus:** marked, of stigmas.  
**stigmô sus:** much marked, pertaining to stigmas.  
**stipulâ ceus:** stipuled, with stipules.  
**stipulâ ris:** stipuled.  
**stipulâ tus:** stipuled.  
**stolonif era:** bearing stolons or runners that take root.  
**stramín eus:** straw-colored.  
**strangulâ tus:** strangled, constricted.  
**streptocâr pus:** twisted-fruited.  
**streptopét alus:** with petals twisted.  
**streptophyl lus:** twisted-leaved.  
**streptosép alus:** with sepals twisted.  
**striât ulus:** somewhat or faintly striped.  
**striâ tus:** striated, striped.  
**strictiflô rus:** strict- or stiff-flowered.  
**stric tus:** strict, upright, erect.  
**strigillô sus:** somewhat strigose.  
**strigô sus:** strigose, covered with sharp straight appressed hairs.  
**strigulô sus:** beset with small or weak appressed hairs.  
**striolâ tus:** striolate, somewhat or faintly striped.  
**strobilif era:** cone-bearing.  
**strumâ rius:** of tumors or ulcers.  
**strumâ tus:** with tumors or ulcers.  
**stylô sus:** with style or styles prominent.  
**styracif lius:** flowing with storax or gum.  
**suavè olens:** sweet-scented.  
**suâ vis:** sweet, agreeable.  
**suavis simus:** sweetest, very sweet-scented.  
**subacâ lis:** somewhat stemmed, nearly stemless.

**subalpi nus:** subalpine, nearly alpine.  
**subauriculâ tus:** somewhat or rather auricled or eared.  
**subcarnô sus:** nearly or rather fleshy.  
**subcordâ tus:** partially or imperfectly or somewhat cordate.  
**subedentâ tus:** nearly toothless.  
**suberculâ tus:** of cork, corky.  
**suberéc tus:** somewhat or rather erect.  
**suberô sus:** cork-barked, full of cork.  
**subfalcâ tus:** somewhat falcate.  
**subglau cus:** somewhat or to some degree glaucous.  
**subhirtêl lus:** somewhat hairy.  
**sublunâ tus:** somewhat, lunate or crescent-shaped.  
**submér sus:** submerged, under water.  
**subperén nis:** imperfectly or nearly perennial.  
**subpetiolâ tus:** somewhat or partially petioled.  
**subsés silis:** nearly sessile, not completely sessile.  
**subsinnuâ tus:** somewhat sinuate or wavy-margined.  
**subterrâ neus:** subterranean, underground.  
**subulâ tus:** subulate, awl-shaped.  
**subumbellâ tus:** somewhat or incompletely umbellate.  
**subvillô sus:** somewhat villose or soft-hairy.  
**subvolâ bilis:** somewhat twining.  
**succulên tus:** succulent, fleshy.  
**suéc icus:** Swedish, of Sweden.  
**suffrutés cens:** slightly shrubby, becoming somewhat shrubby.  
**suffruticô sus:** slightly shrubby.  
**sulcâ tus:** sulcate, furrowed.  
**sulphû reus:** sulfur-colored.  
**sumatrâ nus:** of the Isl. of Sumatra.  
**supêrb iens:** superb, proud.  
**supêr bus:** superb, proud.  
**superciliâ ris:** eyebrow-like.  
**supêr fluus:** superfluous, redundant.  
**surculô sus:** producing suckers.  
**surinamén sis:** belonging to Surinam (Dutch Guiana).  
**susiâ nus:** of the province of Susiana (Persia).  
**suspén sus:** suspended, hung.  
**sylvât icus:** sylvan, forest-loving (also written *silvaticus*).  
**sylvés tris:** of woods or forests.  
**sylvic olus:** growing in woods.  
**syphilît icus:** syphilitic.  
**syri acus:** Syrian, of Syria.  
**sfs tylus:** with styles joined.  
**tabulâ ris:** pertaining to tablets.  
**tabulifôr mis:** tablet-formed.  
**tædig era:** torch-bearing, resin-bearing.  
**taraxiciflô lius:** Taraxicum- or dandelion-leaved.  
**tardiflô rus:** late-flowered.  
**tardî vus:** tardy, late.  
**tatâr icus:** of Tartary (old name for Central Asia).  
**taû reus:** of oxen.  
**taû ricus:** Taurian, Crimean.  
**tauri nus:** bull-like.  
**taxiflô lius:** Taxus-leaved, yew-leaved.  
**tectô rum:** of roofs or houses.

**téc tus:** concealed.  
**temulên tus:** drunken.  
**tenacis simus:** most tenacious.  
**tê nax:** tenacious, strong.  
**tenebrô sus:** of dark or shaded places.  
**tenêl lus:** slender, tender, soft.  
**tén er:** slender, tender, soft.  
**tentaculâ tus:** with tentacles or short projecting parts.  
**tenuicâ lis:** slender-stemmed.  
**tenuiflô rus:** slender-flowered.  
**tenuiflô lius:** slender-leaved.  
**tenuifl obus:** slender-lobed.  
**tenû ior:** more slender.  
**tén uis:** slender, thin.  
**tenuis simus:** very slender, very thin.  
**terebinth inus:** of turpentine.  
**tê res:** terete, circular in cross-section.  
**teretiflô lius:** terete-leaved.  
**terminâ lis:** terminal, at the end of a stem or branch.  
**ternâ tus:** in threes, ternate.  
**terniflô lius:** with leaves in threes.  
**terrés tris:** of the earth, terrestrial.  
**tessellâ tus:** tessellate, laid off in squares or in dice-like pattern.  
**testâ ceus:** light brown, brick-colored; also testaceous, bearing a prominent testa or outer seed-coat.  
**testiculâ tus:** testiculated, testicled.  
**testudinâ rius:** like a tortoise-shell.  
**tetracân thus:** four-spined.  
**tetrâg nus:** four-angled.  
**tetrân drus:** four-anthered.  
**tetrân tus:** four-flowered.  
**tetrâphyl lus:** four-leaved.  
**tetrâp terus:** four-winged.  
**tetraquê trus:** four-cornered.  
**texâ nus, texén sis:** of Texas, belonging to Texas.  
**theif era:** tea-bearing.  
**thermâ lis:** warm, of warm springs.  
**thuyoi des:** like Thuja or arbor-vitæ.  
**thyrsiflô rus:** Thyrsé-flowered.  
**thyrsoid eus:** thyrsé-like.  
**tibic inis:** of a flute player.  
**tigrî nus:** tiger-striped.  
**tinctô rius:** belonging to dyers, of dyes.  
**tinc tus:** dyed.  
**tipulifôr mis:** of the shape of a daddy-long-legs.  
**tomentô sus:** tomentose, matted-pubescent.  
**terminâ lis:** useful against colic.  
**torô sus:** torose, cylindrical with contractions at certain places or at intervals.  
**tôr tilis:** twisted.  
**tortuô sus:** much twisted.  
**tôr tus:** twisted.  
**torulô sus:** somewhat torose.  
**toxicâ rius:** poisonous.  
**tôx icus:** poisonous.  
**toxif era:** poison-producing.  
**transpâ rens:** transparent.  
**trapezifôr mis:** trapezium-formed, a four-sided figure of which no two sides are alike.  
**trapezioides:** trapezium-like.  
**tremuloi des:** like Tremulus, the trembling poplar.  
**trém ulus:** quivering, trembling.  
**triacân thus:** three-spined.  
**triân drus:** with three anthers or stamens.



**triangulâ ris:** three-angled.  
**triangulâ tus:** three-angled.  
**triân gulus:** three-angular.  
**tricaudâ tus:** three-tailed.  
**trichophyl lus:** hairy-leaved.  
**trichosân thus:** hairy-flowered.  
**trichospér mus:** hairy-seeded.  
**trichôt omus:** thrice branched or forked.

**tríc olor:** three-colored.  
**trícór nis:** three-horned.  
**tricuspidâ tus:** three-cusped, three-pointed.

**tridâc tylus:** three-fingered.  
**tri dens:** with three teeth.  
**tridentâ tus:** three-toothed.  
**trifasciâ tus:** three-banded.  
**trif idus:** three-parted.  
**triflô rus:** three-flowered.  
**trifoliâ tus:** three-leaved.  
**trifoliolâ tus:** three-leafleted.  
**triflô lius:** three-leaved.

**trifurcâ tus:** trifurcate, thrice-forked.  
**trilineâ tus:** three-lined.  
**trilobâ tus:** three-lobed.  
**tril obus:** three-lobed.  
**trimés tris:** of three months.  
**tinér vis:** three-nerved.

**trinotâ tus:** three-marked or -spotted.  
**triparti tus:** three-parted.  
**tripét alus:** three-petaled.  
**triphyl lus:** three-leaved.  
**tríp teris:** three-winged.  
**tripunctâ tus:** three-spotted.  
**triquè trus:** three-cornered.  
**trís tis:** sad, bitter, dull.

**triternâ tus:** triternate, thrice in threes.  
**tríum phans:** triumphant.  
**triviâ lis:** common, ordinary, very frequent, found everywhere.

**tróp icus:** of the tropics.  
**truncât ulus:** somewhat or partially truncate.

**truncâ tus:** truncate, cut off square.  
**tuberculâ tus:** tuberculate, with tubercles or small tubers.  
**tuberculô sus:** tubercled, knotted.  
**tuberô sus:** tuberous.

**tubiflô rus:** tube-flowered, trumpet-flowered.

**tubís pathus:** tube-spathed.  
**tubulô sus:** tubulose, with tubes.  
**tulipf era:** talip-bearing.  
**tû midus:** swollen.

**turbinâ tus:** turbinate, top-shaped.  
**túr gidus:** turgid, inflated, full.  
**typhi nus:** smoky or dull; perhaps pertaining to fever.

**týp icus:** typical, conforming to the standard or norm.

**ulíc inus:** like the gorse or furze (*Ulex*).

**uliginô sus:** of wet or marshy places.  
**ulmiflô lius:** *Ulmus*-leaved, elm-leaved.

**umbellâ tus:** with umbels.  
**umbellulâ tus:** with umbellets.  
**umbonâ tus:** bossed, bearing at center an umbo or stout projection.

**umbraculif era:** umbrella-bearing, shade-producing.

**umbrô sus:** shaded, shade-loving.  
**uncinâ tus:** hooked at the point.

**undâ tus:** waved.  
**undecimpunctâ tus:** eleven-spotted.

**undulatiflô lius:** undulate-leaved.  
**undulâ tus:** undulated, wavy.

**unguiculâ ris:** clawed, narrowed to a petiole-like base.

**unguiculâ tus:** unguiculate, clawed.  
**unguipét alus:** petals clawed.

**uníc olor:** one-colored.  
**unicór nis:** one-horned.

**unidentâ tus:** one-toothed.  
**uniflô rus:** one-flowered.

**unilaterâ lis:** one-sided.  
**univittâ tus:** one-striped.

**urceolâ tus:** urn-shaped.  
**ù rens:** burning, stinging.

**urentis simus:** very burning, very stinging.

**urophyl lus:** tail-leaved.  
**urostâ chys:** tail-spiked.

**ursi nus:** pertaining to bears.  
**urticiflô lius:** nettle-leaved (*Urtica*).

**usitatís simus:** most useful.  
**ustulâ tus:** burnt, sere.

**ù tilis:** useful.  
**utilís simus:** most useful.

**utriculâ tus:** uttriculate, with a utricle or small bladder one-seeded fruit.

**utriculô sus:** uttricled.  
**uvif era:** grape-bearing.

**vâ gans:** wandering, vagabondish.  
**vaginâ lis:** vaginate, sheathed.

**vaginâ tus:** sheathed.  
**valdiviâ nus, valdiviân sis:** Valdivian,

of province of Valdivia (Chile).  
**valenti nus:** Valentian, of Valentia (in Spain).

**vâl idus:** strong.  
**variâb ilis:** variable, of many forms.

**vâ rians:** variable.  
**variâ tus:** variable.

**variegâ tus:** variegated.  
**variifór mis:** of variable or many forms.

**vâ rius:** various, diverse.  
**vastâ tor** (feminine *vastatrix*): rava-

ging, devastating.  
**vegetâ tus:** full of growth, vigorous.

**vég etus:** vigorous.  
**velâ ris:** pertaining to curtains or veils.

**velû tinus:** velvety.  
**venenâ tus:** poisonous.

**venô sus:** veiny.  
**ventricô sus:** ventricose, swelling or

inflated on one side or unevenly.  
**venús tus:** handsome, charming.

**verecún dus:** modest, blushing.  
**vermiculâ tus:** worm-like, or like

worm-tracks.  
**vernâ lis:** vernal.

**vernicif era:** varnish-bearing.  
**vér nus:** of spring, vernal.

**verrucô sus:** verrucose, warted.  
**versic olor:** variously colored.

**verticillâ ris:** verticillate.

**verticillâ tus:** verticillate, whorled, arranged in a circle about the stem.

**vê rus:** the true or genuine or standard.

**vês cus:** weak, thin, feeble.  
**vesiculô sus:** with little bladders.

**vespertî nus:** of the evening, western.

**vesti tus:** covered, clothed, as with hairs or pubescence.

**vêx ans:** puzzling, vexatious.  
**vexillâ rius:** of the standard petal (as

of pea-like flowers), with a standard.  
**villô sus:** villous, soft-hairy.

**viminâ lis:** of osiers, of basket willows.  
**vimín eus:** of osiers or wicker-work.

**vinif era:** wine-bearing.  
**vinô sus:** full of wine.

**violâ ceus:** violet.  
**violês cens:** somewhat violet-colored

or becoming so.  
**vi rens:** green.

**virês cens:** greenish, becoming green.  
**virgâ tus:** twiggy.

**virginâ lis:** virgin.  
**virgín eus:** virgin.

**virgín icus, virginién sis:** Virginian, of Virginia.

**viridiflô rus:** green-flowered.  
**viridiflô lius:** green-leaved.

**vîr idis:** green.  
**viridís simus:** greenest, very green.

**virid ulus:** greenish.  
**viscid ulus:** somewhat viscid.

**vís cidus:** viscid, sticky.  
**viscosís simus:** very sticky.

**viscô sus:** viscid.  
**vitellî nus:** dull yellow approaching

red.  
**vitiflô lius:** Vitis-leaved, grape-leaved.

**vittâ tus:** striped.  
**vittíg era:** bearing stripes.

**vivíp arus:** viviparous, producing the young alive (rather than oviparous).

**volgár icus:** Volgan, of the Volga river region (written also *volgáricus*).

**volû bilis:** twining.  
**volûp tas:** pleasure, delight.

**volû tus:** rolled-leaved.  
**vulgâ ris:** vulgar, common.

**vulgâ tus:** common.  
**vulpî nus:** of the fox.

**wolgár icus:** Volgan (see *volgáricus*).

**xanthacân thus:** yellow-spined.  
**xân thi nus:** yellow.

**xanthocâr pus:** yellow-fruited.  
**xantholeû cus:** yellow-white.

**xanthophyl lus:** yellow-leaved.

**yedoén sis:** of Yedo or Yeddo (Japan).  
**yunnanén sis:** of Province of Yun-nan,

China.

**zebrî nus:** zebra-striped.  
**zeylân icus:** Ceylonian, of Ceylon;

Cingalese; same as *ceylanicus*.  
**zonâ lis:** zonal, zoned.

**zonâ tus:** zoned, banded.

# GLOSSARY

## OF THE USUAL BOTANICAL AND HORTICULTURAL TECHNICAL WORDS

The following set of words includes many descriptive terms used in this Cyclopedia and elsewhere, with explanations of their meaning. In some respects, the Name-List (pages 148 to 159) is a glossary, and the consultant should search there when he fails to find the word in the present catalogue.

- Aberrant.** Unusual, or exceptional; a plant or structure that varies from customary structure or from the type; used mostly of variation.
- Abortive.** Defective; barren; not developed.
- Abrupt.** Changing suddenly rather than gradually, as a leaf that is narrowed quickly to a point, or a pinnate leaf that has no terminal leaflet; not tapering.
- Acaulescent.** Stemless, or apparently stemless; sometimes the stem is subterranean or protrudes only slightly.
- Accessory buds.** Buds more than one in an axil.
- Accessory fruit.** Fruit-like body composed of pericarp and other structure or structures seemingly a part of it, but not originally united with it, as wintergreen berry.
- Accrescent.** Increasing; becoming larger after flowering, as the calyx in some plants.
- Accumbent.** Lying against; said of cotyledons when the edges are placed against the radicle.
- Achene (akene).** A dry indehiscent one-seeded pericarp.
- Achlamydeous.** Lacking calyx or corolla; naked.
- Acinaciform.** Shaped like a scimitar; curved, round toward the point, being thicker on the outer side than on the convex or inner side.
- Acotyledonous.** Without cotyledons.
- Adnate.** Grown to, united with another part; as stamens with the corolla-tube or an anther in its whole length with the filament.
- Adventitious buds.** Buds appearing on occasion, rather than in regular places and order, as those arising about wounds.
- Adventive.** Said of an introduced plant not yet established; imperfectly or only partially naturalized.
- Æstivation.** The arrangement of floral envelopes in the bud (æstivus, summer, when flowers mostly appear. Vernation is leaf-arrangement in the bud).
- Affinity.** A plant or part closely related to another or much resembling it in structure.
- Agglomerate.** Piled together, heaped up.
- Aggregate fruit.** One formed by the coherence of pistils that were distinct in the flower, as blackberry.
- Albumen.** Starchy or other nutritive material accompanying the embryo; commonly used in the sense of endosperm, for the material surrounding the embryo.
- Alburnum.** The sapwood or younger wood of a tree.
- Alternate.** Any arrangement of leaves or other parts not opposite or whorled; placed singly at different heights on the axis or stem.
- Alveolate.** Honey-combed, or pitted with angular separated depressions.
- Ament.** Catkin.
- Amentiferous.** Bearing aments or catkins.
- Amorphous.** Formless; of no definite or constant form.
- Amphigean.** Of both worlds, the Old and New; said of distribution of plants.
- Amphitropous.** Said of a straight ovule or seed that is apparently turned a quarter way around, so that it is half inverted and with the scar or hilum on the side.
- Ampullaceous.** Said of plants bearing flask-like parts, as in certain aquatics such as Utricularia.
- Analogous.** Related in function or use, but not in origin. See *Homologous*.
- Anastomosing.** Netted; interveined; said of leaves marked by cross-veins forming a network.
- Anatropous.** Said of a straight ovule or seed that is inverted, with the micropyle next the hilum or scar.
- Ander.** Male; occurs in combinations as, *monandrous*, having one stamen.
- Andræceum.** The male or stamen-bearing part of a flower; the stamens spoken of collectively. See *Gynæcium*.
- Androphore.** The cylinder or column formed by monadelphous filaments, as in the mallow and bombax tribes.
- Angiosperms.** Plants that bear the seeds within a pericarp, in distinction from the gymnosperms which have naked ovules and seeds; having a closed ovary.
- Annual.** Of one season's duration from seed to maturity and death.
- Anterior.** Front; on the front side; away from the axis; toward the subtending bract.
- Anther.** The pollen-bearing part of the stamen, borne at the top of the filament or sometimes sessile.
- Antheriferous.** Anther-bearing.
- Anthesis.** Flowering; strictly, the time of expansion of a flower, but often used to designate the flowering period; the act of flowering.
- Anthocarpous.** Said of a body combined of flowers and fruit united into a solid mass, as in the pineapple or the mulberry.
- Anthodium.** Flower-head of the Composite; in common speech this flower-head is erroneously called a "flower."
- Antical.** Front, anterior.
- Apetalous.** No petals; petals missing.
- Apical.** At the apex or top.
- Apocarpus.** Carpels not united; see *Syncarpous*.
- Appendage.** An attached subsidiary or secondary part, as a projecting part or a hanging part or supplement.
- Appressed.** Closely and flatly pressed against; adpressed.
- Arachnoid.** Cobwebby, by soft and slender entangled hairs; also spider-like.
- Areole, areola.** A small more or less angular space on a surface, as between network of veins.
- Aril.** An appendage or an outer covering of a seed, growing out from the hilum or funiculus; sometimes it appears as a pulpy covering.
- Arillate.** Provided with an aril.
- Arillode.** An aril-like structure, or false aril; a coating or covering of the seed arising from its own surface, and not from the funiculus.
- Armed.** Provided with any kind of strong and sharp defence, as of thorns, spines, prickles, barbs.
- Articulate.** Jointed; provided with nodes or joints, or places where separation may naturally take place.
- Ascending.** Rising up; produced somewhat obliquely or indirectly upward.
- Asexual.** Sexless; without sex.
- Auricle.** An ear-shaped part or appendage, as the projections at the base of some leaves and petals.
- Awl-shaped.** Narrow and sharp-pointed; gradually tapering from base to a slender or stiff point.
- Awn.** A bristle-like part or appendage.
- Azil.** Upper angle that a petiole or peduncle makes with the stem that bears it.
- Azile.** Borne in or on the axis, or relating to it.



- Axillary.** In an axil.
- Axis.** The main or central line of development of any plant or organ; the main stem.
- Bacca.** A berry.
- Baccate.** Berry-like; pulpy or fleshy.
- Banded.** Marked with cross-bars or horizontal lines of color, or with very prominent ribs or other structure.
- Barb.** A short point or bristle; usually employed to designate points with reflexed or fishhook-like rarely ascending appendages.
- Barbulate.** With fine beards.
- Bark.** The word is often used in a general way to designate the softer outer envelope of a stem or root. In this sense, it includes all that peels readily, as the bark of the hemlock and oak, used for tanning leather. In a stricter sense, it is applied to the corky layers formed on the outer surface of woody plants. It is formed from an active layer of tissue,—the phellogen. The bark is developed in different ways on different trees. So distinct are the resulting tissues that species of trees may be readily recognized by their bark alone. Cork of commerce is the bark of the cork oak, a native of southwestern Europe. Inasmuch as the word covers so many structures, it is little used by botanists in technical descriptions.
- Bark-grafting.** A kind of grafting in which the cions are inserted between the bark and wood of a stub; often, but erroneously, called crown-grafting.
- Base.** The bottom or lower end of a part or structure or organ, even though this part may be uppermost as the organ hangs on the plant.
- Basifixed.** Attached or fixed by the base, as an ovule that is affixed to its support by its bottom rather than by its side or by an angle.
- Basin.** The depression at the apex or blossom-end of an apple or other pome fruit.
- Basinerved.** All the ribs or nerves of a leaf or petal starting from its base.
- Bast.** The soft part of the fibro-vascular bundles in plants, abundant in the inner bark. It increases in thickness simultaneously with the wood, but much less rapidly. The fibrous elements in the bast of basswood have been used in making cordage; also in making strong paper.
- Beak.** A long prominent and substantial point; applied particularly to prolongations of fruits and carpels.
- Beard.** A long awn or bristle-like hair.
- Berry.** Pulpy, indehiscent, few- or many-seeded fruit; technically, the pulpy fruit resulting from a single pistil, containing one or more seeds but no true stone, as the tomato.
- Bi- or Bis-.** In Latin compounds, signifying *two* or *twice*.
- Biauriculate, biaurite.** Having two ears.
- Bicallous, bicallous.** Furnished with two callosities, as the lip of some orchids.
- Bicrural.** With two tails, legs, or slender elongations.
- Biennial.** Of two seasons' duration from seed to maturity and death.
- Bifarious.** Arranged in two rows.
- Bifid.** Two-cleft or two-cut.
- Bifoliolate.** With two leaflets to a leaf.
- Biforate.** With two openings, pores or apertures.
- Bigener.** Plant arising from a cross between two genera.
- Bilabiate.** Two-lipped, double-lipped.
- Bilamellate.** Bearing or consisting of two plates.
- Bilobed.** Two-lobed; parted into two lobes.
- Bilocular.** Two-celled; with two locules or compartments.
- Bipartite.** Divided into two parts; separated nearly to base.
- Bipinnate.** Twice-pinnate; when the primary divisions are pinnate.
- Bipinnatifid.** Twice-pinnatifid; when pinnatifid primary parts are pinnately cut.
- Biplicate.** Bearing two plaits or folds.
- Bisepate.** Twice-divided; with two partitions.
- Biserial.** In two series or sets.
- Biserrate.** Doubly serrate; the serratures themselves serrate.
- Bisexual.** Two-sexed; with both stamens and pistils.
- Biternate.** Twice-ternate; when the divisions of a ternate leaf are divided into three.
- Bivalvular.** Two-valved.
- Bivittate.** With two vittae or oil-tubes.
- Bladdery.** Inflated; empty, and the walls thin like the bladder of an animal.
- Blade.** The expanded part of leaf or petal.
- Blanching.** A whitening or decoloring of the usually green parts of plants, as in celery or endive when it is prepared for use.
- Bole.** The trunk of a tree, particularly of a large tree.
- Boss.** A prominent center or projection on a flat and more or less circular surface.
- Bottom-heat.** A term used to designate the condition that arises when the roots of plants, or the soil in which they grow, are exposed to a higher temperature than that of the air in which the aërial parts are growing.
- Brachiate.** Branches or parts spreading at nearly right-angles and placed alternately.
- Brachys.** In Greek compounds, signifying *short*, as brachypodus, on a short foot or stalk.
- Bract.** A much-reduced leaf, particularly the small or scale-like leaves in a flower-cluster or associated with the flowers.
- Bracteal.** Concerning or pertaining to bracts.
- Bracteole.** Bractlet.
- Bractlet.** Bract born on a secondary axis, as on the pedicel or even on a petiole.
- Breaking.** Said when buds start to grow.
- Bristly.** Bearing stiff strong hairs or bristles.
- Bud.** An incipient or nascent shoot; the rudimentary or beginning state of a stem; particularly, in common speech, a thickened and condensed resting-stage of a shoot, or a flower or leaf before expanding; in propagating, a single bud used on a cutting or cion. See *Buds*, p. 586.
- Budding.** The operation of applying a single bud to the surface of the growing wood of the stock, with the intention that it shall grow. The bud is usually inserted underneath the bark of the cion, and is held in place by a bandage. Budding is a part of the general process of grafting. Called *inoculation* in old writings.
- Bulb.** A thickened part in a resting state and made up of scales or plates on a much shortened axis. See *Bulb*, p. 588.
- Bulbel.** A bulb arising from a mother-bulb.
- Bulbiferous.** Bulb-bearing.
- Bulblet.** Aërial bulb; a bulb borne above ground, as in the flower-cluster or a leaf-axil.
- Bulbo-tuber.** Corm.
- Bulbous.** Bulb-like; with the structure or the characteristics of a bulb.
- Bullate.** The surface blistered or puckered, as the leaf of a Savoy cabbage.
- Bursicle.** A little pouch-like or purse-like receptacle.
- Bush.** A low and thick shrub, without distinct trunk.
- Caducous.** Falling off early, or prematurely, as the sepals in some plants.
- Calcarate.** Spurred.
- Calcariform.** Spur-formed; shaped like a calcar or spur.
- Calceolate.** Slipper-like; having the form of a round-toed shoe.
- Callosity.** A thickened and hardened part or protuberance.
- Callus.** A hard prominence or protuberance; in a cutting or on a severed or injured part, the roll of new covering tissue.
- Calyxine.** Pertaining to a calyx, or calyx-like.
- Calyculate.** Calyx-like; bearing a part resembling a calyx; particularly, furnished with bracts against or underneath the calyx resembling a supplementary or outer calyx.
- Calyptra.** A hood or lid; particularly the hood or cap of the capsule of a moss.
- Calyptiform.** Hood-formed; like a cap pulled over.

- Calyx*. The outer circle of floral envelopes.
- Cambium*. The growing or nascent tissue lying between the xylem and phloem of the fibro-vascular bundle, and therefore on the outside of the woody trunk between wood and bast, or in trees and shrubs between wood and "bark." Its function is to increase the stem in diameter.
- Campanulate*. Bell-shaped.
- Campylotropous*. Said of an ovule or seed so curved or turned on itself as to bring the apex and base together.
- Canaliculate*. Grooved or channeled lengthwise.
- Canescent*. Gray-pubescent and hoary.
- Cap*. A convex removable covering of a part, as of a capsule; in the grape, the cohering petals fall off as a cap.
- Capillary*. Hair-like; very slender.
- Capitate*. Headed; in heads; formed like a head; aggregated into a very dense or compact cluster.
- Capitulum*. Head; a close body of sessile flowers.
- Capsular*. Pertaining to a capsule; formed like a capsule.
- Capsule*. Compound pod; a dry fruit of more than one carpel, opening at maturity.
- Carinate*. Keeled; provided with a projecting central longitudinal line or ridge on the lower or under surface.
- Carpel*. One of the foliar units of a compound pistil; a simple pistil contains one carpel.
- Carpophore*. Fruit-stalk; stem bearing the carpels; particularly, in the Umbelliferae, the slender extended axis that supports the ripe seed-like carpels.
- Cartilaginous*. Hard and tough, like parchment.
- Caruncle*. On a seed, a protuberance or growth at or around the hilum.
- Caryopsis*. An achene-like fruit, with the thin pericarp or covering grown fast to the seed; it is the characteristic fruit of the cereal grains and other grasses.
- Cataphyll*. An undeveloped leaf, as at the beginning of a growth.
- Catkin*. A scaly-bracted spike with declinuous flowers; ament; prominent in willows and poplars.
- Caudex*. Stem, trunk; used particularly to designate the persistent base of an herbaceous stem that is otherwise annual, and also for the stem of tree-ferns and palms.
- Caudicle*. Little stem, stemlet; stalk of pollinium in orchids.
- Cauliscent*. More or less stemmed or stem-bearing; having an evident stem above ground.
- Caulicle*. Stemlet of the embryo; radicle.
- Cauline*. Pertaining or belonging to the stem.
- Cavity*. The depression at the bottom or stem-end of an apple or similar fruit.
- Cell*. One of the ultimate compartments or vesicles of which plants are composed or made up; also, a cavity or compartment or locule of an ovary or anther.
- Cellular*. Tissue made up of short thin-walled cells, rather than of fibers or tubes.
- Centrifugal*. Away from the center.
- Centripetal*. Toward the center.
- Centrum*. The central part of any structure; particularly the large central air-space in hollow stems.
- Cephalanthium*. An old name for the flower-head of composites; anthodium.
- Cephalium*. The head-like stem-end of condensed cacti, bearing the flowers and fruits.
- Cernuous*. Drooping; inclining somewhat from the perpendicular.
- Cespirose*. Matted; growing in tufts; in little dense clumps; said of low plants that make tufts or turf of their basal growths.
- Chaeta*. A bristle; seta.
- Chaff*. A small thin dry and membranous scale or bract; in particular, the bracts in the flower-heads of composites.
- Channeled*. Deeply grooved lengthwise; canaliculate.
- Chartaceous*. Thin, hard and stiff; having the texture of writing-paper.
- Chrysos*. In Greek compounds, signifying *golden* or *golden yellow*.
- Ciliate*. Fringed with hairs; bearing hairs on the margin.
- Ciliolate*. Slightly or minutely ciliate.
- Cinereous*. Ash-colored; light gray.
- Cinnamomeus*. Cinnamon-colored.
- Cion*. The bud or branch used in grafting; also spelled *scion*.
- Circinate*. Coiled downward or inward from the top, as the young frond of a fern and cycas.
- Circumscissile*. Opening or dehiscing by a line around the fruit or anther, the valve usually coming off as a lid.
- Cirrhiferous*. Tendril-bearing.
- Cirrhiform*. Tendril-form.
- Cirrus*. *cirrus*. A tendril.
- Cladophyllum*. A flattened leaf-like branch, functioning as foliage, as in many acacias and in asparagus.
- Clados*. In Greek compounds, signifying a *branch*.
- Clasping*. Leaf partly or wholly surrounding stem.
- Clavate*. Club-shaped; said of a long body thickened toward the top.
- Claw*. The long narrow petiole-like base of the petals or sepals in some flowers.
- Cleistogamous flowers*. Small closed self-fertilized flowers, as in some violets and in many other plants.
- Close fertilization*. Fecundation by pollen from same flower; self-fertilization.
- Clove*. One of the separable parts of a composite bulb, as of the garlic.
- Clypeate*. With the form of an ancient buckler or round convex shield; shield-like.
- Coalescence*. The union of similar parts or organs, or of those in the same series as stamens with stamens and petals with petals.
- Coarctate*. Crowded together.
- Coccus*. A berry (plural *cocci*); in particular, one of the parts of a lobed fruit with one-seeded cells.
- Cochleariform*. Spoon-shaped.
- Coherent*. Two or more similar parts or organs joined.
- Cohesion*. The union of two or more organs of same kind.
- Collateral*. By the side; standing side by side.
- Column*. Body formed of union of stamens and pistil in orchids, or of stamens, as in mallows.
- Commissure*. The place of joining or meeting; as the face by which one carpel joins another.
- Comose*. Bearing a tuft or tufts of hair.
- Complete flower*. All parts present.
- Complete leaf*. Having blade, petiole, stipules.
- Complicate*. Folded over or back on itself.
- Compound*. Of two or more similar parts in one organ.
- Compound leaf*. A leaf with two or more separate leaflets; in some cases (as in Citrus) some of the leaflets may be obsolete and the compound leaf have only one leaflet.
- Compound pistil*. Of two or more carpels united.
- Compressed*. Flattened, especially flattened laterally.
- Conchiform*. Shell-form; like one valve of a bivalve shell.
- Conduplicate*. Two parts folded together lengthwise.
- Cone*. A dense and usually elongated collection of flowers or fruits borne beneath scales, the whole with scales and axis forming a detachable homogeneous fruit-like body; some cones are of short duration, as the staminate cones of pines, and others become dry and woody durable parts.
- Confluent*. Running together so as to form a single part or organ; blended.
- Conformed*. Of the same form or character as something else or as a related part or structure.
- Congested*. Crowded very closely together; collected into a mass or body.
- Conglobate*. Gathered into a ball or globe.
- Conglomerate*. Clustered; brought together.
- Coniferous*. Cone-bearing.
- Connate*. United or joined; in particular, like or similar structures joined as one body or organ.
- Connective*. The filament or tissue connecting the two cells of an anther, particularly when the cells are separated.



- Connivent.** Coming together or converging, but not organically connected.
- Conoidal.** Cone-like; nearly conical.
- Convolute.** Said of floral envelopes in the bud when one edge overlaps the next part or petal or sepal or lobe while the other edge or margin is overlapped by a preceding part; rolled up.
- Cordate.** Heart-shaped; with a sinus and rounded lobes at the base and ovate in general outline.
- Cork.** The name applied to the outer impervious mostly not-living part of the bark. Most bark develops a corky exterior, and in some cases it becomes very prominent. In *Evonymus Thunbergianus*, the English maple, the corky barked elm, and other trees and shrubs, it forms wings on the branches. The cork of commerce comes from the bark of *Quercus Ilex* (better known as *Q. Suber*), plantations of which grow in southwestern Europe. The cork tree of the catalogues, *Phellodendron amurense*, is a curious tree, cultivated for ornament.
- Corm.** A solid bulb-like part, usually subterranean, as the "bulb" of crocus and gladiolus.
- Cormel.** A corm arising from a mother-corm.
- Cormlet.** Aërial corm, or one borne in the inflorescence or in the leaf axils.
- Cormous.** With corms, or pertaining to corms.
- Corneous.** Horny; hard and very dense in texture.
- Corniculate.** Bearing or terminating in a small horn-like protuberance or process.
- Corolla.** Inner circle of floral envelopes; if the parts are separate, they are petals; if not separate, they are teeth, lobes or divisions.
- Corona.** Crown, coronet; any appendage or intrusion that stands between the corolla and stamens, or on the corolla, as the cup of a daffodil, or that is the outgrowth of the staminal part or circle, as in the milkweeds.
- Coroniform.** Crown-formed or crown-like; corona-like.
- Corticatè.** Having a cortex or hard bark; also having a rind, as the lemon and orange.
- Corymb.** Short and broad, more or less flat-topped indeterminate flower-cluster.
- Corymbose inflorescence.** Outer flowers opening first.
- Costa.** A rib; in particular a strong rib or line, as a midrib or mid-nerve.
- Costate.** Ribbed.
- Cotyledon.** Seed-leaf; the primary leaf or leaves in the embryo; in some plants the cotyledon always remains in the seed-coats and in others (as bean) it emerges on germination.
- Crateriform.** Deep saucer-shaped; cup-shaped.
- Creeper.** A trailing shoot that takes root in the ground throughout its length.
- Crenate.** Shallowly round-toothed or obtusely toothed.
- Crenulate.** Finely or shallowly crenate.
- Crested.** With elevated and irregular or toothed ridge.
- Cribrose.** Sieve-like; with numerous small apertures.
- Crop.** Produce of tilled, cared-for or protected plants.
- Croppage.** The whole subject of the producing of crops.
- Cross.** The offspring of any two flowers that have been fertilized. A cross-breed is a cross between varieties of the same species. Synonyms are half-breed, mongrel, variety-hybrid. Crossing is the operation of cross-pollinating. Cross-pollination is the transfer of the pollen of one flower to the pistil of another.
- Cross-fertilization.** Fertilization or fecundation secured by pollen from another flower.
- Cross-pollination.** Transfer of pollen from flower to flower.
- Crown.** Corona; also that part of the stem at the surface of the ground; also a part of a rhizome with a large bud, suitable for use in propagation.
- Cruciate.** Cross-shaped or cross-like.
- Crustaceous.** Said of bodies or coverings that are hard and brittle.
- Cryptogam.** Flowerless plant, as fern, moss, fungus, seaweed; less used than formerly as a technical term.
- Cryptos.** In Greek compounds, signifying *concealed*.
- Culm.** The stem of sedges and grasses, and similar plants.
- Cuneate.** Wedge-shaped; triangular, with the narrow end at point of attachment, as of leaves or petals.
- Cupular.** Cup-like or cup-shaped; the acorn nut sits in a cupule or little cup (whence the name Cupuliferæ).
- Cuticle.** The external rind or skin of a plant or part; usually applied to the thin waterproof membrane overlying the epidermis.
- Cutting.** A severed vegetative or asexual part of a plant used in propagation; as a cutting of root, of stem, or of leaf.
- Cyathiform.** Cup-shaped.
- Cymbiform.** Boat-shaped.
- Cyme.** A broad, more or less flat-topped determinate flower-cluster.
- Cymose inflorescence.** With central flowers opening first.
- Cypselæ.** An old term for the fruit of composites, being dry, one-celled and one-seeded.
- Deciduous.** Falling, as the leaves of non-evergreen trees.
- Decom pound.** More than once compound.
- Decumbent.** Reclining or lying on the ground, but with the end ascending.
- Decurrent.** Running down the stem, as the leaf of mullein.
- Decussate.** Opposite leaves in four rows up and down the stem; alternating in pairs at right angles.
- Definite.** Said of a constant or known number, not exceeding twenty; contrasted with indefinite, above twenty, when the parts are usually not counted in systematic descriptions.
- Deflexed.** Turned downward abruptly.
- Defoliation.** The casting or falling of the leaves.
- Dehiscence.** The method or process of opening of a seed-pod or anther.
- Deliquescent.** Trunk or leader lost in the branches; said of tree-top without a leader.
- Deltoid.** Triangular; delta-like.
- Dendroid.** Said of tree-shaped small plants.
- Dendron.** In Greek compounds, signifying a *tree*.
- Dentate.** With sharp spreading teeth.
- Depauperate.** Applied to a plant or part that is less perfectly developed than usual or normal; also said of very small members of a genus or family.
- Depressed.** More or less flattened endwise or from above.
- Descending.** The direction gradually downwards.
- Determinate.** Definite cessation of growth at the apex or in the main axis.
- Di-, Dis-,.** In Greek combinations, signifying *two* or *twice* as *diphyllus*, *two-leaved*.
- Diadelphous.** In two groups, as the stamens of some Leguminosæ, joined by their filaments.
- Diandrous.** With two stamens.
- Diaphanous.** Transparent or translucent.
- Dicarpellous.** Comprised of two carpels.
- Dichlamydeous.** Provided with both calyx and corolla.
- Dichogamy.** Stamens and pistils maturing at different times.
- Diclinous.** Imperfect; having either stamens or pistils but not both; unisexual. See *Monoclinous*.
- Dicoccous.** Separating into two cocci.
- Dicotyledonous.** With two cotyledons.
- Didynamous.** With four stamens in two pairs of different length.
- Diffuse.** Loosely branching or spreading; of open growth.
- Digitate.** Hand-like; compound with the members arising from one point.
- Dimerous.** The parts in twos.
- Dioecious.** Staminate and pistillate flowers on different plants.
- Dipterous.** Two-winged.
- Dippyrenous.** Having two stones or pyrenes.
- Disciform.** Flattish and circular like a discus.
- Discoid.** Disk-like; in particular, said of a head of Compositæ without ray-flowers.

- Disk, disc.* A more or less fleshy or elevated development of the receptacle about the pistil; receptacle in the head of Compositæ.
- Disk-flowers.* The tubular flowers in the center of heads of Compositæ, as distinguished from the ray-flowers.
- Dissected.* Divided into many slender segments.
- Dissepiment.* A partition, particularly in an ovary or fruit.
- Distinct.* Separate; not united with parts in the same series.
- Divided.* Separated to the base.
- Division.* Propagation by means of separating the root system or rhizome system into parts; cutting up the plant into several root-bearing parts or pieces, as when one rhubarb plant is made into two or more.
- Dorsal.* Back; relating to the back or outer surface of a part or organ.
- Dorsiferous.* Bearing anything on the back.
- Dorsifixed.* Attached by the back.
- Dorsoventral.* Literally, back-front; placed with reference to the back or front or to both.
- Double.* Said of flowers that have more than the usual number of floral envelopes, particularly of petals; full.
- Downy.* Covered with very short and weak soft hairs.
- Drupe.* A fleshy one-seeded indehiscent fruit, with seed inclosed in a stony endocarp; stone-fruit.
- Drupelet.* One drupe in a fruit made up of aggregate drupes, as in the raspberry.
- Dumose.* Low and branching, as a bush.
- E- or Ex-.* In Latin-formed words, usually denoting, as a prefix, that parts are missing, as exstipulate, *without stipules*, estriate, *without stripes*.
- Ecalcarate.* Without calcar or spur.
- Ecology.* Study of habits and modes of life of animals and plants.
- Ecostate.* Without ribs.
- Edentate.* Without teeth.
- Effuse.* Loosely spreading; very diffuse.
- Eglandulose.* Without glands.
- Elliptic.* A flat part or body that is oval and narrowed to rounded ends.
- Elongate.* Lengthened; stretched out.
- Embryo.* The plantlet in the seed.
- Endocarp.* The inner layer or part of a pericarp.
- Endogen.* Term applied to stems having scattered bundles, as of Indian corn, not appropriate, and now little used. See *Exogen*.
- Endosperm.* Starch or other food outside or around the embryo; albumen.
- Ensiform, ensate.* Sword-shaped; long, flat, 2-edged, nearly or quite straight, with a sharp point.
- Entire.* Margin not in any way indented; whole.
- Environment.* Surroundings; conditions in which organisms live and grow.
- Ephemeral.* Persisting for one day only, as flowers of spiderwort.
- Epi.* A Greek prefix signifying *on or upon*.
- Epicarp.* The outer layer or surface of the pericarp.
- Epichile.* The upper part of the jointed lip of an orchid.
- Epicotyl.* That part of the caulicle lying above the cotyledons.
- Epidermis.* Superficial layer of cells and underneath the cuticle.
- Epigeal.* Cotyledons rising into the air in germination.
- Epigeous.* Close upon the ground rather than underneath.
- Epigynous.* Borne on the ovary; used of floral parts when ovary is inferior and flower not perigynous.
- Epipetalous.* On a petal.
- Epiphyllous.* On a leaf.
- Epiphyte.* Air-plant; a plant growing on another or on some other elevated support.
- Equivalent.* Sitting astride; used for conduplicate leaves that stand inside each other in two ranks, as in *Iris*.
- Erostrate.* Without a beak.
- Essential organs.* Stamens and pistils.
- Evergreen.* Remaining green throughout the year.
- Exalbuminous.* Seeds without albumen or endosperm.
- Excentric.* Out of or away from the center.
- Excurrent.* The trunk or leader continuing through the top.
- Exfoliating.* Coming off in thin layers, as the bark of birch and other plants.
- Exocarp.* The outside part of a pericarp.
- Exogen, exogenous.* Growing and increasing in diameter by layers on the exterior of the woody cylinder, in distinction from endogens.
- Exserted.* Sticking out; projecting beyond, as stamens from a perianth.
- Exsiccated.* Dry or dried.
- Exstipulate.* Without stipules.
- Extorse.* Looking or facing outward.
- Eye.* The marked center of a flower; a bud on a tuber, as on a potato; a single-bud cutting.
- Facies.* The general appearance or "looks" of a plant; or the characteristic appearance of a plant society.
- Farinaceous.* Containing starch, or starch-like materials.
- Fasciated.* Much flattened; an abnormal or teratological widening and flattening of the stem.
- Fascicle.* A condensed or close cluster, as of flowers.
- Feminine.* Pistillate (in higher plants).
- Fertile.* Said of pollen-bearing stamens and seed-bearing fruits.
- Fertilization.* Impregnation of the ovule; the act of union of sperm and egg cells, in the higher plants taking place within the ovule: fecundation.
- Fetid.* Having a disagreeable odor.
- Fibrillose.* With fine fibers or threads.
- Fibrous.* Fiber-like; containing fibers or thread-like parts.
- Fibro-vascular.* Made up of both fibers and ducts; combination of fibrous and vascular structure.
- Filament.* Stalk of the anther.
- Filiform.* Thread-like; long and very slender.
- Fimbriate.* Fringed.
- Fimbrillate.* Minutely fringed.
- Fistular.* Cylindrical and hollow.
- Flaccid.* Soft; lax and weak; not rigid.
- Flagelliform.* Whip-form; long and slender like a lash.
- Flagging.* Wilting; said particularly of newly made cuttings and recently transplanted plants.
- Flexuous.* Having a more or less zigzag or wavy form; said of stems of various kinds.
- Floccose.* With tufts or flocks of soft wool or woolly hair.
- Flora.* The plant population of a given region; also a book describing this population.
- Florets.* Individual flowers of composites and grasses; also other very small flowers that make up a very dense form of inflorescence.
- Floriferous.* Flower-bearing.
- Foliaceous.* Leaf-like; said particularly of sepals and calyxlobes and of bracts that in texture, size or color look like small or large leaves.
- foliate.* In combinations, -leaved; having leaves; as trifoliate, *three-leaved*.
- foliolate.* Having leaflets; as trifoliolate, *of three leaflets*.
- Follicle.* Dry, dehiscent pericarp opening only on the front suture.
- Follicular.* With follicles; follicle-like.
- Foramen.* An aperture or opening.
- Forked.* Branching or divided into nearly equal parts or members.
- Fornicate.* Arched.
- Free.* Not joined to other organs; as petals free from the stamens or calyx.
- Froned.* Leaf of fern; sometimes used in the sense of foliage.
- Frosted.* With a more or less shining or crystallized white covering.
- Fructification.* The act or process of fruiting; also the fruiting organ or organs.
- Fruit.* The ripened pericarp or pericarps with the adnate parts; the seed-bearing organ.
- Fruiticose.* Shrubby or shrub-like in the sense of being woody.



- Fugacious.** Falling or withering away very early.
- Fumose.** Smoke-colored.
- Function.** What a plant or a part does; its vital activities.
- Funicle.** The stalk or stipe of an ovule or seed.
- Funnelform.** With tube gradually widening upward and passing insensibly into the limb, as in many flowers of *Convolvulus*; *infundibuliform*.
- Furrowed.** With longitudinal channels or grooves.
- Fusiform.** Spindle-shaped; narrowed both ways from a swollen middle, as *dahlia* roots.
- Galea.** A hood or a helmet-shaped part or structure, as found in the upper lip of some corollas.
- Gamete.** One of the sex-cells, either male or female.
- Gamopetalous.** Corolla of one piece; petals united.
- Gamophyllous.** Leaves united.
- Gamosepalous.** Calyx of one piece; sepals united.
- Geminate.** In pairs; twin.
- Gemma.** A bud; particularly a bud or bud-like structure by which a plant propagates.
- Gemmiparous.** Bud-bearing.
- Gemmule.** A little bud or bud-like structure.
- Generation.** Period from birth (impregnation) to death; the epoch from one 1-celled stage of a plant to the next 1-celled stage.
- Germination.** The unfolding of the embryo and becoming self-established of the plantlet.
- Gibbosity.** A swelling or bulging on one side or near the base.
- Glabrate.** Nearly glabrous, or becoming glabrous with maturity or age.
- Glabrous.** Not hairy.
- Gladiate.** Sword-shaped or sword-like.
- Gland.** Properly a secreting part or prominence or appendage, but often used in the sense of gland-like.
- Glandular.** Having or bearing secreting organs, or glands.
- Glandulose, glanduliferous.** Gland-bearing.
- Glaucous.** Covered with a "bloom" or a whitish substance that rubs off.
- Glochidiate.** Said of parts with summit barbed.
- Glomerate.** In dense or compact cluster or clusters.
- Glomerule.** Dense head-like clusters; properly a dense cyme.
- Glume.** A small chaff-like bract; in particular, one of the two empty bracts at the base of the grass spikelet.
- Graft.** A branch or bud inserted on another plant with the intention that it shall grow there; cion.
- Grafting.** The process of inserting a cion in a plant with the intention that it shall grow there. See *Budding*.
- Granular, granulose.** Covered with very small grains; minutely or finely mealy.
- Gymnos.** In Greek compounds, signifying *naked* or *not covered*: as *gymnosperms*, with *naked seeds* (not in a pericarp). See *Angiosperm*.
- Gynandrous.** With the stamens grown on the pistil, forming one organ, as in the orchids.
- Gynobase.** Stipe or stalk of an ovary, being an extension or prolongation of the receptacle; short gynophore.
- Gynæcium.** The female or pistil-bearing part of the flower. See *Andræcium*.
- Gynophore.** Stipe of an ovary prolonged within the calyx.
- Habit.** The looks, appearance, general style or mode of growth; as an upright, open, decumbent or strict habit.
- Habitat.** Particular place in which a plant grows; as a swamp, roadside, lawn, woods, ballast-heap, hillside.
- Hairs.** A general name for many kinds of small and slender outgrowths on the parts of plants; special kinds of hairiness are designated as *setose*, *villous*, *comose*, *pubescent*, *hirsute*, and others.
- Halberd-shaped.** Hastate.
- Hamate.** Hooked.
- Hastate.** Of the shape of an arrow-head but the basal lobes pointed or narrow and standing nearly or quite at right angles; halberd-shaped.
- Haulm.** Straw-like stems, as of the cereal grains; sometimes also applied to the stems of palms; usually a collective noun.
- Head.** A short dense spike; capitulum.
- Heart-shaped.** Cordate; ovate in general outline but with two rounded basal lobes; has reference particularly to the shape of the base of a leaf or other expanded part.
- Heel.** An enlarged or more or less transverse part on the lower end of a cutting secured from the older or larger branch from which the cutting is taken.
- Helicoid.** Twisted or coiled in snail-shell form.
- Heliotropism.** The characteristic of turning toward the light.
- Hemi-** In Greek compounds, signifying *half*.
- Hepta-** In Greek compounds, signifying *seven*.
- Herb.** Naturally dying to the ground; without persistent stem above ground; lacking definite woody firm structure.
- Herbaceous.** Not woody; dying down each year; said also of soft branches before they become woody.
- Hermaphrodite.** Bearing both stamens and pistil in the same flower; two-sexed; bisexual.
- Hesperidium.** The fruit of the orange-kind.
- Heterocarpous.** Various-fruited; with more than one kind or form of fruit.
- Heterogamous.** With two or more kinds or forms of flowers.
- Heteros.** In Greek composition, signifying *various*, or of *more than one kind* or *form*; as *heterophyllous*, with *more than one kind* or *form* of leaf.
- Hilum.** In the seed, the scar or mark indicating the point of attachment.
- Hip.** Fruit of the rose, being an urn-like or closed receptacle bearing the achenes inside. See *Hypanthium*.
- Hirsute.** With rather rough or coarse hairs.
- Hirtellous.** Softly or minutely hirsute or hairy.
- Hispid.** Provided with stiff or bristly hairs.
- Hispidulous.** Somewhat or minutely hispid.
- Hoary.** Covered with a close white or whitish pubescence.
- Homo-** In Greek compounds, signifying *alike* or *very similar*.
- Homocarpous.** All the fruits, as of a flower-head, alike.
- Homogamous.** Presenting only one kind of flowers.
- Homologous.** Related in origin or morphology. See *Analogous*.
- Homomorphous.** Uniform; all the given parts alike.
- Horny.** Hard and dense in texture; corneous.
- Hybrid.** A plant resulting from a cross between two or more parents that are more or less unlike.
- Hygroscopic.** Capable of absorbing moisture from atmosphere.
- Hypanthium.** A fruit-like body (as the rose-hip) formed by the enlargement of the torus and bearing the proper fruits on its upper or inner surface; literally "beneath the flower." Now commonly used to denote the cup-shaped receptacle on which calyx, petals and stamens are inserted in cases of perigyny, as in *plum*, *fuchsia*.
- Hypochil.** The lower or basal part of the lip in orchids.
- Hypocotyl.** That part of the caulicle lying below the cotyledons.
- Hypocrateriform.** Salver-form; that shape of the flower characterized by a cylindrical tube and a flat-spreading limb, as in *phlox*.
- Hypogaeal.** Cotyledons remaining beneath the ground in germination.
- Hypogynous.** Borne on the torus, or under the ovary; said of the stamens or petals.
- Immarginate.** Without a rim or edge.
- Immersed.** Entirely under water.
- Imparipinnate.** Unequally pinnate; odd-pinnate; with a single terminal leaflet.
- Imperfect flower.** Having either stamens or pistils, but not both.
- Implexed, implexuous.** Entangled, interlaced.
- Impregnation.** Fecundation or fertilization of the ovule by the pollen; also, the infiltration of substances.

- Impressed.* Deeply nerved; furrowed or grooved as if by pressure.
- Inarching.* The grafting together of two plants with the intention that, when they are severed, part of one plant will be growing on the other.
- Incanescent.* Hoary- or gray-pubescent; canescent.
- Incised.* Cut; slashed irregularly, more or less deeply and sharply.
- Inclining.* Looking or falling down from the horizontal.
- Included.* Not protruded, as stamens not projecting from the corolla.
- Incomplete.* Lacking some of its parts, as a flower deficient in stamens or calyx.
- Incrustate.* Crusted; with a hard or firm covering.
- Incumbent (cotyledons).* Of a seed so bent over that the back of one cotyledon lies against the radicle.
- Indefinite.* Very numerous, as above twenty; see *Definite*.
- Indehiscent.* Not regularly opening, as a seed-pod or anther.
- Indeterminate.* Growing on from the apex, particularly of the main axis.
- Indigenous.* Native to the region; not introduced from some other country.
- Indumentum.* A covering of hair.
- Induplicate.* With margins folded inward.
- Indurated.* Hard, hardened.
- Indusium.* The little growth covering or surrounding the sorus or fruit-dot in ferns.
- Inferior.* Beneath, lower, below; as an inferior ovary, one that is below the calyx-leaves.
- Inflated.* Blown up; bladdery.
- Inflorescence.* Mode of flower-bearing; technically less correct but much more common in the sense of a flower-cluster.
- Infra-* In combinations, signifying *below*.
- Infundibuliform.* Funnelform.
- Innate.* Said of an anther when attached by its base to the filament.
- Innovation.* An offshoot or departure from the axis.
- Inserted.* Attached; as a stamen growing on the corolla.
- Inter-* In composition, signifying *between*, particularly between closely related parts or organs.
- Interfoliaceous.* Between the leaves, particularly between two leaves of a pair.
- Internode.* The part or space of stem between two nodes or joints.
- Interrupted.* Not continuous; in particular, the interposition of small leaflets or segments between others.
- Intorted.* Twisted upon or around itself.
- Intramarginal.* Just within the margin or edge; between the margins.
- Introduced.* Brought from another region, either intentionally or otherwise; in horticulture, used to designate the intentional bringing of plants into cultivation either from another country or from the wild.
- Introrse.* Turned or faced inward or toward the axis, as an anther looking toward the center of the flower.
- Inverted.* Turned over; end-for-end; top-side down.
- Involucel.* A secondary involucre; small involucre about the parts of a cluster.
- Involucre.* A whorl of small leaves or bracts standing close underneath a flower or flower-cluster.
- Involute.* Said of a flat body (as a leaf) rolled inward or toward the upper side. See *Revolute*.
- Irregular flower.* Some parts different from other parts in same series.
- Jointed.* With nodes, or points of real or apparent articulation.
- Keeled.* Ridged like the bottom of a boat; also the two front united petals of a papilionaceous flower.
- Knaur.* An excrescence, bur or knot of woody tissue that will grow when removed and used as a cutting.
- Labellum.* Lip, particularly the lip of orchids.
- Labiata.* Lipped; a member of the Labiatae.
- Labyrinthiform.* With intricate winding lines or passages.
- Lacerate.* Torn; irregularly cleft or cut.
- Laciniate.* Slashed into narrow pointed lobes.
- Lactescent.* Containing milk or a milk-like substance.
- Lacunose.* Having holes or empty places, particularly in the anatomical structure.
- Lamella.* A thin flat plate or part.
- Lamina.* The blade of a leaf or petal or other expanded part or body.
- Lanceolate.* Lance-shaped; much longer than broad; widening above the base and tapering to the apex.
- Lapidose.* Found in stony places.
- Lateral.* On or at the side.
- Layer.* A branch that takes root and gives rise to an independent plant.
- Leaflet.* One part of a compound leaf; secondary leaf.
- Leaf-stalk.* The stem of a leaf; petiole; foot-stalk.
- Legume.* Simple pericarp dehiscing on both sutures; pod.
- Lemma.* In grasses, the flowering glume,—the lower of the two bracts immediately inclosing the flower.
- Lenticular.* Lentil-shaped; lens-shaped.
- Lepals.* Sterile stamens, particularly those nectaries or scales representing stamens; term little used.
- Lepidote.* Surfaced with small scurfy scales.
- Liana, liane.* A woody twining or climbing plant entangling a tropical forest.
- Life-history.* The sum of the events in the life of a plant.
- Ligneous.* Woody.
- Ligule.* A strap-shaped organ or body; particularly, a strap-shaped corolla, as in the ray-flowers of composites; also a projection from the top of the sheath in grasses and similar plants.
- Limb.* The expanded flat part of an organ; in particular, the expanding part of a gamopetalous corolla.
- Limbate.* Surrounded by an edging of another color; margined with color; also, provided with a limb.
- Line.* One-twelfth of an inch.
- Linear.* Long and narrow, the sides parallel or nearly so.
- Lineate.* Lined; bearing thin parallel lines.
- Linguiiform.* Shaped like a lingula, or with a projecting tongue-like part or process.
- Lip.* One of the parts in an unequally divided corolla or calyx; these parts are usually two, the upper lip and the lower lip, although one lip is sometimes wanting; the upper lip of orchids is by a twist of the stipe made to appear as the lower; a labium.
- Lobe.* Any part or segment of an organ; specifically a part of petal or calyx or leaf that represents a division to about the middle.
- Lobule.* A small lobe.
- Locule.* Compartment or cell of a pistil or anther.
- Loculicidal.* Dehiscence between the partitions into the cavity.
- Lodicule.* A small scale in a grass flower, between the lemma and stamens.
- Loment.* A legume with constrictions or articulations.
- Lorate.* Strap-shaped.
- Lyrate.* Pinnatifid but with an enlarged terminal lobe and smaller lower lobes.
- Medullary.* Relating to the pith; the medullary rays seen in cross-sections of woody trunks radiate from the medulla or pith.
- Meniscoidal.* Like a meniscus or disk; with the form of a watch-crystal.
- Mericarp.* The peculiar seed-like fruit of the Umbelliferae.
- merous.* In composition, referring to the numbers of parts; as flowers 5-merous, in which the parts of each kind or series are five or in fives.
- Mesocarp.* Middle layer or part of a pericarp; the part between the endocarp and exocarp.
- Mesochil.* The intermediate or middle part of the lip of orchids when the lip is separated into three parts.
- Micropyle.* The opening through which impregnation takes place; the point on the seed marking the orifice of the ovule.



*Midrib*. The main rib of a leaf or leaf-like part.

*Mitriform*. Mitre shaped, or like a cap.

*Monadelphous*. Stamens united in one group by their filaments as in many Leguminosæ.

*Moniliiform*. Suggesting a string of beads.

*Mono-*. In Greek compounds, signifying one.

*Monoclinous*. Hermaphrodite; perfect; the two sexes in the same flower. See *Diclinous*.

*Monocotyledonous*. With a single cotyledon.

*Monœcius*. Staminate and pistillate flowers on the same plant.

*Monogynous*. With only one style.

*Monopetalous*. One-petaled; all the petals united to form one body or organ, as a gamopetalous corolla.

*Monopodial*. Axial direction continued by growth from terminal bud or persistence of the leader.

*Monostichous*. In one row.

*Monstrosity*. Deformity; any unusual or non-typical kind of development.

*Morphology*. The science or subject that treats of forms or of the transformations of organs.

*Mucose*. With a slimy covering or secretion.

*Mucro*. A short and sharp abrupt tip.

*Mule*. An old word for a cross, particularly between different species; hybrid; cross-breed.

*Multifid*. Cut or cleft into many narrow lobes or parts.

*Multiple*. Of several or many distinct parts.

*Multiple fruit*. The united product (in one body) of several or many flowers.

*Multiseptate*. With many divisions or chambers, as some nuts.

*Muscariform*. In form of a brush or fly-brush.

*Mycelium*. Vegetative part of a fungus, composed of threads or thready tissue.

*Naked flower*. With no floral envelopes; without calyx and corolla.

*Napiform*. Turnip-shaped; more or less short-fusiform; broader than high and abruptly tapering both ways.

*Navicular*. Boat-shaped; cymbiform.

*Nectariferous*. Nectar-bearing.

*Nectary*. A structure or organ that secretes nectar.

*Nephroid*. Kidney-shaped; reniform.

*Nerve*. A vein or slender rib, particularly if not branched.

*Netted*. Marked with reticulated lines or nerves that project somewhat above the surface.

*Neuter, neutral*. Neither stamens nor pistils; sexless.

*Nidulate*. Nested; as if like or borne in a nidus or nest.

*Node*. A joint where a leaf is borne or may be borne; also incorrectly the space between two joints, which is properly an internode.

*Nucleus*. The kernel of a seed; the central denser structure of a cell.

*Nucule*. A small nutlet; any hard seed-like fruit or part.

*Nut*. An indehiscent 1-celled and 1-seeded hard and bony fruit, even if resulting from a compound ovary.

*Nutlet*. A small or diminutive nut; nucule.

*Ob-*. A Latin syllable, usually signifying inversion.

*Obconical*. Inversely conical; cone attached at the small point.

*Ob lanceolate*. Inversely lanceolate; with the broadest part of a lanceolate body away from the point of attachment.

*Oblique*. Slanting; unequal-sided.

*Oblong*. Longer than broad, and with the sides nearly or quite parallel most of their length.

*Obovate*. Inverted ovate.

*Obovoid*. An ovoid body attached at the smaller end.

*Obsolescent*. Nearly obsolete; becoming rudimentary.

*Obsolete*. Not evident or apparent; rudimentary.

*Obtuse*. Blunt, rounded.

*Ocellated*. Eyed; a circular spot of one color inside a larger spot or area of another color.

*Ochraceous*. Ochre-yellow, gradually changing to brown.

*Ocrea*. A boot-shaped or tubular stipule, as in Polygonum.

*Oculus*. An eye; a leaf-bud when used as a cutting.

*Offset*. A plant arising close to the base of mother plant.

*Oleaginous*. Fleshy and oily.

*Oligos*. In Greek compounds, signifying few.

*Opaque*. Dull; not translucent or shining.

*Operculum*. A lid, as of a circumscissile capsule.

*Orthos*. In Greek compounds, signifying straight.

*Orthotropous* (ovule or seed). An erect straight seed, with the micropyle at the apex and hilum at the base.

*Osseous*. Bony, hard, brittle; of very close texture.

*Ovary*. Ovule-bearing part of a pistil.

*Ovate*. With an outline like that of hen's egg cut in two lengthwise, the broader end downward.

*Ovoid*. A solid that is oval in outline.

*Ovule*. The body which, after fertilization, becomes the seed.

*Ovuliferous*. Ovule-bearing.

*Painted*. Said of colors that are in streaks of unequal brilliancy.

*Palate*. In personate corollas, a rounded projection or prominence of the lower lip, closing the throat or very nearly so.

*Palea, palet*. In the grass flower, the upper of the two inclosing bracts, the lower one being the lemma.

*Palmate*. Lobed or divided in a palm-like or hand-like fashion.

*Palmatifid*. Cut about half way down in a palmate form.

*Panicle*. A branching raceme; flower-cluster in which the branches are racemose, the flowers being pedicellate.

*Papilionaceous corolla*. Butterfly-like; pea-like flower, with a standard, wings, and keel.

*Pappiform*. Pappus-like.

*Pappus*. Peculiar calyx-limb of composites, being plumose, bristle-like, scales, or otherwise.

*Parasitic*. Growing and living on or in another organism.

*Parietal*. Borne on the paries or wall (inner surface) of a capsule.

*Parted*. Cleft or cut not quite to the base.

*Parthenogenetic*. Seed developing without fertilization or fecundation.

*Partial*. Of secondary importance or rank.

*Partite*. Divided very nearly to the base.

*Partitioned*. Divided in compartments or chambers by internal horizontal partitions.

*Pathological*. Diseased.

*Pedice*. Stem of one flower in a cluster.

*Peduncle*. Stem of a flower-cluster or of a solitary flower.

*Pellucid*. Clear, transparent; that can nearly be seen through.

*Peltate*. Attached to its stalk inside the margin; peltate leaves are usually shield-shaped.

*Penninerved*. Nerves arising along the length of a central midrib.

*Pentamerous*. In fives.

*Pepo*. Fruit of pumpkin, squash, and the like.

*Perennial*. Of three or more seasons' duration.

*Perfect flower*. One that has both stamens and pistil.

*Perfoliate*. The stem apparently passing through the part, as a leaf; united around the stem.

*Pergameneous, pergamentaceous*. Texture of parchment.

*Peri-*. In Greek compounds, signifying around.

*Perianth*. The floral envelope considered together; commonly used for flowers in which there is usually no clear distinction between calyx and corolla, as the lilies.

*Pericarp*. The ripened ovary.

*Perigynium*. The sac or utricle that incloses the ovary or achene in Carex; it is sometimes inflated.

*Perigynous*. Borne around the ovary and not beneath it, as when calyx, corolla and stamens are borne on the edge of a cup-shaped hypanthium; such cases are said to exhibit perigyny.

*Persistent*. Remaining attached; not falling off.

*Personate*. Said of a two-lipped corolla the throat of which is closed by a palate, as in toad-flax.

*Petal*. One of the separate leaves of a corolla.

*Petaloid*. Petal-like; of color and shape resembling a petal.

*Petiole*. Leaf-stalk.

- Petiolule*. Stalk of a leaflet.
- Phalanges* (plural of *phalanx*). The groups or bundles of stamens in diadelphous or polyadelphous flowers.
- Phenogam, phenogamous*. Flowering plants; seed-bearing plants (as distinguished from spore-bearing, or cryptogams).
- Phyllodium*. Leaf-like petiole and no blade, as in some acacias and other plants.
- Phyllotaxy*. Order of arrangement of leaves on the stem.
- Phytology*. The study of plants, particularly of the kinds or species; botany.
- Pileate, pileiform*. With the form of a pileus or rimless cap; in particular, pertaining to the cap of a mushroom.
- Pinna*. A primary division or leaflet of a pinnate leaf.
- Pinnate*. Feather-formed; with the leaflets of a compound leaf placed on either side of the rachis.
- Pinnatifid*. Cleft or parted in a pinnate (rather than palmate) way.
- Pinnatifid, Pinnately-parted*.
- Pinnatisect*. Cut down to the midrib in a pinnate way.
- Pinnule*. A secondary pinna or leaflet in a pinnately decompound leaf.
- Pip*. A perpendicular or upright small rootstock used in propagation, as of lily-of-the-valley.
- Pisiform*. Pea-shaped; pea-like.
- Pistil*. The ovule-bearing and seed-bearing organ.
- Pistillate*. Having pistils and no stamens; female.
- Pitted*. Having little depressions or cavities.
- Placenta*. Part or place in the ovary where ovules are attached.
- Plaited*. Folded lengthwise, as a closed fan.
- Plane*. Evenly flat, rather than wrinkled, folded, grooved or otherwise.
- Platys*. In Greek combinations, signifying broad or wide.
- Plumose*. Plumy; feather-like; with fine hairs, as the pappus of some composites.
- Plumule*. The bud in the embryo.
- Plur-annual*. Of one season's duration only because killed by frost.
- Pod*. A dehiscent dry pericarp.
- Pollen*. Spores or grains borne by the anther, containing the male element; sometimes it is not granular.
- Pollination*. The mechanical or physical operation of transferring pollen from stamen to pistil.
- Polliniferous*. Bearing-pollen.
- Pollinium*. A coherent mass of pollen, as in orchids and milkweeds.
- Poly-*. In Greek combinations, signifying numerous or many.
- Polyadelphous*. The stamens in many bundles or fascicles.
- Polygamous*. Bearing imperfect and hermaphrodite flowers on the same plant.
- Polymerous*. Of many parts or series.
- Pome*. Fruit of apple, pear, quince, etc.
- Porose*. With small holes, pores or perforations.
- Posterior*. At or toward the back; opposite the front; toward the axis; away from the subtending bract.
- Præfoliation*. Arrangement of leaves in the bud; vernation.
- Præmorse*. Jagged; as if bitten off.
- Prickle*. A small and weak spine-like body borne irregularly on the bark or epidermis.
- Prismatic*. Prism-shaped; with plane sides separated by angles, body of nearly uniform size throughout, and with similar end-sections.
- Process*. An extension of any surface or part beyond the main outline.
- Procumbent*. Trailing or lying flat, but not rooting.
- Proliferous*. Bearing offshoots or redundant parts; bearing other similar structures on itself.
- Proterandrous*. Anthers maturing before pistils.
- Proterogynous*. Pistils maturing before anthers.
- Pseud-annual*. Perennial by means of bulbs, corms, or tubers.
- Pseudo-*. In Greek compounds, signifying spurious or false.
- Pseudobulb*. The thickened or bulb-form stems of certain orchids, the part being solid and borne above ground.
- Puberulent*. Somewhat or minutely pubescent.
- Pubescent*. Covered with short, soft hairs; downy.
- Pulverulent*. Powdered or dusty.
- Pulvinate*. Cushioned; with a cushion-like enlargement or structure, as at the base of some petioles or leaflets.
- Punctate*. With translucent or colored dots or depressions or pits.
- Pungent*. Ending in a stiff sharp point or tip; also acrid (to the taste).
- Putamen*. The hard or bony shell of a nut or of a stone-fruit.
- Pyrene, pyrena*. Nutlet, particularly the nutlet in a drupe.
- Pyriform*. Pear-formed or -shaped.
- Pyzis*. Pod opening or dehiscing by a transverse ring.
- Quadrangular*. Four-angled.
- Quaternate*. In fours.
- Quincunx*. Five plants in a square, one of them being in the center.
- Quintupled*. Five times; multiplied by five.
- Raceme*. A simple elongated indeterminate cluster with stalked flowers.
- Rachilla, rhachilla*. A diminutive or secondary axis, or rachis; in particular, in the grasses and sedges the axis that bears the florets.
- Rachis*. Axis bearing flowers or leaflets; petiole of a fern frond (plural *rachides* or *rachises*).
- Radiate*. Standing on and spreading from a common center; also, with ray-flowers, as in the Compositæ.
- Radical*. Belonging or pertaining to the root.
- Radicle*. The inferior or downward part of the embryo below the cotyledons; caudicle.
- Radix*. Root.
- Rameal*. Pertaining to a branch or branches.
- Ramenta*. Chaffy loose scales borne on leaves and stems, as on the stems of ferns.
- Ramification*. The mode or style of branching of a plant.
- Raphe, rhaps*. The cord or ridge of fibro-vascular tissue connecting the hilum and chalaza on a seed (when the hilum and chalaza are separated).
- Ray*. Outer modified florets of some composites, with an extended or strap-like part to the corolla; also the branches of an umbel or umbel-like cluster.
- Receptacle*. Torus; the more or less enlarged or elongated end of the stem or flower-axis on which some or all of the flower-parts are borne; sometimes the receptacle is greatly expanded, as in the Compositæ; sometimes it assumes capsule-like forms, as in the hypanthium of the rose.
- Reclinate, reclining*. Bent down or falling back from the perpendicular.
- Recondite*. Concealed; difficult to make out; not easily recognized.
- Recurved*. Bent or curved downward or backward.
- Reflexed*. Abruptly recurved or bent downward or backward.
- Regular flower*. With the parts in each series or set alike; as stamens all like each other, petals all like each other.
- Reinforced fruit*. With other parts grown to the pericarp.
- Remote*. Separated by spaces longer than common.
- Reniform*. Kidney-shaped.
- Repent*. Creeping; rooting at the joints.
- Resupinate*. Upside down; turned over.
- Retorse*. Bent or turned over back or downward.
- Revolute*. Rolled backward, margin rolled toward lower side. See *Involute*.
- Rhachis*. See *Rachis*.
- Rhaps*. See *Raphe*.
- Rhizome*. Underground stem; rootstock.
- Rhizos*. In Greek compounds, signifying root.
- Rib*. In a leaf or similar organ, the primary vein; also any prominent vein or nerve.
- Rimose*. With cracks or chinks.
- Ringent*. Gaping; said of labiate flowers with an open throat or mouth.
- Rootstock*. Subterranean stem; rhizome.



- Rostellum.** A little beak; particularly a projection above the stigma in the orchid flower.
- Rosula.** A rosette, or dense more or less flat imbricated cluster of leaves.
- Rosulate.** In a rosula or rosette.
- Rotate.** Wheel-shaped; with short or obsolete tube and a flat and circular limb.
- Rotund.** Nearly circular; orbicular, inclining to be oblong.
- Rudimentary.** Incomplete; very little developed.
- Ruminated.** Chewed; particularly applied to wrinkled albumen in seeds that are irregularly channeled or pierced, as in nutmeg and in annona fruits.
- Runcinate.** Said of sharply lobed or cut leaves that have the segments directed backward.
- Runner.** A slender trailing shoot taking root at the nodes.
- Sabulose.** Growing in or pertaining to sandy places.
- Sagittate.** Like an arrowhead in form; triangular with the basal lobes pointing downward.
- Salver-shaped.** With a slender tube and an abruptly expanded flat limb, as that of the phlox; hypocrateriform.
- Samara.** Indehiscent winged pericarp, as of the maple.
- Sap.** The watery contents of a plant; an indefinite and undescriptive term little used by botanists.
- Sapid.** With a pleasant or savory taste.
- Scabrous.** Rough; feeling roughish or gritty to the touch.
- Scale.** A name given to many kinds of small mostly dry and appressed leaves or bracts; a vestige.
- Scape.** Leafless peduncle arising from the ground; it may bear scales or bracts but no foliage-leaves, and may be one- or many-flowered.
- Scarious.** Leaf-like parts or bracts that are not green, but thin, dry, and membranaceous, often more or less translucent.
- Scion.** See *Cion*.
- Scleroid.** Of a hard texture.
- Scorpioid.** Said of a cluster in which the flowers are 2-ranked and borne alternately at the right and the left.
- Seed.** The ripened ovule; the essential part is the embryo, and this is contained within integuments.
- Seedling.** A young plant raised from seed; a plant direct from seed without the intervention of grafting of any kind.
- Segment.** One of the parts of a leaf, petal, calyx or perianth that is divided but not truly compound.
- Self-fertilization.** Secured by pollen from same flower; close-fertilization.
- Self-pollination.** Transfer of pollen from stamen to pistil of same flower; close-pollination.
- Sepal.** One of the separate leaves of a calyx.
- Separation.** Multiplication of plants by means of naturally detachable asexual bodies or organs, as offsets, stolons.
- Septate.** Partitioned; divided by partitions.
- Septicidal.** Dehiscence along or in the partitions, not directly into the locule.
- Septum.** A partition.
- Sessile.** Not stalked; sitting.
- Set.** Applied loosely to vegetative parts used in propagation, as to offsets, layers, root-cuttings.
- Seta.** A bristle.
- Setiform.** Bristle-shaped.
- Sheath.** Any long or more or less tubular structure surrounding an organ or part.
- Shoot.** A new plant from the root of the old plant; also any growing twig or axis.
- Shrub.** A woody plant that remains low and produces shoots or trunks from the base.
- Silicle.** The short fruit of certain Cruciferae.
- Siliqua.** The long fruit of certain Cruciferae.
- Silky.** A condition produced by a covering of soft appressed fine hairs; sericeus.
- Silvery.** With a whitish metallic more or less shining luster.
- Simple pistil.** Of one carpel.
- Sinus.** The space or recess between two lobes of a leaf or other expanded organ.
- Slip.** A softwood cutting "slipped" off or pulled off; applied also to similar parts cut off.
- Smooth.** Said of surfaces that have no hairiness, roughness or pubescence, particularly of those not rough.
- Solitary.** Borne singly or alone.
- Sorus.** A heap or cluster. The fruit-dots or -cluster of ferns (plural *sori*.)
- Spadix.** A thick or fleshy spike of certain plants, as the Araceae, surrounded or subtended by a spathe.
- Span.** Nine inches; distance from tip of thumb to tip of little finger when the hand is spread out.
- Spathe.** The bract or leaf surrounding or subtending a flower-cluster or a spadix; it is sometimes colored and flower-like, as in the calla.
- Spawn.** The dried mycelium of mushrooms used in propagation.
- Spheroidal.** A solid that is nearly spherical.
- Spiciform.** Spike-form.
- Spiculate.** With a small, fleshy and erect point.
- Spike.** Compact, more or less simple indeterminate, mostly elongated cluster, with flowers sessile or nearly so.
- Spikelet.** A secondary spike; one part of a compound spike; particularly, one of the ultimate clusters in grasses.
- Spine.** A strong and sharp-pointed woody body mostly arising from the wood of the stem.
- Spinescent.** More or less spiny.
- Spinule.** A little or weak spine.
- Spontaneous.** Said of plants that have escaped from cultivation, but that do not permanently persist.
- Sporangium.** A spore-case; a sac or body bearing spores.
- Spore.** A simple reproductive body, usually composed of a single detached cell, and containing no embryo.
- Sporocarp.** A receptacle containing sporangia or spores.
- Sporophyll.** A spore-bearing leaf.
- Spreading.** Standing outward or horizontally.
- Spur.** A tubular or sac-like projection from a blossom, as of a petal or sepal; it usually secretes nectar.
- Squama.** A scale.
- Squamella.** Very small squama or scale.
- Stachys.** In Greek compounds, signifying a *spike*.
- Stalk.** The stem of any organ, as the petiole, peduncle, pedicel, filament, stipe.
- Stamen.** The pollen-bearing or "male" organ.
- Staminate.** Having stamens and no pistils; male.
- Staminode, staminodium.** A sterile stamen, or a structure resembling such and borne in the staminal part of the flower; in some flowers (as in *Canna*) staminodia are petal-like and showy.
- Standard.** The upper and broad more or less erect petal of a papilionaceous flower.
- Stem.** The main axis of a plant; leaf-bearing and flower-bearing as distinguished from the root-bearing axis.
- Sterile flower.** Without pistils.
- Stigma.** The part of the pistil that receives the pollen.
- Stigmatic.** Pertaining to the stigma.
- Stipe.** The stalk of a pistil or other small organ; also the petiole of a fern-leaf.
- Stipel.** Stipule of a leaflet.
- Stipule.** A basal appendage of a petiole; the three parts of a complete leaf are blade, petiole, stipules (usually 2).
- Stock.** The part on which the cion is grafted; the strain or parentage.
- Stolon.** A shoot that bends to the ground and takes root; more commonly, a horizontal stem at or below surface of the ground that gives rise to a new plant at its tip.
- Stone.** The "pit" or putamen of a stone fruit.
- Stool.** A clump of roots or rootstock that may be used in propagation; also an established low plant from which layers are taken.
- Stratification.** The operation or method of burying seeds to keep them fresh and to soften their integuments, or to expose them without injury to frost, that they may be more readily and successfully used in propagation.
- Strict.** Straight and upright, little if any branched, often rigid.
- Strobile.** Cone.
- Strophiole.** An appendage or protuberance at the hilum.

*Style*. More or less elongated part of the pistil between the ovary and stigma.

*Stylopodium*. Style-foot; an expansion at the base of a style, as in flowers of the Umbelliferae.

*Sub-*. As a prefix, usually signifying *somewhat, slightly* or *rather*.

*Subacute*. Somewhat or partially acute.

*Subcoriaceous*. Somewhat or approaching leathery in texture.

*Subligneous*. Partially or somewhat woody.

*Subterete*. Somewhat or imperfectly terete.

*Succulent*. Juicy; fleshy; soft and thickened in texture.

*Sucker*. A shoot arising from the roots or beneath the surface of the ground.

*Suffrutescent*. Partially or slightly shrubby.

*Suffruticose*. Pertaining to a low and somewhat woody plant; diminutively shrubby or fruticose; woody at base.

*Sulcate*. Grooved or furrowed lengthwise.

*Superior*. Said of an ovary that is free from the calyx.

*Supernumerary*. Said of buds when there is more than one in an axil.

*Suspended*. Hanging from the top, as an ovule attached in the top of the locule.

*Suture*. A line or mark of splitting open; a groove marking a natural division or union; the groove lengthwise a plum or similar fruit.

*Symmetrical*. Said of a flower that has the same number of parts in each series or circle, as five stamens, five petals.

*Symphysis*. Growing together; coalescence.

*Sympodial*. Axial growth continued by successive lateral shoots instead of by terminal bud.

*Syncarpium*. A fruit consisting of many cohering or consolidated carpels.

*Syncarpous*. Having carpels united. See *Apocarpus*.

*Syngenesious*. Anthers united in a ring, as in Compositae.

*Tapering*. Gradually becoming smaller or diminishing in diameter or width toward one end.

*Tap-root*. A strong nearly or quite perpendicular main root that carries the plant axis straight into the ground, all the other roots being secondary to it, rather than branching equally or diversely at the crown.

*Taxonomy*. Classification of species.

*Tendril*. A rotating or twisting thread-like process or extension by which a plant grasps an object and clings to it for support; morphologically it may be stem or leaf.

*Teratology*. The subject of monstrosities, or of abnormal and aberrant forms and malformations.

*Terete*. Circular in transverse section; imperfectly cylindrical because the object may taper both ways.

*Terminology*. The subject dealing with names.

*Ternate*. In threes.

*Testa*. The outer seed-coat, particularly when bony, hard or brittle.

*Tetradynamous*. Six stamens, four being long and two short.

*Tetragonal*. Four-angled.

*Thallus*. A flat leaf-like organ; in some cryptogams, the entire cellular plant body without differentiation as to stem and foliage.

*Throat*. The opening or orifice into a gamopetalous corolla, or perianth; the place where the limb joins the tube.

*Thyrse, thyrsus*. Compact and more or less compound panicle; more correctly a panicle-like cluster with main axis indeterminate and other parts determinate.

*Tip*. The plant arising at the end of a stolon, as in the black raspberry.

*Tomentose*. With tomentum; densely woolly or pubescent; with matted soft wool-like hairiness.

*Tomentulose*. Somewhat or delicately tomentose.

*Tortuous*. Twisted; with irregular bending and twining.

*Torus*. Receptacle.

*Tree*. A woody plant that produces one main trunk and a more or less distinct and elevated head.

*Tri-*. Three or three times.

*Tricarpous*. Of three carpels or fruits.

*Trichome*. A hair, particularly one that is strong or stiff.

*Tricostate*. With three ribs.

*Trifid*. Separated about halfway down into three parts.

*Trifoliate*. Of three leaves.

*Trifoliolate*. Of three leaflets.

*Trigonous*. Three-angled.

*Trimerous*. In threes.

*Trimorphous*. In three forms; as three lengths of stamens.

*Tripinnate*. Three times pinnate.

*Trisected*. In three deeply cut parts.

*Triternate*. Three times three; the leaflets or segments of a twice ternate leaf again in three parts.

*Truncate*. Appearing as if cut off at the end; the end nearly or quite straight across.

*Tuber*. A short congested part; usually defined as subterranean (as of a rootstock), although this is not essential.

*Tubercle*. A small tuber, or rounded protruding body.

*Tuberiferous*. Tuber-bearing.

*Tuberous*. With or resembling a tuber or tubers.

*Tumid*. Swollen.

*Tunicated*. Provided with concentric or enwrapping coats or layers, as bulb of onion.

*Turgid*. Swollen from fullness.

*Umbel*. Corymbose or indeterminate cluster with branches or rays arising from a common point and about equal in length, resembling framework of umbrella; umbels are characteristic of the Umbelliferae.

*Umbellate*. Umbelled; with umbels; pertaining to umbels.

*Umbellet*. Secondary umbel.

*Umbellule*. Umbellet.

*Uni-*. One.

*Unisexual*. Of one sex; staminate or pistillate only.

*Utricle*. A small bladder; a bladdery 1-seeded fruit.

*Valvate*. Opening by valves or pertaining to valves; meeting by the edges without overlapping, as leaves or petals in the bud.

*Valve*. A separable part of a pod; the units or pieces into which a capsule splits or divides in dehiscing.

*Vascular*. With vessels or ducts, or relating to them.

*Vein*. A branch of the evident woody framework of a leaf or similar organ; secondary member of the fibrovascular structure.

*Veinlet*. A small or slender vein; nerve.

*Venation*. Veining; arrangement or disposition of veins.

*Ventral*. Front; relating to the anterior or inner face or part of an organ; opposite the back or dorsal part.

*Vernation*. The disposition or arrangement of leaves in the bud.

*Versatile*. Hung or attached near the middle and usually moving freely, as an anther attached crosswise on the apex of filament and capable of turning.

*Verticil*. A whorl.

*Vesicle*. A little bladder or bladder-like cavity.

*Vexillary*. Pertaining to the vexillum, standard or banner of a papilionaceous flower.

*Villous*. Provided with long and soft, not matted, hairs; shaggy.

*Vitta*. An oil-tube, as in the fruits of Umbelliferae.

*Vittate*. With vittae; also striped lengthwise.

*Volute*. Rolled up.

*Watersprout*. A strong rapid-growing adventitious shoot in a tree-top or bush or on a trunk.

*Whorl*. Three or more leaves or flowers at one node, in a circle.

*Wing*. A thin dry or membranous expansion or flat extension or appendage of an organ; also the lateral petal of a papilionaceous flower.

*Woolly*. Provided with long, soft and more or less matted hairs; like wool; lanate.

*Wort*. Old word for a plant or herb; now used only in combination, as *motherwort, spiderwort, liverwort*.







V. *Anemone coronaria*, an old garden favorite.



# A

**ABACÁ**, or Manila hemp, is the fiber of *Musa textilis*, a native of the Philippine Islands, where it is grown for commerce. The plant is like the banana in general habit of growth, although it is seed-bearing. It is propagated by seeds or suckers or root-cuttings. When two to five years old it is at maturity, reaching a height of 6 to 15 feet and a diameter of trunk of 6 to 15 inches. The fiber is derived from the thick sheathing leaf-stems, the stems being cut between the flowering and fruiting stages. After seed-bearing, the top or "plant" dies and new suckers or shoots spring from the roots. The first stalks may be cut as early as twenty months after planting, and the plantation is cut over about once in eight months until it becomes unproductive, which will be fifteen to forty years. New stalks continue to arise as the old ones are cut. The fiber, as found in the market, is coarse and stiff and 6 to 12 feet long. In the better grades it is very strong. The fruit of *Musa textilis* is not edible. See Cyclo. Agric. II, p. 286, and I, p. 126.

**ABELIA** (bears the name of Dr. Clark Abel, physician and author in China, d. 1826). *Caprifoliaceæ*. Ornamental plants, cultivated chiefly for their handsome flowers.

Shrubs: lvs. opposite, short-petioled, small or medium-sized, entire or dentate: fls. in 1- to several-fl. cymes, axillary or terminal on short branchlets, sometimes forming panicles at the end of the branches; sepals 2-5, conspicuous, persistent; corolla tubular or campanulate, 5-lobed; stamens 4, paired; ovary 3-celled, only 1 cell fertile; style elongated: fr. 1-seeded leathery achene crowned by the persistent calyx.—More than 20 species in E. and Cent. Asia, 1 on the Himalayas and 2 in Mex. For a key to all the species, see Rehder, Synopsis of the genus *Abelia* (in Sargent, *Plantæ Wilsonianæ*, I, pp. 122-129). The genus is sometimes united with *Linnæa*.

The abelias are small or medium-sized bushy shrubs with deciduous or persistent foliage and rather small but numerous flowers varying from white to pink or purple; after the flowers have fallen, the persistent usually purplish sepals are attractive. The recently introduced *A. Graebneriana* and *A. Engleriana* are probably the hardiest; *A. triflora*, *A. chinensis* and *A. grandiflora* are hardy as far north as Philadelphia: the last-named is sometimes grown in sheltered situations as far north as Massachusetts, and, even if partly killed back, the young shoots flower profusely the same season; *A. floribunda* is hardy only south of Washington, D. C.

The cultivation of abelias presents no special difficulties. They do best in sunny, sheltered positions and prefer a well-drained soil enriched by peat or leaf-mold. *A. floribunda* is sometimes grown in pots and kept during the winter in the cool greenhouse; in this case a sandy compost of loam and peat or leaf-mold will be a suitable mixture.

Propagation is usually by greenwood cuttings in

summer under glass; also by cuttings of ripened wood taken in fall. Seeds are not often obtainable; they are sown in spring and germinate after a month or two; the seedlings begin to bloom usually in their third year.

## A. Sepals 2.

**Graebneriana**, Rehd. Shrub, 4-10 ft.: lvs. deciduous, ovate to oblong-ovate, acuminate,  $1\frac{1}{2}$ -2 in. long, remotely serrate, usually finely ciliate and hairy on midrib beneath, sometimes with scattered hairs above: fls. usually few at the end of short branchlets along last year's branches; sepals  $\frac{1}{2}$  in. long, oblong; corolla campanulate, 1 in. long, pink with yellow throat. Summer. China.

**Engleriana**, Rehd. (*Linnæa Engleriana*, Graebn.). Shrub, 3-6 ft.: lvs. deciduous, ovate to elliptic-ovate, acute or acuminate, about 1 in. long, with few small teeth: fls. in few-fl. clusters in the axils of fascicled lvs. along last year's branches, rosy purple or rosy pink, a little over  $\frac{1}{2}$  in. long. Summer. China.—Similar to the preceding but smaller in every part, flowering more profusely and therefore handsomer. Has proved hardy at the Arnold Arboretum.

**AA. Sepals varying from 2 to 5 on the same plant and often partly connate.**

**grandiflora**, Rehd. (*A. chinensis*  $\times$  *uniflora*, *A. rupestris*, Hort., not Lindl. *A. rupestris* var. *grandiflora*, André. *A. uniflora*, Hort., not Turcz. *Linnæa Spaethiana*, Graebn. *L. Perringiana*, Graebn.). Fig. 58. Lvs. ovate, rounded or attenuate at the base, acute,  $\frac{3}{4}$ -1 $\frac{1}{2}$  in. long, serrate, shining above, nearly glabrous, half-evergreen: fls. in terminal, loose panicles, white flushed pink, campanulate,  $\frac{3}{4}$  in. long; stamens not exerted. Of garden origin. Gt. 41:1366. Gn. 76, p. 528. J.H. III. 8:77.—One of the hardiest and most free-flowering abelias; it flowers continuously from June to Nov.

## AAA. Sepals 5.

**chinensis**, R. Br. (*A. rupestris*, Lindl.). Shrub, 3-6 ft.: lvs. ovate, rounded at the base,  $\frac{3}{4}$ -1 $\frac{1}{2}$  in. long, serrate, hairy on the midrib beneath and sometimes with scattered hairs above, deciduous: fls. in terminal dense panicles, funnel-form, white,  $\frac{1}{2}$  in. long; sepals oblong,  $\frac{1}{4}$  in. long; stamens exerted. Summer. China. B.R. 32:8. Gn. 27, p. 424. P.F.G. 2:201. G. 8:143.—*A. rupestris* is sometimes considered a distinct species, but the differences are very slight.

**triflora**, R. Br. Shrub, to 10 ft., branchlets with reflexed hairs: lvs. lanceolate or ovate-lanceolate, 1 $\frac{1}{2}$ -2 $\frac{1}{2}$  in. long, ciliate and sparingly hairy on both sides or nearly glabrous, entire or occasionally on vigorous shoots with a few coarse teeth, half-evergreen: fls. in terminal clusters, fragrant; sepals linear, hairy,  $\frac{1}{2}$  in. long; corolla tubular with spreading limb, white flushed pink,  $\frac{3}{4}$  in. long. Summer. Himalayas. P.F.G. 3:91. Gn. 10:29. G.C. II. 16:34. G. 29:483. R.H. 1870:511. J. F. 3, pl. 319.—A very handsome species; after the



58. *Abelia grandiflora*. ( $\times \frac{1}{2}$ )

flowers are gone the feathery sepals remain as an attractive feature.

**floribunda**, Decaisne. Shrub, 4 ft.: lvs. persistent, oval to oval-oblong,  $\frac{1}{2}$ –1 in. long, crenate-serrate, ciliate; peduncles axillary, 1–3-fld.; corolla carmine-purple, nodding, tubular,  $1\frac{1}{2}$  in. long; sepals oblong,  $\frac{1}{2}$  in. long. Summer. Mex. B.M. 4316. F.S. 2:5. R.B. 23:157. Gn. 13:120. B.R. 33:55. R. H. 1912:544.

*A. biflora*, Turcz. Lvs. ovate-lanceolate, hairy, coarsely serrate, deciduous: fls. white, tubular, in 2's; sepals 4. Manchuria, N. China.—*A. serrata*, Sieb. & Zucc. Similar to *A. biflora*. Fls. funnelform, pink, little over  $\frac{1}{2}$  in. long, in 2's; sepals 2. Japan. S.Z. 1:34.—*A. spathulata*, Sieb. & Zucc. Allied to *A. biflora*. Lvs. ovate: fls. over 1 in. long, white tinged yellow in throat; sepals 5. Japan. S.Z. 1:34. B.M. 6601. G. 27:345. G.M. 45:335 (as *A. serrata*).—*A. uniflora*, R. Br. (*A. serrata*, Nichols, not Sieb. & Zucc.). Lvs. persistent, ovate-lanceolate: fls. in loose terminal panicles, campanulate, 1 in. long, rosy white with yellow in throat; sepals 2. China. B.M. 4694. F.S. 8:824. J.F. 4, pl. 380. B.H. 3:338. G.C. III. 37:323. Gn.W. 21:933 (as *A. chinensis*). Gn. 27, p. 425.

ALFRED REHDER.

**ABELÍCEA**: *Zelkova*.

**ABELMÓSCHUS**: *Hibiscus*.

**ABÈRIA** (named from Mt. Aber, Abyssinia, where first species was found). *Dorydlis*, Arn. & E. Mey. *Flacourtiaceæ*. Small trees or shrubs, with alternate, simple exstipulate leaves and small inconspicuous flowers.

Flowers dioecious; staminate fls. with a 4–5-parted calyx and no petals, and with many stamens, arranged on a fleshy receptacle; pistillate fls. with a 5–7-parted, persistent calyx and no petals, the ovary free, sessile, 1–6-celled, on a lobed usually fleshy disk; fr. fleshy, indehiscent.—Eleven species in Afr. and Ceylon.

**caffra**, Hook. f. & Harv. Fig. 59. Thorny, glabrous: lvs. obovate, obtuse, cuneate at base, entire: fls. dioecious, apetalous. G.C. III. 18.737. R.H. 1904:256.—The kei apple of the Cape of Good Hope; a spiny plant grown S. for hedges; is considered promising for S. Calif. and S. Fla. as a fr. plant. Fruit acid, used as pickles or preserves. Proves quite hardy in S. Calif.

**Gárdneri**, Clos. A small, much-branched tree, 16–20 ft.: lvs.  $2\frac{1}{2}$ –4 in. long, lanceolate or oval, acute at both ends: fls. greenish, staminate fls. in umbellate clusters, the pistillate axillary in the branches: fr. 1 in. diam., pale purple, edible. June. India and Ceylon. N. TAYLOR.†

**ABIES** (derivation doubtful). *Pinææ*. FIR, but the name spruce is often erroneously applied. Tall, pyramidal trees of temperate and cool climates, planted for ornament and for shelter, and also for timber. The word àbi-es is pronounced in three syllables, the *e* being long.

Leaves lanceolate or oblanceolate, entire, sessile, persistent for many years; on young plants and lower sterile branches flattened, usually deep green and lustrous above and silvery white beneath from the presence of many rows of stomata, rounded and variously notched at the apex, appearing 2-ranked by a twist at their base; on upper fertile branches crowded, more or less erect, often incurved or falcate, thickened or quadrangular, obtuse or acute: fls. axillary, appearing in early spring from buds formed the previous summer on branchlets of the year, surrounded by involucre of the enlarged scales of the fl.-buds; staminate fls. pendent on branches above the middle of the tree; pistillate fls. globular, ovoid or oblong, erect on the topmost branches: fr. an erect ovoid or oblong cylindrical cone, its scales longer or shorter than their bracts, separating at maturity from the stout persistent axis. Northern and mountainous regions of the northern hemisphere, often gregarious. Twenty-three species are distinguished; greatest segregation on the Cascade Mts. of Ore., in the countries adjacent to the Medit., and in Japan. Many species which have been referred to Abies

are now included in *Picea*. S.S. 12. Heinrich Mayr, Monographie der Abietineen des Japanischen Reiches. Gn. 11, pp. 280, 281. See *Arboriculture*.

All the species of abies produce soft, perishable wood, sometimes manufactured into lumber, and balsamic exudations contained in the prominent resin vesicles in the bark characteristic of the genus. They are handsome in cultivation, but usually of short-lived beauty. The firs prefer moist, well-drained soil. As timber-producing trees, the species of abies are less valuable than the spruces (*Picea*) and in the United States they have not been planted except for ornament. In Europe, where this tree is sometimes planted as a forest crop, the wood of the European *A. Picea* is valued, and in the Pacific states the wood of *A. grandis*, *A. concolor* and *A. magnifica* is employed in the manufacture of fruit-boxes and woodenware.

In cultivation, firs are most beautiful while young, and usually lose their lower branches and become thin and unsightly as they grow older, and many of the species have little ornamental value for more than fifty years. In the northern and eastern states, the most valuable ornamental species are the Colorado form of *A. concolor*, with pale or bluish foliage, and the

Japanese *A. brachyphylla*, with leaves that are dark green and very lustrous above and silvery beneath. In the United States, *A. brachyphylla* assumes a compact pyramidal form of growth, but in Japan old trees become, unlike those of any other fir, round-headed. The other Japanese fir that

has been cultivated in the United States long enough to show its value as an ornamental tree, *A. Veitchii*, produces longer branches than *A. brachyphylla* and is of more open habit and is less valuable for ornamental use. After *A. concolor* and *A. brachyphylla*, the best fir trees for the eastern United States are *A. cilicica* from Asia Minor and *A. Nordmanniana* from the Caucasus. In its young state, *A. cilicica* forms a dense pyramid of gray-green foliage and as it grows in the Pinetum at Wellesley, Massachusetts, is an object of great beauty. *A. Nordmanniana* is one of the commonest fir trees cultivated in the eastern states, although it sometimes suffers from cold in New England, where it frequently becomes thin and unsightly. In the middle states, however, it is often an object of great beauty. The two eastern American species, *A. balsamea* and *A. Fraseri*, and the related species from the Rocky Mountains, *A. lasiocarpa*, grow badly in cultivation, and are short-lived and not handsome. Of the Pacific coast species, *A. grandis* can be kept alive in favorable situations in the eastern states, and *A. amabilis*, which grows slowly always in cultivation, is hardy but gives little promise of becoming of much value anywhere except on the mountains of northeastern America. The summers in the southern states are too hot for the successful cultivation of fir trees, and the climatic conditions of the Mississippi Valley are not favorable for their successful growth. In the parks and gardens of the Pacific states, fir trees grow better than in any other part of



59. *Abertia caffra*. (fr.  $\times \frac{1}{2}$ )



North America, and in the neighborhood of the Pacific Ocean can be grown successfully the firs of western North America, Mexico, Europe, India and eastern Asia.

Propagation is mostly by seeds. The percentage of fertile seeds produced by firs is much smaller than that yielded by spruces and pines, and small crops of seedlings are often secured from large sowings of the seeds. The seeds lose their fertility sooner than those of many conifers and cannot be safely kept more than one or two years; they should be planted in carefully prepared seed-beds and covered with soil to a depth equal to the thickness of the seed. Young plants begin to appear at the end of a few weeks, and, as they are extremely sensitive to the heat of the sun, they need the protection of lath or brush screens. Like other conifers, the different species can be propagated by side-grafting on other species of the genus. Grafted plants, however, are less valuable than seedlings and propagation in this way is slow and expensive, as the work must be performed in glass houses. The leading or other upright-growing shoot should be chosen for the graft, as trees obtained by the use of lateral branches for grafts do not often grow into erect or shapely trees. The species most commonly used for stocks are *A. Picea* and *A. balsamea*.

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A. *Euabies*. Lvs. flat, grooved on the upper surface, only occasionally stomatiferous above on upper fertile branches.

B. *Lf. blunt*.

C. *Foliage essentially green*,—the lvs. green above and whitish only beneath.

D. *Cones usually upward of 4 in. long*.

1. *Picea*, Lindl. (*A. pectinata*, DC.). SILVER FIR. Fig. 60. Tree, 100–200 ft.: trunk 6–8 ft. in diam.: lvs. flat, distichously spreading, dark green and lustrous above, silvery white below: cones slender, cylindrical, light green to dark purple, 5–6 in. long; bracts slightly longer than their scales. Mts. of Cent. and S. Eu., often gregarious.—Wood esteemed and much used; yields Strasburg turpentine. Dwarf forms, with erect and pendulous and with much abbreviated branches, are common in gardens. Not perfectly hardy in New England.

2. *Nordmanniana*, Spach. Fig. 61. Tree, 100–150 ft.: trunk 4–6 ft. in diam.: lvs. flat, crowded, dark green and very lustrous above, silvery white below: cones oblong-cylindrical or ellipsoidal, dark orange-brown, 4–6 in. long; bracts as long as or slightly longer than their scales. Mts. south and southeast of the Black Sea, and western spurs of the Caucasus. B.M. 6992. G.C. II. 19:797.—Often hardy; one of the most desirable firs in the middle states. Var. *aureo-variegata*, Hort. Shoots colored a pure golden yellow.

3. *cilicica*, Carr. Tree, 45–60 ft.: trunk 2–3 ft. in diam.: lvs. narrow, flat, pale green above, silvery white below: cones stout, cylindrical, orange-brown, 5–6 in. long; bracts rather shorter than their scales. At high elevations on the Anti-Taurus of Asia Minor, and on the Lebanon. A.G. 16:255. Gng. 4:113.—Begins to grow early in the spring and is often injured by late frosts; hardy and desirable in the northern states.

4. *amabilis*, Forbes. WHITE FIR. Tree, 100–150 ft.: trunk 4–6 ft. in diam.: lvs. crowded, dark green and very lustrous above, silvery white below, occasionally

stomatiferous on the upper surface: cones oblong, dark purple, 3½–6 in. long; bracts much shorter than their scales. Cascade Mts. of Wash. and Ore., and Coast Ranges from Vancouver Isl. to Ore. S.S. 12:614. G.C. II. 14:721, 725; III. 30:191.—One of the handsomest of the genus, often forming groves at high elevations; in cult. grows slowly, and is not satisfactory.

DD. *Cones usually under 4 in. long*.

5. *sibirica*, Ledeb. (*A. pichta*, Forbes). Tree, 60–100 ft.: trunk 2–4 ft. in diam.: lvs. crowded, dark yellow-green: cones cylindrical, slender, brownish yellow, 2½–3 in. long; bracts much shorter than their scales. N. and E. Russia to Kamtschatka and Mongolia, gregarious on the Altai Mts.—Very hardy, the early growth often injured by late frosts; in cult. soon becomes thin and loose in habit.



60. Cones of *Abies*.—From bottom to top, *A. grandis*, *A. balsamea*, *A. Picea*.

6. *balsamea*, Mill. BALSAM FIR. BALM OF GILEAD FIR. Fig. 60. Tree, 50–80 ft.: trunk 17–30 in. in diam.: lvs. dark green and lustrous above, pale below, rounded or obtusely short-pointed and occasionally emarginate, acute or acuminate on fertile branches: cones oblong, cylindrical, purple, 2½–4 in. long; bracts shorter or rarely slightly longer than their scales. E. N. Amer. from Labrador and the valley of the Athabasca to Iowa and the mts. of Va. S.S. 12:610. G.C. III. 17:423, 425, 431.—Wood occasionally used for lumber; Cana-



dian balsam, or balsam of fir, is obtained from the bark; in cult. loses its beauty early. Var. *columnaris*, Hort. Branches very short, turned upward at the ends. Var. *hudsônia*, Engelm. (*A. hudsônica*, Hort.), is a dwarf form. Var. *lutescens*, Hort. Lvs. white, yellow or straw-colored when exposed to the sun.

7. *Fraseri*, Poir. SHE BALSAM. Tree, 30–50 or even 70 ft.: trunk reaching  $2\frac{1}{2}$  ft. in diam.: lvs. flat, obtusely short-pointed, twisted at the base so as to appear to be crowded on the upper side of the branches, dark green and lustrous: cones oblong-ovate or nearly oval, rounded at the slightly narrower apex, purple,  $2\frac{1}{2}$  in. long and 1 in. thick, the scales twice as wide as long, and at maturity nearly half covered by the ends of the pale reflexed bracts. Mts. of Va., Tenn., and N. C. S.S. 12:609. G.F. 2:475.—Too much like the balsam fir to be prized as an ornamental tree. Trees sold under this name are nearly always forms of *A. balsamea*. Very short-lived in cult.



61. Cones of Abies.—From bottom to top, *A. concolor*, *A. Nordmanniana*, *A. magnifica*.

8. *grândis*, Lindl. (*A. amabilis*, Murr., not Forbes. *A. Gordoniana*, Carr. *Picea grândis*, Loud.). Fig. 60. Tree, 200–300 ft.: trunk becoming 4 ft. in diam.: lvs. thin and flexible, deeply grooved, very dark green above and silvery white beneath: cones cylindrical, 2–4 in. long, rounded or retuse at the apex, the broad scales somewhat squarrose and irregularly serrate and furnished with a short point. Coast of N. Calif. to Vancouver Isl. and to the western slopes of the Rocky Mts. of Mont. S.S. 12:612. Gn. 38, p. 291. G.C. II. 15:179, 181. R.H. 1894, p. 274.—Occasional specimens are seen in choice grounds, but it rarely does well in the eastern states.

cc. *Foliage pale blue or glaucous.*

9. *côncolor*, Lindl. & Gord. (*A. Lowiana*, A. Murr. *A. Parsonsiana*, Hort., the Pacific form). WHITE FIR. Fig. 61. Tree, 100–250 ft.: trunk 4–6 ft. in diam.: lvs. elongated, stomatiferous on the upper surface, on fertile branches often falcate and thickened and keeled above: cones oblong, gray-green, dark purple or bright canary-yellow, 3–5 in. long; bracts shorter than their scales. W. N. Amer. from S. Ore. to Low. Calif.

and to Utah, S. Colo., New Mex., Ariz. and Sonora. S.S. 12:613. G.C. II. 13:649; II. 15:661; III. 8:748, 749; III. 35:59.—Of all fir trees, the Colorado form best withstands heat and drought; very hardy, grows rapidly, and the most desirable of the genus in the eastern states. The form from the Pacific coast is less hardy and less desirable in the E. as an ornamental tree. Seedlings of the Colorado form, with rather longer and more glaucous leaves, are found in nurseries as *A. côncolor violacea*. Var. *aûrea*, Beiss. Young shoots golden yellow in May, afterward becoming silver-gray. Var. *brevifolia*, Beiss. Lvs. short and obtuse, twice as broad as in typical form. Var. *falcata*, Niem. Lvs. sickle-shaped, curved upward. Var. *globosa*, Niem. Plant spherical, with symmetrical small branches.

BB. *Lvs. pointed, especially on main shoots, and usually rigid.*

10. *Veitchii*, Lindl. (*A. nephrolepis*, Maxim.). Tree, 80–100 ft.: trunk 3–4 ft. in diam.; branchlets slender, pubescent: lvs. crowded, dark green and lustrous above, silvery white below: cones cylindrical, slender, dark purple, 2– $2\frac{1}{2}$  in. long; bracts shorter than their scales. Mts. of Cent. Japan; gregarious and forming great forests, coast of Manchuria. G.C. II. 13:273.—Very hardy in the northern states, and when young is one of the most beautiful of fir trees.

11. *brachyphylla*, Maxim. Tree, 80–100 ft.: trunk 6 ft. in diam.; upper branches long and vigorous, ultimately forming a broad, round-topped head: lvs. elongated, sharp-pointed, dark green and very lustrous above, silvery white below: cones cylindrical, stout, dark purple, 3– $3\frac{1}{2}$  in. long; bracts much shorter than their scales. Mts. of Cent. Japan, singly or in small groves. B.M. 7114.—Very hardy, and when young one of the most desirable of the fir trees for the northern states.

12. *cephalônica*, Loud. Tree, 60–70 ft.: trunk 2–4 ft. in diam.: lvs. broad, rigid, sharp-pointed, standing out from the branches at right angles: cones cylindrical, slender, pointed, gray-brown, 5–6 in. long; bracts longer or rarely shorter than their scales. Mt. Enos, on the Isl. of Cephalonia. Gng. 6:49. G.W. 5, p. 15; 12, p. 399; 14, p. 538.—Doubtfully hardy in northern states.

Var. *Apollinis*, Boiss. (*A. Apollinis*, Link), with narrow and blunter lvs., is remarkable in its power to produce vigorous shoots from adventitious buds. Mts. of Greece and Roumelia; often gregarious; more hardy than the type in the northern states. Page 3565.

13. *Pinsâpo*, Boiss. SPANISH FIR. Tree, 70–80 ft.: trunk 4–6 ft. in diam.: lvs. short, broad, rigid, sharp-pointed, bright green, spreading from all sides of the stiff branchlets: cones cylindrical, slender, gray-brown,  $5\frac{1}{2}$ –6 in. long; bracts shorter than their scales. Mts. of Cent. and S. Spain; often gregarious. G.C. III. 21:407; 29:65; 31:407.—Not hardy north of the middle states.

AA. *Nobiles*. *Lvs. blue-green, often glaucous, stomatiferous on both surfaces, flat or 4-sided on sterile branches, 4-sided acute, incurved and crowded on fertile branches.*

14. *nôbilis*, Lindl. (*Picea nôbilis*, Loud.). RED FIR Tree, 150–250 ft.: trunk 6–8 ft. in diam.: lvs. on lower branches grooved above, rounded and emarginate at the apex: cones oblong-cylindrical, purplish or olive-brown, 4–6 in. long; bracts much longer, thin and covering the scales, strongly reflexed, pale green. Cascade and Coast Mts. of Wash. and Ore.; often gregarious. S.S. 12:617. G.C. II. 19:15; III. 20:275.—There is a var. *glauca* in the trade.

15. *magnifica*, A. Murr. RED FIR. Fig. 61. Tree, 200–250 ft.: trunk 6–10 ft. in diam.: lvs. quadrangular, bluntly pointed on sterile and acute on fertile branches: cones oblong-cylindrical, purplish brown, 6–9 in. long;



bracts much shorter than the scales. Sierra Nevada of Calif.; gregarious and forming great forests. S.S. 12: 618. Gn. 37, p. 591.—Wood occasionally manufactured into lumber. Less hardy in the eastern states than *A. nobilis*.

*Var. shastensis*, Lemm., of S. Ore. and N. Calif., cones somewhat smaller, with bracts as long as or longer than the scales. S.S. 12:620.

*A. Albertiana*, Murr.=*Tsuga heterophylla*.—*A. baborensis*, Let. Lvs. dark, silvery below, very numerous,  $\frac{1}{2}$ –1 in. long; cones 4 or 5 together, reaching 7 or 8 in. long, 1 in. diam. N. Afr. R.H. 1866, p. 106, desc.—*A. bifida*, Sieb. & Zucc.=*A. firma*.—*A. bracteata*, Hook. & Arn.=*A. venusta*.—*A. canadensis*, Michx.=*Tsuga canadensis*.—*A. Delavayi*, Franch. Tree, 20–50 ft.; lvs. rolled back along margin. W. China. G.C. III. 39:212.—*A. Farquhii*, Franch. Tree, to 200 ft.; lvs. very white on under surface; cones deep purple. Cent. and W. China. G.C. III. 39:213.—*A. firma*, Sieb. & Zucc.=*A. Mome*, Sieb. Lvs. thick and rigid, 1 in. long; cones cylindrical, often 6 in. long, with keeled scales.—*A. homölepis*, Sieb. & Zucc. Closely related to *A. brachyphylla* but less valuable as an ornamental tree; rare in cult. (Arnold Arboretum). G.C. II. 12:823. Japan. Promising for the southern states.—*A. Hookeriiana*, Murr.=*Tsuga Mertensiana*.—*A. lasiocarpa*, Nutt. Lvs. blue-green and glaucous; cones 3 in. long, with very broad spineless scales. W. U. S. G.C. II. 13:9. G.F. 4:380. Gng. 4:373. S.S. 12:611.—*Var. arizonica* is a form from the mts. of Ariz. with thicker, paler and more corky bark, the result probably of climatic influence.—*A. macrocarpa*, Vasey=Pseudotsuga macrocarpa.—*A. Mariessii*, Mast. Small tree with crowded branches and short, dark foliage which is pale below; cones large, dark purple. N. Japan. G.C. II. 12:789.—*A. Mentensiana*, Lindl.=*Tsuga heterophylla*.—*A. numidica*, Carrière=*A. baborensis*.—*A. Pindrow*, Spach. Himalayas. This now being recognized as distinct from *A. Webbiana*.—*A. Regina Amaliae*=*A. cephalonica* var. *Apollinis*.—*A. religiosa*, Lindl. Long, slender, drooping branches; lvs. silvery below; cones 5 in. long. Mex. B.M. 6753.—*A. sachalinensis*, Mast. Tall tree, with pale bark, white buds, and long, slender, dark green lvs.; cones 3 in. long. E. Asia. G.C. II. 12:589.—*A. subalpina*, Engelm.=*A. lasiocarpa*. G.C. II. 15:236, 237.—*A. venusta*, Koch. Lvs. acuminate, dark yellow, green above and silvery below; cones 4 in. long, with long, slender bracts. Calif. S.S. 12:615, 616. B.M. 4740.—*A. Webbiana*, Lindl. Lvs. 1–2½ in. long, flat, silvery below; cones cylindrical, 6 or 7 in. long. Himalayas. See *Picea* for *A. ajanensis*, *alba*, *Alcockiana*, *Engelmanni*, *excelsa*, *Gregoriana*, *miniata*, *Morinda*, *nigra*, *obovata*, *orientalis*, *pendula*, *Pseudotsuga*, *Schrenkiana*, *Smithiana*. See also, *Pseudotsuga* and *Tsuga*.

C. S. SARGENT.

**ABOBRA** (Brazilian name). *Cucurbitaceæ*. A monotypic genus allied to *Cucurbita*. The only species is a greenhouse climber, cult. for its numerous small, showy frs.; grows rapidly, and may be planted out in summer. The tuberous roots are stored like dahlias. Prop. by seeds or rarely by soft cuttings.

Flowers dioecious green, all axillary and solitary; staminate fls. with a tubular, cup-shaped calyx and a rotate 5-parted corolla, having oblong-lanceolate segms.; stamens 3, free, the anthers thick, and 1-celled, or sometimes 2-celled; pistillate fls. with a 3–4-celled ovary followed by an ovoid, indehiscent, 6-seeded, showy fr.

*tenuifolia*, Naudin (*A. viridiflora*, Naudin). Height 10–15 ft.; lvs. much divided; fls. small, pale green, fragrant; fr. a scarlet gourd. Trop. Amer. R.H. 1862:111.

**ABRÔMA** (from *a*, not, and *broma*, food). *Sterculiaceæ*. A genus of 2 or 3 species, closely related to the cacao; grown as evergreen greenhouse trees, but apparently not in cult. except in botanical collections. Fls. dingy purple, the calyx 5-parted; corolla lobes 5, clawed. Prop. by seeds or by cuttings in spring from half-ripened wood under glass. Probably not in cult.

*A. augusta*, Linn. f. Lower lvs. cordate, 3–5-lobed; upper lvs. ovate-lanceolate. Trop. Asia. B.R. 518.—*A. fastuosa*, R. Br. Lower lvs. cordate, 5-lobed; upper lvs. ovate; fls. dark purple. Trop. Asia, Austral. *A. sinuosa*, Nichols. Lvs. ovate pedately pinnatifid, on slender petioles. Madagascar.

N. TAYLOR.†

**ABRÔNIA** (from Greek *abros*, delicate, referring to the involucre). *Nyctaginaceæ*. SAND VERBENA. Trailing and upright annuals or perennials, with fragrant verbenalike flowers, suitable for baskets, rockeries or the open border.

Herbs, often viscid: lvs. opposite from swollen nodes, unequal, petioled and entire; fls. 1 to many in a bracted peduncled head, small, salver-form, red, yellow or white, showy in mass, fragrant; stamens mostly 5, unequal, joined to the corolla-tube and included within it; calyx tubular and corolla-like, 4–5-lobed, the base persistent over the 1-seeded ovary or fr. About 30 species in Amer. S. Watson, Bot. Calif. 2:3–5; P.C. Standley, Contr. U. S. Nat. Herb. 12:306.

Abronias are garden annuals, or treated as annuals, of secondary importance. They are low or trailing plants, rising from 6 to 18 inches high and spreading widely. They are best adapted to open sunny places and light soil. *A. umbellata* is the common garden species, the trailing stems often reaching a length of 3 to 5 feet, and the flowers appearing all summer and fall; in mild climates, the plant volunteers from self-sown seeds. It is useful for borders and for baskets and porch-boxes, when a change or variety is wanted from the use of verbenas. Under glass, the plant is nearly perennial.

Propagation is by seeds, sown in open ground after frost, or sown in late summer or early fall in mild climates. For early and continuous summer bloom, seeds may be sown in pots of sandy earth the previous autumn and wintered in a frame. Peel off the husk (calyx) before sowing.

A. Fls. yellow.

*latifolia*, Esch. (*A. arenaria*, Menzies). Fig. 62. Perennial: whole plant viscid-pubescent, prostrate; lvs. thick, ovate, orbicular or reniform, obtuse, stalked; fls. fragrant,  $\frac{1}{2}$ – $\frac{3}{4}$  in. long, lemon-yel-



62. *Abronia latifolia*. ( $\times \frac{1}{2}$ )

low. June, July. Seacoasts, Cent. Calif. and N. B.M. 6546. G.C. II. 16:365

AA. Fls. pink or rose.

*umbellata*, Lam. (*Tricratus admirabilis*, L'Her. *A. rosea*, Hartweg.) Fig. 63. Perennial: similar in habit and pubescence to the above, but lvs. stalked, the blade ovate, acute at both ends; fls. pink, about  $\frac{1}{2}$  in. May, June. Calif. seacoasts to Columbia R. F.S. 11:1095. P.M. 16:36. Var. *grandiflora*, Hort., has larger fls. and lvs.

*villösa*, Wats. Perennial: smaller and slenderer than *A. umbellata* and covered with a glandular-villous pubescence; lvs. rarely 1 in. long; fls. 5–15 in a cluster, rose. Calif., Utah.—Not common in cult., but well suited to sandy and dry situations. Intro. 1891.

AAA. Fls. white.

*mellifera*, Dougl. (*A. Suksdorfii*, Coult. & Fisch.). Perennial: stouter than *A. umbellata*; st. finely hairy; involucre larger, scarious; fls. 1 in. long, the tube

greenish and glabrous: lvs. long-stalked, in opposite pairs. Wash., Ore. B.M. 2879. Intro. 1891.

*fragrans*, Nutt. Erect perennial: lvs. ovate or elliptical, paler beneath than above: fls. night-blooming,  $\frac{3}{4}$ –1 in. long, the tube greenish, the white lobes bifid. Columbia R. to New Mex. B.M. 5544.

*A. puchella*, Nichols. Erect, 6 in.: fls. pinkish rose.—*A. Cruz-malte*, Kellogg, the handsomest of all the species is, *Tripterocalyx Cruz-malte*, which see.

N. TAYLOR.†



63 *Abronia umbellata*. ( $\times \frac{1}{4}$ ; fl.  $\times 1$ )

**ABROPHÝLLUM** (Greek combination signifying *delicate-leaved*). *Saxifragaceæ*. An endemic monotypic genus of New S. Wales: tall, handsome shrub: lvs. alternate, elliptic or ovate-lanceolate and acuminate, to 9 in. long, somewhat toothed: fls. small, yellowish, in dichotomous corymbose panicles terminating the shoots or arising from the upper axils; petals, stamens and calyx-lobes 5; fr. a 5-celled ovoid berry. *A. órnans*, Hook. f., was intro. to Calif. in 1911 by Franceschi.

**ÁBRUS** (from *abros*, delicate, referring to leaves). *Leguminósæ*. Deciduous greenhouse climber, or used South outdoors for screens. Roots a poor substitute for licorice, and the seeds are violently poisonous. Needs strong heat for indoor culture. Propagation is by seeds or by cuttings under glass in sand.

The genus consists of usually creeping or climbing woody herbs with primately compound lvs.: fls. small, in dense racemes on axillary peduncles or short branches; calyx bell-shaped, the teeth very short; corolla pea-like, much exserted; stamens 9, in a tube.

*precatórius*, Linn. CRAB'S-EYE VINE. WEATHER-PLANT. Fig. 64. Height 10–12 ft.; frequently trailing over the ground S.: lfts. oblong, in numerous pairs: fls. varying from rose to white: seeds bright scarlet, with a black spot, used by Buddhists for rosaries, in India as standards of weight, and in the W. Indies in bead work. Seeds irritant; also used as an abortive in U. S. A variety with a cream-colored bean is offered by Reasoner Bros.: Tropics generally.—The claims made for its weather-foretelling properties are exposed by Oliver in Kew Bull. Jan., 1890. It does, however, "go to sleep" during storms, but this is a feature of other legumes. Sometimes confounded with *Rhynchosia phaseoloides* (*R. precatória*), which has similar seeds, but is a very different plant with large, 3-foliate, bean-like lvs.

N. TAYLOR.†

**ABSINTH, ABSINTHE** (ab'sinth). A liquor made from plants of the wormwood group, particularly from the absinthium (*Artemisia Absinthium*). These are aromatic or bitter herbs. *A. Absinthium* yields a bluish or green volatile oil containing absinthol and other principles. Absinth is added to water as a beverage, and in excess produces peculiar intoxication, and may even prove fatal.

**ABÛTA** (native name). *Menispermææ*. Greenhouse evergreen climber: plant dioecious, fasciated or panicked: staminate fls. with 3 exterior and 3 interior larger sepals,

and 6 stamens; pistillate fls. with 6 staminodia and 3 carpels: fr. a drupe; 14 species in S. Amer. Prop. by cuttings under glass with bottom heat, and grown in peaty loam. *A. rufescens*, Aubl. Lvs. broad-ovate or suborbicular, coriaceous, brown or tawny beneath, 3-nerved: fls. small, dark purple within, the 3 large sepals obtuse. Little known in cult.

**ABÛTILON** (name of Arabic origin for a malvaceous plant). *Malvææ*. FLOWERING MAPLE. Attractive coolhouse shrubs and window-plants, and some kinds used for bedding. Sometimes called Chinese Bellflower. Fig. 65.

Leaves long-stalked, often maple-like: fls. mostly pendulous, with naked 5-cleft calyx, 5 separate cbovate petals, many stamens united in a column about the many-branched style, the anthers borne at the top of the column: fr. a collection or aggregate of 2-valved often beaked carpels that are deciduous from the central axis at maturity.—Natives of warm regions in both hemispheres, comprising herbs, shrubs and trees; about 80 species.

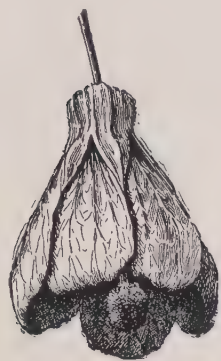
The abutillons oftenest seen in American gardens and conservatories are apparently hybrids and derivatives of pure species. The colors are mostly yellow, white and pink, with attractive veining. Well-known forms are: Arthur Belsham, red, shaded gold. Boule de Neige, pure white, very free. California, a group of free bloomers. Eclipse, foliage marbled green, and yellow fls. of fair size; sepals scarlet; petals orange-buff; suited for baskets and vases; a form of *A. megapotamicum* (another Eclipse is known). Erecta, pink, orange-veined, erect fls. Golden Bell, deep yellow, free-flowering. Golden Fleece, pure yellow, free-flowering. Royal Scarlet, rich, shining scarlet. Santana, deep red. Savitzii, dwarf, with white-edged foliage; useful for bedding. Snowstorm, semi-dwarf, pure white. Souvenir de Bonn, lvs. large, deep green, not mottled, but edged with a broad white margin; distinct and striking; a useful bedding plant. Splendens, bright red.



64. *Abrus precatorius*. ( $\times \frac{1}{4}$ )



The cultivation of abutilons is simple, under conditions suitable for the growing of geraniums and fuchsias. Some of the forms are grown primarily for bloom, and they are practically continuous-flowering when well handled; the variegated-leaved forms are grown for foliage and used more or less for bedding-out. Abutilons make good pot-plants if kept within bounds by pinching back so that they will branch. *A. megapotamicum* and some others are useful for baskets and vases. The showy *A. insigne* is an excellent rafter-plant.



65. A flower of Abutilon.

Propagation is by cuttings or seeds. Cuttings may be made in spring of new wood from old plants that have been cut back, or they may be taken in fall; as the abutilon is active practically all the year, the cuttings may be taken almost at will. Seeds grow readily; if started in March, blooming plants should be had by fall. Bedding material is raised from early-struck cuttings.

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A. *Lvs. not lobed, cordate, but prominently toothed, sometimes angled.*

B. *Corolla wide open.*

1. *insigne*, Planch. (*A. igneum*, Hort.). Lvs. medium size, crenate-dentate, acuminate, villous pubescent underneath: fls. large, flaring-mouthed, under-color white but obscured by very heavy and rich veining and markings of purple and red, on slender hanging peduncles. Colombia. B.M. 4840. Gn. 18:624; 53, p. 300. F.S. 6:551.—Very showy; common. Often trained under the roof of the greenhouse or conservatory. St. green, brown-hairy.

2. *longicuspe*, Hochst. White-canescant much-branched shrub, with long-acuminate broad-cordate and blunt-toothed long-stalked lvs., felt-like below: fls. bluish purple, veiny, wide open, on mostly many-branched axillary peduncles. Abyssinia.—Intro. by S. Calif. Acclimatizing Assoc., from seed collected by Schweinfurth and distributed from Berlin in 1893.

3. *sinense*, Oliver. Lvs. large and broadly cordate-ovate, long-acuminate, notched but not lobed, somewhat tomentose beneath: fls. large (2 in. or more across), open-bellshaped, orange-yellow with large interior veins and marks of reddish brown. Cent. China, recently intro. to cult. Seed apparently not yet in the American trade. R.H. 1909:452.

BB. *Corolla long and narrow.*

4. *megapotamicum*, St. Hil. & Naud. (*A. vezillarium*, Morr.). Fig. 66. Drooping habit: lvs. rather small, lance-ovate, acuminate, sharp-serrate: fls. 2-3 in. long, on short drooping stalks, the long calyx bright red, the protruding petals lemon-yellow, the column of stamens conspicuously protruding. Brazil, etc. B.M. 5717. Gn. 37:274. J.H. III. 18:359.—A strikingly handsome species, particularly for baskets and vases, apparently less seen than formerly. There is a variegated-lvd. variety. Generally misspelled *mesapotamicum*. *Megapotamicum* means "big river," signifying here the Rio Grande.

AA. *Lvs. prominently lobed, mostly maple-like or vitis-like.*

B. *Foliage silky or tomentose, at least beneath.*

5. *Sellovianum*, Regel (*A. Selloanum*, authors, a correction of the published name, as the plant is named for Sello. *A. Sellowianum*, Hort.). Upright, thick-hairy plant: lvs. roundish deep-heartshaped, long-stalked, 3-lobed with long-pointed parts, 7-9-nerved, unequally toothed, the under side soft silky tomentose: fls. light purple, with erect petals. Brazil. Var. *marmoratum*, Hort., has lvs. variegated with golden yellow.—A good summer bloomer. The variegated form is sometimes used for bedding.

6. *Darwinii*, Hook. f. (*A. Hildebrandii*, Fenzl.). Strong pubescent shrub of dwarfish habit: lvs. velvety pubescent beneath, thickish, 5-9-ribbed, the lower ones lobed to the middle, the upper ones shallow-3-lobed: fls. 1-3 in an axil on short sts., 1½-2 in. across, orange-red with blood-red veins, widely open or spreading. Brazil. B.M. 5917. Var. *tessellatum*, Hort., has lvs. handsomely checkered with yellow.—Blossoms in both winter and summer. Much hybridized with other species. *A. grandiflorum* and *A. compactum* are garden forms; also *A. floribundum*, Hort., R.H. 1881:350. Gt. 23:794 (var. *trinerve*, Regel).

BB. *Foliage not tomentose or silky, glabrous or slightly pubescent.*

C. *Fls. blue (varying to white in cult.).*

7. *vitifolium*, Presl. Lvs. cordate in general outline, 3-5-, and sometimes 7-, lobed, the lobes long-pointed: fls. open bell-shaped or cup-shaped, large, lavender-blue, more or less veined (sometimes white), clustered, anthers yellow. Chile.—A hardy species, remaining out-of-doors in S. of England; height becoming 30 ft.: lvs. golden in autumn. B.M. 4227, 7328. Gn. 51:334; 66, p. 8 (clumps); 76, p. 415. J.H. III. 62:380. B.R. 30:57.

CC. *Fls. yellow or orange in ground color.*

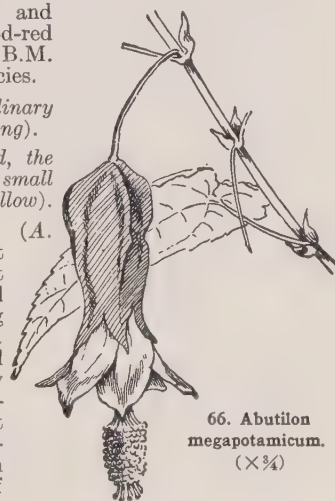
D. *Blossoms very large: lvs. 7-lobed.*

8. *venosum*, Lem. Very strong, tall grower: lvs. large, deeply palmately 7-lobed and strongly toothed: fls. large, 3 in. long, on sts. 10-12 in. long, bell-shaped and not flaring, golden orange, with veins and over-colors of blood-red and brown. Mex. B.M. 4463.—A showy species.

DD. *Blossoms of ordinary size (2 in. or less long).*

E. *Lf.-blades 3-lobed, the side lobes often small (or the clefts shallow).*

9. *pictum*, Walp. (*A. striatum*, Hort., at least in part, not Dickson). Strong and hardy free-blooming species, with lvs. green or variegated and glabrous or thinly pubescent, the middle lobe usually about equaling or sometimes shorter than the undivided part of the lf. and wedge-shape or tapering from the base: calyx about 1 in. long, cleft about to its middle, brownish pubescent; corolla less than 1½ in. long, orange or yellow, veined crimson. S. Brazil to Buenos Ayres.—Has been confused with *A. striatum*.



66. Abutilon megapotamicum. (×¼)

10. *pleniflorum*, N.E. Br. Lvs. green, glabrous both sides, the middle lobe slightly narrowed at its base and half again as long as the undivided part of the blade: fls. double.—Perhaps of hybrid origin, with *A. pictum* a probable parent.

EE. *Lf.-blades 5-7-lobed, the middle lobe always more or less narrowed at its base.*

11. *striatum*, Dicks. A Guatemalan species perhaps not in cult. in its original form: middle lobe of lf. usually at least twice as long as undivided part of blade and twice longer than broad, green: calyx somewhat less than 1 in. long, the lobes about twice as long as tube, brown-pubescent; corolla  $1\frac{3}{4}$  in. or less long, orange, conspicuously dark crimson-veined. B.M. 3840 (as *Sida picta*).—Var. *Thompsonii*, Veitch. Fig. 67. Lvs. variegated with yellow, not pubescent; first exhibited by Veitch & Sons in 1868; said to be from Jamaica; perhaps not in general cult. at present.—Var. *spurius*, Lynch. Lvs. variegated with yellow, thinly pubescent above but thickly pubescent beneath with fine hairs, the calyx white-pubescent: corolla light reddish orange with redder veins; probably of garden origin.—The cult. forms of this species-group are imperfectly understood, particularly those passing as *A. Thompsonii*. In England, the form usually known as *A. Thompsonii*, and used for bedding, is the var. *spurius*. In N. Amer. several different things are called *A. Thompsonii*, some of them not variegated and at least one of the variegated forms having double fls. The Fig. 67 is inserted to distinguish the plant originally distributed as *A. Thompsonii*, and to which the name should be restricted. Probably some of the *A. Thompsonii* forms belong in the general *A. hybridum* group.



67. *Abutilon Thompsonii* as originally pictured in *Florist and Pomologist*, 1869, p. 21. Inserted to show the plant to which the name *Thompsonii* should be applied.

The confusion between the Brazilian *A. pictum* and the Guatemalan *A. striatum* is reduced by N. E. Brown, G. C. 1910 (2) pp. 427 and 488.

12. *hybridum*, Hort. Under this name have been placed the many garden forms and hybrids, most of which have many of the features of the *A. striatum* group. *A. Darwinii* has been one of the parents in some of them, as in *A. roseiflorum*, and Golden Fleece (Gn. 53:300), both of which are recorded as offspring of

*Darwinii* and Boule de Neige. Other varieties referable here are Fireball, Golden Bell, Gold Ball, Savitzii, Souvenir de Bonn, Caprice, Boule de Neige (Snowball). Fig. 68 shows one of the forms of this garden group, passing sometimes erroneously as *A. Thompsonii*.

*A. arboreum*, Sweet. Lvs. cordate, tomentose: fls. pale yellow. Peru.—*A. Bedfordianum*, St. Hil. Lvs. lobed: fls. yellow with red: very tall. Brazil.—*A. esculentum*, St. Hil. Lvs. cordate, acuminate, toothed, tomentose: fls. purple, solitary. Fls. said to be cooked and eaten by natives in Brazil under name of Bencade Deos.—*A. globiflorum*, Don. Fls. large, cream-colored. Mauritius.—*A. integririma*, Hook. & Jackson, Index Kewensis. (*Sida integririma*, Hook. B.M. 4360.) Lvs. entire, cordate, tomentose below: fls. large, yellow, flaring. Colombia.—*A. paoniflorum*, Walp. Fls. rather small pink. Brazil.—*A. pulchellum*, Sweet, and *A. pulchrum*, Don. = *Plagianthus pulchellus*. L. H. B.

#### ACACALLIS: *Aganisia*.

**ACACIA** (from word meaning a *point* or *thorn*, referring to the stipules often spinescent). *Leguminosæ*, tribe *Mimosæ*. Trees or shrubs grown out-of-doors in warmer parts of the United States and some of the species as cool greenhouse plants for the showy yellow bloom.

Leaves bipinnate or reduced to phyllodia with vertical edges (i.e., lf.-like petioles): fls. regular, orange-yellow, occasionally lemon-yellow or white, in cylindrical spikes or globular heads, solitary, or in pairs or clusters, or in axillary racemes; sepals and petals 5, 4 or 3, free or united; stamens many, long: pod a legume, opening by two valves (occasionally indehiscent): funicle of the seed filiform or ending in club-shaped aril, either twice encircling the seed or simply bent back upon itself. (The difference between *Acacia* and *Albizzia* lies in the stamens, which are free in the former and united at base in the latter.) A very large genus (said to be 450 species) dispersed throughout the tropical parts of the earth and even pushing their way into parts of the temperate zones. The phyllodine series is confined almost entirely to Australia and the Pacific Isls., while the bipinnate series is scattered over the warm parts of the remainder of the globe. The number of species reported from Amer. is large (about 70), of which at least 30 are Mexican. Acacias are said to be natives of the following states: Ariz., Ark., Calif., Fla., Okla., Kan., La., Mo., Nev., New Mex. and Texas. Those in the following account are Australian, unless otherwise stated. This list will undoubtedly be modified as botanists segregate the other genera from the *Mimosæ* group. Acacias vary greatly under cult., the variation affecting infl., size and shape of lf., and even the funicle. One should not expect to determine an unfamiliar species without lvs., fls. and fr., with its seeds in place.

Other species interesting because of their ant-inhabited thorns are described under *Bull-horn Acacias*. Other species referred to *Acacia* are to be found under *Albizzia*.

Acacias are quick-growing plants and are short-lived. Various kinds have been known to grow from 11 to 12 feet in four months and 25 feet in six years. These trees are thus in their full maturity at thirty years of age, and shortly afterward begin to deteriorate. While they may thus be used as street trees to secure immediate effects, more permanent trees should also be planted to take their places. The leaves of some species are used in cookery, the flowers of *A. Farnesiana* for perfumery, the bark of various species for tanning; *A. Senegal* furnishes most of the gum arabic of commerce; a drug or medicine is made from the wood of *A. Catechu*; a soap or hair-wash from *A. concinna*; several are used as forage plants, others for dyes, and still others for fiber. Many of them have scented wood, others make fine furniture wood, and are used for cabinetwork and fence-posts or fuel, still others for street trees (as *A. melanoxylon* and *A. dealbata*), and all are more or less ornamental. The Ark of the Covenant, as well as the furniture of the Tabernacle, are said to have been made



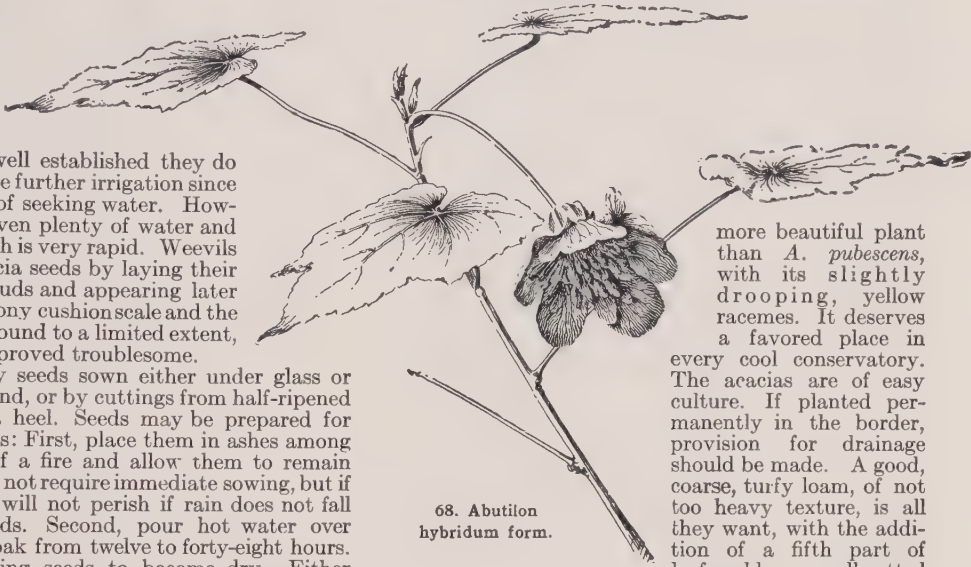
from timber of *A. Seyal*, which yields the Shittim wood of the Bible. Also on account of its incorruptible wood, this species for ages was used by the Egyptians to make coffins for the burial of their kings.

*Acacias out-of-doors* will not endure much frost. They seem to thrive very well in localities in which the winter temperature is as low as 20° F., or even 18°, and it is to be hoped that by careful selection strains may be secured that will withstand an even lower temperature. Some species are alkali-resistant as *A. cyclops*, *A. retinodes* and perhaps others. After the trees are once well established they do not ordinarily require further irrigation since they have a faculty of seeking water. However, if they are given plenty of water and good soil their growth is very rapid. Weevils sometimes ruin acacia seeds by laying their eggs in the flower-buds and appearing later in the pod. The cottony cushion scale and the black scale are also found to a limited extent, but so far have not proved troublesome.

Propagation is by seeds sown either under glass or out in the open ground, or by cuttings from half-ripened wood, taken with a heel. Seeds may be prepared for planting in two ways: First, place them in ashes among the dying embers of a fire and allow them to remain until cool. These do not require immediate sowing, but if they are sown they will not perish if rain does not fall very soon afterwards. Second, pour hot water over seed, let cool and soak from twelve to forty-eight hours. Sow without allowing seeds to become dry. Either method softens the hard seed-coats and hastens germination. They will then usually germinate in about seven days to three or four weeks, depending upon the species and the season in which they are sown. Seed may be sown in the propagating-house at any time throughout the year, though early spring is the natural time. For open ground, sow in March or April. After germination, the plants are pricked off into flats or pots and shifted into larger ones as occasion requires. They are thus kept in pots until they are ready to be transplanted to their permanent quarters, since if placed in the open ground at once the tap-roots will grow with too great rapidity and the tree will either have to be balled or transplanted with the greatest care to prevent its receiving a shock, from which it will take at least a year to recover. When buying seedlings from a nursery, therefore, reject all those whose roots have penetrated the pot. While several species (*A. pycnantha*, *A. melanoxylon*, *A. decurrens* var. *dealbata*, etc.) have been known to resow themselves in California, there is no danger of their becoming a pest (such as *A. armata* in Australia), since the seedlings are seldom able to live through the dry season without irrigation. Cuttings should be made from the half-ripened wood, of which the best are from the side shoots of the main stem, taken with a heel. No bottom heat is required, or very little, but they should be covered with a light frame and kept moist and cool by shading. They root slowly but freely and should be potted immediately after rooting, but should not be planted in the open soil until they have developed good roots.

*Cultivation in greenhouses as florists' plants* is confined to few species, perhaps not more than a dozen being commercially valuable. All of this most important section thrive in a winter temperature ranging from 40° to 50°; in fact, little above the freezing point is sufficient. They do not like heat, and consequently are not adapted for forcing. If wintered cool and allowed to come along naturally with the increasing heat and light of the spring, they will flower in March and April.

a season when their graceful beauty is appreciated in the private conservatory or is valuable to the commercial florist. The prevailing color of all the Australian species is yellow, varying from pale lemon to deep orange. The tall-growing kinds, or rather those inclined to make long, straight shoots, make excellent subjects for planting permanently against a glass partition of a conservatory, or against a pillar. There is scarcely a



more beautiful plant than *A. pubescens*, with its slightly drooping, yellow racemes. It deserves a favored place in every cool conservatory. The acacias are of easy culture. If planted permanently in the border, provision for drainage should be made. A good, coarse, turfy loam, of not too heavy texture, is all they want, with the addition of a fifth part of leaf-mold or well-rotted

spent hops. Few of our greenhouse pests trouble them. Water in abundance they like at all times, and in their growing season, which is the early summer months, a daily syringing is necessary. Several of the species of bushy habit are very much grown as pot-plants in Europe, and are now largely imported and sold for the eastern trade. *A. armata* and *A. Drummondii* are good species for this purpose. With our hot summers, the commercial man will do better to import than to attempt to grow them from cuttings. The acacias need pruning, or they will soon grow straggling and unshapely; more especially is this true of those grown in pots. After flowering, cut back the leading shoots rather severely. Shift into a larger pot if roots demand it, and encourage growth by a genial heat and syringing, giving at same time abundance of light and air. They should be plunged out-of-doors as soon as danger of frost is past, and removed to the greenhouse before any danger of early fall frosts. Cuttings root surely but not quickly. The best material is the side shoots from a main stem in the condition that florists call half-ripened—that is, not green and succulent as for *verbena*, nor as firm and hard as the wood of a hybrid perpetual rose in November. The wood or shoot will be in about the right condition in June. No bottom heat is needed, but the cuttings should be covered with a close frame and kept moderately moist and cool by shading. The following spring these young plants can be either planted out-of-doors, where there is a good chance to keep them well watered, or grown on in pots, as described above. A few of the finest species are *A. pubescens*, suitable for training on pillars; *A. Riceana* makes a bush or can be trained; *A. longifolia*, an erect species, deserves a permanent position in the greenhouse border. Of all the species best adapted for medium-sized, compact pot-plants, *A. armata* and *A. Drummondii* are the best. The former has small, simple, dark green leaves and globular, pure yellow flowers. *A. Drummondii* has drooping, cylindrical, pale lemon flowers. As both these flower in March without any forcing in our northern greenhouses,

they are very valuable acquisitions to our Easter plants. The acacia has two distinctive charms: the foliage is either small, simple and glaucous, as in *A. armata*, or much divided, graceful and fern-like, as in *A. pubescens*. All the acacias are among the freest-flowering of our hard-wooded plants. (William Scott.)

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## KEY TO THE SPECIES.

- A. Lvs. reduced to phyll. (i. e., the petiole is flattened to resemble a simple l.).  
B. Fls. in globular heads.  
C. Phyll. terete or slightly flattened.  
D. The phyll. tapering into points.  
E. Funicle filiform to its end. . . . . 1. juniperina  
EE. Funicle ending in enlarged aril.  
F. Fls. cream-yellow; phyll. slender, broad at base. . . . . 2. tenuifolia  
FF. Fls. rich yellow; phyll. thick, narrower at base. . . . . 3. diffusa  
DD. The phyll. with innocuous points, not pungent.  
E. Peduncle usually more than 1-headed. . . . . 4. calamifolia  
EE. Peduncle mostly 1-headed.  
F. Phyll. obscurely nerved. . . . . 5. juncifolia  
FF. Phyll. prominently nerved, st. almost winged. . . . . 6. extensa  
CC. Phyll. vertically flattened.  
D. Veins of phyll. 1, or very rarely 2.  
E. Fl.-heads solitary or in pairs or clusters.  
F. Length of phyll. 1 in. or less.  
G. Stipules persistent as slender spines.  
H. Pods hirsute.  
I. Phyll. semioval. . . . . 7. armata  
II. Phyll. wedge-shaped. . . . . 8. cuneata  
HH. Pod glabrous; phyll. triangular or rhomboidal. . . . . 9. decipiens  
GG. Stipules deciduous, small or none.  
H. Peduncles shorter than phyll. . . . . 10. Meissneri  
HH. Peduncles longer than phyll.  
I. Nerve near one edge; phyll.  $\frac{1}{2}$  in. wide. . . . . 11. lineata  
II. Nerve central; phyll. over  $\frac{1}{2}$  in. wide.  
J. Phyll. orbicular. . . . . 12. obliqua  
JJ. Phyll. oblong. . . . . 13. acinacea  
FF. Length of phyll.  $1\frac{1}{4}$ –4 in.  
G. More or less spinescent. . . . . 21. sentis  
GG. Not spinescent. . . . . 14. dodonæifolia  
EE. Fl.-heads in axillary racemes (rarely reduced to a solitary head).  
F. Length of phyll. 2 in. or less.  
G. Racemes much exceeding phyll.  
H. Phyll. hoary or pubescent. . . . . 15. podalyriæfolia  
HH. Phyll. glabrous.  
I. The phyll. nearly as broad as long.  
J. Shape of phyll. obliquely olate. . . . . 16. cultriformis  
JJ. Shape of phyll. triangular. . . . . 17. pravissima  
II. The phyll. oblong-falcate, not so broad as long. . . . . 18. lunata  
GG. Racemes not or only slightly exceeding phyll. (except *A. linifolia* var. *prominens*).  
H. Phyll. obliquely obovate. 19. brachybotrya  
HH. Phyll. lanceolate (often 3 in. long in Calif.) . . . . . 20. myrtifolia  
HHH. Phyll. linear.  
I. Stipules spinescent. . . . . 21. sentis  
II. Stipules not spinescent.  
J. Gland at base. . . . . 22. linifolia  
JJ. Gland below middle. 22. linifolia var. *prominens*  
FF. Length of phyll. over 2 in. (except *A. salicina* var. *Wayæ*).  
G. Some of phyll. over 1 in. wide.  
H. Funicle encircling seed and bent back in double fold.  
I. Pod  $\frac{1}{4}$  in. wide. . . . . 23. falcata  
II. Pod over  $\frac{1}{4}$  in., nearly  $\frac{1}{2}$  in. wide. . . . . 24. penninervis  
HH. Funicle not encircling seed.  
I. Phyll. sickle-shape. . . . . 25. pyncnantha  
II. Phyll. not sickle-shape. 26. saligna  
27. cyanophylla  
GG. All phyll. under 1 in. wide.  
H. Phyll. linear-lanceolate, mostly widest above middle.  
I. Midrib much to one side, gland one-third from base, making a notch. . . . . 28. obtusata  
II. Midrib central or nearly so, gland  $\frac{1}{4}$ – $\frac{1}{2}$  in. from base.  
J. Funicle surrounding seed. . . . . 29. retinodes  
JJ. Funicle not surrounding seed. . . . . 30. neriifolia  
HH. Phyll. linear-oblong, not widest above middle.  
I. Seeds nearly transverse. . . . . 31. suaveolens  
II. Seeds longitudinal.  
J. Racemes compound. 32. macradenia  
JJ. Racemes simple, often reduced to 2 or 3 heads.  
K. Foliage pale. . . . . 33. salicina  
KK. Foliage dark green. . . . . 33. salicina var. *Wayæ*  
DD. Veins of phyll. several (rarely only 2), longitudinal.  
E. Fl.-heads in racemes.  
F. Phyll. 2-nerved. . . . . 34. binervata  
FF. Phyll. more than 2-nerved.  
G. Pod with narrow wing. . . . . 35. pendula  
GG. Pod not winged.  
H. Funicle encircling seed in double fold. . . . . 36. melanoxydon



- HH. Funicle folded at end of seed, not encircling it.  
 I. Width of pod  $\frac{1}{4}$  in. . . . . 37. *implexa*  
 II. Width of pod  $\frac{3}{4}$ –1 in. 38. *koa*
- EE. Fl.-heads solitary or in pairs or clusters.  
 F. Width of phyll.  $\frac{1}{2}$  in. or less, linear.  
 G. Phyll. viscid. . . . . 39. *viscidula*  
 GG. Phyll. not viscid. . . . . 40. *elongata*  
 FF. Width of phyll. over  $\frac{1}{2}$  in., not linear.  
 G. The fl.-heads sessile, or nearly so. . . . . 41. *Oswaldi*  
 GG. The fl.-heads not sessile.  
 H. Funicle short, half as long as seed. . . . . 42. *harpophylla*  
 HH. Funicle long, scarlet, encircling seed in double fold. . . . . 43. *cyclops*
- BB. Fls. in spikes.  
 C. Shape of phyll. narrow ( $\frac{1}{2}$  to less than  $\frac{1}{4}$  in.), pungent pointed.  
 D. Nerves 3 or 4; phyll. scattered. . . 44. *oxycedrus*  
 DD. Nerves 1.  
 E. Phyll. whorled. . . . . 45. *verticillata*  
 EE. Phyll. clustered: fls. mostly 3-merous . . . . . 46. *Riceana*
- CC. Shape of phyll. broader (except *A. aneura* and *A. longiflora* var. *floribunda*), less rigid, not pungent pointed.  
 D. Pod winged. . . . . 47. *aneura*  
 DD. Pod not winged.  
 E. Calyx and phyll. pubescent (*A. Maidenii* only slightly so).  
 F. Sepals velvet-like, bright orange-yellow. . . . . 48. *glaucescens*  
 FF. Sepals not velvet-like yet more or less pubescent.  
 G. Funicle encircling seed. . . 49. *Maidenii*  
 GG. Funicle folded and enlarged into cup-shaped aril . . . 50. *holosericea*  
 EE. Calyx and phyll. not pubescent.  
 F. Phyll. linear. . . . . 51. *linearis*  
 FF. Phyll. elliptical, lanceolate.  
 G. Width of phyll. over  $\frac{1}{4}$  in. . . 52. *longifolia*  
 GG. Width of phyll. less than  $\frac{1}{4}$  in. . . . . 52. *longifolia* [var. *floribunda*]
- AA. Lvs. all bipinnate.  
 B. Fls. in globular heads.  
 C. Stipules none or brown and scarious.  
 D. Pinnæ few, 2–10 pairs.  
 E. Rachis hirsute. . . . . 53. *pubescens*  
 EE. Rachis not hirsute.  
 F. Lfts.  $1\frac{1}{4}$ – $1\frac{1}{2}$  in. long. . . . 54. *elata*  
 FF. Lfts. less than  $1\frac{1}{4}$  in. long.  
 G. Length of pinnæ 1 in. . . . . 55. *Baileyana*  
 GG. Length of pinnæ over 1 in.  
 H. Funicle filiform. . . . . 56. *discolor*  
 HH. Funicle cup-shaped aril. 57. *pruinosa*
- DD. Pinnæ many, 8–25 pairs.  
 E. Plant a tree: lfts. 30–40 pairs, more or less tomentose-pubescent. . . . . 58. *decurrens*  
 F. Lfts. dark green, shining above, imbricate: fls. bloom in June, pale yellow. . . . 58. *decurrens* [mollis]  
 FF. Lfts. more or less gray, farther apart: fls. bloom in Jan. and Feb., deep yellow. 58. *decurrens* [dealbata]  
 FFF. Lfts. light green, distant: sepals as long as petals. . . 58. *normalis*  
 EE. Plant a shrub: lfts. 20–50 pairs, glabrous. . . . . 59. *filicina*
- CC. Stipules spinescent.  
 D. Pinnæ 1 pair. . . . . 60. *pulchella*  
 DD. Pinnæ more than 1 pair.  
 E. Pod round. . . . . 61. *Farnesiana*  
 EE. Pod moniliform. . . . . 62. *Cavenia*  
 EEE. Pod not moniliform. . . . 63. *arabica*  
 64. *eburnea*
- BB. Fls. in spikes.  
 C. Pinnæ 10–40 pairs. . . . . 65. *Catechu*  
 CC. Pinnæ 2–4 pairs.  
 D. Pod not exceeding 1 in. long. . . 66. *Drummondii*  
 DD. Pod  $1\frac{1}{2}$ –4 in. long. . . . . 67. *Greggii*

1. *juniperina*, Willd. (*A. echinula*, DC. *A. pungens*, Spreng.). A stiff shrub, 8 to 12 ft., with branchlets either pubescent or smooth: phyll. scattered, numerous and tapering into a sharp point,  $\frac{1}{2}$  to rarely  $\frac{1}{2}$  in. long, 1-nerved: fl.-heads solitary on peduncles longer than the phyll., 5-merous; petals ciliate; petals acute, with prominent midrib: pod more or less falcate, flat, 1–2 in. long, about  $\frac{1}{2}$  in. broad, usually contracted between the seeds; seeds longitudinal, the funicle but little folded and filiform to the end. May, June.—May be distinguished from *A. tenuifolia* by its funicle filiform the entire length, its petals with prominent midrib, and its 5-merous fls.

2. *tenuifolia*, F. v. M. Fig. 69. An everblooming shrub with a sticky exudation on sts. and over the young fl.-buds: branchlets slender and drooping: phyll. linear-subulate,  $\frac{3}{4}$ –1 in. long,  $\frac{1}{2}$  in. wide, 1-nerved, ending in a pungent point; gland at base: fls. lemon-yellow, with peduncles  $\frac{1}{4}$  in. long, solitary in axils of the phyll., 30 or more in a head: pods straight, slightly constricted between seeds, 2–3 in. long, nearly  $\frac{1}{4}$  in. wide, pointed at both ends and bearing two rough longitudinal marks over each seed, characteristic of this species; funicle silvery white, half as long as seed and enlarged into a cup-shaped aril over one end; ripe June–Nov. Fls. every month. F. v. M. Icon. 1:8.—This attractive shrub is easily grown from seed, germinating in about three weeks and growing steadily. It is delightful for situations that demand a low-branching habit. Its everblooming fls., honey-like odor and dust-resistant qualities also recommend it.



69. *Acacia tenuifolia*. ( $\times \frac{1}{2}$ )

3. *diffusa*, Lindl. (*A. genistæfolia*, Link). A shrub of 5 or 6 ft. with loosely scattered foliage: phyll. linear or subulate,  $\frac{1}{2}$ – $1\frac{1}{4}$  in. long (mostly  $\frac{3}{4}$  in.),  $\frac{1}{2}$ – $\frac{1}{8}$  in. wide, 1-nerved, ending in sharp point: fls. in pairs or reduced to a single head, either 4- or 5-merous; peduncles  $\frac{1}{4}$  in. long; sepals not half length of petals: pod stipitate, flat, acute, 3–4 in. long,  $\frac{1}{8}$  in. broad, valves convex over seeds; funicle much folded and thickened from the middle. Apr., May. B.M. 2417. B.R. 634. Var. *cuspidata*, Benth. (*A. cuspidata*, Cunn.). Phyll. more slender, from  $\frac{3}{4}$ –2 in. long, about as broad as thick.

4. *calamifolia*, Sweet. BROOM WATTLE. Fig. 70. A tall shrub or small tree with slender erect branches: phyll. narrow-linear to subulate, with oblique point at apex and narrowed to base,  $1\frac{1}{2}$ – $2\frac{1}{4}$  in. long,  $\frac{1}{8}$  in. wide, 1-nerved; gland near base (obscure in dried specimens): racemes short, of 3 or 4 heads, or reduced to a single one; fls. 20 to a head, 5-merous; sepals half as long as petals; peduncles  $\frac{1}{4}$  in. long: pods a rich brown, slightly contracted between the seeds,  $1\frac{1}{4}$ –3 in. long,  $\frac{3}{8}$  in. wide; funicle red, almost encircling the seed in a double fold, ending in a silvery club-shaped aril; ripe Aug. Fls. Feb.–Apr. B.R. 839.—An attractive ornamental at all times but especially so when in full bloom. An excellent tan-bark species, analysis showing as much as 20.63 per cent of tannin.

5. *juncifolia*, Benth. (*A. pinifolia*, Benth.). A tall shrub with terete branches, either glabrous or hirsute: phyll. from slightly flattened to tetraginous, 3-6 in. long or more, with a nerve on each side: fls. 5-merous, either solitary or in pairs, about 40 in a head; petals united; calyx spatulate and ciliate, not half so long as petals; peduncles  $\frac{1}{4}$  in. long (rarely  $\frac{1}{2}$  in.); pod flat, with nerve-like margins, 3-4 in. long, less than  $\frac{1}{4}$  in. wide; seeds oblong, longitudinal; funicle half as long as seed, filiform but slightly thickened at hilum. F. v. M. Icon. 2:8.

6. *extensa*, Lindl. (*A. pentandra*, Regel). A shrub 5 ft. tall, with more or less winged angular branchlets: phyll. linear-subulate or needle-like, 3-4 in. long (sometimes 8),  $\frac{1}{4}$  in. wide, 1-nerved, ending in sharp point; gland  $\frac{1}{2}$ -1 in. from base: fls. solitary or shortly racemose, 20 in a head, 5-merous; sepals short; peduncles  $\frac{1}{4}$  in. long: pods with nerve-



70. *Acacia calamifolia*. ( $\times \frac{1}{2}$ )

like margins, constricted between the seeds, 2-4 in. long,  $\frac{1}{4}$  in. wide; funicle straight and only slightly thickened at hilum end; ripe May. Fls. March.

7. *armata*, R. Br. (*A. undulata*, Willd. *A. paradoxa*, DC. *A. furcifera*, Lindl. *Mimosa paradoxa*, Poir.). KANGAROO THORN. Fig. 71. A spreading shrub 8-10 ft. wide, 7-11 ft. tall, with pendent finger-like branchlets: phyll. half-ovate, the straight edge hugging the st., the other edge more or less undulate; nerve excentric, ending in a pungent point; stipules reduced to slender spines about  $\frac{1}{4}$  in. in length: fls. solitary on peduncles  $\frac{3}{4}$  in. long; petals 5; sepals 5, more than one-half length of corolla: pods hairy, straight or slightly curled, in clusters of 2-5 or reduced to 1,  $1\frac{1}{2}$ -2 in. long,  $\frac{3}{8}$  in. wide; funicle silvery, as long as seed and enlarged to a cup-shaped aril; ripe Aug. Fls. Feb.-Apr. B.M. 1653.—A shrub with breadth often much greater than its height, sometimes 15-20 ft. across, hence suitable for large grounds and roomy corners. Makes a good hedge plant, and is also used to reclaim sand-dunes. It is a good rich green and withstands considerable dust and drought. There is a larger-ld. form with fissured bark and more straggling habit. The phyll. is greener and more tender in texture than the type, and the fls. are larger.

8. *cuneata*, Benth. A tall glabrous shrub: phyll.  $\frac{1}{2}$  to scarcely 1 in. long, wedge-shaped, truncate at the apex, nerve excentric, ending in sharp point at one angle while the other angle is tipped by a gland; occasionally a faint secondary nerve; stipules setaceous: fls. solitary; peduncles about as long as phyll., 8-15 in a head, 4-merous; petals separate; calyx turbinate, half as long as corolla and with broad lobes: pod hirsute, thick margins, 2-3 in. long and  $\frac{1}{6}$  in. wide. B.R. 1839.—An interesting ornamental species, somewhat resembling *A. pravissima*.

9. *decipiens*, R. Br. (*A. dolabriformis*, Colla. *A. incrassata*, Hook. *A. biflora*, Paxt.). A shrub either low and bushy or up to 10 or 12 ft. tall, glabrous or rarely hirsute: phyll. triangular or trapezoid,  $\frac{1}{3}$ - $\frac{3}{4}$  in. long and nearly as broad; principal nerve excentric, ending

in small point, gland on other angle; the occasional stipules are spinescent: fls. solitary or in pairs, 6-10 in a head: pod thick, hard, much incurved, 1-2 in. long,  $\frac{1}{3}$ - $\frac{1}{2}$  in. wide, narrowed at each end; seeds longitudinal; funicle ending in club-shaped aril. B.M. 1745, 3244.—The difference between this and *A. cuneata* seems to lie chiefly in fls. and phyll., which are about as broad as long in *A. decipiens*, and much longer than broad in *A. cuneata*, and wedge-shaped.

10. *Meissneri*, Lehm. Tall shrub: young branches glabrous, acutely angular: phyll.  $\frac{1}{2}$ -1 in. long,  $\frac{1}{6}$ - $\frac{1}{4}$  in. broad, obovate-oblong or obliquely cuneate, obtuse, or with a small, hooked point: peduncles shorter than the phyll.: pod flat,  $\frac{1}{4}$ - $\frac{1}{2}$  in. broad, the margins not thickened; seed oblong, longitudinal; funicle very long and much folded, the last fold almost encircling the seed and returning, but thickened only at the end.

11. *lineata*, A. Cunn. (*A. runciformis*, A. Cunn.). A bushy shrub: branches usually pubescent, terete and often slightly resinous: phyll. linear,  $\frac{1}{2}$ - $\frac{3}{4}$  in. long or more,  $1\frac{1}{2}$  in. wide, nerve near the margin and ending in small hooked point: fls. solitary, 5-merous, equal to or exceeding the phyll.; sepals distinct, linear-spatulate; peduncles  $\frac{1}{4}$ - $\frac{1}{2}$  in. long: pod curved or twisted,  $\frac{1}{6}$  in. wide; funicle not so long as seed, ending in a clavate fleshy aril. Fls. March. B.M. 3346 (as *A. runciformis*).—This differs from *A. acinacea* and *A. obliqua* in only its narrow phyllodia. Habitat in barren forest grounds in the interior of New South Wales.

12. *obliqua*, Cunn.

(*A. rotundifolia*, Hook.). A drooping shrub, with finger-like branches, angular and slightly pubescent: phyll. obliquely ovate to orbicular,  $\frac{1}{4}$ - $\frac{1}{2}$  in. long,  $\frac{1}{4}$ - $\frac{3}{8}$  in. wide; 1 excentric nerve ending in recurved point; stipules minute; gland, when present, one-third distant from base: fls. 5-merous, solitary or in pairs on peduncles  $\frac{1}{2}$  in. long; fls. 15-20 in a head; petals with midrib; sepals narrow, half as long as petals: pod more or less twisted and constricted between the seeds, 1-2 in. long,  $\frac{1}{6}$  in. wide, thin, with nerve-like margins; funicle club-shaped, half as long as seed; ripe July, Aug. Fls. Feb. B.M. 4041.

13. *acinacea*, Lindl. (*A. Latrobei*, Meisn.). A much-branched shrub: phyll. obliquely oblong,  $\frac{1}{2}$ - $\frac{3}{4}$  in. long,  $\frac{1}{4}$ - $\frac{1}{2}$  in. wide, obtuse, with a recurved point; gland one-third distance from base: fls. in pairs (rarely solitary), 5-merous; calyx spatulate, ciliate, half as long as petals; petals united; peduncles  $\frac{1}{2}$ - $\frac{3}{4}$  in. long: pod twisted or curved,  $\frac{1}{6}$  in. wide, more or less constricted between the seeds; seed longitudinal; funicle not so long as seed and thickened into fleshy clavate aril. Fls. March. F. v. M. Icon. 4:7.—F. v. Mueller proposed to unite this with the broad-ld. *A. obliqua*, since the only difference between them seems to be based upon shape of phyll. This group should be given further study to determine whether transition stages may be found between the narrow and the round forms and whether



71. *Acacia armata*. ( $\times \frac{1}{2}$ )



the supposed distinction of straight pods in *A. acinacea* can be traced into the curled pods of *A. obliqua*.

14. *dodoneifolia*, Willd. A tall, glabrous, very resinous shrub; phyll. lanceolate to linear-falcate, tapering to base, having the appearance of being encrusted with a brownish powder,  $1\frac{1}{2}$ –2, sometimes 4, in. long, about  $\frac{1}{4}$  in. wide, the lateral veins prominent and anastomosing; 1 central nerve ending in an oblique point; fls. solitary or in pairs, not exceeding the phyll.; peduncles  $\frac{1}{2}$  in. long; about 40 fls. in a head, 5-merous; calyx more than half as long as corolla; pod straight or falcate, about  $\frac{1}{4}$  in. wide; seeds longitudinal; funicle with last 2 or 3 folds dilated into an irregular cup-shaped aril. March.—Superficially this resembles the *A. retinodes* group, but the fls. are solitary or in pairs instead of in racemes, and it has an apparent incrustation on foliage.

15. *podalyriæfolia*, Cunn. (*A. Fraseri*, Hook. *A. Calayi*, Cunn.). Fig. 72. A tall, glabrous shrub with conspicuous gray branchlets covered with a soft pubescence: phyll. pinniveined, pubescent (rarely glabrous), ovate or oblong,  $1\frac{1}{2}$  in. long,  $\frac{1}{2}$ – $1\frac{1}{4}$  in. wide, nerve-like margins and prominent excentric midrib ending in oblique point, the margins and midrib ciliate; gland at middle or just below: racemes simple, longer than phyll., of numerous small heads; calyx turbinate, not half so long as corolla; petals hirsute, with prominent midrib; pod flat, either glabrous or pubescent, 1–3, or more, in. long,  $\frac{3}{4}$  in. broad; seeds longitudinal; funicle not encircling seed but in short folds at hilum end, the last fold slightly thickened. R.B. 33:105. G.C. III. 43:11. Gt. 54:1541. G.W. 9, p. 158.—Its neat gray ovate lvs. and abundant long yellow racemes at the end of the branches make it a very decorative and popular species.

16. *cultriformis*, Cunn. (*A. cultrata*, Ait.). A tall shrub with gray foliage thickly clothing the branches: phyll. with nerve-like margins, obliquely ovate to almost triangular,  $\frac{1}{2}$ –1 in. long,  $\frac{1}{4}$ – $\frac{1}{2}$  in. wide, with gland on upper edge one-third distance from base, the intervening edge straight and closely hugging the branchlets; vein excentric, much curved, ending in mucronate point; racemes axillary, much exceeding the phyll.; fls. 30–40 in a head; sepals half as long as petals; peduncles  $\frac{1}{4}$  in. long; pod a rich brown, with nerve-like margins,  $1\frac{1}{2}$ –3 in. long,  $\frac{1}{4}$  in. wide, occasionally constricted between the seed; seed oblong, longitudinal; funicle half as long as seed, silvery and enlarged into a cup-shaped aril almost from the beginning; ripe Sept., Oct. Fls. March, Apr. R.H. 1896, p. 503. J.H. III. 34:131.—If kept well pruned it makes a good hedge. Has been cult. in Calif. for many years in the open, and is considered a desirable plant.

17. *pravissima*, F. v. M. Fig. 72. A small tree, 15–20 ft. high with decurrent, pendulous, finger-like branchlets thickly clothed with short foliage: phyll.  $\frac{1}{4}$ –1 in. long,  $\frac{1}{4}$ – $\frac{1}{2}$  in. broad, cuneiform to trapezoid, one angle rounded, the other acute, indistinctly 2-nerved, the prominent nerve excentric and ending in a mucronate point; gland large, near middle of upper edge: racemes much longer than phyll., 10 to more fls. in a head; peduncles  $\frac{1}{8}$  in. long; pods, when ripe, once or twice twisted, with nerve-like margins and mucronate tip,  $1\frac{1}{2}$ – $2\frac{3}{4}$  in. long,  $\frac{1}{4}$  in. wide; seed small, longitudinal, with prominent central marking; funicle as long as seed, enlarged into club-shaped aril; ripe July, Aug. Fls. Feb., March.—A very graceful showy species that is becoming popular.

18. *lunata*, Sieb. (*A. oleæfolia*, Cunn.). A glabrous shrub with angular branches: phyll. oblong-falcate, obtuse, with sharp point,  $\frac{3}{4}$ –1 in. long,  $\frac{1}{4}$ – $\frac{1}{2}$  in. wide; vein excentric; gland one-third distance from base: racemes simple, longer than phyll.; fls. 4–15 in a head; calyx united, about one-third length of corolla; pod straight or curved,  $\frac{1}{3}$  in. wide, seeds longitudinal, near

upper suture, the last fold of the funicle thickened into a lateral club-shaped aril, the lower folds very small. Apr. B.R. 1352.—This resembles *A. linifolia* var. *prominens* in fls. and foliage; the fr. is necessary to distinguish them.

19. *brachybōtrya*, Benth. Tall shrub: phyll.  $\frac{1}{2}$ – $1\frac{1}{4}$  in., rarely, in luxuriant specimens, 2 in. long, obliquely obovate or oblong, firm, rather broad, obtuse or mucronulate: fl.-heads few, short, axillary racemes, about equaling the phyll., or rarely reduced to 1 head; fls. 20–50 in a head; pod flat, linear to narrow-elliptical.

Var. *argyrophylla*, Benth. (*A. argyrophylla*, Hook.). Silvery-silky, turning sometimes golden yellow: phyll. mostly  $\frac{3}{4}$ – $1\frac{1}{2}$  in. long: fl.-heads often solitary. B.M. 4334.

Var. *glaucophylla*, Benth. Glaucous and more or less pubescent: phyll. mostly  $\frac{1}{2}$ – $\frac{3}{4}$  in. long: fl.-heads mostly 2–5, shortly racemose.

Var. *glabra*, Benth. Quite glabrous: phyll. small and narrow: fl.-heads small.

20. *myrtifolia*, Willd. A tall shrub with angular branchlets, the angles, glands and margins of phyll. edged with light red or pink: phyll. oval to ovate-lanceolate, the apex either acute with oblique point or obtuse and rounded,  $1\frac{1}{4}$ –2 in. long,  $\frac{1}{3}$ – $\frac{1}{2}$  in. wide; gland  $\frac{1}{4}$  in. from base; nerve excentric: fls. in racemes nearly as long as phyll.; peduncles  $\frac{1}{2}$  in. long; fl.-heads few (3–5), though large, 4-merous; petals with prominent midrib; sepals short, united: pod with nerve-like margins, curved and contracted between the seeds and tough, 3 in. long,  $\frac{1}{2}$  in. broad; funicle short, thickened into cup-shaped aril. B.M. 302. Fls. Feb–Mar.

Var. *celastrifolia*, Benth. (*A. celastrifolia*, Benth.). Phyll. mostly  $1\frac{1}{2}$  in. long and often 1 in. broad. B.M. 4306.

Var. *normalis*, Benth. Phyll. mostly 1–2 in. long and about  $\frac{1}{2}$  in. broad.

Var. *angustifolia*, Benth. Phyll. mostly 2–4 in. long,  $\frac{1}{6}$ – $\frac{1}{3}$  in. broad.

21. *séntis*, F. v. M. A rigid shrub or small tree 30 or 40 ft. high, with terete branchlets and when young either glabrous or pubescent: phyll. various, either lanceolate-oblong with a short point or linear with a hooked point, in some specimens  $\frac{3}{4}$  in. long by  $\frac{1}{6}$  or  $\frac{1}{4}$  in. broad and in others again they may be 2 in. long and  $\frac{1}{3}$  in. broad; marginal gland near base or wanting; stipules reduced to spines, occasionally none: fls. solitary or in pairs or racemes, 20–30 fls. in a head; sepals linear, spatulate, ciliate: pod flat, 2–3 in. long,  $\frac{1}{2}$ – $\frac{3}{4}$  in. broad; seeds nearly oblique, the funicle gradually thickened and folded several times, fitting against seed like a cap. May. F. v. M. Icon. 4:9.—A desert species commonly growing in sandy soil. It thrives with scant rainfall but requires much light, although in its native country it is now and then found among large trees. It is a valuable fodder plant, cattle eating it greedily. A specimen in Calif. was growing on soil that was almost rock and consequently became shallow-rooted. The wind threw it down repeatedly but each time when set in place it continued its growth, apparently unharmed. In New S. Wales it is said that the presence of this tree is a sure indication of underground water. Its roots have been found 80 ft. from the surface.

22. *linifolia*, Willd. A tall shrub with a minute pubescence on the branchlets and at the base of the young phyll.: phyll. linear on young shoots to linear-lanceolate on more mature ones,  $\frac{3}{4}$ – $1\frac{1}{2}$  in. long,  $\frac{1}{8}$ – $\frac{1}{3}$  in. wide, 1-nerved, ending in mucronate point; gland below the middle small: racemes shorter than phyll., with 8–12 fls. in a head: pod flat, with nerve-like margins,  $2\frac{1}{2}$ –4 in. long,  $\frac{3}{8}$  in. wide; funicle half as long as seed, with club-shaped aril. B.M. 2168.

Var. *prominens*, Moore (*A. prominens*, Cunn.). Phyll. wider, oblong-lanceolate,  $1\frac{1}{2}$  in. long,  $\frac{1}{6}$ – $\frac{1}{3}$  in.

wide; very prominent gland, its position varying, sometimes above, sometimes below the middle: pod wider,  $1\frac{1}{2}$ –3 in. long,  $\frac{1}{2}$  in. wide; funicle short (not surrounding the seed), filiform and ending in fleshy aril. Fls. late Feb. and March. B.M. 3502.—This variety does not appear to seed in Calif.

23. *falcata*, Willd. (*A. plagiophylla*, Spreng.). Tree or tall shrub: phyll. distinctly pinniveined, lanceolate-falcate, much narrowed toward base, 3–6 in. long; nerve excentric; gland at base or none: racemes shorter than phyll., 20 fls. in a head; sepals free, narrow, ciliate, about half as long as petals; petals striate, with prominent midrib: pod flat, 2–3 in. long,  $\frac{1}{4}$  in. wide; seed longitudinal, close to the margin; funicle colored, extending around seed and bent back on itself in a double fold, enlarged at hilum end into a fleshy aril.—This may be distinguished from *A. penninervis* by its smaller pod (half the size), by its gland close to base instead of distant from it, and by its free, narrow, spatulate ciliate sepals.

24. *penninervis*, Sieb. MOUNTAIN HICKORY. A tall glabrous shrub or a tree, 40–80 ft. high: phyll. pinniveined, lanceolate-falcate, acuminate, much narrowed at the base, 3–4 in. long (sometimes twice that length) about  $\frac{1}{2}$  in. broad; nerve excentric with a short secondary nerve terminating in a marginal gland below the middle: fls. pale yellow, in short racemes, much shorter than phyll.; peduncles

25. *pycnantha*, Benth. (*A. petiolaris*, Lehm.). GOLDEN WATTLE. BROAD-LEAVED WATTLE. Fig. 72. A small tree with more or less pendulous branchlets: phyll. pinniveined, oblong-lanceolate to falcate-lanceolate or even broadly obovate,  $2\frac{1}{2}$ –6 in. long,  $\frac{3}{4}$ – $1\frac{1}{2}$  in. wide, 1-nerved, the nerve more or less excentric; gland  $\frac{1}{2}$ – $\frac{3}{4}$  in. from base: racemes either simple or compound, large-fl., fragrant and showy, often bending the tree with its weight of bloom; 50–60 fls. in a head with peduncles  $\frac{1}{2}$  in. long; sepals 5, ciliate, almost as long as petals: pods varying, 2– $4\frac{1}{2}$  or 5 in. long,  $\frac{1}{4}$  in. wide, contracted and slightly constricted between the seeds and with nerve-like margins; funicle whitish, club-shaped, not folded, half as long as seed or occasionally folded and transverse to the seed; ripe Aug. Fls. Feb., March. Maiden Wattles and Wattlebark, p. 39. R.H. 1896, p. 504 Brown, For. Flora of S. Austral.—The name “broad-leaved” is derived from its reference to the seedling lvs., which are of great size, sometimes 5 in. long and 4 in. wide. The bark contains the highest percentage of tannin of any of the species, but the tree does not attain the size of *A. decurrens*, and hence so great a quantity is not obtained from any one tree. It is made into perfume, exudes a good gum, and is used as a sand-binder.

26. *saligna*, Wendl. (*A. leiophylla*, Benth.). Fig. 72. A low tree or tall shrub with angular, rather drooping branches: phyll. lanceolate to linear-lanceolate, or even oblanceolate, 3– $8\frac{1}{2}$  in. or lower lvs. 1 ft. long,  $\frac{1}{4}$ – $1\frac{1}{4}$  or even  $1\frac{3}{4}$  in. wide, acute to obtuse, narrowed to base; 1 central nerve, often excentric, ending in a recurved point or obtuse; gland at base or none: fls. large ( $\frac{1}{2}$  in. in diam.), either in large racemes at the ends of the branches or reduced to 4 or 5 heads strung along the axils of the lvs. for 2 or 3 ft.; peduncles varying from  $\frac{1}{4}$ – $\frac{1}{2}$  in. in length: pods constricted between the seeds, flat with nerve-like margins, 3–5 in. long,  $\frac{1}{4}$  in. wide; funicle club-shaped, three-fourths length of seed; ripe Aug. Fls. March–May and to slight extent at various times.—Botanists do not find any well-marked differences between this species and the next and are therefore inclined to combine the two. Nurserymen base their distinction on the color of the phyll., a bluish-tinged one being called *A. cyanophylla*, while the green phyll., especially if it is smaller, is called *A. saligna*. Both forms are also said to have been secured from seed gathered from a single tree. Nurserymen should test this to satisfy themselves. Another so-called botanical distinction gives the funicle straight in one species and folded in the other. This does not hold, as such a combination can be seen in the same plant, and even in the same pod. This species is variable in other respects. Fls. may be in groups of 4 or 5 and strung along the axis of lvs. for 2 or 3 ft. This type may have either large or small or even mixed phyll., or the fls. may be in large clusters (either erect or pendulous) at the ends of the branches. In either case, the large or the small or the mixed types of phyll. may accompany them.

27. *cyanophylla*, Lindl. BLUE-LEAVED WATTLE. Tall shrub, 18 ft., stoloniferous: branches drooping; lower phyll. about 12 in. long; upper 6 in. or less and narrower, linear-oblong to lanceolate-falcate, much narrowed toward the base, glabrous and often glaucous: peduncles  $\frac{1}{4}$ – $\frac{1}{2}$  in. long; fls. 3–5, large, golden yellow. March. Gn. 52, p. 99.—Said to be the same as *A. saligna*, as they run into each other.

28. *obtusata*, Sieb. Tall, glabrous shrub: phyll.  $1\frac{1}{2}$ –3 in. long, oblong-linear, or almost spatulate, usually almost straight, rather obtuse, point not curved, thick, rigid, with thickened, nerve-like margins; marginal gland 1, distant from the base, not prominent: racemes about  $\frac{3}{4}$  in. long, with densely packed heads; fls. 30 or more. March.

72. *Acacia* leaves. 1, *A. longifolia*; 2, *A. praviissima*; 3, *A. cyclops*; 4, *A. binervata*; 5, *A. implexa*; 6, *A. pycnantha*; 7, *A. saligna*; 8, *A. podalyriifolia*; 9, *A. melanoxydon*. ( $\times\frac{1}{2}$ )

$\frac{1}{4}$  in. long; pod  $3\frac{1}{2}$ –5 in. long,  $\frac{1}{2}$  in. broad with nerve-like margins; seed longitudinal; funicle colored, extending around seed and bent back on same side so as to encircle in double fold. B.M. 2754. Maiden Wattles and Wattlebark, p. 35.—A variable species with very narrow phyll., often  $\frac{1}{4}$ – $\frac{1}{2}$  in. wide and 8–12 in. long, the average being 1 in. broad and 5 in. long.

Var. *falciformis*, Benth. (*A. falciformis*, DC.). A shrub 6–10 ft. high with young shoots and infl. minutely hoary or golden pubescent: phyll. broad, obliquely ovate-oblong, obtuse, smooth and feather-veined, 3–4 in. long, 1 in. broad; gland at base: fls. in racemes.—Larger and more falcate than the type.



29. *retinodes*, Schlecht. A tall shrub or small tree: phyll. lanceolate, with nerve-like margins and narrowed to base, acute, pinnately veined, 3-6 in. long,  $\frac{1}{4}$ - $\frac{3}{4}$  in. wide; gland  $\frac{1}{4}$  in. from base: fls. in racemes, mostly compound; peduncles  $\frac{1}{4}$  in. long; 30-40 fls. in a head: pod flat, with nerve-like margin, 3-4 in. long, about  $\frac{1}{4}$  in. wide; funicle colored red, encircling seed, bent back upon itself in a double fold and ending in club-shaped aril; ripe June-Oct. Fls. Feb.-Sept. F. v. M. Icon. 5:9.—Very closely resembling *A. neriifolia* in foliage and fls., but differs in pod, being narrower than that of *A. neriifolia*, while the funicle is red and encircles seed in double fold.

30. *neriifolia*, Cunn. A small tree with angular branchlets: phyll. lanceolate, acute, narrowed at both ends,  $1\frac{1}{2}$ - $5\frac{1}{4}$  in. long,  $\frac{1}{4}$ - $\frac{3}{8}$  in. wide, 1 central nerve; gland  $\frac{1}{2}$  in. from base: fls. about 40 in a head, 5-merous, in short racemes; sepals 5, separate, ciliate; peduncles  $\frac{1}{8}$ - $\frac{1}{4}$  in. long: pods with nerve-like margins, contracted between the seeds and often constricted, a rich brown, 3-6 in. long,  $\frac{3}{8}$  in. wide; funicle white, short, not encircling seed, but thickened into a club-shaped aril; seed longitudinal, oval, with central depression. Fls. July.

31. *suavæolens*, Willd. A glabrous shrub, 3-6 ft. tall: phyll. linear to lanceolate, apex acute, tapering to base; 1 central nerve; gland near base: fl.-heads in axillary racemes, at first inclosed by imbricate scaly bracts, which soon fall; fls. 6-10 in a head: pod oblong, rounded at both ends, flat, impressed between the seeds,  $1\frac{1}{2}$  in. long,  $\frac{1}{2}$ - $\frac{3}{8}$  in. wide; seeds transverse; funicle filiform and suddenly enlarged into fleshy aril at right angles to itself. Fls. Apr.—Superficially it resembles narrow-ld. *A. retinodes*, but note the imbricated bracts; the pods are shorter and wider and the funicle does not encircle the seed.

32. *macradènia*, Benth. A glabrous shrub, 10-12 ft. tall, or, in favorable situations, a tree 30-50 ft. high: phyll. lanceolate-falcate, narrowed to base,  $5\frac{1}{2}$ -12 in. long,  $\frac{1}{2}$  in. wide; veins fine, prominent and transverse; gland at base, large or often wanting: racemes compound, short; fls. small; petals pubescent; calyx more than half as long as corolla, turbinate, toothed and ciliate: pod with nerve-like margin, 2-4 in. long,  $\frac{1}{4}$  in. wide or more, slightly constricted between the seeds; seeds longitudinal; funicle not enfolding seed but bent upon itself and ending in club-shaped aril, about half as long as seed. F. v. M. Icon 5:7.—A beautiful close-grained wood that is capable of taking a high polish.

33. *salicina*, Lindl. Small tree; branches drooping: foliage pale; phyll. 2-5 in. long,  $\frac{1}{4}$ - $\frac{1}{2}$  in. wide, oblong-linear or lanceolate, narrowed at base, thick, rigid, with a curved point; midrib and marginal veins scarcely prominent: racemes short, often reduced to 2 or 3 heads, or even only 1; peduncles slender; fls. about 20 in the head: pods straight, 1-3 in. long,  $\frac{1}{4}$  in. broad, valves convex, hard and thick; seeds longitudinal; funicle thickened and usually scarlet almost from the base, forming several folds under the seed.—The timber is dark brown and tough, taking a high polish. It is a good forage plant and on this account is becoming scarce in the wild state.

Var. *Wàyæ*, Maiden. Fig. 73. A shrub 8 ft. tall, which blooms sparingly at various times during the year: phyll. somewhat thick (flat when dried) and succulent-looking, oblong-linear, narrowed at base,  $1\frac{1}{2}$ - $2\frac{1}{2}$  in. long, less than  $\frac{1}{4}$  in. wide; 1 central nerve ending in oblique point; gland below middle: fls. solitary or in pairs, or occasionally in short racemes of 3-5 fls.; sepals united, truncate; petals 5: pod 1-2 in. long, less than  $\frac{1}{4}$  in. broad, contracted between the seeds; seed longitudinal; funicle scarlet its entire length, folded several times at one end of seed; ripe June-Sept. Fls. Feb.-May.—A neat little shrub with bright green lvs. The pods must be picked as soon as ripe and

just before dehiscence, for the elastic opening of the pod will discharge the seed in every direction.

34. *binervata*, DC. (*A. umbròsa*, Cunn.). Fig. 72. TWO-VEINED HICKORY. A tall shrub or shrubby tree of 25 ft., with terete branchlets: phyll. falcate-lanceolate to triangular, with 2 distinct veins (occasionally 3-veined) and pinnately veined between,  $2\frac{1}{2}$ -4 in. long,  $\frac{1}{6}$ -1 in. wide; gland  $\frac{1}{2}$  in. from base: fls. in racemes shorter than phyll.; peduncles  $\frac{1}{4}$  in. long or more, 30 fls. in a head, 4- or 5-merous; calyx not half so long as corolla: pods straight, very thin, convex over seed, 4-5 in. long,  $\frac{1}{2}$  in. wide; seed oblong; funicle long, nearly encircling seed and bent back upon itself in double dark red fold, with light aril at hilum end. B.M. 3338. Maiden, Flowering Plants of New S. Wales, pt. 5, p. 53. Wattles and Wattlebarks, p. 50.—It inhabits dry, shaded woods in the mountainous district of the coast.

35. *péndula*, Cunn. WEEPING MYALL. A small tree with gray foliage and pendulous branchlets: phyll. covered with a minute pubescence, finely striate with 3-5 obscurely parallel veins, linear-lanceolate, often falcate, acuminate, ending in mucronate point,  $2\frac{1}{2}$ - $3\frac{1}{2}$  in. long,  $\frac{1}{4}$ - $\frac{1}{2}$  in. wide; gland less than  $\frac{1}{4}$  in. from base: fl.-heads in pairs or clusters, about 30 in a head; peduncles less than  $\frac{1}{2}$  in. long; petals with midrib; sepals spatulate, reticulately veined, half as long as petals: pods  $\frac{1}{2}$  in. broad, 2-3 in. long, bordered by a narrow wing along each suture. F. v. M. Icon. 6:8.—The ornamental value of this species lies rather in drooping foliage than in the fls.

36. *melanóxylon*, R. Br. BLACKWOOD ACACIA. Fig. 72. A good-sized evergreen tree of pyramidal form and dense foliage: phyll. oblanceolate to lanceolate, usually one edge straight, the other curved,  $2\frac{1}{2}$ - $4\frac{1}{2}$  in. long (average  $3\frac{1}{2}$  in. long by  $\frac{3}{4}$  in. wide), 3-6 parallel nerves, reticulately veined between; gland  $\frac{1}{6}$  in. from base: fls. cream-color, 40-50 in a head, with peduncles over  $\frac{1}{2}$  in. long, and in short racemes of 3-5 heads: pod reddish brown, with nerve-like margins, more or less twisted into shape of letter C or S, 3-5 in. long,  $\frac{3}{8}$  in. wide; seed longitudinal,  $\frac{1}{8}$  in. in length, encircled in double fold by a long red funicle which is very characteristic of the species, the seed hanging on the trees thus for months; pods ripe July-Nov. Fls. late Feb. and March. B.M. 1659.—Its wood is but little inferior to black walnut for furniture-making and grillwork; it makes a good street tree in Calif. and as a fuel it is equal to hickory.

37. *impléxa*, Benth. Fig. 72. A tall tree, 50 ft. high, with light green foliage and rough bark: phyll. falcate-lanceolate, acuminate, with a more or less hooked point, 4-7 in. long,  $\frac{3}{8}$ - $\frac{3}{4}$  in. wide, veins 3-5, with finer parallel veins between; no gland: fls. cream-yellow, in racemes much shorter than phyll., 40-50 in a head; peduncles  $\frac{3}{8}$  in. long: pod curved, often like an interrogation point, light brown with nerve-like margin, more or less constricted and contracted between the seeds, 4-6 in. long,  $\frac{1}{4}$  in. wide; seeds longitudinal; funicle



73. *Acacia salicina* var. *Wayæ*.  
( $\times \frac{1}{2}$ )

club-shaped, folded once or twice at end of seed. F. v. M. Icon. 8:2.—Distinguished from *A. melanoxylon* by the more pointed and hooked phyll., while the funicle is cream-colored and folded at the end of the seed instead of being scarlet and twice encircling it as in *A. melanoxylon*.

38. *kōa*, Gray. KOA. Tree of 50–60 ft., with spreading branches: phyll. falcate, acuminate and tapering to base, striate with 3–5 parallel nerves more prominent, 4–5 in. long,  $\frac{3}{8}$ – $\frac{1}{2}$  in. wide; gland at base prominent: fls. in short racemes or rarely solitary, or in pairs, 50–60 fls. in a head; peduncles  $\frac{1}{2}$  in. long, 5-merous; calyx united, ciliate edges: pod brown, flat, thin, reticulately nerved, more or less constricted between seeds, 5–6 in. long,  $\frac{3}{4}$ –1 in. wide; seed dark brown, nearly transverse, oblong, about  $\frac{1}{2}$  in. long by  $\frac{1}{4}$  in. wide; funicle light brown, filiform, not encircling seed but with 2 or 3 twists at hilum end. Hawaiian Isls.—A valuable timber tree, capable of receiving a high polish. It should be more largely grown in Calif.

39. *viscidula*, Cunn. A tall shrub, 12–15 ft. high, with terete branches covered by a glossy viscid gum: phyll. long-linear, with a small oblique point, sparingly pubescent, at least when young, 2–3½ in. long,  $\frac{1}{2}$  to less than  $\frac{1}{4}$  in. wide, with several obscure parallel veins; gland near base; fls. 40 in a head, solitary or in pairs, either 5- or 4-merous, with peduncles  $\frac{1}{4}$  in. long; calyx and corolla pubescent; pod hirsute, with nerve-like margins, 1¼–2 in. long,  $\frac{1}{6}$  in. wide, slightly depressed between the seeds; seed small, longitudinal; funicle silvery, twice or thrice twisted and thickened into cap at end of seed; ripe Aug. Fls. March, Apr.—At first glance easily mistaken for narrow-ld. *A. retinodes*, but its short-std. fls. in pairs, the resinous viscid substance on phyll. and its small narrow pods will at once distinguish it.

40. *elongata*, Sieb. A tall shrub with angular branchlets: phyll. distinctly striate, 3-nerved, or often obscured, long-linear, slightly falcate, narrowed to base, obtuse and ending in oblique point, 2–3½ or 4 in. long (or narrower and 5½ in. long), hardly  $\frac{1}{2}$  in. broad; peduncles  $\frac{1}{2}$  in. long, solitary or in pairs; pod thin, with nerve-like margins, 1½–2½ in. long,  $\frac{1}{6}$  in. wide, slightly impressed between seeds, pod convex over them; seed oblong, brown; funicle not folded about seed but with 2 or 3 folds fitting over end of seed like a cap. B.M. 3337.—Especially suitable for damp, sandy land.

41. *Óswaldii*, F. v. M. A stiff shrub, 8 to 10 ft. tall: phyll. linear to oblong-falcate, with numerous fine parallel veins ending in oblique mucronate point, 1–2 in. long, nearly  $\frac{1}{4}$  in. wide; gland near base; fl.-heads sessile, solitary or in pairs, about 15–20 in a head; sepals over half as long as petals: pods hard, curved into crescents about each seed; funicle filiform, half the length of seed and suddenly dilated into a cap nearly as long, which fits over and covers up one-third of seed. F. v. M. Icon. 6:10.—May be easily recognized by its finely striate, narrow, 2-in.-long phyll., its sessile yellow fls. that sit at base of phyll., nearly hiding st., by the pods twisted in lunar shape with valves convex over seed and by the cap covering one-third of seed. A small bushy tree in Australia, producing a scented timber; the natives make short weapons from it.

42. *harpophylla*, F. v. M. A tree with slightly angular branchlets: phyll. striate, 3–5-nerved, falcate-lanceolate, tapering to both ends, 6–8 in. long,  $\frac{1}{4}$ – $\frac{3}{8}$  in. wide: fls. in clusters with peduncles  $\frac{1}{2}$  in. long, or in short racemes, much shorter than phyll., 15–20 fls. in a head; sepals not half so long as petals: pod striate,

more or less constricted and contracted between seeds, 3–4, or even 5, in. long,  $\frac{1}{6}$  in. wide; seed elliptic; funicle half as long as seed and but slightly enlarged into aril. F. v. M. 6:9.

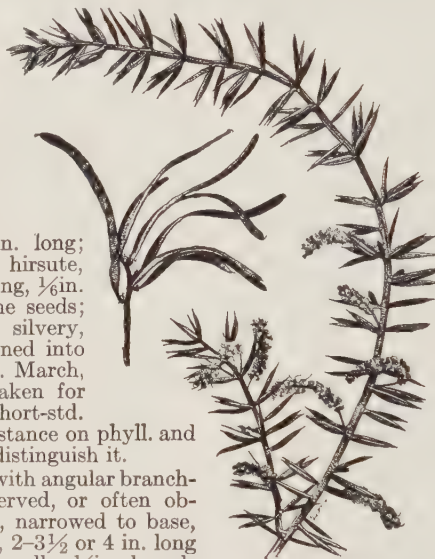
43. *cyclops*, Cunn. Fig. 72. A low spreading shrub, 8–10 ft. tall, with many sts.: phyll. narrow-oblong to lanceolate or even falcate-lanceolate, with oblique point, 1½–3½ in. long,  $\frac{1}{4}$ – $\frac{3}{8}$  in. wide, gland at base more or less obscure; 3–6 longitudinal nerves: fls. solitary or in pairs, or even in short racemes; peduncles  $\frac{1}{4}$  in. long; pods in clusters of 2–7 from one head, 2–2½ in. long,  $\frac{3}{8}$  in. wide, more or less curled; seeds transverse, with odor, when fresh, something like a leek, surrounded by conspicuous scarlet funicle in double fold; ripe Aug.–Nov. Fls. off and on from July–Dec. F. v. M. Icon. 8:3.—Young specimens are very compact and attractive, although in a few years they become spreading and unsymmetrical; but, as short-lived tub-plants for certain formal effects, they would be very effective. While

the seed-pods are at first charmingly artistic with the scarlet funicle surrounding the black seeds and the rich brown pods, in age they are unsightly, as they persist until they are ragged, ugly and black. The pods contain much tannin that is hard on the mucous membrane when the seeds are cleaned.

44. *oxycèdrus*, Sieb. A rigid shrub with terete and usually pubescent branches: phyll. striate, linear-lanceolate but broad at base and tapering to a pungent point,  $\frac{1}{2}$ – $\frac{3}{4}$  in. or even 1 in. long and 3–4-nerved on each side; small stipules, often spinescent: spikes 1 in. long; fls. 4-merous; calyx short with obtuse lobes: pods 3 in. long,  $\frac{1}{6}$  in. wide, striate, incurved and with convex valves; seed longitudinal; funicle thickened from the base and much folded. B.M. 2928.—Superficially resembles *A. verticillata*, but the phyll. are broader and the valves of the pods are thicker than in that species.

45. *verticillata*, Willd. (*Mimosa verticillata*, L'Her.). WHORL-LEAVED ACACIA. Fig. 74. A spreading shrub or small tree of graceful habit; branches more or less pubescent: phyll. in whorls or often scattered, linear-subulate, about  $\frac{1}{2}$ – $\frac{5}{8}$  in. long, or more, less than  $\frac{1}{6}$  in. wide, ending in a pungent point; 1-nerved; occasional gland near middle: spikes  $\frac{1}{2}$ –1 in. long, often concealing the phyll.: pods flat, straight or slightly curved, with nerve-like margins, 2–3 in. long,  $\frac{1}{6}$  in. wide, tapering to a point; seeds longitudinal,  $\frac{1}{4}$  in. long, with light-colored funicles of about same length thickened at end of seed into cup-shaped aril; ripe June and early July. Fls. March, Apr. B.M. 110.—Used for hedges and as ornamental; also to some extent as a street tree, in which case it may be trimmed to assume a pyramidal form, but can hardly be recommended for this purpose since it is short-lived and in age becomes straggling. It may be made to assume a pendulous habit by weighting its branches with a brick when young. There seem to be several types, some being soft to the touch while others are harsh and rigid. There is also much difference in the length of the fl.-spikes.

46. *Riceana*, Hensl. (*A. erythropus*, Tenore). A tall shrub or small tree, with graceful drooping branchlets: phyll. clustered, less than 1 in. long and  $\frac{1}{2}$  in. broad (or narrower and  $\frac{1}{2}$  in. long) linear-subulate, tapering into pungent point: spikes slender, 1½–2 in. long;



74. *Acacia verticillata*.  
( $\times \frac{1}{2}$ )



peduncles  $\frac{1}{2}$  in. long; fls. distant, acute in the bud, 3-merous, the petals with distinct nerve; calyx short, ciliate: pod usually curved, acuminate, often 2-3 in. long, scarcely  $\frac{1}{6}$  in. broad, slightly pubescent when young, but soon glabrous; valves very convex, coriaceous, contracted between the seeds; seeds longitudinal; funicle much folded and thickened nearly from the base. Fls. lemon-yellow, last of Feb. and March to Apr. Tasmania. N 1:7. This may be distinguished from *A. verticillata* by its phyll. in clusters rather than in whorls and by its distant, 3-merous fls. Its habitat is in moist shady places in its native country.

47. *aneûra*, F. v. M. MULGA. A shrub with terete branches lined with gum along the longitudinal fissures: phyll. rigid, with oblique point, varying from lanceolate-falcate to long-linear or almost terete on the same plant, 1-3 in. long,  $\frac{1}{4}$  in. wide; no prominent nerves, but distinctly striate under a lens: fls. in spikes (which may be single or in pairs),  $\frac{1}{2}$ - $\frac{3}{4}$  in. long, 5-merous; calyx narrow spatulate, not half so long as petals; peduncles less than  $\frac{1}{4}$  in. long: pods flat, oblique, with a narrow wing at suture and recurved point at apex, 1-1 $\frac{1}{2}$  in. long, nearly  $\frac{1}{2}$  in. wide; seeds nearly transverse, marked by a minute horseshoe; funicle not encircling seed but with 2 or 3 short thick folds. F.v.M. Icon. 10:8.

48. *glaucescens*, Willd. (*A. cinerascens*, Sieb. *A. homomilla*, Wendl. *A. leucadendron*, Cunn.). A tree up to 50 ft. high, with branchlets and phyll. covered with a gray pubescence which gives an ashy hue to the foliage, the young shoots yellowish: phyll. lanceolate to sickle-shaped, widest in center and tapering at both ends, striate, with 3 or 4 nerves more prominent,  $3\frac{1}{2}$ -6 in. long, from less than  $\frac{1}{2}$ - $\frac{3}{4}$  in. or even 1 in. wide; gland near base: spikes several, in the axils of the phyll., 1-2 in. long; fls. 4- or 5-merous; petals united and very narrow at base giving prominence to the short united sepals covered with a bright yellow pubescence like pile on velvet. According to J. H. Maiden, the pod, as originally described, was that of *A. Maidenii*, and the error seems to have been copied into subsequent publications. B.M. 3174.—This is often confused with *A. Maidenii*, but that species is less pubescent, has a much-twisted pod, and red funicles almost encircling seeds. It is known as the Coast Myall.

49. *Maidenii*, F. v. M. A tall shrub or tree 50 ft. high, with rough bark, fissured at intervals: phyll. lanceolate to lanceolate-falcate, narrowed at each end, striate with fine veins, several more prominent, more or less pubescent, 4-6 in. long,  $\frac{1}{6}$ - $\frac{1}{2}$  in. wide; gland about  $\frac{1}{4}$  in. from base: fl.-spikes in pairs about 1 in. long; fls. 4-merous, calyx not half so long as corolla: pod narrow,  $\frac{1}{2}$  in. wide, variously twisted into bow-knots and usually with one suture of the valves gaping open; seeds longitudinal, shining, black, funicle pale reddish, almost or quite encircling the seed and suddenly doubled back from the summit. Fls. Sept.

50. *holosericea*, Cunn. (*A. leucophylla*, Lindl. *A. neurocarpa*, Cunn.). A shrub or small tree 10 to 20 ft. high, clothed with a white, silky pubescence; branchlets with 3 much-raised angles: phyll. obliquely oval-oblong, obtuse or mucronate, 4-6 in. long, 1-3 in. wide, 3-4 nerves, pinnately veined between them: fls. 5-merous in spikes 2 in. long; calyx and corolla pubescent: pod more or less twisted; seeds longitudinal; funicle folded and enlarged into cup-shaped aril. Fls. March.

51. *linearis*, Sims (*A. longissima*, Wendl.). A straggly shrub with phyll. as long and slender as pine needles, 4-8 in. long, or twice that length,  $\frac{1}{2}$  in. wide; prominent longitudinal vein: fls. loose, slender in interrupted spikes, 1-2 in. long, 4-merous; calyx short, not half so long as corolla: pod 4 in. long,  $\frac{1}{2}$  in. broad, slightly impressed between seeds and convex over them; seeds longitudinal, oblong, shining; funicle not surrounding seed but bent back and forth into a cap-

shaped aril over one end. B.M. 2156. B.R. 680.—It may grow to 20 ft. in height, and the wood is useful for furniture and many small articles.

52. *longifolia*, Willd. SYDNEY GOLDEN WATTLE. Fig. 72. A tall shrub or small tree: phyll. oblong-lanceolate, either acute or obtuse, narrowed to the base, 2-3 in. or even 4-6 in. long and from  $\frac{1}{4}$ - $\frac{1}{2}$  in. wide; 3 or 4 longitudinal nerves, reticulately veined between; gland very near base: fls. in spikes  $\frac{3}{4}$ -2 $\frac{1}{4}$  in. long, 4-merous: pods  $1\frac{1}{2}$ -3 $\frac{3}{4}$  in. long or more, about  $\frac{1}{4}$  in. broad, coriaceous, terete until fully ripe when their valves flatten, separate, become dark and curled and persist on the tree; seeds longitudinal, black, fat and shining; funicle silvery, not enfolding seed but bent upon itself several times, dilated and fitted like a cap over one end of the seed; ripe Aug, Sept. Fls. Feb., March. B.R. 362. B.M. 2166. R.H. 1896, p. 504. Wattles and Wattlebarks, p. 51.—A valuable ornamental as well as a good tree for narrow streets; also used as a tan for heavy leathers.

Var. *Sophoræ*, F. v. M. (*A. Sophoræ*, R. Br.). Phyll. shorter, and with rounded apex,  $1\frac{1}{2}$ -3 $\frac{1}{2}$  in. long,  $\frac{3}{4}$ -1 $\frac{1}{2}$  in. broad: spikes generally shorter, 1-1 $\frac{1}{2}$  in.; blooms later and seed matures later than type. Brown, Fl. of S. Austral.—Under cult. it becomes difficult to distinguish this from the type, but in general its foliage is shorter and more rounded at apex.

Var. *floribunda*, F. v. M. A tall shrub or small tree, with the foliage all at the ends of the branches, giving the tree a thin, delicate appearance: phyll.  $2\frac{1}{2}$ -3 $\frac{1}{4}$  in. long,  $\frac{1}{8}$ - $\frac{1}{4}$  in. wide, or more, linear-lanceolate, ending in oblique point, acuminate, striate, several nerves more prominent than others: spikes  $1\frac{1}{2}$  in. long, flowering to base; fls. whitish yellow: pods contracted and long-constricted between seeds; seed longitudinal; funicle silvery, not encircling seed but folded like a cap; ripe July, Aug. Fls. Feb., March. B.M. 3203 (as *A. intermedia*).—This varies so much from the type that it is difficult to conceive of its relationship, but since all variations between this and the type can be traced, it can be given only varietal rank.

53. *pubescens*, R. Br. HAIRY WATTLE. A shrub, with drooping branches and hirsute petioles and rachis; pinnæ 3-10 pairs (mostly 3-8),  $\frac{1}{2}$ - $\frac{3}{4}$  in. long; lfts. 6-20 pairs (mostly 16), crowded, linear, smooth,  $\frac{1}{2}$ - $\frac{1}{6}$  in. wide: fls. in simple racemes longer than lvs., on long pubescent peduncles, 15-20 in a head; calyx short, sinuate-toothed; corolla smooth, protruding in bud, the petals united. Blooms in spring. B.M. 1263. F.R. 1:733.—This belongs to the series in which the pods are all flat, seeds longitudinal, last fold of funicle forming a short lateral or oblique aril, with very small folds below it. Much grown in greenhouses in the E. U. S., where it is a general favorite on account of its feathery lvs. and bright blossoms, which are in their full beauty at Eastertide, and are becoming very popular for church decorations at that time.

54. *elâta*, Cunn. A handsome tree of 50-60 ft. with dark green foliage and young shoots clothed with a yellow pubescence: lvs. compound, 1 ft. long by 8-10 in. wide; pinnæ 2-6 pairs, 5-7 in. long; lfts. 8-13 pairs, lanceolate, acuminate, pubescent,  $1\frac{1}{4}$ -1 $\frac{1}{2}$  in. long,  $\frac{1}{4}$ - $\frac{3}{8}$  in. wide, about  $\frac{3}{8}$  in. distant: fls. in compound racemes, about 40 in a head; sepals 5, united, half as long as petals; petals 5: pod a rich brown, with nerve-like margins,  $3\frac{1}{2}$ -6 in. long,  $\frac{3}{8}$  in. broad; funicle silvery, the club-shaped aril half as long as lenticular seed; ripe Aug. Blooms Sept., Oct., Dec. etc. F. v. M. Icon. 12:7. Wattles and Wattlebarks, p. 54.—Rich in tannic acid. Grows in shaded ravines in its native country.

55. *Baileyana*, F. v. M. An attractive shrub or small tree, with gray foliage arranged spirally around the branchlets and nearly concealing them: lvs. com-

pound, 1-2 in. long, with gland at base of each pair of pinnæ; pinnæ 2-3 pairs (occasionally 4), 1 in. long; lfts. about 20 pairs,  $\frac{1}{4}$  in. long, nearly  $\frac{1}{16}$  in. wide; racemes longer than lvs., 2-3  $\frac{1}{2}$  in. long; fls. 15 in a head, on peduncles  $\frac{1}{8}$ - $\frac{1}{4}$  in. long; pod  $1\frac{1}{2}$ -4 in. long,  $\frac{1}{2}$  in. wide, with nerve-like margins, occasionally constricted between seeds; seeds transverse,  $\frac{1}{4}$  in. long, with club-shaped funicle one-half its length; ripe July, Aug. Fls. Jan., Feb. F. v. M. Icon. 12:5. G.C. III. 15:37.—A much-prized ornamental and sometimes used as a street tree.

56. *discolor*, Willd. A tall shrub or small tree, either glabrous or pubescent: pinnæ 2-6 pairs; lfts. 10-15 pairs,  $\frac{1}{4}$ - $\frac{1}{2}$  in. long, 1-nerved, pale beneath; large gland on petiole and a few small ones on upper pairs of lfts.: fls. 6-15 in a head, in axillary racemes, 5-merous; petals with prominent midribs; calyx short, ciliate: pod flat, with nerve-like margins, 1-3 in. long,  $\frac{3}{8}$  in. wide; funicle enlarged at hilum end.

57. *pruinosa*, Cunn. A small tree with young foliage bronze-like: pinnæ 2-4 pairs,  $2\frac{1}{2}$ -4 in. long; lfts. 11-24 pairs,  $\frac{1}{2}$ - $\frac{3}{4}$  in. long, oblong to linear; nerve excentric, occasionally 1 or 2 short nerves; gland prominent, distant from base: fls. in racemes, 30 in a head, 5-merous; sepals united, half the length of petals: pods with nerve-like margins,  $2\frac{1}{2}$ -3 in. long,  $\frac{3}{8}$  in. broad, occasionally constricted between seeds; funicle short, filiform half its length, then enlarged into club-shaped aril. Fls. Feb.-Apr.

58. *decurrens*, Willd. GREEN WATTLE. A handsome tree, glabrous or more or less tomentose-pubescent with branches more or less prominently angled: pinnæ 8-15 pairs or more (sometimes reduced to 5 or 6); lfts. 30-40 pairs or more, linear, from under 2 to nearly 5 lines long, according to the variety: fls. 20-30 in a head, mostly 5-merous: pods 3-4 in. long, about  $\frac{1}{4}$  in. broad, more or less contracted between the seeds. Wattles and Wattle-barks, p. 55. Brown, For. Fl. of S. Austral.—

There is much confusion regarding this group among nurserymen and others.

Var. *normalis*, Benth. SYDNEY BLACK WATTLE. Lfts.  $\frac{1}{4}$ - $\frac{1}{2}$  in. long. Restricted range on the coast of Austral. According to Maiden, var. *normalis* differs from type in having sepals as long as petals and cilia on interior of lobe: in *A. decurrens*, the petals have a midrib and a short, broadly lobed ciliate calyx.

Var. *mollis*, Lindl. (*A. mollissima*, Willd.). BLACK WATTLE. A tree 20-50 ft. high, with reddish bark showing under the fissures: pinnæ 8-20 pairs, shining on upper surface, 2-6 in. long; lfts. 30-60 pairs, closely crowded, not  $\frac{1}{2}$  in. in length; gland between each pair of pinnæ and generally additional ones on internodes between: fl.-clusters in racemes, 30-36 in a head, 5-merous; peduncles  $\frac{1}{8}$ - $\frac{1}{4}$  in. long; pods dark, pubescent, 2-4 in. long, not  $\frac{1}{4}$  in. wide, constricted and contracted between the seeds; seed longitudinal; funicle filiform, enlarged to a light-colored cap over seed; ripe June-Oct. Fls. pale yellow, blooming profusely in June and intermittently at other times. B.R. 371.—Distin-

guished from var. *dealbata* by its later blooming period, by its lighter fls., its characteristic pubescent pods and smaller seeds and by the short lfts., shining above, which sit close together.

Var. *dealbata*, F. v. M. (*A. dealbata*, Link). SILVER WATTLE. Fig. 75. A tree 50 or more ft. high, with smooth bark and gray pubescent branchlets: lvs. silver-gray to light green, 3-6  $\frac{1}{2}$  in. long; pinnæ 13-25 pairs; lfts. 30-40 pairs; glands 1 between each pair of pinnæ: racemes often compound, 30 fls. in a head, 5-merous; sepals united; petals with faint midrib; peduncles  $\frac{1}{4}$  in. long; pods  $1\frac{1}{2}$ -4  $\frac{1}{4}$  in. long,  $\frac{3}{8}$ - $\frac{1}{2}$  in. wide, smooth, a rich brown; seeds longitudinal; funicle as long as seed, filiform half its distance and ending in silvery club-shaped aril; ripe July, Aug. Fls. Feb., March. A.F. 13:880. R.H. 1896 p. 502.—Mts. in its native country. It is sometimes given specific rank as *A. dealbata*, but intermediate forms occur.

59. *flicina*, Willd. (*Mimosa flicioides*, Cav.). TIMBE. Unarmed shrub: lvs. fern-like; pinnæ 5-30 pairs; lfts. 20-50 or more pairs (rarely 10-15), very small: fl.-heads globular, orange or yellow, in terminal panicles: pods broadly linear, straight or slightly curved, often irregular, flat not pulpy. Texas and Mex.—The astringent, bitter bark called *timbe* is used by the Mexicans in making pulque for precipitating mucilaginous matter. Safford, Science, Jan. 22, 1909: 160.

60. *pulchella*, R. Br. A handsome shrub, either glabrous or hirsute, with slender branches, mostly armed with subulate spines: pinnæ 1 pair; lfts. 4-7 pairs, obovate-oblong,  $\frac{1}{12}$ - $\frac{1}{4}$  in. long; gland on stipes between pinnæ, or none: peduncles solitary; fls. 5-merous; petals with prominent midrib; calyx half as long as petals and sinuate-toothed: pods flat, thick margins, 1-2 in. long,  $\frac{1}{6}$ - $\frac{1}{4}$  in. wide; seed longitudinal; funicle filiform and thickened into club-shaped aril. Fls. Apr.

Var. *grândis*, Hort. (*A. grândis*, Henfr.). Glabrous: lfts. 8-10 pairs, a little larger and more numerous than the type. Fls. Feb.-May. J.H. III. 35: 369 (1897).

Var. *hispidissima*, Hort. (*A. hispidissima*, DC.). Branches covered with long, spreading hairs: lfts. narrow and revolute: fls. white. B.M. 4588.

61. *Farnesiàna*, Willd. (*A. leptophylla*, DC.). POPANAC. OPOPANAX. CASSIE. HUISACHE. Much-branching shrub, 6-10 ft.: stipules straight, slender, sometimes minute spines; pinnæ 5-8 pairs; lfts. mostly 10-25 pairs, 1-2 lines long, narrow, linear, glabrous: peduncles 2 or 3 in the older axils; fl.-heads large, globular, deep yellow, very fragrant. pods almost terete, indehiscent, at length turgid and pulpy. Feb., March. Texas, Mex., Asia, Afr. and Austral. Grown in France for perfumery.—Its origin is probably American, but it is now naturalized in nearly every tropical country. It was intro. into the Hawaiian Isls. as an ornamental, but escaped from cult. and has now almost become a pest. A new variety of *A. Farnesiàna* has been discovered which is more hardy than the type and grows more rapidly. It produces two crops of fls. a year, which makes it very lucrative for the making of perfumery. The pods are said to contain a tannin.

62. *Cavènia*, Bert. ESPINO CAVAN. Height 20 ft.: spines stout: lfts. scabrous, scabrous-pubescent. Otherwise near to *A. Farnesiàna*, of which it is sometimes considered a mere variety. Chile.—A good hedge plant.

63. *arábica*, Willd. GUM ARABIC TREE. Fig. 76. Shrub or small tree with gray branchlets; stipules spiny: pinnæ 3-8 pairs,  $\frac{1}{2}$ -1  $\frac{1}{2}$  in. long; lfts. 10-20 pairs,  $\frac{1}{8}$ - $\frac{1}{4}$  in. long, glands several: fls. in groups of 2-5, calyx half the length of corolla: pods distinctly stalked, flat, mostly moniliform, gray-downy, 3-6 in. long. Arabia and Eu.—Some confusion exists between this species and *A. Farnesiàna*, but they are easily distinguished by means of the pod which in *A. arabica* is

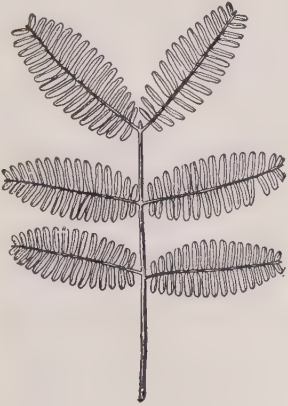


75. *Acacia decurrens* var. *dealbata*. ( $\times \frac{1}{2}$ )



from slightly constricted between the seeds to moniliform or bead-like, while in *A. Farnesiana* it is round and smooth with the seeds arranged in 2 rows in a pulpy mass.

64. *ebúrnea*, Willd. A shrub with a reddish brown bark: lvs.  $1\frac{1}{4}$  in. long; phyll. 5 or 6 pairs,  $\frac{1}{4}$ – $\frac{3}{8}$  in. long; lfts. 5–9 pairs, less than  $1\frac{1}{2}$  in. long; stipules  $\frac{1}{4}$ – $\frac{1}{2}$  in. long; gland between each of the 2 lowest pairs: fls. 40 in a head on peduncles  $\frac{1}{2}$ –1 in. long with a circle of bracts at middle; petals 5; sepals united, half as long as petals; pod flat, 3–6 in. long,  $\frac{3}{8}$  in. wide; seeds longitudinal; funicle short.—A desert region species and also used as a forage plant.



76. *Acacia arabica*.

like margin, 2–3 (or 5) in. long,  $\frac{1}{2}$ – $\frac{3}{4}$  in. broad; seed orbicular, transverse; funicle flat, not curving around seed but leading directly to hilum with a twist or two. E. Indies.

66. *Drummondii*, Benth. Bush or small tree: pinnæ 2–4 pairs, each with 4–10 linear, very obtuse, glabrous lfts.: fls. pale lemon-yellow, in dense, solitary, drooping spikes 1– $1\frac{1}{2}$  in. long: pod not exceeding 1 in. long,  $\frac{1}{4}$  in. broad, flat, with thickened margins, glabrous or pubescent; seeds transverse; funicle short, thickened into small aril of about 2 folds under seed. B.M. 5191.—A favorite greenhouse species.

67. *Gréggii*, Gray. TEXAS MIMOSA. Sometimes a tree 20 ft. high, but usually a shrub of 4–5 ft., growing in thickets along river banks: compound lvs. 1 in. long, pubescent; pinnæ 2–3 pairs (occasionally reduced to 1 pair),  $\frac{1}{2}$ – $\frac{3}{4}$  in. long; lfts. 4–7 pairs (usually 5), oblong, pubescent and 2-nerved: spikes cream-yellow,  $1\frac{1}{2}$ – $2\frac{1}{2}$  in. long, including the peduncles, which are half the length of spikes; petals and sepals greenish, 5-merous; sepals united and half as long as petals: pods much bent and twisted, nerve-like margins and more or less constricted between the seeds,  $1\frac{1}{2}$ –4 or more in. long, about  $\frac{3}{4}$  in. wide; seed  $\frac{1}{2}$  in. long,  $\frac{1}{4}$  in. wide with an arrow-shaped depression in the center; funicle filiform its entire length. Fls. Aug., Sept. In dry or rocky places in Texas and N. Mex. and S. Known as Devil's Claws and Catsclaw from the short curved, spines; also as Paradise Flower.

In the following supplementary list, the heights given are those attained by the plants under glass in N. Eu.; in the open air in the S. W. U. S. they often grow much taller, and sometimes flower 2 months earlier. Except when otherwise stated, the fls. are yellow. Those marked (\*) are considered most desirable. Those marked "stove" need hothouse treatment; the others can be grown in a cool-house, or in the open in Calif. *A. abietina*, Willd.—*A. linifolia*—*A. acanthocarpa*, Willd.—*Mimosa acanthocarpa*.—*A. acapulcensis*, Kunth.—*Lysiloma acapulcensis*.—*A. accola*, Maiden & Betche.—*A. acicularis* (Needle-leaved Acacia). 4 ft.—*A. affinis*, Sweet.—*A. dealbata*.—*A. alata*, R. Br. 6 ft. May. B.R. 396.—*A. albicans*—*Pithecolobium albicans*.—*A. amana*, Wendl. 3 ft. May. Near to *A. heterophylla*.—*A. angulata*, Desv.—*A. discolor*.—*A. angustifolia*, Lodd.—*A. longifolia* var. *floribunda*.—*A. argyrophylla*, Hook.—*A. brachybotrya* var. *argyrophylla*.—*A. aspera*, Lindl. (A. Ausfeldii, Regel. *A. densifolia*, Benth.). 4 ft. May.—*A. Ausfeldii*, Regel.—*A. aspera*.—*A. Bancroftiana*, Bert.—*Cesalpinia bijuga*.—*A. Barthiana*, Hort.—*A. Berteriana* (?).—*A. Berlandieri*, Benth. Fls. (?).

Mex.—*A. Berteriana*, Balb.—*Pithecolobium fragrans*.—*A. biflora*, R. Br. 3 ft. May.—*A. brachyacantha*, Humb. & Bonpl.—*Mimosa acanthocarpa*.—*A. brevifolia*, Lodd.—*A. lunata*.—*A. brevipes*, Cunn.—*A. melanoxylon*.—*A. Burmanniana*, DC. Shrub 6 ft. Ceylon. Stove.—*A. buxifolia*, Cunn. 4 ft. Apr. Hook. Icon. 164.—*A. casia*, Wight & Arn. (A. Intsia, Willd.). Climber beset with curved prickles. E. Indies. Stove.—*A. calamistrata*, Hort. lists=?).—*A. celestifolia*, Benth.—*A. myrtifolia* var. *celestifolia*.—*A. centrophylla*, DC. 20 ft.; white. Jamaica. Stove.—*A. Ceratonia*, Willd.—*Mimosa Ceratonia*.—*A. chrysostachys*, Hort.—*Piptadenia chrysostachys*.—*A. citrata*, R. Br.—*A. strigosa*.—*A. cinerascens*, Sieb.—*A. glaucescens*.—*A. cochlearis*, Wendl. 4 ft. Apr. to May.—*A. cerulea*, Lenol.—*A. concinna*, DC. 20 ft.; fls. white. E. Indies. Stove.—*A. Concordiana*, Lodd.—*Pithecolobium umbellatum*.—*A. conferta*, Cunn. Apr.—*A. cordata*, a trade name, probably belongs to some other species.—*A. coriacea*, DC. 5 ft. May.—*A. coronillifolia*, Desf. 10 ft. N. Afr. Stove.—*A. corymbosa*, Hort. lists=?).—*A. crassicaarpa*, Cunn. 6 ft. May.—*A. cultrata*, Hort.—*A. cultriformis*.—*A. cuspidata*, Cunn.—*A. diffusa* var. *cuspidata*.—*A. cyanophylla* magnifica, Hort. lists=?).—*A. cynodrum*, Hook.—*A. obscura*.—*A. Daviesiaefolia*, Cunn. 6 ft. June.—*A. decipiens* var. *praemorsa*, Hort.\* 3 ft. May. B.M. 3244.—*A. densifolia*, Benth.—*A. aspera*.—*A. dentifera*, Benth. Apr. B.M. 4032.—*A. dependens*, Cunn.—*A. longifolia* var. *mucronata*.—*A. detinens*, Burch. 3 ft. May. S. Afr.—*A. Dietrichiana*, F. Muell.—*A. diptera*, Willd.—*Prosopis juliflora*.—*A. diptera*, Lindl. Shrub: fls. (?).—*A. diptera* var. *eripoptera*, Graham. Sept. B.M. 3939.—*A. dissitiflora*, Benth.—a form of *A. longifolia*.—*A. divaricata*, Willd.—*Lysiloma Schiedeana*.—*A. dolabriformis*, Colla.—*A. decipiens*.—*A. Donkelaarii* is a trade name.—*Mimosa* (?).—*A. doratoxylon*, Cunn. (Currawang), a beautiful small tree: fls. golden yellow.—*A. dumosa*, Wight & Arn.—*A. latronum*.—*A. echinula*, DC.—*A. juniperina*.—*A. edulis*, Humb. & Bonpl.—*A. Farnesiana*.—*A. emarginata*, Wendl.—*A. stricta*.—*A. erioclada*, Benth. June.—*A. Esterházia*, Mackay. 4 ft. May.—*A. falciformis*, DC.—*A. penninervis* var. *falciformis*.—*A. ferruginea*, DC. From E. Indies. Stove.—*A. flexicaulis*, Benth.—*Pithecolobium flexicaule*, Coult.—*A. floribunda*, Willd.—*A. longifolia* var. *floribunda*.—*A. floribunda*, Hort.—*A. nerifolia*.—*A. formosa*, Kunth.—*Calliandra formosa*.—*A. fragrans*, Tenore—*Albizzia fragrans* ("Acacia fragrance" Hort.?).—*A. frondosa*, Willd.—*Leucæna glauca*.—*A. fruticosa*, Mart.—*Piptadenia latifolia*.—*A. genistæfolia*, Link.—*A. diffusa*.—*A. giraffe*, Willd. (Camel-thorn). 40 ft. S. Afr. Fls. (?). Stove.—*A. glauca*, Hort.—*A. glaucescens*.—*A. grandis*, Henfr.—*A. pulchella* var. *grandis*.—*A. grata*, Willd.—*Piptadenia macrocarpa*.—*A. graveolens*, Cunn.—*A. verniciflua*.—*A. guayaquilensis*, Desf.—*Mimosa guayaquilensis*.—*A. guianensis*, Willd.—*Stryphnodendron guianense*.—*A. gummiifera*, Willd. 30 ft. Guinea. Fls. (?).—*A. Hamatoxylon*, Willd. 20 ft. Fls. yellow or white. S. Afr. Stove.—*A. hastulata*, Smith. 4 ft. May. B.M. 3341.—*A. heteracantha*, Burch. 15 ft.; fls. (?). S. Afr.—*A. heterophylla*, Willd. 5 ft. May. Mascarene Isls.—*A. hispida*, Hort.—*Robinia hispida*.—*A. hispidissima*, DC.—*A. pulchella* var. *hispidissima*.—*A. holosericea*, A. Cunn.—*A. homalophylla*,\* "Yarran".—*A. homatophylla*, probably clerical error for *A. homalophylla*.—*A. homomalla*, Wendl.—*A. glaucescens*.—*A. horrida*, Willd. S. Afr.—*A. Huegelii*, Benth.\* Pale yellow. Feb.—*A. humifusa*, Cunn. Austral.—*A. hybrida*, Lodd.—*A. armata*.—*A. imperialis*, Hort. lists=?).—*A. intermedia*, Cunn.—*A. longifolia* var. *floribunda*.—*A. intertexta*, Sieb.—*A. longifolia*.—*A. Intsia*, Willd.—*A. casia*.—*A. Jonesia*, F. Muell. Racemes simple, longer than lvs. which somewhat resemble those of green-ld. *A. dealbata*.—*A. Julibrissin*, Willd.—*Albizzia Julibrissin*.—*A. Kalkora*, G. Don.—*Albizzia Julibrissin*.—*A. Lambertiana*, D. Don.—*Calliandra Lambertiana*.—*A. lanigera*, Cunn. 6 ft. Apr. B.M. 2922.—*A. latifolia*, Benth.—*A. latistylus* Willd.—*Lysiloma latistylus*.—*A. Latrobei*, Meisn.—*A. acinacea*.—*A. latronum*, Willd. (A. dumosa, Wight & Arn.). Up to 20 ft.; E. Indies. Stove.—*A. laurifolia*, Willd. 4 ft. May. Pacific Is. Stove.—*A. Lebbeek*, Willd.—*Albizzia Lebbeek*.—*A. leiophylla*, Benth.—*A. saligna*.—*A. lentisifolia*, Desf. 20 ft.; fls. (?). Mex. Stove.—*A. leprosa*, Sieb.\* May. B.R. 1441. "Graceful, linear leaves, and habit of a willow."—*A. leprosa* var. *tenuifolia*, Benth. Stove.—*A. leptocarpa*, Cunn. 6 ft. Apr.—*A. leptoclada*, Cunn.—*A. leptoneura*, Benth. 6 ft. Apr. B.M. 4350.—*A. leptophylla*, DC.—*A. Farnesiana*.—*A. leucocéphala*, Link.—*Leucæna glauca*.—*A. leucophaea*, Willd. 12 ft.; pale yellow. Trop. Asia. Stove.—*A. leucophylla*, Colvill.—*A. holosericea*.—*A. ligulata*, Cunn.—*A. salicina*.—*A. longifolia* var. *mucronata*, F. v. M. (A. dependens, Cunn. A. mucronata, F. v. M.). March. B.M. 2747.—*A. longissima*, Wendl.—*A. linearis*.—*A. lophantha*, Willd.—*Albizzia lophantha*.—*A. lophantha* var. *gigantea*, Hort.—*Albizzia lophantha* var. *gigantea*.—*A. lucida*, Baill.—*Albizzia lucida*.—*A. Manguin*, Willd. 10 ft. Molucca Is. Stove.—*A. microphylla*, Willd.—*Piptadenia peregrina*.—*A. mollis*, Wall.—*Albizzia Julibrissin*.—*A. Nemu*, Willd.—*Albizzia Julibrissin*.—*A. neurocarpa*, Cunn.—*A. holosericea*.—*A. nigricans*, R. Br. 6 ft. Apr. B.M. 2188.—*A. notabilis*, F. Muell.—*A. nudiflora*, Willd. (A. Rohriana, DC.). 30 ft.; white. W. Indies. Stove.—*A. obscura*, DC. (A. cynodrum, Hook.). 2½ ft. B.M. 4653.—*A. odoratissima*, Willd.—*Albizzia odoratissima*.—*A. oleifolia*, Cunn.—*A. lunata*.—*A. oligophylla*, Hoffmg. 4 ft. Habitat(?). Stove.—*A. ornata* is a name in the trade, probably of some well-known species.—*A. paradoxa*, DC.—*A. armata*.—*A. pentadenia*, Lindl. 10 ft. May. B.R. 1521.—*A. pinifolia*, Benth.—*A. pinifolia*, Cunn.—*A. pinnata*, Link.—*A. tamandifolia*.—*A. platyphylla*, Sweet. 10 ft. June.—*A. plumosa*, Lowe. 20 ft. Brazil. B.M. 3366. A stove climber.—*A. podalirica*, Hort. lists=?).—*A. polybotrya*, Benth.\* A beautiful pinnate-ld. species.—*A. portoricensis*, Willd.—*Calliandra portoricensis*.—*A. primosa*, probably clerical error for *A. pruinosa*.—*A. prismatica*, Hoffmg. 6 ft. Habitat(?). Stove.—*A. primovins*, Cunn.—*A. linifolia* var. *prominens*.—*A. Pseudacacia*, Hort.—*Robinia Pseudacacia*.—*A. pulcherrima*, Willd.—*Stryphnodendron floribundum*.—*A. pyramidalis*, Hort. lists=?).—*A. quadrang*



*gularis*, Link.=*Calliandra tetragona*.—*A. Reimerii*, local name for variety intro. by Reimers into San Francisco.—*A. riparia*, HBK. (*A. sarmentosa*, Griseb.). 10 ft. W. Indies. A stove climber.—*A. Rohriana*, DC.=*A. nudiflora*.—*A. rosea*, Hort.=*Robinia hispida*.—*A. ruscifolia*, Cunn.=*A. verticillata* var. *latifolia*.—*A. sarmentosa*, Griseb.=*A. riparia*.—*A. scandens*, Willd.=*Entada scandens*.—*A. semicordata*, Roxbg. 40 ft.: fls. (?) E. Indies. Stove.—*A. Sénégal*, Willd. 30 ft.: fls. white. Trop. W. Afr. Stove.—*A. sericata*, Cunn. Apr.—*A. Simsii*, Cunn. Apr.—*A. Sphoræ*, R. Br.=*A. longifolia* var. *Sphoræ*.—*A. speciosa*, Willd.=*Albizzia Lebbek*.—*A. spectabilis*, Cunn.\* Apr. B.R. 1843:46. Remarkably beautiful.—*A. Spini*, Balb. 15 ft.; red and yellow. Guadeloupe Isl. Stove.—*A. squamata*, Lindl. Apr. Hook. Icon. Plant. 367.—*A. stenophylla*, Cunn. March.—*A. stipulata*, DC.=*Albizzia stipulata*.—*A. stolonifera*, Burchell, a species from S. Afr. with underground sts.—*A. stricta*, Willd. (*A. emarginata*, Wendl.). 2 ft. March. B.M. 1121.—*A. strigosa*, Link (*A. ciliata*, R.Br.). 4 ft.—*A. strombulifera*, Willd.=*Prosopis strombulifera*.—*A. subulata*, Bonpl. 4 ft. May.—*A. sulcata*, R. Br. 2 ft. July. B.R. 928.—*A. Suma*, Gurz. 10 ft.: fls. (?) E. Indies. Stove.—*A. tamarindifolia*, Willd. (*A. pinnata*). 4 ft.: white. S. Amer. Stove.—*A. taxifolia*, Lodd.=*A. Riceana*.—*A. tomentosa*, Willd. 20 ft.: fls. (?) E. Indies. Stove.—*A. trichodes*, Willd.=*Leucaena trichodes*.—*A. trinervata*, Sieb. 6 ft. Apr.—*A. tristis*, Graham.=*A. armata*.—*A. umbellata*, Cunn. Apr.—*A. uncinata*, Lodd.=*A. undulfolia*.—*A. undulfolia*, Lodd. 4 ft. May. B.M. 3394.—*A. urophylla*, Benth. Pale yellow. Apr. B.M. 4573.—*A. vaga*, Willd. 40 ft.: white. Brazil. Stove.—*A. venusta*, Willd.=*Calliandra portoricensis*.—*A. vera*, Willd.=*A. arabica*.—*A. verniciflua*, Cunn. (*A. graveolens*, Cunn. *A. virgata*, Lodd.). 6 ft. Apr. B.M. 3266, 3279.—*A. verticillata* var. *angusta*, Hort. 10 ft. Apr.—*A. verticillata* var. *latifolia*, Benth. (*A. ruscifolia*, Cunn. *A. moesta*, Lindl.). 10 ft. Apr. B.M. 3195. B.R. 1846:67.—*A. vestita*, Ker-Gawl.\* 6 ft. June. B.R. 698.—*A. viminatis*, Ait. Apr.—*A. viridescens*, DC. 20 ft. S. Amer. Stove.—*A. virgata*, Lodd.=*A. verniciflua*.—*A. viridifolia*, Burch.=*Xerocladia Zeyheri*.—*A. viscidula*, Cunn. 6 ft. Feb. Gt. 1109. *A. viscida*, Schrad.=*A. donnellifolia*.—*A. vomeriformis*, Cunn. Apr.—*A. Wallichiana*, DC.=*Catechu*.

KATHERINE D. JONES.

ACACIA, FALSE: *Robinia Pseudacacia*.

ACACIA, ROSE: *Robinia hispida*.

**ACÆNA** (from Greek word signifying *thorn*). *Rosaceæ*. NEW ZEALAND BUR. Trailing, more or less evergreen plants used in rockwork and as ground cover under trees and between other plants.

About 40 species of sub-shrubs or herbs of the southern hemisphere, allied to *Agrimonia* and *Sanguisorba*: lvs. unequally pinnate, alternate, the lfts. toothed or cut: fls. small, crowded in erect terminal spikes or heads; petals none; calyx 5-7-lobed, usually armed

with spines; stamens 1-10, or even more: fr. an achene, 1 or 2 being enclosed in the hardened calyx.

Acænas are little grown in this country, but are prized in England as groundwork for dwarf spring-flowering bulbs, as trilliums; also useful in protecting native orchids and bog plants. Propagation is by cuttings, divisions and seeds.

**Buchananii**, Hook. f. Plant usually densely or silky pale gray, the numerous sts. and branches lying very close on the ground: lvs. 1 in. or less long, the lfts. 3-6 pairs, very broad, finely serrate: fls. in small sessile heads; spines or bristles 4, yellow and hairy or barbed, the fruiting calyx broader than long. New Zeal.

**microphylla**, Hook. f. Plant glabrous or only sparingly silky, often making very large patches: lvs. pale, 2 in. or less long; lfts. 3-6 pairs, broad, deeply cut: fls. in globose stalked heads; fruiting calyx broader than long, the red spines attractive all summer and autumn. New Zeal.—Grows well in either wet or dry soils.—Var. **inermis**, Kirk (*A. inermis*, Hook. f.), has longer lvs. and the fruiting calyx without spines or bristles.

**ovalifolia**, Ruiz & Pav. Lvs. a little larger than the last; lfts. oblong, subcuneate. Chile. Gn. 52, p. 46.

**adscendens**, Vahl. Plant usually glabrous bronzy, the sts. stout and prostrate, the leafy branches ascending at the tips: lvs. 2-4 in. long: lfts. 4-6 pairs, ovate or obovate, deeply toothed: fls. in stalked heads; calyx-tube longer than broad, the spines 4 and stout. New Zeal., S. Amer.—Apparently the plant in the trade under the name of *A. adurgens*.

*A. argentea*, Ruiz & Pav. Lvs. silvery. Chilean Andes.—*A. myriophylla*, Lindl. Fern-like: lfts. deeply cut: fls. green, Chile.—*A. nova-zealandica*, Kirk. Prostrate, silky: lfts. oblong, coarsely serrate: heads globose, stalked: bristles reddish purple: achene narrowed both ways. New Zeal.—*A. ovina*, A. Cunn. Said to be much like *A. ovalifolia*, but larger and less graceful: fls. purple, in long spikes. Austral.—*A. Sanguisorbæ*, Vahl. Prostrate, silky: lfts. broad, toothed or serrate: heads globose, stalked; bristles long and barbed, at each angle of calyx: achene broadest near base and narrowing upward; one of the troublesome sheep-burs. New Zeal.—*A. sarmentosa*, Carnich.=*A. Sanguisorbæ*.

L. H. B.

**ACALYPHA** (a name given by Hippocrates to a nettle). *Euphorbiaceæ*. COPPER-LEAF. THREE-SEEDED MERCURY. Brilliant tender foliage shrubs or herbs much used for greenhouse ornament, and especially for bedding-out; and in Florida and southward for lawn shrubs and hedges.

The acalyphas are erect shrubs or, in the native species, rather weedy herbs, with alternate stipulate lvs: fls. in spikes or spike-like racemes, the staminate cluster peduncled, each fl. in the axil of a minute bractlet, with a 4-parted calyx and 8-16 stamens; pistillate fls. subtended by a foliaceous bractlet, the calyx 3-5 parted; petals wanting in both kinds of fls., the long spike-like ament being the showy part of the fls.: fr. usually of 3-2-valved carpels, each 1-seeded.

For bedding, it is desirable to have strong, well-hardened plants in 4-inch pots, which should be set out the last week in May, and grown in a rich, moist soil without check. The leading horticultural species is *A. hispida*. The main point in the cultivation of this species is that it can be grown either to a single stem or in a spreading bush form, both of which ways are effective. Stock plants of acalypha do well in a mixture of three parts loam, one part well-decomposed manure, and, if the loam is heavy, also some sharp sand. In central Florida, none of the acalyphas is quite hardy. They should be banked late in the fall with dry sand, which must be removed when all danger of frost is over.

Propagation is by cuttings, chiefly in three ways: (1) in fall from outdoor bedded plants; (2) from plants lifted in fall, cut back, and kept for spring stock; (3) from stock plants in pots reserved from the previous season. The well-ripened wood of these last is a great advantage, and gives cuttings that may be taken with a heel. A mature stem will furnish several beside the



77. *Acalypha hispida* (A. Sanderi).



top one. This is the best method for general purposes. Cuttings may also be taken below the joints when the shoots are half mature. The cuttings require mild bottom heat. For greenhouse ornament in fall and winter, excellent specimens may be secured from cuttings made in summer from such stock plants.



78. *Acalypha Wilkesiana* var. *Macafeana*. ( $\times \frac{1}{2}$ )

The acalyphas are subject to mealy-bug, scale and red-spider. For the first two, fumigate with hydrocyanic acid gas. The red-spider can be kept in check by syringing or spraying.

*A. Annual.*

*indica*, Linn. An erect hairy plant 1-3 ft.: lvs. broad, ovate, the petiole longer than the blade; fls. greenish, the spikes 1-2 in. long. Old World tropics.—Not showy. The hort. name *A. Miltoniana* may belong here.

*A. Perennial.*

*B. Fl.-clusters much exceeding the lvs.*

*hispida*, Burm. f. (*A. Sanderi*, N. E. Br.). RED-HOT CAT-TAIL. Fig. 77. Cult. chiefly for its long red, amarantus-like spikes of fls. which are much longer than the lvs.: lvs. green. E. Indies. Burm. Fl. Ind., p. 303, t. 61, f. 1. A.F. 13:1285. A.G. 19:453, 827. F.E. 10:554. G.C. III. 23:248. Gt. 47:276; 48:1465. Gn. 54:62. Gng. 6:279. B.M. 7632. R.H. 1898:456.—A very striking garden plant. Called by various names, as Chenille Plant, Philippine Medusa, and others. Var. *ramôsa*, Hort., has upper spikes branched or compound. Var. *alba*, Hort., spikes creamy white.

BB. *Fl.-clusters shorter than, and usually half hidden by the lvs.: branches not spiny.*

*Wilkesiana*, Muell. Arg. (*A. tricolor*, Hort. ex Seem.). Lvs. ovate-acuminate, bronzy green, variously mottled with red; fls. usually some shade of red, inconspicuous. S. Sea Isls. Var. *Macafeana*, Hort. Fig. 78. Lvs. red, marked with crimson and bronze.—Perhaps the commonest variety. R.H. 1882:288. Var. *macrophylla* (*A. macrophylla*, Hort., not HBK.). Lvs. cordate, ovate, russet-brown. Var. *marginata*, Hort. Lvs. with marked crimson margin. F.M. 1875:156. Gn. 7, p. 521. I.H. 24:275. Var. *musâica*, Hort. Lvs. green, with orange and red markings. Var. *obovata*, Hort. Lvs. obovate, green, edged white when young, changing to bronzy green with rosy pink margins. Var. *triumphans*, Hort. (*A. triumphans*, Lind. & Rod.). Lvs. large,

spotted with crimson, green, and brown. I.H. 35:55 (1888).

*integrifolia*, Willd., not Bojer (*A. colorata*, Spreng. *A. Commersoniana*, Baill.). Shrub, 4-6 ft.: lvs. oblong-fiddle-shaped, variable in size, crenate or entire, green above, purplish beneath; fls. small, the clusters shorter than the lvs. Mauritius and Madagascar.

*Godseffiana*, Mast. Low-growing shrub of dense bushy habit: lvs. short-petioled, ovate or ovate-lanceolate, cordate, acuminate, coarsely toothed, green with a prominent cream-colored margin; fls. inconspicuous, greenish-yellow, the clusters shorter than the lvs. Apr., May. New Guinea. G.C. III. 23:242. Gng. 6:278. F.E. 10:554. A.F. 13:1286. Var. *heterophylla*, Hort. Lvs., especially the lower, linear-lanceolate, irregularly repand.

BBB. *Fl.-cluster as in BB, but branches spiny.*

Var. *eremôrum*, Muell. Of peculiar habit and with spiny branches: lvs. green, short-petioled, crenate: fls. in spikes, the clusters shorter than the lvs. Austral.—Coolhouse plant, chiefly interesting botanically.

*A. Chantrieri*, Hort. = *A. Hamiltoniana*  $\times$  *Wilkesiana* var. *macrophylla*.—*A. marginata*, Hort., not Spreng. = *A. Wilkesiana* var. *marginata*.—*A. obovata*, Hort., not Benth. = *A. Wilkesiana* var. *obovata*. Other trade names are *A. Hamiltoniana*, Hort. Bruant 1895. Lvs. bright green, the rounded teeth yellow-margined.—*A. Miltoniana*, Hort. Intro. 1911. *A. morfontanensis*, Hort. = *A. Hamiltoniana*  $\times$  *Wilkesiana* var. *marginata*. *A. torta*, Hort. Lvs. dark green, the margins cut into blunt oblong segms. Samoan Isls.

N. TAYLOR.†

**ACÂMPE** (named from the brittle nature of the flower). *Orchidaceæ*. Greenhouse epiphytes.

*A. longifolia*, Lindl. (*Vanda longifolia*, Lindl.). E. Indies. A plant of no decorative value, and rarely, if ever, seen in cult.

**ACANTHEPHÍPPÍUM:** *Acanthophippium*.

**ACANTHOCÈREUS** (Greek, *thorn* and *cereus*). *Cactacæ*. An erect or clambering night-flowering cactus, the sts. elongated, usually 3-angled, but young shoots very diverse and sometimes 8-ribbed, never producing aerial roots; areolæ remote, bearing prominent spines: fls. large, funnelform: fr. a berry, sometimes with spines; flesh red; seeds black.—Perhaps several species, but some authors recognize only one species.

*pentagônus*, Brit. & Rose (*Cactus pentagônus*, Linn. *Cereus princeps*, Pfeiff. *C. baxaniensis*, Karw. *C. variabilis*, Engelm.). Half erect, 3-20 ft. high: spines 4-6, the longer  $1\frac{1}{2}$  in. long; fls. 7-8 in. long. Trop. Amer.—This species grows wild in S. E. Texas and does well there as a garden plant. It is also a common greenhouse plant where it does well, often growing to considerable size. It blooms freely, but the fls. are not very attractive.

J. N. ROSE.

**ACANTHÔDIUM:** *Blepharis*.

**ACANTHOLIMON** (*akanthos*, spine, and *limon*, sea lavender). Syn., *Armeridstrum*. *Plumbaginacæ*. PRICKLY THRIFT. Hardy evergreen perennials, sometimes a little woody.

Leaves stiff, linear, round or slightly 3-angled, the angles channeled, the apex nearly always sharp-pointed: scape and peduncle nearly always simple, sometimes a little branched: fls. usually between and half hidden by the numerous bracts of the tightly compressed heads, spikes or racemes; corolla rose or white,



79. *Acantholimon glumaceum*

the petals at the base united to form a ring around the stamens; calyx tubular, the tube 10-ribbed. Boissier describes 74 species in the *Flora Orientalis*. See A. Bunge, *Die Gattung Acantholimon*, St. Petersburg, 1872.

The acantholimons are dwarf, tufted herbs, with sharp-pointed, rigid leaves; less common than *Statice* and *Armeria*, from both of which it is distinguished by its sharp-pointed leaves. An oriental genus of slow-growing and sun-loving plants for rockeries and sandy places. Most of them can be grown in the open border, *A. glumaceum* particularly, but they prefer warm, sunny situations in the rock-garden.

Propagation is best effected by cuttings taken in late summer and kept in a coldframe, protected from the frost, over winter. Layering is also a quicker method of propagation.

**acerðsum**, Willd. Woody, low perennial, with glaucous, spotted foliage: lvs. thick, 2-3 in. long, long-



80. *Acanthopanax ricinifolium*. ( $\times \frac{1}{3}$ )

pointed, flatly 3-angled, the margins rough: scape longer than the lvs., topped by a laxly many-spiked fl.-cluster; petals white. E. Medit. region.—Most suitable for rock-garden. Scarcely grown in Amer.

**glumaceum**, Boiss. (*Statice Ararátii*, Hort.). Fig. 79. Height 6 in.: lvs. green: fls. small, rose, on 1-sided spicate racemes, 6-9 in each short, dense racemelet. July-Sept. Armenia. F.S. 7:677. Gn. 31:350. R.H. 1891, p. 489.

**venustum**, Boiss. (*Armeriastrum dianthifolium*, O. Kuntze). About 8 in.: lvs. gray-green, very stiff: fls. larger than the last, rose, 12-20 in each long, loose spikelet. July-Sept. Asia Minor. R.H. 1866:450. Gn. 13:186. B.M. 7506. Gn. 53, p. 405.

*A. Kotschyi*, Boiss. Fls. white, rising well above the lvs. Cilicia. —*A. melananthum*, Boiss. Short dense spikes; sepals violet or blackish-margined. Persia.

N. TAYLOR.†

**ACANTHOMÍNTHA** (from Greek words for a *prickle* or *thorn*, and *mint*). *Labiatae*. THORNY MINT. A genus of only 2 species of tender annuals, with the habit of *Lamium*. Its chief interest is botanical, the nearest relative of the genus being the Brazilian genus *Glechom*. Calyx tubular-campanulate, 13-nerved, and with the

calyx teeth all spinulose-tipped; corolla exceeding the calyx. Prop. by seeds in spring under glass.

**ilicifolia**, Gray. Height 6 in.: lvs. petioled, ovate, coriaceous, coarsely crenate-dentate: fls. 3-8 in a whorl, chiefly rose or purplish rose, with yellow and white marks. Calif. B.M. 6750. Intro. 1891.—Less desirable than *Lamium*, which see. N. TAYLOR.†

**ACANTHONÈMA** (Greek combination referring to the spinous processes on the filaments). *Gesneriaceae*. A monotypic genus, comprising *A. strigðsum*, Hook. f., from Trop. Afr., closely resembling *Streptocarpus*: hothouse perennial with small fls. dark purple on the limb and otherwise white, in panicles 2 in. or less high arising from the base of the solitary prostrate narrowly oblong lf.

**ACANTHÓPANAX** (*acanthos*, thorn, and *panax*, a prickly panax-like plant). *Araliaceae*. Including *Kalopanax* and *Eleutherococcus*. Hardy trees or shrubs, cultivated chiefly for their ornamental foliage.

Branches and sts. usually prickly: lvs. alternate, long-petioled, palmately lobed or digitate, deciduous: fls. small, usually greenish, perfect or polygamous, in umbels, sometimes forming large terminal panicles; calyx-teeth minute; petals and stamens 5, rarely 4; ovary 2-5-celled; styles 2-5, free or connate: fr. a black, 2-5-seeded berry.—More than 15 species in Cent. and E. Asia and in the Himalayas.

The members of this genus are trees or large shrubs with stout, usually prickly branches and large, palmately lobed or digitate leaves, small greenish flowers in umbels, sometimes forming large terminal panicles, followed by small black berries.

For cultivation of *Acanthopanax*, see the genus *Aralia*. The species described below are hardy except *A. pentaphyllum*, which is tender north of Massachusetts, and *A. trifoliatum* and *A. setchuenense*, which are probably still more tender.

Propagation is by seeds, to be sown as soon as received, or stratified and sown in spring; they germinate irregularly and may lie two years; also propagated by root-cuttings with bottom heat, and by soft-wood cuttings taken from forced plants; *A. pentaphyllum* grows also from cuttings of ripened wood.

A. Lvs. simple, palmately lobed.

**ricinifolium**, Seem. (*Kalopanax ricinifolium*, Miq. *A. ricinifolium* var. *magnificum*, Zabel. *A. acerifolium*, Schelle). Fig. 80. Sparingly branched tree, to 80 ft.: branches and sts. with numerous stout prickles: lvs. 5-7-lobed, 9-14 in. in diam., lobes triangular-ovate, acuminate, serrate, glabrous or nearly so: infl. compound, terminal, large; styles 2, nearly connate. Japan. S.I.F. 2:56. G.W. 11:537. Var. **Maximowiczii**, Schneid. (*Aralia Maximowiczii*, Van Houtte). Fig. 81. Lvs. deeply 5-7-lobed, with oblong-lanceolate lobes, downy beneath. Japan. F.S. 20:2067. M.D.G. 1897:233.—Very ornamental trees of striking subtropical effect.

AA. Lvs. digitate.

B. Fls. short-pedicelled.

**sessiliflorum**, Seem. (*Panax sessiliflorum*, Rupr. & Max.). Shrub with stout upright branches, to 12 ft.: branches with only few prickles: lfts. mostly 3, obovate-lanceolate or oblong-lanceolate, cuneate, acuminate, 3-7 in. long, irregularly crenate-serrate, nearly smooth: fls. dull purplish, nearly sessile, in globular heads on stout, downy peduncles, usually several at the end of the branches. Manchuria, N. China. G.C. III. 22:339. Gt. 11:369.—The freely produced heads of black berries are decorative. Var. **párviceps**, Rehd. Lower and denser: lvs. elliptic, 2-3 in. long: heads smaller, usually solitary.



BB. *Fls. slender-pedicelled.*

C. *Lvs. usually 3-foliolate.*

**trifoliatum**, Schneid. (*Zanthoxylum trifoliatum*, Linn. *A. aculeatum*, Seem. *A. sépium*, Seem.). Climbing shrub, to 20 ft.: branches with few hooked spines: petiole 1-1½ in. long; lfts. stalked, ovate to ovate-lanceolate, acuminate, 1¾-3 in. long, remotely and finely serrate, glabrous, light green beneath: the slender-peduncled umbels in terminal whorls; pedicels slender; styles 2, connate to the middle. China, Himalayas. L.B.C. 10:977 (infl. abnormal; a better figure is found in Jacquin, Icon. Pl. Rar. 3:634). Recently intro. from China.

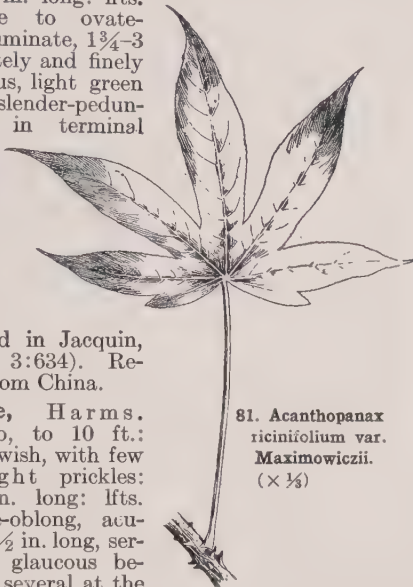
**setchuenense**, Harms. Upright shrub, to 10 ft.: branches yellowish, with few nearly straight prickles: petiole 2-4 in. long; lfts. stalked, ovate-oblong, acuminate, 2½-3½ in. long, serrate, glabrous, glaucous beneath: umbels several at the end of the branches, peduncles ½-1 in. long, pedicels slender; ovary 5-celled, styles connate into one. W. China.

CC. *Lvs. 5-7-foliolate.*

**senticosum**, Harms (*Eleutherococcus senticosus*, Maxim.). Shrub, to 15 ft.: branches upright, densely covered with slender prickles: lfts. 5, occasionally 3, stalked, elliptic-obovate to oblong, shortly acuminate, narrowed at the base, 3-5 in. long, sharply and doubly serrate, bright green; when young, with brown hairs on the veins beneath and with scattered hairs above: umbels long-peduncled, several at the end of the branches; ovary 5-celled, styles connate: fr. about ½ in. long. July. N. China, Manchuria. Gt. 12:393.

**pentaphyllum**, Marsh. (*A. spinosum*, Hort., not Miq. *Aralia pentaphylla*, Thunb.) Fig. 82. Shrub, 5-10 ft.: branches arching and slender, with few compressed, straight prickles: lfts. 5-7, oblong-obovate or oblong-lanceolate, cuneate, acute, ¾-1½ in. long, crenate-serrate, smooth: fls. green, in slender-peduncled umbels, solitary on spur-like branchlets along last year's branches; styles 5, connate. Japan.—A graceful shrub, with arching branches and bright green, shining foliage, excellent on rocky banks and slopes. Only the pistillate form seems to be in cult., but produces no fr. for want of pollen. Var. **variegatum**, Hort. Lvs. edged white. F.S. 20:2079.—Possibly a variety of *A. spinosum*. Also *A. quinquefolium variegatum*, Veitch Cat., may be the same.

*A. divaricatum*, Seem. Allied to *A. sessiliflorum*. Lfts. 5, downy beneath: fls. pedicelled. Japan. S.I.F. 2:56.—*A. Henryi*, Harms (*Eleutherococcus Henryi*, Oliver). Allied to *A. sessiliflorum*. Branches with few hooked prickles: lfts. 3-5, nearly sessile, cuneate at the base, oblong, 2-3 in. long; fls. pedicelled. Cent. China. B.M. 8316.—*A. innovans*, Franch. & Sav. Unarmed small tree: lvs. fasciated 3-foliolate, occasionally 2-foliolate or undivided and cordate; lfts. nearly sessile, glabrous: umbels paniculate. Japan.—*A. leucorrhizum*, Harms. Allied to *A. senticosum*. Branches only below the petiole with several straight reflexed prickles: lfts. oblanceolate, glabrous: umbels solitary or few. Cent. China.—*A. sciadophtyloides*, Franch. & Sav. Unarmed tree, to 40 ft.; lfts. 5, stalked, nearly glabrous: umbels forming large terminal panicles. Japan. S.I.F. 2:55.—*A. Simonsii*, Schneid. Allied to *A. senticosum*.



81. *Acanthopanax ricinifolium* var. *Maximowiczii*. (× ¼)



82. *Acanthopanax pentaphyllum*. (× ½)

spiny: infl. (spadix) twice branched, sometimes smooth, but often hairy or even spiny, hanging by a short, stout stalk; the secondary branches slender or sometimes thick and twisted: spathes 2, flattened, soon falling: fls. monœcious, in spirally disposed 3-fld. clusters, red, pinkish or orange; inner segms. of the perianth valvate in male fls., imbricate in female fls.; stamens 12, reduced in the pistillate fls. to a ring of functionless staminoidea: fr. black, about twice the size of a grain of wheat.—There are only 3 or 4 species confined

Branches with several prickles below the petiole: lfts. 5, prickly on both sides, oblong. China. M.D.G. 1910:25.—*A. spinosum*, Miq. Allied to *A. pentaphyllum*. Lvs. often sparingly appressed-setose above: peduncles shorter than petioles; styles 2, separate. China.

ALFRED REHDER.

**ACANTHOPHIPPIMUM** (meaning unexplained). Sometimes spelled *Acanthephippium*. *Orchidaceæ*. Stove terrestrial orchids.

Pseudobulbs conic or cylindric, of several internodes, with several large, plicate-veined, jointed lvs. at the apex: fls. borne on a lateral leafless scape, in a few-fld. raceme; the broad, fleshy sepals form an urn-shaped tube, which incloses the narrower petals and the lip; lip jointed to the apex of the short, thick column which is produced below into a foot to which the sepals and petals are attached; pollinia 8.—A genus of 4 species, natives of the E. Indies and Malay Archipelago.

These are very rarely seen in cultivation, but are warmhouse terrestrial orchids from the hottest moist shaded jungles of Java. A compost of fibrous loam and leaf-mold is best suited to them, keeping the plants in the warmest house in winter. Propagate by dividing the pseudobulbs in spring before growth has made much advancement. (Orpet.)

**javanicum**, Blume. Fls. yellow, flushed and striped with purplish red, the sepals and petals spreading at the tip. Java. J.F. 1:35. B.M. 4492.

*A. bicolor*, Lindl. Fls. yellow, tipped and marked with purple.—*A. Cürstisi*, Reichb. Fls. light rose, flushed and striped with purple. The 5 keels between the side lobes serve to distinguish this from related species. Malay Archipelago.—*A. sylhetense*, Lindl. Fls. about 2 in. long, white. Himalayas.

GEORGE V. NASH. †

**ACANTHOPHÆNIX** (*acantha*, thorn, and *phœnix*, a date palm). *Palmaceæ*, tribe *Arèceæ*. Very elegant greenhouse palms.

Leaves pinnate, finely dissected, more or less armed with long, slender, brown or black spines; lfts. narrow, linear-lanceolate, acute, rarely acuminate, prominently veined above, scaly beneath, the margins revolute; rachis 3-angled in sections; sheath long, smooth or

83. *Acanthophœnix crinita*.

exclusively to the Mascarene Isls., Mauritius and Bourbon. G.C. II. 22:426.

These are tall palms or sometimes of moderate stature, the spiny and often ringed trunks conspicuously swollen at the base. Horticulturally, they have not figured very prominently in the trade in this country, but they are among the finest of cultivated palms in the collections of fanciers and botanic gardens.

They should be grown in a warm house, from 70 to 90°, never less than a night temperature of 55 to 60°. They will root best in a soil composed as follows: loam three parts, peat one part, leaf-mold one part, mixed with a little sand or crushed charcoal. The drainage, so long as the plants are in pots and tubs, must be very good, as they require much water. If possible, when the plants are 6 feet or more, plant out permanently.

Propagation is only by seeds, which frequently require two to three years to germinate. The seeds should be placed in a seed-pan and kept in a warm, moist place.

**crinita**, H. Wendl. (*Arëca crinita*, Bory.). Fig. 83. Trunk 50–60 ft.: lvs. 7–13 ft. long; petiole densely tomentose, 4–8 in. long; lf.-sheath  $2\frac{1}{2}$ –4½ ft. long, thickly covered with short brown bristles and spines; segms. silvery white beneath; spadix 1–2 ft. long, brown, woolly and with slender brown spines; perianth reddish pink, or sometimes whitish: fr.  $\frac{1}{8}$ –½ in. long. F.S. 16:1706. F.R. 2:201.—Young plants have pale yellowish green lvs.

**rùbra**, H. Wendl. (*Arëca rùbra*, Bory. *Calamus Verschaffeltii*, Hort.). Trunk 60 ft.: lvs. 6–12 ft. long; petiole glabrous, 2–4 in. long; lf.-sheath  $2\frac{1}{2}$ –4½ ft. long, thickly covered with long, brown-black spines; pinnæ slightly glaucous beneath; spadix  $2\frac{1}{2}$ –3½ ft. long, armed with straight black spines; perianth reddish brown: fr. globose.  $\frac{1}{8}$ –¾ in. in diam., with a prominent ridge extending from the stigma to the base.—Young plants have dark green lvs. with red veins. N. TAYLOR. †

**ACANTHORHÏZA** (Greek *or* thorn, and *rhiza*, root). *Palmaceæ*, tribe *Corypheæ*. A genus of tropical American medium-sized palms.

Leaves crowded at the end of the trunk, palmate, 3 to many, divided to the base, but the segms. stalkless, and in age becoming typically 3–4 divided,

the segms. then wedge-shaped; lf.-stalk flattened, very persistent, slender and smooth, the sheath short and fibrous; as the lvs. unfold the margins are bent inward, the external faces applied together: infl. flattened at first, the short peduncle and thickening branches, white, bracteate, the bracts diminishing downward; fls. cream-white, in spike-like, dense clusters, these racemose; stamens quite free, differing from *Trithrinax*, where they are united to form a tube. It has never been known to fruit in cult.—Three or four species only, are known, all from Trop. Amer., but not so well known to the trade as their great beauty and stately dimensions deserve. G.C. II. 22:426.

These palms have spineless trunks, except at the base, where the aerial roots subsequently harden into stiff downward-pointing spines; differing in this from *Trithrinax*, the nearest relative.

They should be grown as stove palms, a night temperature not less than 60° being preferable. If possible, plant out the tall plants, as they do much better when not disturbed by subsequent repotting. A good mixture should contain good, fibrous loam and considerable sand.

Propagation is only by seeds, sown preferably in the spring, in fresh peat over bottom heat.

**aculeata**, H. Wendl. (*Chamærops stauracantha*, Hort.).

Fig. 84. St. 30–40 ft., spiny at base through the thickening of the aerial roots: lvs. orbicular, much cut in young trees, subsequently 3–4-divided and palmate in the older specimens, 5 ft. in diam., whitish beneath; lf.-stalk 3–4 ft.: infl. and fls. dark creamy pink; fls. spicate, thick and coriaceous; calyx lobes erect, oblong, equaling the roundish and concave petals. Mex. I.H. 26:367. B.M. 7302.—Succeds in an intermediate house.

**Chùco**, Drude (*Thrinax*

*Chùco*, Mart.). Trunk smooth, about 30 ft. high, usually not more than 5 in. in diam., slender, flexuous: lvs. orbicular, with a narrow sinus at the base, usually 10–25 in a cluster; petioles slender, 3–6 ft. long, smooth; blade 6 ft. in diam., divided to or beyond the middle; segms. 15–20, lanceolate, acute, 1–2 in. wide, dark green above, paler and glandular below: fls. and fr. unknown, except from a wild specimen in which the fr. is described as yellow and about 1 in. diam. Brazil.

The following species are rarely seen outside botanic gardens, and need stove temperature: *A. Wallisii*, H. Wendl. Gt. 28:977.—*A. Warszewiczii*, H. Wendl. Panama, Gt. 25:860.

N. TAYLOR. †

**ACÁNTHUS** (*akanthos*, thorn). *Acanthaceæ*.

BEAR'S BREECH. A genus of twenty species of temperate Old World, mostly hardy herbaceous perennials of vigorous growth and broad pinnatifid foliage, suitable for backgrounds of borders and sub-tropical effects.

Height 3–4 ft.: spikes 1–1½ ft. long; fls. dull white to rose or purplish, sessile, spicate, densely clustered; corolla 1-lipped, the lip 3-lobed; anthers 1-celled, ciliate. Mostly S. Eu.

They need a rich, light, well-drained soil and much sunshine. Excessive moisture is fatal, especially in winter and spring. Fall-planted stock should always be protected for the winter by long litter or evergreen boughs, even where established plants are hardy. Must be deeply mulched north in winter. Propagation is by division in spring or early autumn, and by seeds.

84. *Acanthorhiza aculeata*.



It is supposed that acanthus leaves afforded the suggestion for the foliage decoration on the capital of the Corinthian and other columns. Fig. 85 shows the conventionalized decoration, and Fig. 86 the form of leaf of *A. spinosus*. The leaves of *A. mollis* were probably also involved in variations of decoration.

*A. Lvs. spiny.*

**Cárolí-Alexándri**, Hausskn. Nine to 18 in.: lvs. few, radical, in a lax rosette, lanceolate, spiny, 16 in. long, 3-3½ in. broad: spike dense; fls. white or suffused rose-color. Summer. Greece.



85. The Acanthus decoration of an architectural column.

**spinosissimus**, Desf.

Fig. 87. Lvs. dark green, pinnately parted; spines glistening, whitish: fls. infrequent, rosy, sessile: autumn; spikes loose, pilose or glabrescent:

spines of the bracts recurved. S. Eu. Grows 3-4 feet.

**Péringi**, Siehe. About 1-1½ ft. high: lvs. sessile, 5-6 in. long, lanceolate tapering, deeply toothed and spiny: fls. very profuse, rosy red, its bracts spiny. Mts. of Turkey in Asia. June.—Suitable for alpine garden. Doubtfully hardy where summers are hot and dry.

**spinösus**, Linn. Fig. 86. Lvs. lanceolate, pinnatifid, pubescent; spines short, whitish: fls. smaller than in the last, purplish, summer; spikes dense, slightly villous. B.M. 1808. Gn. 8:147.

**montānus**, T. Anders. Lvs. pinnatifid or sinuate-spinose, 1 ft. or more long, olive-green, the lobes spine-pointed: fls. rosy white in a long spike. Trop. Afr.—Greenhouse.

*AA. Lvs. not spiny.*

**möllis**, Linn. Fig. 88. Lvs. 2 x 1 ft., cordate, sinuately pinnatifid, mostly radical: fls. summer; spikes loose, pubescent. Gn. 52, p. 239.—Also recommended as a window plant. Var. **latifolius**, Hort. (*A. latifolius*, Hort. *A. lusitanicus*, Hort.) is larger and hardier. Gn. 1, p. 303.

**longifolius**, Poir. Lvs. radical, longer and narrower than in *A. mollis*, bright green: fls. purple, June. Dalmatia.



86 Acanthus spinosus. From drawing by John Ruskin.

tings under glass. E. Asia.—*A. niger*, Mill. Lvs. not spiny, sinuate, glabrous: fls. purplish white. Portugal.

N. TAYLOR.†

**ÁCER** (classical Latin name). *Aceraceæ*. MAPLE. Native and foreign trees cultivated chiefly for shade and for the ornamental foliage.

Trees, rarely shrubs: lvs. opposite, petioled, simple and mostly palmately lobed, or 3-5 foliolate, deciduous, rarely evergreen: fls. small, polygamous or dioecious, in racemes, panicles or corymbs; petals and sepals 5, rarely 4, rarely sepals connate and petals wanting; disk usually annular, conspicuous, rarely lobed or wanting; stamens 4-10, mostly 8; styles 2, usually more or less connate: fr. consisting of 2 long-winged, compressed nutlets (samaras), each containing 1 seed.—About 110

species in N. Amer., Asia, especially Cent. and E. Asia, Europe and N. Afr. Monogr. by Pax in Engler, Pflanzenreich IV, fam. 163 (1903), quoted below as Pax; see, also, Rehder, The Maples of E. Continental Asia, in Sargent, Trees and Shrubs, 1:175 (1905), and Koidzumi, Revisio Aceracearum Japonicarum in Jour. College of Science, Tokyo, 32, Art. 1 (1911), both with many plates. Monogr. of the garden forms by Graf Schwerin in Gt. 1893; see also G.C. II. 16:75.

The maples are hardy ornamental trees or shrubs, with handsome large foliage which, in some species, shows a remarkable tendency to vary in shape and coloring. Numerous garden forms are in cultivation. Though the flowers are small, they are quite attractive in the early-flowering species as in *A. rubrum* and *A. saccharum*, since they appear in great profusion; in some species the young fruits assume a bright red color, particularly in *A. tataricum*, *A. ginnala*, *A. pseudoplatanus* var. *erythrocarpum*, and *A. rubrum*. The maples are among our most ornamental and valuable trees for park and street planting. Nearly all assume a splendid color in autumn, especially the species of North America and Eastern Asia, which surpass by far the European maples. Many species are valuable timber trees, and some American species, especially *A. saccharum*, produce sugar. For purposes of shade, the common sugar maple is best and most popular. The Norway maple makes a very dense and round head, and is excellent for lawns, but it is too low-headed for the streets. *A. pictum* is similar, but smaller in every part. The silver maple, *A. saccharinum* and its vars., is also popular where quick-growing trees are desired. The Japanese maples of the *Palmata* section are among the most striking and showy exotic small trees, and are adapted for fine grounds and for growing in pots.

The maples are not particular as to soil; some species, as *A. monspesulanum* and *A. campestre*, prefer drier situations, while *A. saccharinum* and *A. rubrum* prefer moist situations, the latter growing well even in swampy soil. Most of the species are hardy in the northern and middle states; among the hardest are *A. Negundo*, *A. saccharum* (Figs. 89, 90), *A. saccharinum*, *A. rubrum*, *A. nigrum*, *A. pennsylvanicum*, *A. spicatum*, *A. platanoides*, *A. tataricum*.

Propagation is by



87. Acanthus spinosissimus. (× 1/2)



88. Acanthus mollis. (× 1/2)

seeds, which soon lose their germinating power and must be sown soon after maturity or stratified and sown in spring; *A. saccharum* and *A. Negundo* keep their germinating power somewhat longer. The early-ripening species, like *A. saccharinum* and *A. rubrum*,

must be sown as soon as they are ripe and they will germinate the same year. *A. campestre*, *A. monspessulanum* and other species of this group do not usually germinate until the second year. The varieties and rare species may be budded in summer on the typical forms or on species of the same group; kinds belonging to different groups cannot, as a rule, be grafted on each other; e.g., va-



89. A pasture maple in autumn, showing the strong framework.

rieties of *A. platanoides* will not grow on *A. pseudoplatanus* and vice versa, but *A. insigne* will grow on *A. pseudoplatanus*, as they belong to the same group. Some shrubby species, as *A. palmatum*, also *A. cissifolium*, *A. ginnala* var. *Semenowii*, and *A. latum* var. *rubrum*, may be propagated by layers or half-ripened greenwood cuttings in summer, or, still better, by cuttings taken from forced plants in early spring in the greenhouse. *A. Negundo* grows also from hardwood cuttings. Fancy maples are readily winter-grafted by the veneer method, the stocks being grown in pots. The Japanese kinds are usually worked on imported stocks of *A. palmatum*.

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90. Pasture tree of *Acer saccharum*, sugar maple. Tree flatter-topped than usual.

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#### KEY TO THE SPECIES.

- A. Lvs. simple, mostly palmately lobed (occasionally 3-foliolate in No. 11).
- B. Sepals and petals distinct (petals wanting in Nos. 27 and 35).
- C. Fls. appearing with or after the lvs. in corymbs, panicles, or racemes.
- D. Arrangement of infl. corymbose (broadly paniculate in No. 4).
- E. Winter-buds with several imbricate scales: lobes entire or coarsely toothed, rarely lvs. without lobes.
- F. Lobes obtuse or bluntly pointed.
- G. Lvs. 1-3½ in. across, usually 3-lobed; lobes usually entire or with few teeth.
- H. Corymbs glabrous: lobes entire, lvs. glaucous beneath . . . . . 1. monspessulanum
- HH. Corymbs pubescent, upright: lobes usually dentate, lvs. green beneath . . . . . 2. campestre
- GG. Lvs. 3-6 in. across, 3-5-lobed; lobes toothed.
- II. Infl. corymbose, many-fl. pendulous: lvs. glaucescent beneath; lobes obtuse or acute . . . . . 3. Opalus
- HH. Infl. paniculate, upright: lvs. green beneath and pubescent; lobes obtusely acuminate . . . . . 4. Miyabei
- FF. Lobes acuminate, finely pointed: corymbs glabrous.
- G. Lvs. glabrous beneath, 5-7-, rarely 3-lobed: corymbs stalked.
- H. Bark of mature branches ashy gray or light grayish brown, slightly fissured and marked with lenticels.
- I. The lobes coarsely toothed . . . . . 5. platanoides
- II. The lobes entire or rarely with few teeth.



- J. Wings about as long as nutlets: lvs. truncate at base: . . . 6. *truncatum*
- JJ. Wings about twice as long as nutlets: lvs. cordate or subcordate. . . . . 7. *pictum*
- HH. Bark remaining smooth and lustrous for several years, without or with few inconspicuous lenticels, greenish or purplish. . . . . 8. *cappadoci-*  
[cum]
- GG. Lvs. pubescent beneath, usually 3-lobed, occasionally 5-lobed or quite entire: corymbs nearly sessile, very large. . . . . 9. *longipes*
- FFF. Lobes none or not prevalent, the lvs. quite entire, ovate to ovate-oblong, rarely mixed with a few 3-5-lobed lvs.: corymb nearly sessile, very large. . . . . 10. *catalpifolium*
- EE. Winter-buds with 2 outer valvate scales: lobes serrate or doubly serrate: corymbs small.
- F. Lvs. 3-lobed or 3-foliolate, occasionally 5-lobed, pale or glaucous beneath, quite glabrous. . . . . 11. *glabrum*
- FF. Lvs. 5-11-lobed, green beneath.
- G. Petioles and peduncles glabrous: ovary glabrous.
- H. Sepals purplish; petals white: lvs. lobed nearly to the middle. . . . . 12. *circinatum*
- HH. Sepals and petals purplish: lvs. lobed beyond the middle. . . . . 13. *palmatum*
- GG. Petioles and peduncles pubescent, at least while young: ovary villous.
- H. Fls. yellowish: lvs. subcordate or cordate, sharply or doubly serrate. . . . . 14. *Sieboldia-*  
[num]
- HH. Fls. purple, larger: lvs. deeply cordate, incisely serrate. . . . . 15. *japonicum*
- DD. Arrangement of infl. paniculate or racemose.
- E. Infl. paniculate (nearly corymbose in No. 16).
- F. Lvs. dentate or serrate, usually lobed.
- G. Edges of lvs. sharply serrate.
- H. Panicle only little longer than broad.
- I. The lvs. 5-lobed, sharply and simply serrate. . . . . 16. *Oliverianum*
- II. The lvs. 3-lobed or without lobes, doubly serrate.
- J. Foliage dull green; lvs. ovate-oblong, not lobed. . . . . 17. *tataricum*
- JJ. Foliage shining dark green: lvs. 3-lobed. . . . . 18. *ginnala*
- HH. Panicle narrow, spike-like, upright: lvs. 3-5-lobed, doubly serrate: petals linear, much longer than the sepals.
- I. Foliage pubescent beneath: lvs. 3-, rarely 5-lobed. . . . . 19. *spicatum*
- II. Foliage glabrous or pubescent beneath: lvs. 5-, rarely 7-lobed. . . . . 20. *caudatum*
- GG. Edges of lvs. coarsely or crenately dentate, 5-lobed.
- H. Panicles pendulous, much longer than broad.
- I. Fr. hispid: lvs. 10-12 in. long, deeply lobed. . . . . 21. *macrophyllum*
- II. Fr. glabrous: lvs. 4-6 in. long. . . . . 22. *pseudoplat-*  
[anus]
- HH. Panicles upright, little longer than broad.
- I. Blade with middle lobe free nearly to the base. . . . . 23. *Heldreichii*
- II. Blade with lobes divided to the middle or little beyond.
- J. Lobes longer than broad: lvs. glaucous beneath. . . . . 24. *Trautvetteri*
- JJ. Lobes about as long as broad: lvs. green beneath. . . . . 25. *insigne*
- FF. Lvs. quite entire, generally oblong. . . . . 26. *oblongum*
- EE. Infl. racemose.
- F. Lvs. oblong, undivided, serrate, with about 20 pairs of parallel veins: winter-buds with many imbricate scales. . . . . 27. *carpinifolium*
- FF. Lvs. lobed or undivided, with about 10 pairs of veins or less: winter-buds with 2 outer valvate scales.
- G. Sepals and petals 5, racemes terminal: lvs. brownish pubescent beneath while young, at least on the veins.
- H. Outline of lvs. oblong, without lobes or with 2 lobes near the base.
- I. The lvs. undivided, crenately serrate. . . . . 28. *Davidii*
- II. The lvs. lobed.
- J. With lvs. green beneath, sharply serrate, long-acuminate, slightly lobed. . . . . 29. *laxiflorum*
- JJ. With lvs. glaucous beneath, unequally serrate, acuminate, often deeply lobed. . . . . 30. *cratægifolium*
- HH. Outline of lvs. ovate or roundish, 5-lobed. . . . . 31. *Tschonoskii*
- HHH. Outline of lvs. obovate, 3-lobed, with the lobes near or above the middle.
- I. Young branchlets bloomy: young lvs. densely brownish villous on the veins beneath: raceme pubescent. . . . . 32. *rufinerve*
- II. Young branchlets not bloomy: young unfolding lvs. brownish villous on the whole under side, primary veins glabrescent: raceme often glabrous. . . . . 33. *pennsylvan-*  
[icum]
- GG. Sepals and petals 4; staminate fls. from lateral leafless buds: lvs. doubly serrate, 5-lobed or without lobes.
- H. Lvs. undivided or incisely lobed, ovate to oblong. . . . . 34. *tetramerum*
- HH. Lvs. distinctly 5-lobed, roundish in outline. . . . . 35. *argutum*
- CC. Fls. appearing long before the lvs. in dense lateral clusters: lvs. 5-lobed, fr. ripening in May or June.

- D. Ovary and young fr. tomentose; short-stalked: lvs. deeply 5-lobed. . . . . 36. *saccharinum*
- DD. Ovary and young fr. glabrous: fls. on long pedicels: lvs. 3-5-lobed. . . . . 37. *rubrum*
- EE. Sepals connate and petals wanting at least in the staminate fls.; fls. on long, pendulous, mostly hairy pedicels.
- C. Pistillate and staminate fls. corymbose, terminal and lateral: fr. glabrous or villous. American species.
- D. Corymb sessile or nearly sessile.
- E. Lvs. glaucous or pale beneath.
- F. Lobes acuminate; lvs. glabrous beneath at maturity. 38. *saccharum*
- FF. Lobes obtuse; lvs. pubescent beneath. . . . . 39. *floridanum*
- EE. Lvs. green beneath; lobes acuminate.
- F. Bark of trunk dark: lvs. hirsute-pubescent, 5-6 in. across. . . . . 40. *nigrum*
- FF. Bark pale: lvs. soft-pubescent beneath, 2-3½ in. across. 41. *leucoderme*
- DD. Corymbs short-stalked: lvs. pubescent beneath; lobes obtuse or acute. . . . . 42. *grandi-dentatum*
- CC. Pistillate fls. racemose, with petals and distinct sepals, staminate corymbose, with connate sepals and without petals, both from lateral leafless buds. Japanese species. . . 43. *diabolicum*
- AA. Lvs. 3-5-foliolate: fls. diæcious.
- B. Fls. in terminal corymbs, after the lvs.: winter-buds with several imbricate scales: disk large, annular: lvs. 2-foliolate.
- C. Petioles, lvs. beneath and corymbs pilose; petioles short.
- D. Shape of lvs. elliptic-oblong, sparingly serrate, 2-5 in. long. . . . 44. *nikoense*
- DD. Shape of lvs. elliptic, coarsely dentate, 1-2 in. long. . . . . 45. *griseum*
- CC. Petioles, lvs. and corymbs glabrous; lvs. oblong-lanceolate; petioles slender. . . . . 46. *mandshuricum*
- BB. Fls., at least the pistillate, in lateral, long and slender racemes: winter-buds with 2 valvate scales.
- C. Petals present; fls. of both sexes in racemes, sometimes leafy at base, with the lvs.: lvs. 3-foliolate. . . .
- D. Petioles and lvs. pubescent beneath: sepals and petals 5. . . . . 47. *Henryi*
- DD. Petioles and lvs. glabrous at maturity: sepals and petals 4. . . . 48. *cissifolium*
- CC. Petals wanting; pistillate fls. in pendulous racemes, staminate corymbose, pendulous, both sexes from lateral leafless buds before the lvs.: lvs. 3-5-foliolate. . . . . 49. *Negundo*

## Section CAMPESTRIA.

1. *monspessulanum*, Linn. (*A. trilobatum*, Lam.). Shrub or small tree, 25 ft.: lvs. 3-lobed, coriaceous, 1-3 in. across, shining above, glaucous and glabrous beneath; lobes entire or with few obtuse teeth: corymbs erect: fr. with slightly spreading wings. S. Eu., N. Afr., W. Asia. Gt. 1893, p. 363. H.W. 3, p. 46. G.W. 8, p. 195 (habit).—Shrub or small tree of slow growth, with a dense, rounded head and, in temperate regions, nearly evergreen foliage, thriving well in dry situations. Var. *ibericum*, Koch. (*A. ibericum*, Bieb.). Lvs. larger, the inner lobes usually slightly 3-lobed, obtuse.

2. *campêtre*, Linn. Shrub or tree, occasionally 50 ft., with corky branches: lvs. 3-5-lobed, 1½-3½ in. long, green and pubescent beneath or nearly glabrous; lobes entire or the middle one slightly 3-lobed: corymbs erect, hairy: fr. with horizontally spreading wings. Eu., W. Asia. H.W. 3:46, p. 45. F.E. 20, pl. 108

(habit). Gt. 1893, p. 327.—Shrub or tree of moderate, dense growth, with dull green foliage, valuable for planting as undergrowth and on dry ground. Many varieties and garden forms: Var. *argenteo-variegatum*, Schwerin. Lvs. with large white blotches. Var. *pulverulentum*, Kirchn. Lvs. sprinkled with white. Var. *austriacum*, DC. Usually a tree: lvs. 5-lobed, with acute, nearly entire lobes: fr. glabrous. F.E. 19, pl. 95 (habit). Var. *tauricum*, Kirchn. Shrub: lvs. 5-lobed small, lobes 3-lobed. Var. *hebecarpum*, DC. Fr. and generally the lvs. pubescent beneath.

3. *Opalus*, Mill. (*A. latum*, Lauth). Small tree, 30 ft.: lvs. 5-lobed, 3-5 in. long, glaucous beneath and at length glabrous; lobes obtusely dentate, short and broad, the middle ones often 3-lobed: corymbs somewhat drooping: fr. with slightly spreading wings. S. Eu., Orient. W.D.B. 2:171.—A variable species, similar to a small-ld. sycamore maple. Var. *hyrcanum*, Pax (*A. hyrcanum*, Fisch. & Mey. *A. tauricum*, Hort. *A. trilobatum*, Hort., not Lam.). Petioles very slender, red, 2-4 in. long; segms. of the lvs. 3-lobed, longer than broad, with straight margins. Gt. 1893, p. 361.



91. *Acer Miyabei*.  
(×½)

## Section PLATANOIDEA.

4. *Miyabei*, Maxim. Fig. 91. Tree, to 40 ft.: branches corky: lvs. 5-lobed, lobes lobulate or coarsely dentate, obtusely acuminate, with obtuse teeth, at first pubescent on both sides, later only beneath, pale green beneath, 5-6 in. long: corymbs long-stalked, 10-15-fl. pubescent: fr. pubescent with horizontally spreading wings. Japan. G.F. 6:143 (adapted in Fig. 91). S.I.F. 2:45.—Handsome, vigorous tree, quite hardy at the Arnold Arboretum.

5. *platanoides*, Linn. NORWAY MAPLE. Fig. 92. Large tree, to 100 ft.: lvs. 5-lobed, cordate at base, glabrous, light green and lustrous beneath, lobes pointed, remotely dentate with pointed teeth: corymbs glabrous; fls. yellowish green: fr. glabrous, with horizontally spreading wings. Eu., Caucasus. H.W. 3:45. Pax 49. Gt. 42, p. 561, 584, 585.—Large, handsome tree, with round, spreading head, resembling somewhat *A. saccharum*. The lvs. turn pale yellow in autumn. Many garden forms, some of which are here arranged in two groups, the first being remarkable for the manner in which the lvs. are cut and for the habit; the second being chiefly remarkable for their coloring:

(1) Var. *cucullatum*, Nichols. Lvs. irregularly and shortly lobed, crimped, light green. Var. *dissectum*,



Jacq. Similar to var. *Lorbergii*, but with darker foliage and of slower growth. Var. *globosum*, Nichols. Forming a globose head. M.D.G. 1903:189. G.W. 5, p. 14. Var. *laciniatum*, Ait. Lvs. irregularly divided, the divisions bending downward; growth upright. Gt. 42, p. 584. Var. *Lorbergii*, Van Houtte. Lvs. divided nearly to the base, divisions deeply lobed. Gt. 1893, p. 584. Var. *columnare*, Carr. Habit columnar.



92. Upright tip shoot of Norway maple.—*Acer platanoides*.

(2) Var. *álbo-variegátum*, Nichols. Lvs. with large white blotches. Var. *áureo-marginátum*, Pax. Lvs. with yellow margin, somewhat irregularly lobed. Var. *rúbrum*, Herd. (var. *Reitenbachii*, Nichols.). Lvs. greenish red when unfolding, turning dark blood-red in late summer. Gt. 16:

545. B.H. 18:39. Var. *Genéva*, Ellwanger & Barry, is probably not much different. Var. *Schwédleri*, Koch. Lvs. bright red when young, changing to dark green. G.C. II. 15:565. Var. *Stöllii*, Spaeth. More upright-growing; lvs. usually 3-lobed, with entire lobes, purple when unfolding, later dark green. Gt. 42, p. 585. Var. *Wittmäckii*, Schwerin. Lvs. usually 3-lobed, with an irregularly dentate and undulate yellow margin, reddish brown when unfolding, later bright green with most of the tips transformed into peculiar reddish brown appendages becoming, finally, dark green. Gt. 52:1516. Var. *Drummondii*, Drum. Lvs. green with white margin, red when unfolding. M.D. 1910:1.

6. *truncátum*, Bunge. Tree, to 25 ft.: lvs. deeply 5-lobed and mostly truncate at the base,  $2\frac{1}{2}$ –4 in. across, glabrous, light green, purplish when unfolding; lobes acuminate. setosely pointed, entire or sometimes the middle ones 3-lobed: fr. with yellow, short and broad wings, spreading at right or obtuse angles. N. China. S.T.S. 1:76.—Hardy tree, with handsome, dense foliage.

7. *píctum*, Thunb. Tree, 60 ft.: lvs. 5- or 7-lobed, 3–7 in. across, usually pubescent beneath when young; lobes entire, acuminate, sometimes very broad and short: fls. yellow: wings of the fr. upright, brown or brownish yellow, hardly twice as long as the nutlets. Manchuria, Japan. S.I.F. 1:65.—Handsome round-headed tree, with bright green foliage, hardy. Var. *parviflórum*, Schneid. (*A. píctum* var. *Mono*, Pax. *A. Mono*, Maxim.). Wings of the frs. spreading: lvs. more cordate. China. J.H.S. 29:349, 350. The form intro. as *A. tenellum* belongs here; the true *A. tenellum*, Pax, is not in cult.

8. *cappadócićum*, Gled. (*A. lætium*, C. A. Mey.). Tree, to 50 ft.: lvs. 5–7-lobed, usually cordate, 3–6 in. across, glabrous, light green and lustrous beneath; lobes entire, acuminate: fls. greenish yellow, in upright peduncled corymbs: fr. with spreading wings, the wings usually 2–3 times as long as the nutlets. From the Caucasus to W. China and the Himalayas.—Resembles *A. platanoides*, but lobes of lvs. entire and branches smooth; not quite hardy N. Var. *sínicum*, Rehd. Smaller in every part: lvs.  $2\frac{1}{2}$ –4 in. across, usually 5-lobed, subcordate or truncate at the base: wings of fr. about twice as long as nutlet. W. China. J.H.S. 29:358 (as *A. lætium* var. *cultratum*).—Very similar to *A. píctum*, but always easily distinguished by the smooth greenish bark of the younger branches. Var. *tricaudátum*, Rehd. Similar to the preceding, but lvs.

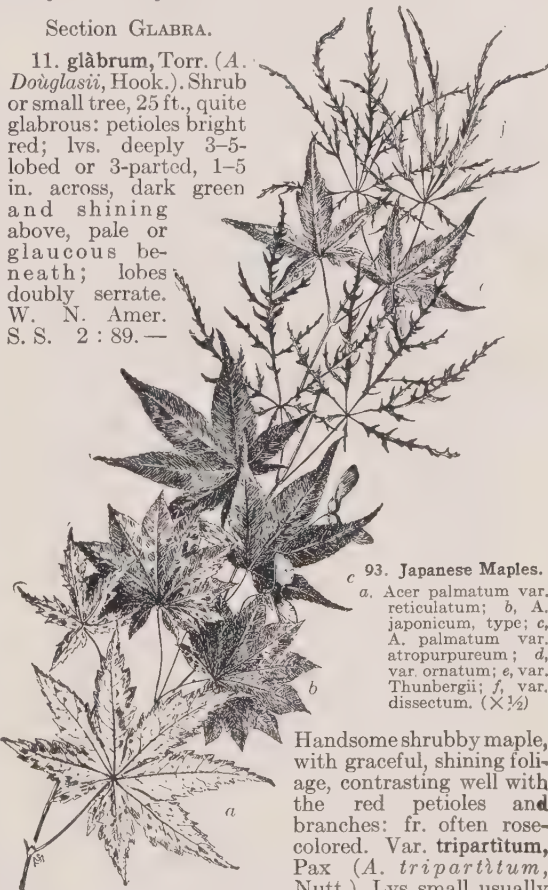
3-lobed. J.H.S. 29:357, 358. Var. *hortícola*, Rehd. (*A. lætium* var. *rúbrum*, Schwerin; *A. colchicum* var. *rúbrum*, Hort.). Lvs. blood-red, when unfolding. Var. *tricolor*, Rehd. (*A. lætium* var. *tricolor*, Schwerin). Lvs. blood-red, sprinkled with rosy pink, when young. The last two beautiful forms usually remain shrubby. Var. *áureum*, Rehd. (*A. lætium áureum*, Hesse). Lvs. red and golden yellow.

9. *lóngipes*, Rehd. Tree, to 30 ft.: young branches with smooth greenish bark: lvs. 3-, rarely 5-lobed, or occasionally undivided and ovate, 5–7 in. broad, lobes entire, long-acuminate, light green and soft-pubescent beneath, purple when unfolding: corymb large and loose, short-peduncled or nearly sessile, glabrous: fr. with the wings spreading at right angles. W. China.—A very handsome maple, easily distinguished from all allied species by the large, 3-lobed lvs., pubescent beneath.

10. *catálpifólium*, Rehd. Tree, to 60 ft.: younger branches smooth, greenish: lvs. ovate to ovate-oblong, undivided, entire, sometimes with a broad rounded lobe near the base, 4–8 in. long and 2–5 in. broad, rarely mixed with a few 3–5-lobed lvs., light green and glabrous beneath: corymbs sessile, large and loose, to 8 in. across: wings of the fr. spreading at obtuse angles. W. China.—Very distinct and beautiful tree, but apparently not hardy N.

#### Section GLABRA.

11. *glábrum*, Torr. (*A. Douglasii*, Hook.). Shrub or small tree, 25 ft., quite glabrous: petioles bright red; lvs. deeply 3–5-lobed or 3-parted, 1–5 in. across, dark green and shining above, pale or glaucous beneath; lobes doubly serrate. W. N. Amer. S. S. 2:89.—



93. Japanese Maples.

a. *Acer palmatum* var. *reticulatum*; b. *A. japonicum*, type; c. *A. palmatum* var. *atropurpureum*; d. var. *ornatum*; e, var. *Thunbergii*; f, var. *dissectum*. ( $\times \frac{1}{2}$ )

Handsome shrubby maple, with graceful, shining foliage, contrasting well with the red petioles and branches: fr. often rose-colored. Var. *tripartitum*, Pax (*A. tripartitum*, Nutt.). Lvs. small, usually

3-foliolate. Var. *rhodocárpum*, Schwerin. Frs. bright red until fully ripe.

#### Section PALMATA

12. *circinátum*, Pursh. Small tree, rarely 40 ft.: branchlets, petioles and peduncles glabrous: lvs. 7–9-lobed, 2–7 in. across, glabrous; lobes acute, doubly serrate: fls. in drooping corymbs, with purple sepals. W.

N. Amer. S.S. 2:87.—Handsome, round-headed tree or shrub, beautiful with its delicate light green foliage, red fls., rose-colored fr., and its orange and scarlet fall coloring.

13. *palmatum*, Thunb. (*A. polymorphum*, Sieb. & Zucc.). JAPAN MAPLE. Shrub or small tree, 20 ft.: branchlets, petioles and peduncles glabrous: lvs. 5-9-lobed or divided, 2-4 in. across, glabrous, lobes oblong, acuminate, doubly serrate or incised: corymbs few-fl., glabrous, erect, with small purple fls.: fr. small, glabrous; the wings spreading at an obtuse angle. Japan. S.Z. 1:145, 146. S.I.F. 1:68. F.E. 19, pl. 92 (habit).—A.F.



94. *Acer japonicum*. ( $\times \frac{1}{2}$ )

12:11. J.H.S. 29:340.—This species and *A. japonicum* are known as Japanese maples. They are extremely handsome shrubs of dense though graceful habit, and with elegant foliage, beautiful especially in spring for its delicate shades of green and red, and again in autumn, when the lvs. assume the most striking tints. Some of the more vigorous-growing varieties, like *atropurpureum*, *dissectum*, *ornatum*, and the typical forms, are hardy even in New England, while most of the variegated forms are more tender. They grow best in partly shaded situations and in well-drained, rich soil. There are many varieties, mostly intro. from Japanese gardens, of which the following are some of the best. They may be divided into 5 groups, representing various degrees of dissection of the lvs.:

(1) *A. palmatum* var. *Thûnbergii*, Pax (*A. palmatum*, Thunb.). Fig. 93, *e*. Lvs. deeply 5-9-lobed or cleft; lobes oblong-lanceolate, coarsely and doubly serrate or incised. Var. *atropurpureum*, Van Houtte (var. *nigrum*, Hort.). Fig. 93, *c*. Lvs. dark purple, coarsely doubly serrate. F.S. 12:1273. J.H.S. 29:342. F.E. 14, pl. 42, 32:767 (habit). Var. *sanguineum*, Carr., is lighter red than var. *atropurpureum*. I.H. 14:526. Var. *bicolor*, Koch (var. *atropurpureum variegatum*, Hort.). Lvs. dark purple, with large carmine blotches, the lobes half purple and half carmine. Var. *aureum*, Nichols. Lvs. yellow. Var. *versicolor*, Schwerin (*A. polymorphum septemlobum versicolorum*, Van Houtte). Lvs. bright green, with large white spots. F.S. 14:1498. Var. *roseo-marginatum*, Schwerin (*A. polymorphum septemlobum marginatum*, Pynaert). Lvs. small, deeply cut, with narrow pink margin. F.S. 15:1566. I.H. 28:430. Var. *crispum*, André. Lvs. small, with involute margins; of distinctly upright growth. I.H. 17:43.

(2) Var. *septemlobum*, Koch (*A. septemlobum*, Thunb.). Lvs. mostly 7-lobed; lobes broad, equally doubly serrate. Gt. 42, p. 680. J.H.S. 29:345. Var. *rubrum*, Schwerin. Lvs. large, deep red when young, becoming almost green later. Var. *reticulatum*, André. Fig. 93, *a*. Lvs. greenish yellow, with green margin and dark green veins. I.H. 17:18. Var. *tricolor*, Nichols. Lvs. with red, pink and white spots.

(3) Var. *linearilobum*, Sieb. & Zucc. (var. *scolopendrifolium*, Hort., not Schwerin). Lvs. divided nearly to the base; lobes linear, remotely serrate or nearly

entire. Gt. 42, p. 681. Var. *atrolineare*, Schwerin (var. *linearilobum atropurpureum*, Nichols.; var. *pinnatifolium atropurpureum*, Hort.). Lvs. dark red.

(4) Var. *dissectum*, Koch (*A. polymorphum* var. *decompositum*, Sieb. & Zucc. *A. polymorphum palmatifidum*, Van Houtte). Fig. 93, *f*. Lvs. divided to the base in 5-9 pinnatifid lobes. S.Z. 1:146. F.S. 21:2156. J.H.S. 29:346. M.D.G. 1902:209. F.W. 1875: G.C. III. 31:46 (suppl.). Var. *ornatum*, Carr. (var. *dissectum atropurpureum*, Hort.). Fig. 93, *d*. Lvs. deeply cut, deep red. I.H. 17:46. R.H. 1867:391. F.E., pl. 49 (habit). Var. *Frederici-Guilémi*, Carr. (var. *pinnatifidum roseo-pictum*, Lem.). Lvs. finely cut, green, with white and pink spots. I.H. 14:523. R.H. 1867:391.

(5) Var. *sessilifolium*, Maxim. Lvs. deeply cut, with very short petioles. G.C. II. 16.—Of little decorative value.

14. *Sieboldianum*, Miq. (*A. japonicum* var. *Sieboldianum*, Franch. & Sav.): Small tree or shrub: branchlets, petioles and peduncles pubescent when young: lvs. 7-9-lobed, cordate or nearly truncate at the base, 2-3½ in. across, glabrous except on the veins beneath; lobes ovate-oblong, acuminate, sharply serrate: corymbs long-peduncled, nodding; fls. yellowish, small: fr. small, glabrous or slightly pubescent, the wings spreading at an obtuse angle. Japan. S.I.F. 2:45. Var. *microphyllum*, Maxim. Lvs. smaller, 1½-2½ in. across. S.I.F. 2:42.—This species is hardy at the Arnold Arboretum; it is similar to *A. palmatum*, but somewhat coarser.

15. *japonicum*, Thunb. Figs. 93, *b*, and 94. Small tree or shrub: branchlets, petioles and peduncles pubescent when young: lvs. 7-11-lobed, cordate, 3-6 in. across, light green, with silky hairs when unfolding; lobes ovate, doubly serrate: corymbs few-fl., pendulous; fls. large, purple: fr. finally glabrous; wings spreading at an obtuse angle. Japan. S.Z. 1:144. S.I.F. 1:66. Var. *macrophyllum*, Schwerin. Lvs. large, light green. Var. *aureum*, Schwerin. Lvs. yellow. Var. *Parsonsii*, Veitch (var. *filicifolium*, Hort.; var. *laciniatum*, Hort.). Lvs. large, divided nearly to the base in 9-11 pinnatisect segms. J.H.S. 29:334. R.B. 32:197.

#### Section SPICATA.

16. *Oliverianum*, Pax. Tree, to 30 ft.: branchlets glabrous: lvs. 5-lobed, truncate or subcordate at the base, glabrous, finely reticulate and lustrous beneath, 2½-4 in. across; lobes broad, ovate, long-acuminate, finely serrate: panicles nearly corymbose, long-peduncled, glabrous; fls. whitish, small: wings of fr. spreading nearly horizontally; wing with nutlet about 1 in. long. W. China. S.T.S. 1:77.—A graceful maple, resembling *A. palmatum*, but larger. In young plants, the lvs. are often deeply cut with narrow, elongated lobes. J.H.S. 29:356, 359 (as *Acer* sp.).

17. *tataricum*, Linn. Shrub or small tree, 20 ft.: lvs. roundish oval or oblong, cordate, sometimes slightly lobed, 2-4 in. long, doubly serrate, nearly glabrous: fls. in long-peduncled panicles, white: wings of fr. nearly upright or slightly spreading, bright red in summer. S.E. Eu., Orient. H.W. 3, p. 43.—Round-headed small tree, growing best in somewhat moist soil.

18. *ginnala*, Maxim. (*A. tataricum* var. *ginnala*, Maxim.). Fig. 95. Shrub or small tree, 20 ft.: lvs. 3-lobed, 1½-3½ in. long, glabrous, the terminal lobe elongated, doubly serrate: fls. in long-peduncled panicles, yellowish, fragrant. Manchuria, N. China, Japan. Gt. 1877:308. S.I.F. 2:44. F.E. 17, pl. 72 (habit). Var. *Semenowii*, Pax (*A. Semenowii*, Regel & Herd.). Shrub: lvs. smaller, deeply 3- or nearly 5-lobed. Turkistan.—Graceful shrub, with handsome foliage, turning bright red in autumn; may be used as a substitute for the Japanese maples where these are not hardy.

19. *spicatum*, Lam. (*A. montanum*, Ait.). MOUNTAIN MAPLE. Shrub or small tree, rarely 30 ft.: lvs. 3-,



or slightly 5-lobed, coarsely serrate, pubescent beneath,  $2\frac{1}{2}$ – $4\frac{1}{2}$  in. long: racemes rather dense, long, upright: fr. with diverging wings, bright red in summer. E.N. Amer. S.S. 2:82, 83. H.T. 328.—Valuable as undergrowth; lvs. turn yellow and scarlet in fall. Var. *laciniatum*, Jouin. Lvs. deeply and irregularly lobed and incised.

20. *caudatum*, Wall. Large tree: lvs. 5-, or sometimes 7-lobed, cordate, 3–5 in. long and about as broad, brownish pubescent on the veins beneath; lobes ovate, long-acuminate, incisely serrate: panicle upright, cylindric, with the peduncle 5–6 in. long: fr. small, in upright panicles; wings spreading at right angles. Himalayas. The type is not in cult., but the two following varieties are: Var. *ukurunduense*, Rehd. (*A. ukurunduense*, Fisch. & Mey. *A. spicatum* var. *ukurunduense*, Maxim.). Small tree: branchlets and petioles pubescent while young: lvs. glabrous above, pubescent beneath, sometimes only along the veins; lobes coarsely serrate: panicle pubescent: wings of the fr. often nearly upright; otherwise like the type. Japan, Manchuria. S.T.S. 1:82. S.I.F. 2:43. G.C. II. 15:172. Var. *multiserratum*, Rehd. (*A. multiserratum*, Maxim. *A. erodum*, Pax). Tree, to 30 ft.; very similar to the preceding variety, but glabrous or nearly glabrous. W. China.

21. *macrophyllum*, Pursh. LARGE-LEAVED MAPLE. Tree, to 100 feet high: lvs. cordate, deeply 3–5-lobed or cleft, pubescent when young, pale green beneath, 8–12 in. across; middle lobe mostly 3-lobed: panicles glabrous, narrow, pendulous, 4–5 in. long: fr. with yellow, bristly hairs, wings spreading at right angles or nearly upright, over 1 in. long. W. N. Amer. S.S. 2:86, 87. F.E. 14, pl. 44 (habit). Gn.M. 2:107 (habit).—Handsome round-headed tree, remarkable for its large foliage; not hardy in the N.

22. *pseudoplatanus*, Linn. SYCAMORE MAPLE. Tree, 70 ft. high: lvs. 5-lobed, coarsely crenate-serrate,  $3\frac{1}{2}$ –7 in. across, deep green above, glaucous and mostly glabrous beneath: racemes pendulous: fr. glabrous. Eu., Caucasus. Gt. 42:260, 261. H.W. 3:44, p. 39. F.S. R. 3, p. 181. F.E. 15, pl. 47 (habit).—Large tree of vigorous growth, with large, spreading head; thrives well even in exposed situations. Many varieties and garden forms: Var. *villosum*, Presl. Lvs. chartaceous, pubescent beneath. Var. *erythrocarpum*, Carr. Fr. bright red: lvs. smaller and more lustrous. R.H. 1864: 171. M.D. 1905:1. Gn. 76, p. 540. Var. *purpurascens*, Pax (vars. *purpureum* and *atropurpureum*, Hort.). Lvs. purplish red beneath; of robust growth. Var. *Handjeryi*, Spaeth (var. *Prinz Handjery*, Hort.). Lvs. purplish beneath, bright red when unfolding. Var. *Wörleei*, Schwerin (var. *lutescens*, Hort.). Lvs. yellow. Var. *albo-variegatum*, Kirchn. Lvs. with white blotches and spots, reddish while young. Var. *Leopoldii*, Lem. Similar to the preceding variety; bright rosy pink while young. I.H. 1864:411. R.B. 1906:197. Var. *bicolor*, Spaeth. Lvs. light green while young, with yellow, finally whitish, spots. Var. *tricolor*, Kirchn. Lvs. purplish while young, spotted with yellow. Var. *quadricolor*, Schwerin (var. *Simoni* Pax, var. *Simon-Louis freres*, Degen). Lvs. with large, white spots and also sprinkled with small dots; pink while young. Var. *nervosum*, Schwerin. Habit pyramidal, of slow growth: lvs. marked with yellow between the veins above, purplish beneath.

23. *Heldreichii*, Orph. Tree: lvs. 5-lobed, the middle lobe divided nearly to, the outer half way to the base, 3–5 in. across, glabrous, dark green and shining above, glaucous beneath; lobes coarsely and doubly serrate: panicle erect, long-stalked, ovate. S. E. Eu. Gt. 34:1185. G.C. II. 16:141. Var. *purpuratum*, Schwerin. Lvs. intensely red beneath.

24. *Trautvetteri*, Medw. (*A. velutinum*, Hort., not Boiss. *A. insigne*, Nichols., not Boiss. & Buhse). Lvs. slightly cordate, deeply 5-lobed, 5–7 in. across, glau-

cous beneath and pubescent when young; lobes coarsely crenate-serrate, longer than broad: panicle erect, ovate. Caucasus. Gt. 40, pp. 264–266. G.C. II. 16:75. B.M. 6697 (as *A. insigne*).—Similar to *A. insigne*, but hardier, with smaller lvs. and smaller panicle.

25. *insigne*, Boiss. & Buhse (*A. Van Vólxemi*, Mast.). Large tree: lvs. 5-lobed, deeply cordate, 5–10 in. across, bright green above, glaucous and at length glabrous beneath; lobes about as long as broad, coarsely crenate-serrate: panicles large, erect. Caucasus, N. Persia. G.C. II. 7:73; III. 10:9.—Remarkable for its large, handsome foliage; not hardy in the N. Var. *velutinum*, Boiss. Lvs. densely pubescent beneath. G.C. III. 10:189. Var. *Wölfii*, Schwerin. Lvs. red beneath.

#### Section INTEGRIFOLIA.

26. *oblongum*, Wall. Tree, to 50 ft.: lvs. coriaceous, oblong, entire, long but bluntly acuminate, rounded and 3-nerved at the base, glabrous, reticulate and usually glaucous beneath, 2–7 in. long: panicle short, pubescent; fls. small, greenish: wings of fr. at right angles or horizontally spreading. Himalayas, W. and Cent. China. Jacquemont, Voy. Inde 4:34. Var. *concolor*, Pax. Lvs. green beneath.—Not hardy in the northern states. In young plants, the lvs. are sometimes lobed at the base. J.H.S. 29:95. Recently advertised as *A. discolor*; the true *A. discolor*, Maxim., is not in cult.

#### Section INDIVISA.

27. *carpinifolium*, Sieb. & Zucc. HORNBEAM MAPLE. Tree, 30 ft.: lvs. oblong-ovate, acuminate, sharply and doubly serrate, nearly glabrous, 3–6 in. long: staminate fls. apetalous, in few-fl. racemes; pistillate with petals, in longer racemes. S.Z. 2:142. G.C. II. 15:564. Gt. 41, p. 174. S.I.F. 1:69. J. H.S. 29:75. G. W. 3:615.—Very distinct, hardy species; the lvs. are almost exactly like those of *Carpinus*. This is the only species of this section; the other species included here by Pax have been referred to other sections, mostly to the following (see Sargent, *Plantæ Wilsonianæ* 1:92).



#### Section MACRANTHA.

28. *Davidii*, Franch. Tree, to 50 ft.: branchlets glabrous: lvs. ovate or oblong-ovate,  $2\frac{1}{2}$ –8 in. long, acuminate, subcordate or rounded at base, unequally crenate-serrate, green beneath and rufously villous on the veins while young, finally glabrous or nearly so: racemes slender, pendulous, glabrous: wings of fr. spreading horizontally. Cent. China. S.T.S. 1:83. J.H.S. 29:86, 90.—Handsome tree; hardy at the Arnold Arboretum, the lvs. turning bright yellow or purple in autumn. In young plants, the lvs. are often lobed at the base.

29. *laxiflorum*, Pax. Tree, to 50 ft.: lvs. ovate-oblong, with 2 or 4 short lobes near the base,  $2\frac{1}{2}$ –4 in.

long, long-acuminate, cordate at the base, sharply serrate, green beneath, soon glabrous: racemes slender, pendulous, glabrous; fls. yellowish: wings of fr. spreading at right angles, rarely horizontally. W. China. Pax 35. Var. *longilobum*, Rehd. Lvs. distinctly 5-lobed, upper pair of lobes long-acuminate, floccose-tomentose on the veins beneath while young; fls. purple. W. China.—More graceful than the typical form.

30. *cratægifolium*, Sieb. & Zucc. Small tree, to 30 ft.: lvs. oblong-ovate, often with 2 or 4 lobes near the base, 2–3 in. long, acuminate, rounded or cordate at the base,



96. *Acer saccharinum* (or *A. dasycarpum*).—Silver or soft maple. ( $\times \frac{1}{3}$ )

lobes ovate, long-acuminate, sharply and doubly serrate, the middle one slightly lobed: racemes slender, few-fl'd.: fr. on slender, filiform stalks; wings spreading at about right angles. Japan. S.T.S. 1:17. S.I.F. 2:43.—Graceful shrubby tree; hardy at the Arnold Arboretum.

32. *rufinerve*, Sieb. & Zucc. Tree, to 40 ft., with striped bark: branches glaucous when young: lvs. rounded at the base, 3-lobed, 3–5 in. long, doubly serrate, ferrugineously pubescent on the veins beneath when young: racemes ferrugineously pubescent: fr. short-stalked; wings spreading at right angles. Japan. S.Z. 2:148. S.I.F. 1:67. Var. *álbo-limbátum*, Hook. Lvs. edged with white. B.M. 5793.

33. *pennsylvanicum*, Linn. (*A. striátum*, Dur.). STRIPED MAPLE. MOOSEWOOD. Tree, rarely 40 ft.: bark greenish, striped with white lines: lvs. slightly cordate, roundish-obovate, 3-lobed at the apex, 5–7 in. long, finely serrate, ferrugineously pubescent on the whole lower surface when young: racemes glabrous, drooping: fr. short-stalked, in long, drooping racemes; wings spreading at right angles. E. N. Amer. S.S. 2:84, 85. Michx. Hist. Arb. 2:17. Em. 566. H.T. 330.—Handsome medium-sized tree of upright, dense habit, with bright green, large foliage, turning clear yellow in autumn, and attractive even in winter from its smooth, greenish bark, striped with white. Var. *erythrócladum*, Spaeth. Shoots bright red during autumn and winter.

#### Section ARGUTA.

34. *tetrámerum*, Pax. Tree, to 25 ft: branchlets glabrous: lvs. ovate to oblong-ovate, 2–3½ in. long, acuminate, truncate or rounded and usually 3-nerved at the base, unequally incisely serrate or sometimes slightly lobed, light green and pubescent beneath, rarely nearly glabrous: staminate fls. in few-fl'd. sessile racemes from lateral leafless buds; stamens 4 or sometimes 6; disk lobed; pistillate fls. in elongated racemes, usually few-fl'd.: fr. slender-stalked; nutlet thick, strongly veined. Cent. and W. China. S.T.S. 1:85.—Graceful, hardy tree, very variable. Var. *lobulátum*,

Rehd. Lvs. distinctly lobed, nearly glabrous. J.H.S. 29:352, 355. Var. *betulifolium*, Rehd. (*A. betulifolium*, Maxim.) Lvs. not, or very slightly, lobed, rounded or cuneate at the base, glabrous or glabrescent. Var. *elobulátum*, Rehd. Lvs. not or scarcely lobed, long-acuminate, rounded and 3-nerved at the base, pubescent beneath. Intro. as *A. stachyophyllum*, but the true *A. stachyophyllum* is a Himalayan species, not in cult. Var. *tilifolium*, Rehd. Lvs. ovate, cordate at the base, and 5-nerved, pubescent beneath. Var. *longeracemósum*, Rehd. Lvs. like in var. *elobulatum*: racemes to 6 in. long, slender.

35. *argútum*, Maxim. Small tree, to 25 ft.: branchlets pubescent: lvs. broadly ovate in outline, 5-, or rarely 7-lobed, 2–3½ in. long, pale green beneath and grayish pubescent chiefly on the veins, finally nearly glabrous; lobes ovate, long-acuminate, sharply serrate: staminate fls. in short racemes from lateral leafless buds; stamens 4; pistillate fls. in slender many-fl'd. racemes: fr. slender-stalked, in pendulous racemes; wings spreading horizontally. Japan. S.I.F. 1:69. S.T.S. 66.—Graceful shrubby tree; hardy at the Arnold Arboretum.

#### Section RUBRA.

36. *saccharinum*, Linn. (*A. dasycarpum*, Ehrh. *A. eriocarpum*, Michx.). WHITE or SILVER MAPLE. Fig. 96. Large tree, 120 ft.: lvs. deeply 5-lobed to 5-cleft, 4–6 in. long, green above, silvery white beneath; lobes deeply and doubly serrate: fls. greenish yellow, apetalous: fr. pubescent when young. E. N. Amer. S.S. 2:93. G.C. II. 1:37. Em. 556. H.T. 332. F.E. 32:443 (habit); 29:983 (habit).—Ornamental tree, with wide-spreading, slender branches, growing best in rich and moist soil, but succeeds almost anywhere. Lvs. turn clear yellow in fall. Many garden forms: Var. *Wièri*, Schwerin (var. *Wièri laciniátum*, Hort.). Branches pendulous: lvs. deeply cleft, with dissected lobes.—A graceful variety, remarkable for its drooping branches and finely divided foliage. M.D.G. 1903:628 (habit). Var. *heterophyllum*, Pax (var. *heterophyllum laciniátum*, Hort.). Upright: lvs. deeply and unequally divided, with narrow lobes.

Var. *tripartitum*, Pax. Upright: lvs. 3-parted. Var. *lutescens*, Spaeth. Lvs. yellow, bronze-colored when unfolding. Var. *álbo-variegátum*, Spaeth (var. *Jühlkei*, Hort.). Lvs. spotted with white or rosy pink. Var. *crispum*, Schwerin. Lvs. deeply cut and crimped.—Linnaeus evidently supposed this species to be the sugar



97. *Acer rubrum*.—Red Maple. (Enlarged)

maple, and named it accordingly. He did not know the true sugar maple.

37. *rùbrum*, Linn. RED, SCARLET or SWAMP MAPLE. Fig. 97. Large tree, 120 ft.: lvs. 3–5-lobed, 3–4 in. long, green above, pale or glaucous beneath; lobes unequally and crenately serrate: fls. red or scarlet, rarely yellowish; petals 5; fr. glabrous. E. N. Amer. S.S. 2:94. Em. 557. G.C. II. 1:173. H.T. 334.—Very valuable tree for street and park planting; attractive at every season from its excellent habit, earliness of the scarlet fls., bright red frs. in late spring, and the beautiful foliage, which turns bright scarlet or orange in autumn. Var. *columnàre*, Rehd. Of upright, colum-



nar habit. Var. *globosum*, Rehd. Dwarf, compact: lvs. glaucous beneath: fls. bright scarlet. Var. *Drummondii*, Sarg. (*A. Drummondii*, Hook. & Arn.) Lvs. large, mostly 3-lobed, tomentose beneath: fr. bright scarlet. Southern states. S.S. 2:95. Var. *tomentosum*, Kirchn. (*A. tomentosum*, Desf. *A. rubrum* var. *fulgens*, Hort.). Of moderate growth: lvs. 5-lobed, pubescent beneath: fls. bright red. Var. *tridens*, Wood (*A. microphyllum*, Pax, *A. semiorbiculatum*, Pax). Lvs. 3-lobed, rather small, rounded or rarely cuneate at the base, usually pubescent below. On young plants and vigorous shoots, the lvs. are like those of the type. S.S. 13:626. Var. *magnificum*, Schwerin. Fall-coloring of the lvs. scarlet with green veins. M.D. 1910:1.—The form distributed as var. *Schlesingeri*, Schwerin, does not differ from the type.

#### Section SACCHARINA.

38. *saccharum*, Marsh. (*A. saccharinum*, Wang., not Linn. *A. barbatum*, Michx.). SUGAR or ROCK MAPLE. Fig. 98. Large tree, 120 ft., with gray bark: lvs. 3-5-lobed, cordate, 3-6 in. long, with narrow and deep sinuses; lobes acuminate, sparingly dentate, usually glaucous and glabrous beneath: corymb hairy: fr. with slightly spreading wings, glabrous. E. N. Amer. S.S. 2:90. Em. 558. H.T. 324. Gn. 65, p. 55 (habit).—An excellent street and shade tree of upright, dense growth, turning bright yellow and scarlet in autumn. It does well in almost every soil. Var. *Rugelii*, Rehd. (*A. Rugelii*, Pax, *A. saccharum* var. *barbatum*, Trel.). Lvs. 3-lobed, generally broader than long, 2-5 in. across, pale green or glaucous beneath, and at length mostly glabrous, coriaceous; lobes nearly entire. Central states. S.S. 2:91 (as var. *nigrum*). Var. *monumentale*, Schwerin (*A. nigrum* var. *monumentale*, Rehd.). Of upright, columnar habit.

39. *floridanum*, Chapm. (*A. barbatum* var. *floridanum*, Sarg.). Tree, rarely 50 ft., with pale bark: lvs. mostly truncate at the base, 3-lobed,  $1\frac{1}{2}$ -3 in. across, glaucous beneath, pubescent; lobes obtuse, entire or slightly 3-lobed: corymb sparingly hairy or nearly glabrous: fr. sparingly villous, finally glabrous. Gulf states. S.S. 2:91. G.F. 4:148.

40. *nigrum*, Michx. (*A. saccharinum* var. *nigrum*, Torr. & Gray. *A. saccharum* var. *nigrum*, Brit.). BLACK MAPLE. Fig. 99. Large tree, 120 ft., with black bark: lvs. cordate, with the sinus mostly closed, generally 3-lobed, 5-6 in. across, with broad sinuses, the sides of the blade mostly drooping, green and pubescent beneath; lobes acute, entire or obtusely toothed: fr. with diverging wings. Central states. S.S. 13:625. H.T. 326.—Similar to *A. saccharum*, but of duller appearance and less dense habit

41. *leucoderme*, Small (*A. saccharum* var. *leucoderme*, Sarg.). Tree, to 25, rarely to 40 ft., with light gray or grayish brown bark: lvs. 3-5-lobed, 2-3 $\frac{1}{2}$  in. across, truncate or slightly cordate at the base, bright yellow-green and soft-pubescent beneath; lobes acuminate, sinuately dentate: corymbs glabrous: fr. vil-



98. *Acer saccharum*.—Common Sugar Maple. ( $\times \frac{1}{2}$ )

lous, finally glabrous; wings wide-spreading. From N. C. to Ga. and La. S.S. 13:624.—Sometimes planted as a street tree in Ga. and Ala.; hardy at the Arnold Arboretum.

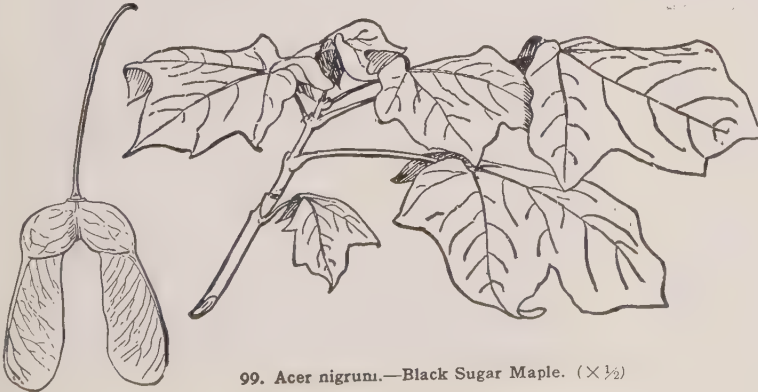
42. *grandidentatum*, Nutt. Tree, 40 ft., with dark brown bark: petioles comparatively short: lvs. slightly cordate, 3-5-lobed, with broad sinuses, 2-3 in. across, pubescent beneath, coriaceous; lobes acute or obtuse, entire or slightly 3-lobed: corymbs few-fl., hairy, short-stalked. Rocky Mts. S.S. 2:92.—Hardy at the Arnold Arboretum.

43. *diabolicum*, Koch. Tree, to 30 ft: branchlets pubescent: lvs. 5-lobed, cordate or subcordate, 4-6 in. across, pale green beneath and sparingly pubescent; lobes broadly ovate-acuminate, coarsely and remotely dentate with acute or obtusish teeth: fls. from lateral leafless buds; staminate on long and pendulous, hairy pedicels; sepals wholly or partly connate, petals wanting; pistillate in few-fl. racemes; sepals and petals distinct: pedicels of the fr.  $\frac{1}{2}$ -2 in. long; nutlets thick, strongly veined, bristly; wings upright or slightly spreading. Japan. G.C. II. 15:532. S.T.S. 1:67. Var. *purpurascens*, Rehd. (*A. purpurascens*, Franch. & Sav. *A. pulchrum*, Lavallé). Fls. purple: lvs. turning red in autumn. S.I.F. 1:65.—Hardy at the Arnold Arboretum; similar to *A. pseudoplatanus*, but lvs. larger; the var. *purpurascens* is to be recommended for its early-appearing purple fls.

#### Section TRIFOLIATA.

44. *nikoense*, Maxim. Fig. 100. Tree, 40 ft.: branchlets pubescent: lfts. ovate or oblong-elliptic, short-stalked, acute, entire or obtusely dentate, 2-5 in. long, villous-pubescent beneath, petioles hairy,  $\frac{3}{4}$ -1 $\frac{1}{2}$  in. long; corymb few-fl., pubescent: fr. on nodding pedicels  $\frac{1}{8}$ - $\frac{1}{2}$  in. long; nutlets thick, hairy; wings upright, curved inward. Japan, Cent. China. G.F. 6:155 (adapted in Fig. 100.) Gt. 41, p. 149. S.I.F. 1:68. J.H.S. 29:81. R.H. 1912:126, 127.—Very distinct; lvs. turning brilliant scarlet in autumn.

45. *griseum*, Pax (*A. nikoense* var. *griseum*, Franch.). Tree, to 25 ft., with cinnamon-brown bark separating in thin flakes: branchlets pubescent: lfts. short-stalked, elliptic or ovate-oblong, 1-2 in. long, acute, coarsely toothed with large bluntish teeth, the lateral ones



99. *Acer nigrum*.—Black Sugar Maple. ( $\times \frac{1}{2}$ )

unequal, deeply dentate on the outer margin, entire or nearly so on the inner, glaucous and pubescent beneath; petioles densely hairy: fls. rather large, in few-fl. hairy corymbs: fr. pendulous on short stalks, with the peduncle scarcely  $\frac{1}{2}$  in. long; nutlets thick, tomentose; wings spreading at an acute angle. W. China.—J.H.S. 29:98. R.H. 1912:127.—Remarkable for its flaky bark, resembling that of the river birch; hardy at the Arnold Arboretum.

46. *mandshuricum*, Maxim. Shrub or small tree: branchlets glabrous: lfts. oblong or oblong-lanceolate, 2-3½ in. long, short-stalked, acuminate, remotely and obtusely serrate, glabrous, glaucous beneath; petioles glabrous, red, 2-4 in. long; fls. in few-fl. glabrous corymbs: fr. on stalks  $\frac{1}{2}$ -¾ in. long; nutlets thick, glabrous; wings spreading at obtuse angles. Manchuria.—Graceful maple, hardy at the Arnold Arboretum; the red color of the slender lf.-stalks contrasts well with the dark green foliage.

#### Section NEGUNDO.

47. *Hénryi*, Pax. Tree, to 30 ft.: branchlets slightly pubescent: lfts. 3, elliptic, 2-3½ in. long, stalked, acuminate, entire or coarsely serrate, pale green and pubescent beneath; petioles finely puberulous: fls. nearly sessile, small, greenish in slender pendulous pubescent racemes, lateral, without lvs. or with small lvs. at the base: fr. glabrous, short-pediceled, in pendulous racemes with the stalk 4-7 in. long; wings upright or slightly spreading. Cent. China. J.H.S. 20:93, 96 (as *A. sutchuenense*).—Hardy at the Arnold Arboretum.—It has been concluded that this and the following species which have been hitherto referred to the preceding section are more closely related to *A. Negundo* and therefore better transferred to this section.

48. *cissifolium*, Koch (*Negundo cissifolium*, Sieb. & Zucc. *Crúla cissifolia*, Nieuwl.). Small tree: lfts. 3, stalked, ovate or elliptic, acuminate, coarsely serrate, sparingly ciliate, 2-3½ in. long, light green beneath and glabrous, or nearly so: racemes slender, many-fl., pu-

bescent; pedicels less than ¼ in. long; sepals and petals 4, small: fr. in pendulous racemes; wings slightly spreading. Japan. S.I.F. 2:41.—Handsome, round-headed tree, with slender, spreading branches and graceful bright green foliage, turning orange-yellow and scarlet in autumn; hardy at the Arnold Arboretum.

49. *Negúndo*, Linn. (*Negundo fraxinifolium*, Nutt. *N. aceroides*, Moench. *Rúlac Negúndo*, Hitchc.).

ASH-LEAVED MAPLE. BOX ELDER. Fig. 101. Large tree, 70 ft.: lvs. pinnate; lfts. 3-5, ovate or oblong-lanceolate, coarsely serrate or 3-lobed, mostly glabrous, 2-5 in. long: fls. before the lvs.; staminate fls. in pendulous corymbs, pistillate fls. in pendulous racemes. E. N. Amer. S.S. 2:96. Michx. Hist. Arb. 2:18. H.T. 336.—Large, rapid-growing tree of spreading habit, thriving best in moist and rich soil. Much prized in the W., where it withstands cold and dryness. Largely used for shelter-belts and for planting timber-claims. Var. *californicum*, Sarg. (*A. californicum*, Dietr. *Negundo californicum*, Torr. & Gray). Branches pubescent when young: lfts. 3, of firmer texture, densely pubescent beneath: fr. not constricted at the base. W. N. Amer. S.S. 2:97. Nutt. N. Amer. Sylv. 2:72. Var. *pseudo-californicum*, Schwerin (*A. californicum*, Hort. *A. Negundo* var. *californicum*, Kirchn.). Branches green, bloomy; of vigorous growth. Var. *violaceum*, Kirchn. (*A. californicum*, Hort.). A vigorously growing form: branches purplish with glaucous bloom or finely pubescent when young. Var. *argenteo-variegatum*, Bonamy. Lvs. with broad white margin. Probably the most effective of all variegated hardy trees. F.S. 17:1781. Gn. 68, p. 402 (habit). G. 2:37; 11:97 (habit). Var. *aureo-variegatum*, Booth (var. *aureo-maculatum*, Schwerin). Lvs. spotted with yellow. Var. *aureo-marginatum*, Dieck. Lvs. with yellow margin. Var. *auratum*, Spaeth (var. *californicum aureum*, Hort.). Lvs. yellow. R.B. 1906:197. Var. *crispum*, G. Don. Lfts. curled. These horticultural varieties may be grafted on common box elder seedlings, like the grape. Two new forms have been recently described as new species by Britton: *A. interior*, distributed from Alberta and Mont. to Ariz. and New Mex. (B.T. 655), and *A. Kingii* (B.T. 656), from Utah; they are closely allied to var. *californicum*, but differ in their glabrous foliage; in the first the wings of the samara are adnate to the nutlet only to or above the middle; in the second the wings reach the point of union of the nutlets.

*A. acuminatum*, Wall. (*A. caudatum*, Brandis, not Wall. *A. steruliaceum*, Koch, not Wall.). Allied to *A. argutum*. Tree: lvs. 3-lobed, 3-4½ in. long, glabrous and light green beneath; lobes long-acuminate, and doubly serrate: wings of fr. spreading at a right angle. Himalayas. G.C. II. 15:364 (as *A. caudatum*). Tender at the Arnold Arboretum.—*A. ambiguum*, Dippel. Allied to *A. pictum*. Lvs. pilose beneath: fls. and fr. unknown. Doubtful species of unknown origin.—*A. amplum*, Rehd. Allied to *A. longipes*. Tree, to 35 ft.: lvs. 5-lobed, 4-7 in. broad, glabrous: corymb nearly sessile, 5-6 in. across. Cent. China.—*A. barbinerve*, Maxim. Allied to *A. argutum*. Shrubby tree: lvs. 5-lobed, coarsely serrate: pistillate racemes usually 7-fl.: fr. larger. Manchuria. S.T.S.



101. Raceme of young fruit of box elder.—*Acer Negundo*. (Nat. size)



100 *Acer nikoense*. (× ½)



1:86.—*A. Boscii*, Spach. Probably hybrid. *A. monspessulanum* × *tataricum*.—*A. brevifolium*, Hesse=*A. parviflorum*.—*A. caesium*, Wall. Allied to *A. insignis*. Tree: lvs. 5-lobed, glabrous, whitish beneath, 6-8 in. across; lobes acuminate, obtusely crenulate-serrate. Himalayas. Not hardy N.—*A. capillipes*, Maxim. Allied to *A. rufo-nerve*. Tree, to 30 ft.: lvs. 3-lobed, glabrous beneath, red when unfolding,  $3\frac{1}{2}$ -5 in. long; fls. on slender stalks about  $\frac{1}{2}$  in. long. Japan. S.T.S. 1:16. Not perfectly hardy at the Arnold Arboretum.—*A. caudatum*, Brandis=*A. acuminatum*.—*A. cinerascens*, Boiss. Shrub or small tree: lvs. 3-lobed;  $\frac{1}{2}$ -2 in. long. Similar to *A. monspessulanum*. Persia.—*A. coriaceum*, Tsch. (*A. creticum*, Tratt.=*A. polymorphum*, Spach). Probably *A. creticum* × *pseudoplatanus*.—*A. crassipes*, Pax. Supposed to be a hybrid between *A. obtusatum* and *A. pennsylvanicum*.—*A. crassipes*, Hesse=*A. parviflorum*.—*A. creticum*, Linn.=*A. orientale*.—*A. creticum*, Tratt.=*A. coriaceum*.—*A. Dieckii*, Pax (*A. platanoides* var. *integrilobum*, Zabel). Similar to *A. platanoides*, but lobes entire; probably *A. Lobelii* × *platanoides*.—*A. distylum*, Sieb. & Zucc. Allied to *A. oblongum*. Tree: lvs. ovate, 5-7 in. long, cordate, crenately serrate, light green and lustrous beneath. Japan. G.C. II. 15:499. S.I.F. 2:41. J.H.S. 29:76.—*A. Duréti*, Pax. Probably *A. monspessulanum* × *pseudoplatanus*.—*A. erianthum*, Schwin. Allied to *A. caudatum*. Small tree: lvs. 5-lobed, 2-3½ in. long, lobes broad, unequally and simply serrate, nearly glabrous beneath; fls. with densely villous disk. W. China. S.T.S. 1:80.—*A. Fargesii*, Franch. (*A. laevigatum* var. *Fargesii*, Veitch). Allied to *A. oblongum*. Tree, to 30 ft.: lvs. coriaceous, lanceolate-oblong, 2-3½ in. long, narrowed at the base, pinninerved, glabrous, light green beneath, not reticulate. W. China. J.H.S. 29:91.—*A. flabellatum*, Rehd. Allied to *A. Oliverianum*. Tree, to 30 ft.: lvs. 7-lobed, deeply cordate, 3-5 in. across, light green beneath and villous along the veins. Cent. China. S.T.S. 1:81.—*A. Franchetii*, Pax. Tree, to 15 ft.: lvs. 3-lobed; slightly pubescent beneath or glabrous at maturity and light green, 3-4 in. long; lobes broadly ovate, acute, remotely toothed; fls. in short pubescent racemes from lateral leafless buds, with the lvs.: fr. with the wings spreading at right angles or less, nutlets thick, hairy; winter-buds with numerous imbricate scales. Cent. China. S.T.S. 1:87. Belongs to the section *Lithocarpa*.—*A. fulvescens*, Rehd. Allied to *A. pictum*. Tree, to 60 ft.: lvs. usually 3-lobed, 2-4 in. across, beneath covered with a yellowish or fulvous pubescence. W. China. Hardy at the Arnold Arboretum.—*A. heterophyllum*, Willd.=*A. orientale*.—*A. Hookeri*, Miq. Allied to *A. Davidii*. Tree, 60 ft.: lvs. cordate-oblong, serrate, 4-6 in. long, quite glabrous beneath. Himalayas.—*A. hybridum*, Spach. Probably *A. italum* × *pseudoplatanus*.—*A. hybridum*, Baudr.=*A. Boscii*.—*A. laevigatum*, Wall. Allied to *A. oblongum*. Small tree: lvs. oblong, nearly entire, attenuate at the base, pinninerved, green beneath. Himalayas, China.—*A. laevigatum*, Hort.=*A. acuminatum*.—*A. Lobelii*, Ten. Allied to *A. cappadocicum*. Branches glaucous: lvs. rounded at the base; lobes mostly undulate, abruptly pointed. Italy.—*A. Maximowiczii*, Pax (*A. urophyllum*, Maxim.). Allied to *A. Tschonoskii*. Small tree: lvs. 3-5-lobed, doubly serrate, the middle lobe much elongated, long-acuminate, glaucescent beneath, glabrous, 2-3 in. long; fr. slender-stalked; wings spreading at an obtuse angle. Cent. China. S.T.S. 1:84.—*A. Mayrii*, Schwin. Allied to *A. cappadocicum* and *A. amplum*. Tree with smooth bark: lvs. usually 3-lobed, glabrous, 3 in. across; lobes very broad, long-acuminate; wings of fr. upright, incurved. Japan.—*A. mexicanum*, Pax (Negundo mexicanum, DC. *A. serratum*, Pax). Allied to *A. Negundo*. Lifts. 3, pubescent beneath, densely serrate; fr. glabrous; wings spreading at an acute angle. Mex.—*A. micranthum*, Sieb. & Zucc. Allied to *A. Tschonoskii*. Shrub or small tree: lvs. 5-7-lobed; lobes incised and doubly serrate, glabrous; fls. and fr. small. S.Z. 1:141. S.I.F. 2:44.—*A. neapolitanum*, Ten.=*A. obtusatum*.—*A. neglectum*, Lange (*A. zoeschense*, Pax). Probably *A. campestre* × *Lobelii*. Var. Anne, Schwin. Young lvs. deep red, later olive-green. M.D. 1903:1.—*A. obtusatum*, Waldst. & Kit. (*A. neapolitanum*, Ten.). Allied to *A. Opalus*. Small tree or shrub: lvs. 5-lobed, pubescent beneath, about 4 in. across; lobes broad, often rounded, obtusely denticulate; wings of fr. spreading at a right angle or less. S. Eu., N. Afr. H.W. 3, p. 47. Tender at the Arnold Arboretum.—*A. orientale*, Linn. (*A. creticum*, Linn. *A. sempervirens*, Linn. *A. heterophyllum*, Willd.). Allied to *A. monspessulanum*. Shrub, 4 ft.: lvs. nearly evergreen, short-stalked, orbicular or oval, entire or 3-lobed,  $\frac{1}{2}$ -1½ in. long, glabrous. Orient.—*A. parviflorum*, Franch. & Sav. (*A. crassipes*, Hesse, not Pax. *A. brevifolium*, Hesse). Allied to *A. caudatum*. Tree: lvs. 3-5-lobed, pubescent beneath, 4-6 in. across; lobes broadly ovate, acute, doubly serrate; wings of fr. spreading at an obtuse angle. Japan. S.I.F. 2:42. Not quite hardy at the Arnold Arboretum.—*A. pectinatum*, Wall. Allied to *A. pennsylvanicum*. Tree: lvs. 3-lobed, setosely serrulate,  $2\frac{1}{2}$ -3½ in. across, the middle lobe elongated, acuminate. Himalayas. G.C. II. 15:365.—*A. Peronai*, Schwin. Supposed hybrid of *A. Opalus* × *monspessulanum*. Originated at Vallombrosa near Florence.—*A. robustum*, Pax. Allied to *A. palmatum*. Small tree: lvs. 7-9-lobed, cordate, 3-4 in. across, glabrous beneath except the tufts of hairs in the axils of the veins; lobes ovate, acuminate, sharply serrate; wings of fr. nearly horizontally spreading. Cent. China.—*A. rotundifolium*, Schwin. (*A. barbatum*, Booth, not Michx.). Possibly *A. obtusatum* × *monspessulanum*.—*A. Schvärinii*, Pax. Affinity doubtful. Lvs. coriaceous, ovate-oblong, cordate, undivided or 3-lobed, glaucous beneath, soon glabrous, 5-7 in. long; fls. and fr. unknown. Probably from the Himalayas. Var. *marmoratum*, Schwin, has the lvs. variegated with light green. Var. *monophyllum*, Schwin, has the lvs. 2-3½ in. long.—*A. sempervirens*, Linn.=*A. orientale*.—*A. serratum*, Pax=*A. mexicanum*.—*A. sikkimensis*, Miq. Allied to *A. Davidii*. Tree: lvs. cordate-ovate, coriaceous, long-acuminate, quite glabrous, entire or serrulate, 4-7 in. long; wings of fr. spreading at a right angle. Himalayas.—*A. sinense*, Pax. Allied

to *A. Oliverianum*. Tree: lvs. 5-lobed, cordate or sometimes truncate, glaucescent beneath, glabrous, 3-6 in. long; lobes ovate, acuminate, sparingly appressed-serrate; panicle elongated; wings of fr. spreading horizontally. Cent. China. S.T.S. 1:78. J.H.S. 29:92.—*A. sterculiaceum*, Wall. (*A. villosum*, Wall.) Allied to *A. Franchetii*. Tall tree: lvs. 3-5-lobed, cordate, 6-8 in. across, tomentose below, coarsely serrate; racemes from lateral leafless buds; fr. in long pendulous racemes, often branched at the base; wings of fr. nearly upright. Himalayas.—*A. sutchuenense*, Franch. (*A. sutchuense*, Pax). Allied to *A. mandshuricum*. Small tree. Lifts. 3, oblong-lanceolate, unequally serrate, glaucous beneath,  $1\frac{1}{2}$ -3 in. long; corymb many-fl., rather dense. Cent. China. S.T.S. 2:112.—Probably not in cult.; the plant figured by Veitch under this name is *A. Henryi*.—*A. tegmentosum*, Maxim. Allied to *A. pennsylvanicum*. Lvs. 3-4 in. long, glabrous beneath; lobes short; fls. small. Manchuria. G.C. II. 15:75.—*A. trifidum*, Hook. & Arn. Allied to *A. tataricum*. Small tree: lvs. coriaceous, cuneate-obovate, 3-lobed, glaucous beneath, glabrous, 2-3 in. long; lobes entire. China, Japan. S.Z. 2:143.—*A. urophyllum*, Maxim.=*A. Maximowiczii*.—*A. Veitchii*, Schwin. Possibly *A. cratægifolium* × *rufinerve*.—*A. villosum*, Wall.=*A. sterculiaceum*.—*A. Wilsonii*, Rehd. Allied to *A. Oliverianum*. Tree: lvs. 3-lobed, light green beneath, glabrous,  $3\frac{1}{2}$ -4 in. across; lobes ovate to oblong-ovate, acuminate, entire, or sparingly serrate; panicle elongated; wings of the fr. spreading at a right angle. Cent. China. S.T.S. 1:79.—*A. zoeschense*, Pax=*A. neglectum*.

ALFRED REHDER.

**ACERÁNTHUS** (*Acer*, maple, and *anthos*, flower, in allusion to the maple-like flowers). *Berberidaceæ*. **BARENWORT.** A genus of 4-6 species of slender, hardy, herbaceous perennials from Temp. Asia and Algeria, related to the native twin-leaf, *Diphylleia*. Fls. variously colored, racemose; sepals 7-8, petaloid, the

102. *Achillea Millefolium* var. *rubrum*. (× ½)

outer ones smaller than the inner; petals flat; lvs solitary.—Not commonly cult. and the following seen only in botanic gardens.

*A. diphyllum*, Morr. & Deene. (*Epimedium diphyllum*, Lodd.). Plant rhizomatous; lifts. obliquely cordate, green above, glaucous beneath; fls. small, bluish white. Japan. B.M. 3448. L.B.C. 19:1858.

N. TAYLOR.

ACHANIA: *Malvaviscus*.

**ACHILLÆA** (its virtues said to have been discovered by Achilles). *Compositæ*. Includes *Platnica*. About 100 species, some of which are hardy herbaceous border and alpine perennials of easy culture.

Leaves simple or compound, often ternate; fl.-heads small, corymbose or racemose; receptacle nearly flat

or convex, chaffy; ray fls. pistillate, fertile, the rays white or pink; disk fls. perfect, fertile.

Most of the achilleas can be grown in ordinary garden soil, preferring open sunlight and well-drained situations. Some are alpine or sub-alpine and require rock-garden conditions. These are indicated under the individual species. Dwarf kinds make carpets in dry, sunny places; large kinds suitable for wild gardens.

Propagation in spring by division, cuttings and seeds; chiefly by the first method and easily accomplished.

A. Rays about 5, except in double forms, half as long as the ovate-oblong involucre; fls. white, red, or yellow.

B. Fls. white or red.

**Millefolium**, Linn. **MILFOIL**. YARROW. Height 1-3 ft.: lvs. bipinnately parted, segms. linear, 3-5 cleft; fls. in flat corymbs. June-Oct. Eu., Asia, Amer. Common in pastures.—Less commonly cult. than vars. **rubrum** (Fig. 102) and **roseum**, with red or purple fls.

BB. Fls. yellow.

**Tournefortii**, DC. (*A. ægyptiaca*, Linn.). Height 12-18 in.: lvs. pinnatisect; segms. roundish, coarsely toothed; fls. pale yellow. June-Oct. Greece.

**filipendulina**, Lam. (*A. Eupatorium*, Bieb.). Fig.

103. Height 4-5 ft.: st. erect, furrowed, glandular spotted and almost hairy; fls. yellow in dense, convex compound corymbs, often 5 in. across. June-Sept. Orient.—Needs staking.

**holosericea**, Sibth. & Sm. Similar to preceding, but not glandular spotted; fls. as in *A. filipendulina*, but corymbs simple, terminal, and the petals scarcely as long as the bracts of the involucre. Mts. of Greece. Summer.—More suitable to semi-alpine situations than *A. filipendulina*.

**tomentosa**, Linn. A woolly, carpet-like plant for rockeries. Height 8-10 in. Eu., Orient, N. Amer. B.M. 498. Gn. 52, p. 421.

AA. Rays 6-20, as long as or longer than the rotund or campanulate involucre; fls. white.

B. Lvs. not divided.

**Ptarmica**, Linn. (*A. macrocephala*, Pill. & Mitterb.). **SNEEZEWORT**. Height 1-2 ft.: lvs. serrate; fls. in loose corymbs; all summer. North temperate regions.—Its full-double var. The Pearl (Fig. 104) is much used for cut-flowers and in cemeteries, and is one of the most popular of all hardy herbaceous plants. There are many other varieties.

**lingulata**, Waldst. (*A. buglossis*, Hort.). A stiff, simple-stemmed, perennial, simulating *A. Ptarmica*, but hairy: lvs. broadly spatulate, the petiole long-attenuate and dotted; heads corymbose, the fls. numerous; petals 3-4 times as long as the involucre. Sub-alpine. Hungary and southward. Summer.



103. *Achillea filipendulina*.  
(Plant  $\times \frac{1}{2}$ )

**sibirica**, Ledeb. (*A. mongolica*, Fisch. *A. Ptarmicoides*, Maxim.). Denser than the last, more erect and rigid; height 1½-2 ft.: fls. larger and in more compact corymbs. July-Sept.

**grandiflora**, Bieb. A smooth and erect perennial: lvs. narrowly linear, narrower than in any of the *Ptarmica* group, distinctly serrulate; corymbs simple or sometimes loosely branched, the peduncles 4-5 times longer than the head; fls. white, large and more showy than most of the genus, longer than the bracts of the involucre. Sub-alpine and scarcely good for ordinary garden conditions. Caucasus. June, July.

BB. Lvs. deeply divided.

**macrophylla**, Linn. Height 3 ft.: lvs. long, broad. July. Alps. Gn. 52, p. 421.—Better suited to shrubbery than to herbaceous border.

**Clavénæ**, Linn. (commonly spelled *A. Clavénæ*. *A. argentea*, Hort., not Lam.). Dwarf, tufted, hoary alpine plant; height 10 in.: lvs. dentate at apex; segms. obtuse; fls. spring and summer. Eu. B.M. 1287. Gn. 52, p. 421.—Thrives in sand.

*A. Ageratum*, Linn. Fls. yellow. Eu.—*A. ageratifolia*, Benth. & Hook. (Anthemis Aizoon). Tufted, woolly, silvery gray; fls. white. May, June. Alps.—*A. asplenifolia*, Vent. Lvs. pinnate, smooth; fls. white. There is a red-fl. form. N. Amer.—*A. atrata*, Linn. Dwarf, tufted, aromatic; radical lvs. petiolate; cauline lvs. pinnatisect; fls. white. Alps.—*A. aurea*, Lam. Fls. golden yellow, the seeds stipitate; lvs. woolly. Aug., Sept. S. Eu.—*Chrysanthemum achilleaeifolium* (which see).—*A. decolorans*, Schrad. Lvs. undivided; fls. pale yellow. July. Eu.—*A. Herbarota*, All. Dwarf, tufted, aromatic alpine; lvs. undivided, serrate; fls. white. May, June.—*A. ligustica*, All. Lvs. pinnatifid; fls. white. Eu., Orient.—*A. moschata*, Jacq. Lvs. smooth, pinnately parted, lobes uncut; fls. white. Eu.—*A. nana*, Linn. Dwarf, hairy, woolly, aromatic; lvs. pinnatisect; fls. white. Spring. Eu. Used in making Chartreuse.—*A. odorata*, Linn. Lvs. pinnatisect; lobes cut; fls. white.—*A. pectinata*, Willd. Fls. pale yellow.—*A. rupes-tris*, Huter. Lvs. ½ in. long, linear-spatulate, entire. S. Italy. B.M. 6905.—*A. santolinoides*, Lag. 1 ft.: lvs. pinnatisect, hairy-woolly; fls. white. July. Spain.—*A. serrata*, Retz. Lvs. pinnatifid, woolly; fls. white. Siberia(?).—*A. Siehiana*, Hort. Fls. golden yellow, fragrant. Asia Minor.—*A. umbellata*, Sibth. Very woolly rock plant, 4-5 in.: lvs. pinnatifid; lobes oblong, bluntish, entire or serrate; fls. white. June. Greece.—*A. valesiaca*, Stein. Lvs. pinnately parted; fls. white. June-Aug. Eu. Other trade names are *A. corymbosa*, *A. transylvanica* and *A. Hüteri*; none is known in hort. or botanical literature.

N. TAYLOR.†

**ACHIMENES** (Greek, *cheimaino*, to suffer from cold). Including *Scheeria*. *Gesneriaceæ*. Greenhouse herbs, allied to gloxinias, native to tropical America, grown for bloom in late spring and in summer.

Plant upright, erect, or drooping; lvs. opposite or whorled, serrate or toothed, mostly hairy; underground sts. scaly and catkin-like, and similar growths sometimes in the axils of the lvs; fls. axillary; 5 calyx-lobes narrow and short; corolla-tube cylindrical and limb spreading; anthers 4, connivent in the tube, and a rudiment of a fifth stamen; style long, usually exserted, the stigma dilated or obscurely 2-lobed.—Perhaps 40 species.

The garden achimenes are much confused by hybridization, and it is doubtful whether any of the pure species are in general cultivation in this country. Years ago, the small red-flowered types (of the coccinea section) were frequent, but modern evolution has proceeded from the broad-flowered purple species. The species



104. *Achillea Ptarmica* var. The Pearl.



described further on seem to have contributed most largely to the present garden forms. Some of the best species are *A. longiflora*, purplish blue; *A. longiflora* var. *alba maxima*, the best white kind; *A. patens* var. *major*, a large flower of purplish rose; *A. pedunculata*, orange; *A. heterophylla*, tubular, a fiery orange at one end and blazing yellow at the other. There are many named varieties, some of the names being Latin in form. In the grandiflora group the tubers or bulbs are clustered; in the longiflora group the tubers are pear-shaped bodies, growing on the ends of root-like rhizomes. The coccinea (Fig. 105) and hirsuta groups are late bloomers.

The rhizomes of achimenes should be removed from their winter quarters and spread out thinly in boxes, using a size some 3 inches deep, and a light open mixture of leaf-mold and sand to start them in. The lower inch in the box should be covered with some material that will act as drainage; then cover with an inch or so of the compost, and spread out the rhizomes on this and cover with half an inch of the mixture which has been passed through a half-inch mesh sieve. Place in a moist house in a temperature of 60° to 65° F. and water sparingly until the young growths appear. When these are some 2 inches high, they should be lifted from the boxes with the material that is attached to the roots and potted up into 5- or 6-inch pots or 8-inch pans, spacing them equally, and using some ten to fifteen growths for each pot or pan. The material used for this potting should be rich in humus and of a very open porous nature, so as to provide free access of air to the roots and at the same time allow any excess of water to pass away freely. A useful mixture for this purpose is equal parts of loam, leaf-mold and sand. About one-third the depth of the pots or pans should be occupied with drainage. All the rhizomatous forms of achimenes are shallow-rooting, so that there is no advantage in using large and deep pots. This method of starting the rhizomes first and then potting those that have been started together, is much to be preferred to potting them up directly into the flowering sizes, which method, however, is practised by many cultivators. The advantage of the method advised is that all the pots are filled regularly with growths of equal size and vigor, whereas in the other and older method the rhizomes often start irregularly and the pots are only partially filled with growths. After potting up, the pots should be replaced again in the same house as the rhizomes were started in, and kept shaded from all hot sun. From this period onward, growth is rapid and care must be taken not to allow any of them to suffer for want of moisture at the roots, or failure will ensue. When the plants are 6 or 8 inches high, feeding with weak liquid manure should begin, and should be continued regularly until the plants show signs of exhaustion after flowering. When the flowers appear, the plants should then be removed to a somewhat drier airy greenhouse, kept at a temperature of about 50° F., where they will remain until the flowering season is over. They may then be removed to a greenhouse or coolframe to ripen up. The water-supply should be gradually reduced until the plants die down. The best method of storing the rhizomes is to shake entirely out of the old soil, mix them up in a box



105. Achimenes; tubers of the coccinea section.

of sand, and keep them entirely dry in a shed which does not fall below a temperature of 45° F. until the time comes round for starting them again in March or April.—Propagation is readily effected by means of the rhizomes. Each of these may be used for forming one or many plants. Some of the kinds form numerous scaly buds or short rhizomes in the axils of the upper leaves; these may be saved and treated in exactly the same way as the underground rhizomes for propagation. Cuttings of any of the sorts root readily in a moist warmhouse in summer-time. Every node may be used for stock and the parts may be inserted without removing the leaves.—All members of the genus, including the numerous garden forms, are of the easiest possible culture, and there are few greenhouse plants that will furnish such a display of flowers at such a little cost in time and attention. Some of the forms of weak habit make charming subjects for growing as basket plants. (C. P. Raffill.)

A. Fls. colored, the tube usually not more than twice the length of the limb.

B. Blossoms small, red, scarlet, or orange the limb narrow and sometimes not much spreading.

*ocellata*, Hook. Rhizomes small and tuberous: st. 1-2 ft.: lvs. rich green above and purple beneath, ovate, strongly serrate, with conspicuous purplish petioles: fls. small, 1 in. long, broad-tubed, spotted with black and yellow, the lobes short and obtuse and well separated, drooping on reddish peduncles. Panama. B.M. 4359.—Fine for foliage.

*coccinea*, Pers. Fig. 105. Height 1-2 ft.: st. reddish: lvs. 3-whorled or opposite, green, ovate-acuminate, serrate: fls. small, scarlet, the corolla twice longer than the erect lanceolate parted calyx on short peduncles. Minute lvs. often borne in the axils. Blooms late. Jamaica.—One of the older types.

*heterophylla*, DC. (*A. ignescens*, Lem. *A. Ghiesbreghtii*, Hort.). Root fibrous: st. 1 ft. or less, dark purple, somewhat hairy: lvs. ovate-acuminate, stalked, serrate, the 2 of each pair usually unequal in size: fls. solitary, on peduncles somewhat longer than the lf.-stalks, long-tubular and slightly curved, with a narrow, nearly equal flaring limb, rich scarlet, yellow within. Mex. B. M. 4871.—This species has tubers like those of the grandiflora section.

*pedunculata*, Benth. Rhizomes scaly: st. 1½-2 ft., hairy, reddish, tuber-bearing: lvs. opposite, small, ovate, sharply serrate, green, hairy, on short reddish stalks: fls. medium size, drooping and dilated upwards, yellow-red with dark markings and a yellow throat, the limb comparatively short; on long (4-5 in.) bracted sts. Guatemala. B.M. 4077.

BB. Blossom large, with wide-flaring limb, mostly violet in main color.

*longiflora*, DC. (*A. Jaureguia*, Warscz.). Fig. 106. Rhizomes root-like and filiform, producing pear-shaped tubers at their ends: st. 1-2 ft., hairy: lvs. opposite or 3-4-whorled, ovate-oblong, serrate, hairy, paler and



106. Achimenes longiflora. (×½)

sometimes tinted beneath: fls. solitary, the corolla salver-shaped, with a long and graceful tube; the limb very large and widely spreading, violet-blue and whitish beneath, the lowest segm. sometimes divided. Guatemala. B.M. 3980. P.M. 9:151.—A popular blue type. Var. *alba máxima*, Hort. Fls. large, white.

**grandiflora**, DC. Fig. 107. Lvs. mostly larger than in last, rusty below: fls. often more than one from an axil, very large, distinctly red-tinged. Mex. B.M. 4012.—A popular red or wine-colored type.

**pätens**, Benth. Height 1-1½ ft.: lvs. unequal, ovate-acuminate, hispid and serrate: fls. violet-blue, with downy calyx, tube shorter than spreading crenate limb. Var. *major*, Hort. Large-flid. Mex.

AA. Fls. pure white, the tube 3-4 times the length of the limb.

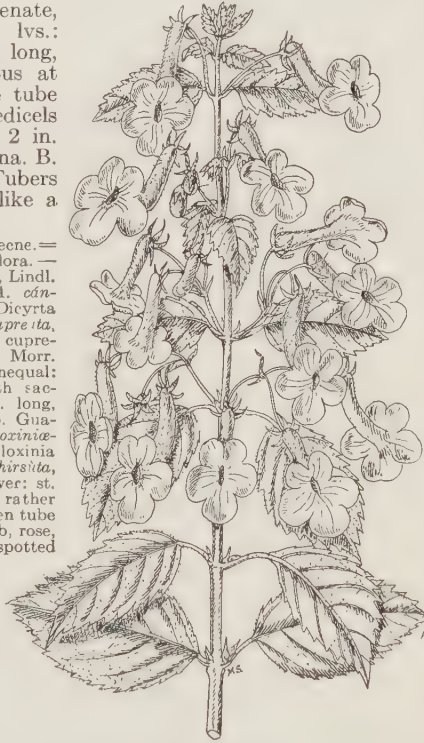
**tubiflora**, Nichols., Suppl. p. 483 (*Gloxinia tubiflora*, Hook. *Dolichodeira tubiflora*, Hanst.). St. short, with opposite oblong-acuminate, crenate, short-petioled lvs.: fls. 4 in. long, curved, gibbous at the base, the tube downy, the pedicels opposite and 2 in. long. Argentina. B.M. 3971.—Tubers solid, much like a potato.

*A. amabilis*, Deene. = *Nægelia multiflora*. — *A. atrosanguinea*, Lindl. = *A. foliosa*. — *A. candida*, Lindl. = *Dicytra candida*. — *A. cupreita*, Hook. = *Episcea cupreata*. — *A. foliosa*, Morr. Lvs. cordate, unequal: fls. crimson, with sacate tube 1 in. long, with narrow limb. Guatemala. — *A. gloxiniflora*, Forkel. = *Gloxinia glabrata*. — *A. hirsuta*, DC. Loose grower: st. bulbiferous: fls. rather large, with swollen tube and oblique limb, rose, with yellow and spotted throat. Guatemala. B.M. 4144. P.M. 12:7. Once popular. — *A. Klei*, Paxt. Dwarf: fls. pink-purple. P.M. 16:289. Form of *A. longiflora*. — *A. lanata*, Hanst. (*Scheeria lanata*, Hanst.). Woolly or white-hairy: fl. pinkish or lilac, large and showy. Mex. B.M. 4963 (alt. to 4954). — *A. multiflora*, Gardn. Hairy: lvs. broad-ovate: fls. blue, fringed. Brazil. B.M. 3993. — *A. picta*, Benth. = *Tydaea picta*. — *A. rosea*, Lindl. Fls. pink or rose, the peduncles many-flid. Guatemala. — *A. Scheerii*, Hemsl. (*Scheeria mexicana*, Seem.). Erect, with purple or blue, large and showy fls. Mex. B.M. 4743. — *A. Skinneri*, Gord. = *A. hirsuta*. — Garden forms and hybrids are *A. floribunda*, *A. intermedia*, *A. Jayii*, *A. Mountfordii*, *A. nage-lio des*, *A. nana*, *A. venusta* (P.M. 15:121), *A. Verschaffeltii*.

L. H. B.

**ÄCHLYS** (the goddess of obscurity). *Berberidaceæ*. Hardy herbaceous perennial allied to the may-apple, and sometimes so called where wild. Lvs. all radical, with 3 lfts.: fls. minute, apetalous, numerous, spicate, on a slender scape: fr. very small, at first pulpy but becoming dry.—Species 2, one of them Japanese.

**triphylla**, DC. Rootstock terminated by a strong, scaly winter-bud: lvs. 1 or 2, on petioles 1 ft. or more long; lfts. fan-shaped, sinuate-dentate, 2½ x 5 in.: scape 1 ft. long: spike 1 in. long. Spring. Calif. to Brit. Col., in shady woods.—An interesting and delicate plant. Intro. 1881.



107. *Achimenes grandiflora*. (X¼)

**ÄCHRAS**: *Sapodillo*.

**ACHYRANTHES**: *Iresine*.

**ACIDANTHÈRA** (from *akis*, a cusp, and *anthera*, an anther, in allusion to cuspidate anthers). *Iridaceæ*. Tender herbaceous perennials.

Leaves many, linear, ensiform, 1-1½ ft. long: spikes 3-6-flid., simple, lax: fls. long-tubed, the tube slightly dilated upwards; stamens unilateral, inserted at or below the throat: corms roundish, flattened, covered with a matted fiber. Natives of Trop. and S. Afr., and intermediate between *Gladiolus* and *Ixia*.

The propagation is by seed or by the numerous corms.

**bicolor**, Hochst. Fig. 108. St. 15-18 in.: fls. creamy white, blotched chocolate-brown within, fragrant: corms ½-1 in. diam. Abyssinia. G.F. 1:486, 487 (adapted in Fig. 108). Gn. 47:343. G.C. III. 20:393. Mn. 8:11.—Requires a somewhat stiffer soil than the tender species of *gladiolus*. May be grown in a tub outdoors during summer, and flowered within during Oct. Several corms in a large pot give good results. Corms should be dried as soon as lifted, to prevent rot.

*A. equinoctialis*, Baker. St. 3-4 ft., stout, stiffly erect: lvs. strongly ribbed: fls. about 6 in. a distichous spike, the tube 5-6 in. long, white, blotched crimson or purple within: corms large. Sierra Leone. B.M. 7393. May be a stronger-growing and more tropical form of the above. Requires warmhouse culture.—*A. cándida*, Rendle. A slender, erect, leafy herb: fls. white, very sweet-scented. Trop. E. Afr. B.M. 7879.

N. TAYLOR.†

**ACINÈTA** (*immovable*, referring to the jointless lip). *Orchidaceæ*. Epiphytic hothouse orchids.

Pseudobulbs conic or ovate, with the large plicate-veined lvs. articulated to the summit: fls. fleshy, borne in pendulous racemes on lateral leafless scapes; sepals broad, equal, finally somewhat spreading; petals similar to the sepals but smaller; lip fleshy, continuous with the base of the column, the middle lobe continuous or articulated, entire or 3-lobed; pollinia 2.—About 10 species, distributed from Mex. to northern S. Amer.

These plants require a warm house and plenty of moisture during the growing season, with a decided rest, to make them flower. They need to be cultivated in wooden baskets and suspended from the roof of the house, as the flower-spikes are always produced from the base of the bulbs and there should be no hindrance in the way of crocks to prevent their egress. The rooting material may be peat fiber only, and not a great quantity under the plants, but plenty around them. With basket culture of orchids, it is very necessary, once a week in the growing season, to take the plants down and give a soaking by immersion, in addition to the ordinary spraying overhead from day to day; in this way alone can one be sure of the proper growing conditions. In winter, much less water is required. Propagation is by division of the plants in spring. (Orpet.)

**Bärkeri**, Lindl. (*Peristèria Bärkeri*, Batem.). Fig. 109. Pseudobulbs conic, 4-5 in. long, usually bearing 3 or more lvs. 2-3 ft. long: fls. yellow, striped with red-brown, 12 or more, in pendulous racemes. Mex. B.M. 4203. I.H. 2:44. Gn. 54, p. 332. P.M. 14:145. G.M. 40:697.

**Humboldtii**, Lindl. (*Peristèria Humboldtii*, Lindl. *A. superba*, Reichb.). Pseudobulbs ovate, about 3 in. long, bearing 3 or 4 lvs. about 1 ft. long: fls. chocolate, spotted with crimson, 6 or more, in pendulous racemes. Mts. of N. S. Amer. Gn. 3:11; 32, p. 157; 25, p. 482. Var. **Còlmanii**, Hort. Fls. profusely spotted with purple.

*A. chrysantha*, Lindl. Fls. golden yellow, the lip whitish, and the column purplish or crimson. Mex.—*A. densa*, Lindl. (*A. Warszewiczii*, Klotzsch). Fls. in a dense raceme, pale yellow, externally spotted with reddish brown, fragrant; lip yellow, marked with crimson. Costa Rica. B.M. 7143.—*A. Hrubyanæ*, Reichb. Fls. white, the lip spotted with purple. Colombia.—*A. Moorei*, Rolfe. Fls. straw-colored, sub-globose, thickly brown-spotted:



the lip fleshy, the lateral lobes obliquely reniform, the midlobe oblong, blunt. S. Amer. B.M. 8392.—*A. sulcata*, Reichb. f. Fls. yellow; otherwise similar to *A. Humboldtii*.

GEORGE V. NASH. †

**ACIPHÝLLA** (Greek for *sharp-leaved*). *Umbelliferae*. About a dozen or so herbs, all of New Zealand except 2 in the mts. of Austral., sometimes seen in rock-gardens but apparently not grown in N. Amer. Plant erect, and rigid, somewhat spiny, with thick pinnate lvs., and the small fls. in compound bracted umbels. Some of them are large plants. Allied to *Ligusticum*.

**ACIS:** *Leucojum*.

**ACOCANTHÈRA** (*mucronate anthers*). Sometimes spelled *Acocanthèra*. Syn., *Toxicophlœa*. *Apocynaceæ*. A genus consisting of 5 species of African shrubs, cult. in greenhouses N., and outdoors in Fla. and Calif. Fls. with the odor of jasmine, lasting; calyx 5-parted, glandless; corolla 5-parted, its 5 lobes twisted. In Cent. Fla., they require some protection during the winter. Prop. by cuttings taken early in the spring.

*spectabilis*, G. Don (*Toxicophlœa spectabilis*, Soud. *T. Thünbergii*, Hort., not Harv.). WINTER-SWEET. Lvs. 3-5 in. long, short petiolate, leathery, elliptic, acute, shining above; fls. numerous, in dense, axillary, branched cymes, which are sometimes 2 ft. long, pure white, very sweet-scented; fr. blackish purple, almost as large as an olive and of the same form; contains one large, nut-like seed. Natal. B.M. 6359. R.H. 1879:270. G.F.6:185. G.C. 1872:363.—Poisonous. The plants cult. under this name are said by trade catalogues to have pink or violet fls.

*venenata*, G. Don (*Toxicophlœa cestroides*, DC. *T. Thünbergii*, Harv., not Hort.). BUSHMAN'S POISON. Fls. white or rose. Differs from the above in the

marked venation of the lvs., its fls. a third smaller, its calyx not pubescent, and its corolla-limb less widely spreading. I. H. 32: 553. R.H. 1880:370.

N. TAYLOR. †

**ACCELORRHÂPHE** (name of uncertain origin). *Palmaeæ*, tribe *Corypheæ*. A genus of 2 species of American palms allied to *Brahea* and distinguished from it by technical characters of the albumen. *A. Wrightii*, Wendl., a graceful, slender palm with almost orbicular-bladed lvs.: trunk thin, scarcely exceeding 4-7 ft.: lvs. long-petioled, made up of about 50 narrow segms., all united at the base. Cuba and Honduras.—Has been cult. outdoors at the botanic gardens at Buitenzorg and Calcutta and in extreme S. Fla. Unique but little known outside of botanic gardens. Grows with great vigor in rich moist soil.

N. TAYLOR.

**ACONITE, WINTER:** *Eranthis*.

**ACONÏTUM.** *Ranunculaceæ*. ACONITE. MONKSHOOD. WOLFSBANE. A group of hardy ornamental, perennial herbs, much used in borders and masses for their showy flowers and effective foliage.

Root tuberous, turnip-shaped, or

thick-fibrous: st. tall or long, erect, ascending or trailing; lvs. palmately divided or cleft and cut-lobed; fls. large, irregular, showy; sepals 5, the large upper sepal in shape of a hood or helmet; petals 2-5, small; stamens numerous; carpels 3-5, sessile, many-ovuled, forming follicles when ripened. The number of species varies from 18-80, with different botanists. Native in mountain regions of Eu., Temp. Asia, and 5 in N. Amer. Reichenbach Monographia Generis Aconiti, Leipsic, 1820, 2 vols., folio; Illustratio Specierum Aconiti, Leipsic, 1822-7, folio. Many species are planted in European gardens, but only a few have been much used in Amer.

The aconitums yield important drugs, although none of them is grown for this purpose in this country. The officinal aconite is derived from the roots of *A. Napellus* from England and continental Europe. The leaves are also used for medicinal purposes. *A. japonicum* yields Japanese aconite; *A. chinense*, the Chinese aconite; and *A. ferox* the "bish" or Nepaul aconite. The poisonous alkaloid *aconitin* is secured from *A. Napellus*, and similar alkaloids from *A. ferox*, *A. luridum* and *A. palmatum*, of India. *A. Fischeri*, *A. Lycotomum*, *A. septentrionale*. Not all these species are described here, as they are not horticultural subjects.

These plants present a pleasing contrast to the yellow helianthus and rudbeckias, the white of *Phlox paniculata*, to *Chrysanthemum maximum* and *Anemone japonica*. They are also effective for mixing in on shrub borders. The first season, these herbs do not attain their full perfection. Aconitums should be left undisturbed as long as possible. They will survive the northern winters if kept under a leaf-covering, while for the central part of the country, straw or evergreen boughs are sufficient protection.

The following species do well in any garden land, but respond better if given very rich soil. They thrive in open sun, but flowers last longer in shaded places. Aconites should never be planted in or too near the kitchen-garden or the children's garden, as the roots and some of the flowers have a deadly poison. They are suited to the back of the border, as they are tall.

Propagation is effected easily by division of roots in either late fall or early spring; also by seeds sown as soon as mature, in warm spring, in the North, the seeds may be started in small seed-beds in the spring and then be transplanted when the seedlings are about 2 inches high. In the Central States and southward, a year is gained by sowing the seed in late summer or early fall.

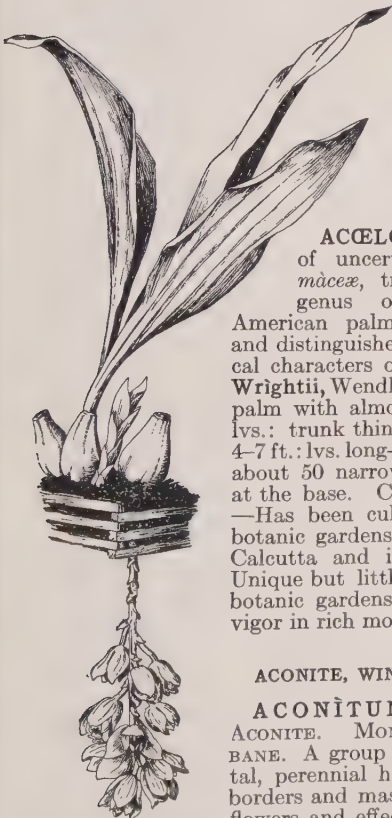
A. Roots globular-tuberous.

B. Lvs. deeply cut, but not to the base.

*Fischeri*, Reichb. (*A. columbianum*, Nutt. *A. californicum*, Hort.). Sts. 4-6 ft.: lvs. large, smooth, 3-



108. *Acidanthera bicolor*. (× 1/4)



109. *Acineta Barkeri*. (× 1/6)

parted, attractive; segms. much cut and divided: fls. numerous, pale blue, panicle, pedicels pubescent; helmets hemispherico-conical. Autumn. N. Amer. and Asia. F.S.R. 1: 214. R.B.33: 205 (as *A. sinensis* var. *bicolor*). Var. *Wilsonii* (*A. Wilsonii*, Stapf), is a very tall form, with violet fls. R.H. 1910, p. 223. Gn. W. 21: 197. Gn. 64, p. 339. B.M. 7130 (as *A. Fischeri*).

**Cammàrum**, Linn. (*A. decorum*, Reichb. *A. exaltatum*, Bernh.). St. 3-4 ft.: lvs. with short, bluntish lobes: fls. purple or blue; panicles or loose spikes few-fl'd; helmet hemispherical, closed. July-Sept. Hungary. Intro. 1889.—*A. Storkianum*, Reichb., is a dwarf form of this, with fewer fls. and somewhat fibrous roots.

**uncinatum**, Linn. WILD MONKSHOOD. Fig. 110. St. slender, 3-5 ft., inclined to climb: lvs. thick, deeply cut into 3-5 cut-toothed lobes: fls. loosely panicle, but crowded at the apex, blue, pubescent, 1 in. broad; helmet erect, nearly as broad as long, obtusely conical: follicles 3. June-Sept. Low grounds of Pa., S. and W. Japan. Mn. 4: 81.—Much planted now.

BB. Lvs. divided to the base.

**variegatum**, Linn. Erect, 1-6 ft.: lvs. variously divided into usually broad lobes and cut divisions; lower petioles long, others short or none: fls. in a loose panicle or raceme, blue, varying to whitish, rather smooth; helmet higher than wide, top curved forward; visor pointed, horizontal or ascending. July. Eu.—*A. album*, Ait., is a pure white-fl'd. form of this, with rather fibrous roots. *A. volubile*, var. *latisectum*, Hort., is a twining form of *A. variegatum*. The plants are allowed to ramble naturally or to climb on arbors; height 8 ft. Var. *tensisectum*, Hort. Sts. slender though not twining: large blue fls. Manchuria.

AA. Roots long-tuberous.

B. Carpels usually 5.

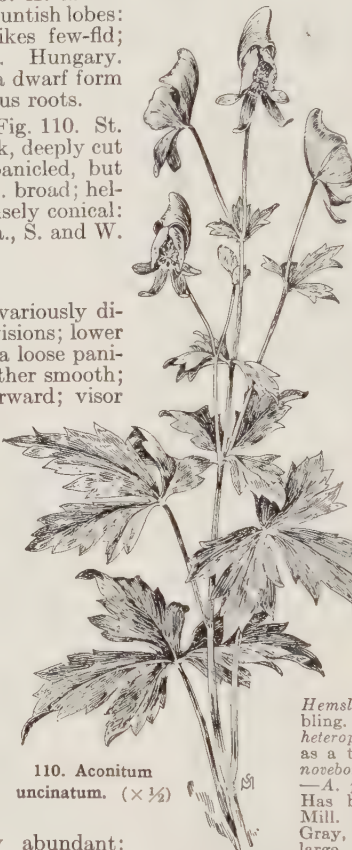
**japonicum**, Decne. St. erect, 3-4 ft., smooth: lvs. dark green, shining, petioled; lobes 2-3 times cut, the parts blunt and deeply toothed: fls. large, deep blue or violet, tinged with red, on loose panicles with ascending branches; helmet conical; beak abruptly pointed: follicles 5. July-Sept. Japan. Intro. 1889. R.H. 1851, p. 475. Var. **cæruleum**, Hort. Fls. very abundant; panicles shortened.

BB. Carpels 3 or 4.

**Napellus**, Linn. (*A. turicum*, Jacq. *A. pyramidale*, Mill. *A. inunctum*, Koch). TRUE MONKSHOOD. OFFICIAL ACONITE. Fig. 111. The best known and most poisonous species, and used in medicine. Sts. erect, 3-4 ft.: lvs. divided to the base, and cleft 2-3 times into linear lobes: fls. blue, in a raceme; peduncles erect, pubescent; helmet broad and low, gaping, smoothish: fr. 3-4-celled. June, July. Gn. M. 4: 34. R.V. 8: 2. Gn. 12, p. 302.—Very many varieties, differing in shade of fls., often mottled or lined with white. Var. *album* is nearly white. Var. *bicolor* and var. *versicolor*, much used in gardens for the large blue and white fls. Reichenbach has divided this species into 20-30 species. *A. Halleri* is one of his divisions appearing in catalogues. B.M. 8152 (as var. *Emnicus*).



111. *Aconitum Napellus*.  
( $\times \frac{1}{2}$ )



110. *Aconitum uncinatum*. ( $\times \frac{1}{2}$ )

AAA. Roots in the form of a scaly, elongated bulb, or somewhat fibrous.

B. Sepals deciduous.

**autumnale**, Reichb. AUTUMN ACONITE. Fig. 112. St. 3-5 ft.: lvs. pedately 5-lobed: fls. in a simple spike, becoming a panicle, blue, lilac, or whitish; helmet closed. Sept.-Nov. N. China.

**Lycótonum**, Linn. (*A. barbátum*, Patr. *A. squarrósum*, *A. ochroleucum*, Willd.). PALE YELLOW WOLFSBANE. St. slender, simple, 3-6 ft.: lvs. deeply cut into 5-9 lobes; long petioles and under ribs pubescent: fls. yellow or whitish, in racemes; helmet a pinched elongated cone; middle sepals usually bearded: fr. usually 3-celled. June-Sept. Eu., Siberia. B.M. 2570. G.M. 34: 124.

BB. Sepals persistent.

**Anthòra**, Linn. (*A. pyrenæicum*, Pall.). St. 1-2 ft.: lvs. parted almost to the base, parts deeply cut and lobed, more or less hispid beneath, smoothish above; petioles long: fls. in lateral and terminal racemes, pale yellow, often large; racemes or panicles generally pubescent; spur bent back or hooked; helmet arched, but cylindrical at base: follicles 5. June, July. S. Eu. B.M. 2654. Var. **aureum**, Hort., and several other varieties.

*A. chinense*, Sieb. Deep blue spike of fls. from the axil of every lf.: foliage bold and handsome. B.M. 3852. P.M. 5: 3.—*A. delphinifolium*, DC. Allied to *A. Napellus*.—*A. gymnándrum*, Maxim., is a good species. B.M. 8113.—*A. Hemsleyanum*, E. Pritz. Sts. twining and rambling. China. R.B. 33, p. 328. G. 32: 39.—*A. heterophyllum*, Wall. Fls. yellow and violet. Used as a tonic medicine in India. B.M. 6092.—*A. noveboracense*, Gray. Probably=*A. paniculatum*.—*A. paniculatum*, Lam. (*A. toxicum*, Reichb.). Has blue fls. L.B.C. 9: 810.—*A. pyramidale*, Mill. Form of *A. Napellus*.—*A. reclinatum*, Gray, of the Alleghanies, with white fls. and large lvs., is worth cult.—*A. scapòsum* var. *pyramidale*, Franch. Lvs. broadly 5-lobed: fls. very numerous,  $\frac{3}{4}$ -1 in. long, heliotrope, greenish yellow at the throat. Cent. China.—*A. septentrionale* var. *capricum*, Sims, is a beautiful purple kind closely related to *A. Lycotonom*. B.M. 2196.—*A. Storkianum*, Hort., may be a form of *A. variegatum*, with the lvs. so much cut up as to give a pinnate form.—*A. tortuosum*, Willd. Once listed in the trade; not now found.

K. C. DAVIS.

**ÁCORUS** (ancient name of unknown meaning). *Aracæx*. Hardy, herbaceous water-loving plants. Lvs. sword-shaped, erect: spadix appearing lateral, with no true spathe; fls. inconspicuous. They thrive best in moist soil, and may be grown in shallow water or on dry land. Prop. easily in spring or autumn by division.

**Cálamus**, Linn. SWEET FLAG. Height 2 ft.: root-stock horizontal, pungent, aromatic: fls. early summer. N. Amer., Eu. V. 2: 198. Var. **variegátus**, Hort. Lvs. striped deep yellow when young, fading to a paler color later in summer. Eu.—Commoner in cult. than the type.

**gramíneus**, Soland. Height 8-12 in. Much smaller than *A. Calamus*, forming compact, grassy tufts. Japan. Var. **variegátus**, Hort. Lvs. striped white.—Used in hanging-baskets, vases, rockeries and for cutting. Often grown indoors.

*A. japonicus argenteò-striátus*, Hort., and *A. japonicus folia variegátus*, Hort., are catalogue names, and are referable, from description, to *A. gramineus*, Soland. var. *variegatus*, Hort.

GEORGE V. NASH.†



**ACRÍOPSIS** (Greek combination for *top* and *eye*). *Orchidaceæ*. A few epiphytic orchids from the E. Indies, with panicles of small fls. with colors in green, pink, yellow and purple, and little known in cult. *A. latifolia*, Rolfe, has very broad lvs. and very small whitish yellow red-striped and spotted fls.

**ACRÍSTA** (origin of name unexplained). *Palmaceæ*, tribe *Arécæ*. A tall palm suitable for planting S.

Leaves pinnate, usually very large, from 10–20 in a terminal crown: infl. usually maturing well below the lvs; the spadix 1-branched, the branches coarse, tapering.—Only 1 species, *A. monticola*, confined to Porto Rico, Cuba and St. Kitts. The nearest relative, the royal palm, differs in having a bulging trunk, and in having 2–3-branched infls. See Bull. Torrey Club, 28:555 (1901).

This palm is not as yet common, but well worthy of a wider cultivation. It resembles the royal palm but is shorter, and has a smooth trunk of uniform diameter. For cultivation see *Palms*.

**monticola**, O. F. Cook. Thirty-five to 45 ft.: trunk smooth, with many ring-like scars: lvs. about 6 ft., the lfts. lanceolate in one plane, equally spaced, and nearly at right angles to the rachis: infl. coming out between the lvs., and by the dropping of latter, appearing well below the lf.-crown at maturity; fls. not well known: fr. with lateral stigma, grayish brown, nearly smooth, obovate,  $\frac{1}{2} \times 1$  in. Bull. Torrey Club, 28, pl. 44 (as *Thrincoma alta*).

N. TAYLOR.

**ACROCLINIUM**: *Helipterum*.

112. *Aconitum autumnale*.  
( $\times \frac{1}{2}$ )

means a *tuft of leaves at the top*). *Palmaceæ*, tribe *Bactridinæ*. A showy genus of American palms. Not popular in the trade because of their spiny habit and rather unattractive young state. The adult plants, however, are very graceful.

Leaflets narrowly linear, long, usually obliquely acuminate, the margins naked and recurved, the midrib often spiny on lower sides of lfts.; rachis and petioles usually hairy, always more or less spiny: fls. yellowish, monœcious, the spathes ultimately becoming woody; calyx small, of 3 ovate sepals; corolla of 3 oblong-lanceolate or ovate petals: fr. usually about 1 in. diam., glabrous or sometimes prickly or tomentose.—There are only 8 species, all natives of Trop. Amer. except *A. Totai*. Most closely related to *Cocos*, from which the Amer. species differ in having spines. See G.C. II. 22:427. Bull. Torrey Club, 28:565.

These palms are usually spiny and have large, terminal, pinnate leaves. All except *A. Totai* should be grown in a greenhouse, with a night temperature not lower than 60°. They should be potted in soil similar to that for the coconuts, and, if possible, planted out directly. It has been found by some that overpotting the young plants is a danger likely to be incurred. The palms grow slowly and should not be transferred to a new pot until they become almost pot-bound.

Propagation is by suckers, which come freely in most species. Seeds are not known in cultivation for any of the species except *A. sclerocarpa*.

A. *Trunk greater in diam. a few ft. above the ground than elsewhere; spines 5–6 in. long.*

**mèdia**, O. F. Cook. Trunk 20–30 ft., conspicuously thickened above the ground; spines slender, black, mostly confined to the lower half of the internodes: lvs. opening about as they are pushed out, not spire-like, as in the royal palm, forming a dense crown; lfts. coming out from the rachis at all angles: fr. about  $1\frac{1}{2}$  in. diam., fibrous on the outside, yellowish.—A magnificent palm, known only from U. S. and not common outside of fanciers' collections and botanic gardens.

AA. *Trunks of essentially uniform diam. near base; spines 1–4 in. long.*

B. *Lvs. more or less spreading, and sometimes drooping; trunk predominately spiny throughout, 10–20 ft.*

**mexicana**, Karw. Trunk brown-woolly, and covered with stout spines 1–3 in. long: lvs. terminal. 6–8 ft. long, the sheathing bases armed with long black spines; rachis and petiole spiny; lfts. rather stiff, linear, and shining: spathe very spiny: fr. globose, about 1 in. diam. Mex.—This palm is said to be perfectly hardy at Santa Barbara, Calif.

BB. *Lvs. more or less stiff and erect: trunks predominately more spiny above than below, 30–40 ft.*

**sclerocarpa**, Mart. (*A. aculeata*, Lodd.). Fig. 113. Height 30–45 ft.: trunk cylindrical, about 1 ft. thick, with black spines 2–4 in. long, more common toward the summit than below: lvs. 12–15 ft. long, more or less erect; segms. in irregular groups of 2 or 3, 2–3 ft. long,  $\frac{3}{4}$ –1 in. wide, smooth and shining above, whitish, appressed-pilose below, entirely free of spines, except along the midrib on the under side; rachis tomentose, and bearing a few small spines: fr. yellowish, a little more than 1 in. diam. Brazil to W. Indies. I.H. 15:547.—Not hardy at Oneco, Fla. Cult. in Calif. but apparently not out-of-doors. "Gru-gru" and "corozo" are native names of this palm.

**Totai**, Mart. Trunk 30–40 ft., about 10–15 in. diam., clothed with stout spines, especially near the summit: lvs. not so large as in the preceding, green and glabrous on both sides; petioles tomentose and a little spiny: spathe very spiny, the fls. yellowish: fr. globose, yellow, a little less than 1 in. diam., scarcely known in cult. specimens. Paraguay and Argentine, perhaps in Brazil.—May be grown in coolhouse. Offered in 1912 by Reasoner Bros., Oneco, Fla.

*A. havanensis*, Hort. A slow-growing, thorny plant, of which little is known; a trade name.

N. TAYLOR.

**ACROPÈRA**: *Gongora*.

**ACROPHYLLUM** (Greek, *top* and *leaf*). *Cunoniaceæ*. A monotypic genus allied to *Cunonia*, containing the Australian evergreen shrub, *A. venosum*, Benth. (*A. verticillatum*, Hook.), excellent for spring flowering in the coolhouse. Prop. by cuttings in early summer. Let the plant rest during summer. Do not expose to frost. It produces many pinkish fls. in dense spicate whorls near the top of the branches. Lvs. in 3's, nearly all terminal and above the fls., sessile, dentate or serrate, cordate and acute: fls. with 5 petals and 10 stamens: 4–6 ft. B.M. 4050 (as *A. verticillatum*).

N. TAYLOR.†



**ACROSPIRA** (name of ambiguous application) *Liliacæ*. One species, *A. asphodeloides*, Welw., from Trop. Afr., with the habit of *Eremurus*, and white fls. in spikes; has been offered in Eu.

**ACRÓSTICHUM** (derivation uncertain). *Polyodiaceæ*. As properly delimited, a small genus of coarse tropical swamp ferns, sometimes grown under glass.

Stem stout, erect; lvs. clustered, erect, once-pinnate, 3-8 ft. high; sporangia completely covering the backs of some or all the pinnæ of the fertile lvs.

**aureum**, Linn. Fig. 114. Three to 8 ft. long, with pinnæ 6-10 in. long, short-stalked, coriaceous; sporangia only on upper pinnæ of fertile lvs. Fla. to Brazil and in the tropics of the Old World. S. 1:187.—Strong-growing. One of the best. Should be treated as an aquatic.

**excelsum**, Maxon (*A. lomarioides*, Jenman). Similar in size to preceding; sterile lvs. also similar. Distinguished by having sporangia on all the pinnæ of the fertile lvs. Fla. to Brazil.

*Acrostichum* has been considered to include a much larger array of species, including, as in the previous editions of the *Cyclopedia of Horticulture*, ferns of very diverse form and habit of growth. Fern students, however, are now united in distributing the species of *Acrostichum* as formerly understood among several genera. Thus the species included in *Acrostichum* in the former *Cyclopedia* are here grouped in several genera as follows: **Acrostichum**: (as above).

**Elaphoglossum**: *conforme*, *crinitum*, *flaccidum*, *gorgoneum*, *muscosum*, *pilosum*, *reticulatum*, *simplex*, *squamosum*, *ricosum*, *villosum*; **Leptochilus**: *alienum*, *nicotianæfolium*; **Olfersia**: *cervina*; **Polybotrya**: *osmundacea*; **Rhipidopteris**: *peltata*; **Stenochlæna**: *scandens*, *scrobifolia*.

R. C. BENEDICT.

**ACTÆA** (ancient name of the elder, transferred by Linnaeus). *Ranunculacææ*. **ACTEA**. **BANEERRY**. **COHOSH**. Native hardy herbaceous perennials. Sometimes offered in collections of hardy border plants. Not to be confounded with blue cohosh, which is *Caulophyllum*.

Leaflets of the twice- or thrice-ternate lvs. ovate, sharply cleft, and cut-toothed; fls. small, white, in terminal racemes; sepals 4 or 5, falling early; petals 4-10, clawed; stamens many; fr. a many-seeded berry.

*Acteas* are grown chiefly for the showy spikes of small white flowers in spring, and handsome clusters of berries in autumn. Useful for rockery and wild garden, or for clumps and borders. They thrive in rich woods and shade.

Propagation is by seeds sown in late fall to germinate the next spring or sown in spring. Old seed is said not to germinate well. A more satisfactory means of propagation is by root-division in spring.

**álba**, Mill. (*A. rubra*, Bigel.). **WHITE BANEERRY**. Height 1-1½ ft.: much like *A. spicata*, but the lfts. more cut, teeth and points sharper; plant smoother; fls. white, in an oblong raceme, and a week or two later; pedicels in fr. very thick, turning red; berries white, ovate-oblong, often purplish at the end. N. states.

**spicata**, Linn. **COHOSH**. **HERB-CHRISTOPHER**. Plant 1-2 ft.: lvs. bi- or triternate, serrated; fls. white or bluish, in ovate racemes in Apr. to June; berries purplish black, oblong. Eu., Japan.—Less cult. than the red-fruited variety. Figured as *A. racemosa* in G.W. 5:4 and 14:507. Figured as *A. japonica* in G.M. 50:28 and G.W. 5:3 and 15:173.

**Var. rubra**, Ait. (*A. rubra*, Willd.). **RED BANEERRY**. Rather taller than *A. álba*: lvs. bi- or triternate, serrated; fl.-cluster white, larger than in *A. spicata*; berries bright red, very handsome. Northern states.

**Var. arguta**, Torr. Sts. rather taller than *var. rubra*: lfts. very deeply incised; racemes elongated in age; berries either red or white. Neb., W., and N. W.

K. C. DAVIS.

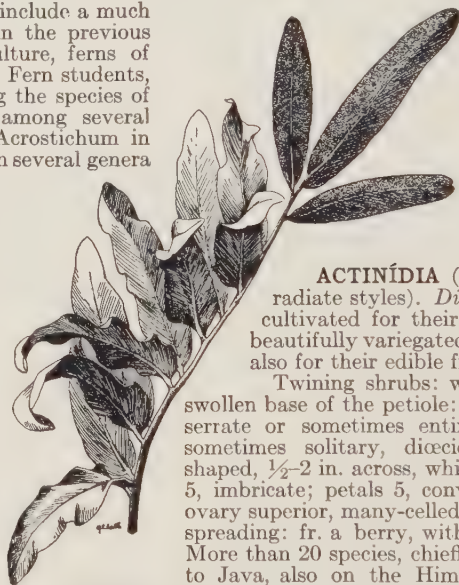
**ACTINÉLLA** (Greek, *small-rayed*). *Tetraneüris*, Greene. *Compósitæ*. Hardy perennials from W. N. Amer., for cult. in alpine gardens and the open border. Height 6-12 in.: fls. tubular and radiate, yellow; bracts of the involucre appressed; rays 3-toothed.—Of easy culture in light soil. Prop. by division of the roots in spring, or by seeds.

**grandiflora**, Torr. & Gray (*Rydbergia grandiflora*, Greene). Plant densely woolly; lower lvs. pinnately or bipinnately parted, with margined petioles from broad, scarious bases; upper cauline lvs. simple or sparingly divided; fls. 2-3 in. wide; summer.—A pretty alpine plant.

**scaposa**, Nutt. Plant villous: lvs. radical, linear-spatulate, 2-3 in. long, punctate, entire; fls. 1 in. wide; scapes single, leafless, 1-flid., 3-9 in. long.

*A. lanata*, Pursh=*Eriophyllum cæspitosum*.—*A. lanata*, Nutt. Short, densely hairy lvs. with scape 5-9 in. long. Summer.

N. TAYLOR.†



114. *Acrostichum aureum*. (×¼)

**ACTINÍDIA** (*aktis*, ray; referring to the radiate styles). *Dilleniaceæ*. Climbing shrubs cultivated for their handsome foliage which is beautifully variegated in some species, and a few also for their edible fruit.

Twining shrubs: winter-buds inclosed in the swollen base of the petiole; lvs. alternate, long-stalked, serrate or sometimes entire; fls. in axillary cymes sometimes solitary, diceious or polygamous, cup-shaped, ½-2 in. across, white or rarely reddish; sepals 5, imbricate; petals 5, convolute; stamens numerous; ovary superior, many-celled; styles numerous, ray-like spreading; fr. a berry, with numerous small seeds.—More than 20 species, chiefly in E. Asia from Saghalin to Java, also on the Himalayas. A revision of the genus has been published by Dunn in Jour. Linn. Soc. Bot. 39:394-410 (1911).

About 7 species are in cultivation; of these *A. Kolomikta* is the hardiest, growing as far north as eastern Canada; *A. arguta* and *A. polygama* are hardy in Massachusetts, while *A. chinensis*, which is the most beautiful of all, and *A. coriacea*, are hardy only south of Washington, but may be grown farther north if taken down in autumn and covered with leaves. *A. arguta* is excellent for covering arbors, trellises, walls and the like and is remarkably free from insects and fungi. *A. Kolomikta* and *A. polygama* show a very striking silvery white or pinkish variegation of the foliage, which is more pronounced in the staminate plant. *A. arguta* and *A. chinensis* are also worth cultivating for their edible fruits, particularly the latter, which has fruits up to 2 inches long, of a gooseberry-like flavor; to obtain fruit, it is necessary to plant both sexes or a plant with polygamous flowers. *A. polygama*, and, in a lesser degree, *A. Kolomikta*, attract cats and are often destroyed by them if not protected by screens.

The actinidias prefer somewhat moist and rich soil and grow as well in a sunny as in a half-shady position.

Propagation is by seeds, which are sown in spring and germinate readily; also by cuttings, of half-ripened wood in summer or by hardwood cuttings under glass, and also by layers.



- A. Branchlets glabrous: lvs. glabrous beneath or only pubescent on the veins, acuminate.  
 B. Lvs. dark green, shining above, chartaceous, never variegated: anthers dark purple.

**arguta**, Miq. (*A. polygama*, Lauche, not Miq. *A. volubilis*, Carr., not Miq. *A. rufa*, Miq.). Fig. 115. High-climbing: branches with brown lamellate pith: lvs. broad-elliptic or broadly ovate, 4-5 in. long, cuneate to subcordate at the base, setosely appressed serrate, glabrous beneath except the setose midrib:



115. *Actinidia arguta*. ( $\times \frac{1}{3}$ )

fls. 3 or more, white,  $\frac{3}{4}$  in. across; sepals elliptic-oblong, tomentulose; petals brownish at the base: fr. subglobose, greenish yellow, about an inch long, sweet. June. Japan, Korea, Manchuria. L.I. 25. R.H. 1874, p. 394. B.M. 7497 (as *A. polygama*). A.G. 1891:147. M.D.G. 1895:97; 1898:378. G. 29:503.

BB. Lvs. bright green, membranous, often variegated: anthers yellow: fls. 1-3.

**polygama**, Maxim. To 25 ft.: pith of branches solid, white: lvs. broadly ovate to ovate-oblong, 3-6 in. long, rounded or subcordate at the base, appressed serrate, mostly setose on the veins beneath, variegation white or yellowish: fls. white,  $\frac{3}{4}$  in. across; ovary bottle-shaped: fr. yellow, bitter. June. Japan, Korea, Manchuria to Cent. and W. China.—Known as silver vine on account of the beautiful silvery white color of the young lvs. of the staminate plant.

**Kolomikta**, Maxim. Climbing 15 ft. high: pith of branches lamellate, brown: lvs. ovate-oblong, 4-5 in. long, rounded or cordate, unequally setosely serrate, pubescent on the veins beneath, variegation white or pink: fls. white,  $\frac{3}{4}$  in. across; ovary cylindric: fr. oblong-ovoid, blue, sweet. June. Japan, Saghalin, Manchuria, Cent. and W. China. R.H. 1898:36. M.D.G. 1896:397. G.W. 3, p. 61.—The staminate plant is very striking with its beautifully white and carmine variegated young lvs.

AA. Branchlets densely hairy: lvs. tomentose beneath, usually rounded or emarginate at the apex.

**chinensis**, Planch. Climbing, to 25 ft.: hairs of young branchlets and lvs. bright red; pith of branches lamellate: lvs. orbicular or oval, cordate, firm, 3-5 in. long, ciliate-serrulate, finally glabrous above and dark green, whitish beneath: fls. several, creamy white,  $1\frac{1}{2}$ -2 in. across: fr. ovoid or subglobose, 1-2 in. long, hairy, edible. China. G.C. III. 46:77 and 79. R.H. 1909, p. 473. J.H.S. 1903:59. H.I. 16:1593.—The most beautiful of the actinidias with the largest fls. and a

promising fruiting vine; the frs. have the flavor of a gooseberry.

**A. callosa**, Lindl. Similar to *A. Kolomikta*. Branchlets with conspicuous lenticels, with lamellate pith: lvs. oval to oblong, 3-5 in. long, serrulate, quite glabrous: fls. white,  $\frac{1}{2}$  in. across: fr. ovoid, spotted, 1 in. long. China.—*A. coriacea*, Dunn. Allied to the preceding species. Lvs. coriaceous, oblong to lanceolate, remotely serrate, 3-4 in. long; petioles less than 1 in. long: fls. several, reddish: fr. ovoid, spotted,  $\frac{1}{2}$ - $\frac{3}{4}$  in. long. China. Recently offered under the name of *A. Henryi*, which is a totally different species, allied to *A. chinensis*.—*A. melanandra*, Franch. Allied to *A. arguta*. Lvs. ovate-oblong or oblong, closely serrulate: staminate corymbs many-fl.; petals greenish at the base: fr. purple. China.

ALFRED REHDER.

**ACTINÓLEPIS** (Greek, a scale-like ray). *Compositæ*. About 6-8 species of hardy annuals, mostly from Calif.; freely branching, and mostly yellow-fl. The fls. are in pedunculate heads at the tips of the branches; rays usually 2-3-toothed, in one series: lvs. opposite. Considered by de Della Torre and Harms to be a section of the genus *Eriophyllum*, and by Gray to belong properly to *Baeria*.

**coronaria**, Gray (*Shörtia californica*, Hort. *Baeria coronaria*, Gray). Fig. 116. Lvs. opposite, except the upper ones, 2 in. or more long, pinnately, or the lower ones bipinnately, parted into linear, narrow divisions: pappus of awned or of muticous, often erose paleæ, rarely wanting. B.M. 3828 (as *Hymenozys californica*).—One of the prettiest of annual fls., and deserving of greater popularity. Excellent for edging. An everlasting.

N. TAYLOR.†

**ACTINÓMERIS** (from Greek *aktis*, ray, and *meris*, part, alluding to the irregularity of the rays). *Compositæ*. Native hardy herbaceous perennials suitable for wild gardens and shrubbery.

Tall, branching, yellow-fl. herbs, with aspect of native sunflowers, but with smaller fls.: lvs. often decurrent on the stem: fls. in corymbose or solitary heads, composed of both ray and tubular fls.—Cult. like *Helianthus*. Prop. by division.

**squarrosa**, Nutt. (*Verbesina alternifolia*, Linn.). Height 4-8 ft.: lvs. lance-oblong, acuminate, toothed, subpetiolate, tapering to both ends: fls. numerous, corymbed, yellow, 1-2 in. across; rays 2-10, irregular. Autumn. E. N. Amer.

*A. helianthoides*, Nutt. (*Verbesina helianthoides*, Michx.). Lvs. silky villous underneath: rays about 8, usually more than in *A. squarrosa*. Mn. 4:129.—*A. procera*, Steud., is only a taller form of *A. squarrosa*.

N. TAYLOR.†

**ACTINÓPTERIS** (*aktis*, ray, and *pterus*, the leaves radiately cut). Syn., *Actinópteris*. *Polypodiaceæ*. Greenhouse ferns from India, resembling miniature fan-palms. The sori are linear-elongate and submarginal, and covered with indusia. *A. radiata*, Link (*A. australis*, Linn. f.) is the only recognized species. Apparently not in the horticultural trade.

**ACTINOSTÉMMMA** (ray and wreath or stems). *Cucurbitaceæ*. Three or 4 species of climbing or running plants from China and Japan, of which *A. paniculatum*, Maxim., has been grown in European collections. It is a hardy perennial in Cent. Eu., with tuberous roots, palmate lvs. and small fls.; said to thrive in dry and barren places.



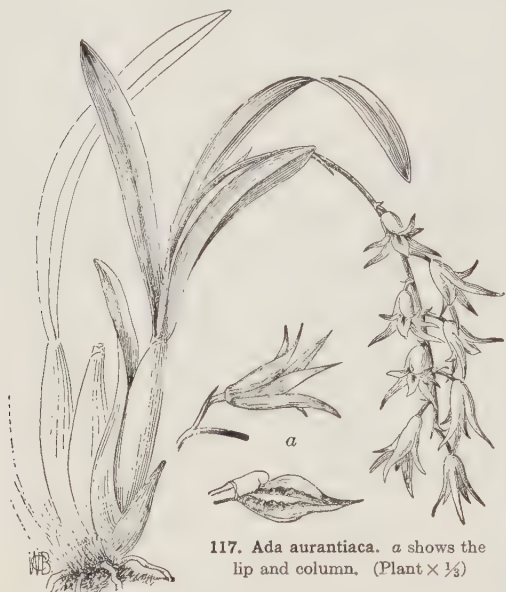
116. *Actinolepis coronaria* flower.

**ÀDA** (a complimentary name). *Orchidaceæ*. Epiphytic coolhouse orchids.

Pseudobulbs elongated, bearing at the apex 1-3 coriaceous lvs.: fls. nodding, in a somewhat 1-sided raceme, terminating the lateral leafless scape; sepals nearly equal, free, usually spreading above; petals similar to the sepals but smaller; lip sessile, continuous with the base of the column, entire, shorter than the

sepals; pollinia 2.—Species 2, natives of the Colombian Andes.

*Ada aurantiaca* is a coolhouse orchid and will thrive well with the odontoglossums where they are cultivated; the bright orange-colored blooms add interest to the collection when in spring display. The culture is



117. *Ada aurantiaca*. *a* shows the lip and column. (Plant  $\times \frac{1}{4}$ )

simple if potted in peat fiber with plenty of drainage; sphagnum may be added if it can be made to grow, but if not it becomes sour and inert, and is best left out of the material for cool orchids. Adas are evergreen and should never be dried at the roots as they grow in boggy soil at 8,500 feet elevation in Colombia. There is another species, *A. Lehmannii*, which is very distinct, but since the unfortunate death of Consul Lehmann, it seems never to have been reintroduced to cultivation. (Orpet.)

*aurantiaca*, Lindl. Fig. 117. Pseudobulbs 2–3 in. long, usually somewhat compressed, tapering, bearing 1–3 lvs. up to 12 in. long; fls. cinnabar, the sepals and petals lanceolate, twice as long as the lip. B.M. 5435. C.O., pl. 1. G.C. III. 43:247. F.W. 1873:225. Var. *maculata*, Hort. Sepals and petals spotted with dark brown. C.O., pl. 1a. GEORGE V. NASH.

ADAM-AND-EVE: *Sempervivum tectorum*, and *Aplectrum hyemale*.

ADAMÀRA (from a personal name). *Orchidaceæ*. A name proposed by the Royal Horticultural Society of London to cover the multigeneric hybrids of the genera *Brassavola*, *Cattleya*, *Epidendrum* and *Lælia*, the name *Linneara* being proposed for combinations of certain other orchid genera. The International Congress of Horticulture held at Brussels in 1910 adopted *Linneara* for four genera named above, and legislated that "multigeneric hybrids receive a conventional generic name, preferably that of a distinguished man, to which is added the termination *ara*. A distinct generic name will be formed for each different combination of genera." See *Linneara*; also *Brasso-cattleya*.

ADÀMIA: *Dichroa*.

ADAM'S APPLE: *Citrus Limetta*, *Musa paradisiaca*, and *Tabernaemontana coronaria*.

ADAM'S NEEDLE: *Yucca*.

ADANSÒNIA (named after M. Adanson, French botanist). *Bombacaceæ*. A genus of 10 species of tropi-

cal shrubs and trees, closely related to *Bombax*: fls. large, pendulous; petals 5, white, obovate; stamens numerous, united in a column about the styles; ovary 5–10-celled: fr. oblong, woody, indehiscent, filled with a mealy pulp in which are numerous seeds.

*digitata*, Linn. BAOBAB TREE. Figs. 118, 119. Height not more than 60 ft.: diam. said to be sometimes 30 ft. or more and to have the thickest trunk of any tree in the world: lvs. palmate, with 3 lfts. in young plants, and 5–7 in older ones; fls. 6 in. across, with purplish anthers, on long axillary, solitary peduncles; stigma 7–10-rayed in full anthesis. Afr. B.M. 2791–2792. G.C. III. 27:57.—Rarely cult. in extreme S. Fla., where fr. is 9–12 in. long, and called "monkey's bread." Figs. 118 and 119 are from specimens growing in the American tropics. The fl. opens wide, something like a spreading hibiscus, and the petals soon roll back and wither, as shown in Fig. 119. The tree is very thick-boled, and the wood is soft and light. The tree is supposed to attain to vast age. The fr. of the baobab is a gourd-like structure, of which the pulp is said sometimes to be eaten and the juice used for the making of a beverage. The bark produces a very strong fiber.

N. TAYLOR.†

ADDER'S-TONGUE: *Erythronium*.

ADDER'S-TONGUE FERN: *Ophioglossum*.

ADÈLIA (Greek, *adelos*, obscure, from the small flowers). *Ricinella*, Muell. Arg. *Euphorbiaceæ*. Thorny, Trop. American trees, rare in cult. and probably of little horticultural value. Lvs. alternate, short-petioled, clustered on short side branches: fls. dioecious in axillary clusters or the pistillate single; stamens 8–15. *A. Ricinella*, Linn., is the best known. Those grown under the name of *A. acidotonis* should perhaps be referred to *Securinega buxifolia*.

J. B. S. NORTON.

ADÈLIA: *Foerstiera*.

ADENÁNDRA (from the glandular anthers). *Rutaceæ*. Small, summer-flowering, tender shrubs from the Cape of Good Hope.

Lvs. alternate, small, leathery, subsessile, entire, glandular-dotted: fls. white or rosy, solitary and usually terminal; petals obovate; stamens 5, alternating with 5



118. *Adansonia digitata*.—Baobab tree as grown in American tropics.

staminodia which are longer than the stamens.—About 20 species. Prop. by cuttings from the ripened wood.

*fràgrans*, Roem. & Schult. (*Diósma fràgrans*, Sims). BREATH OF HEAVEN. Height 2–3 ft.: lvs. oblong, obtuse, dark green above, whitish beneath, with a glandular, denticulate margin: fls. rosy. B.M. 1519.—A favorite in Calif.

The following are sometimes cultivated in botanic gardens: *A. amàna*, Bartl. & Wendl. 1–2 ft.: lvs. oblong or oval, obtuse, glabrous, dotted beneath: fls. white above, reddish beneath.—*A.*



*coriacea*, Lichtst. 1-2 ft.: lvs. oblong, obtuse, glabrous, revolute: fls. solitary, terminal, pink.—*A. umbellata*, Willd. 1-2 ft.: lvs. oblong or obovate, dotted beneath, fringed on the edges: fls. sessile or nearly so, terminal, pink, the petals fringed.—One of the best.

N. TAYLOR.†

**ADENANTHÈRA** (from the deciduous pedicellate gland on each anther). *Leguminosæ*. A group of 4 species of tender trees, allied to *Mimosa*. Lvs. bipinnate or decompound: fls. small, racemose, usually golden yellow or whitish.—The following unarmed evergreen tree is cult. in greenhouses only for its economic interest, and also in Calif. in the open air. Prop. by seeds, which should be softened in hot water previous to sowing.

**pavonina** Linn. RED SANDALWOOD TREE. Lfts. about 13, ovate, obtuse, glabrous on both faces: fls. in an axillary spike-like raceme, white and yellow in the same cluster. Trop. Asia, where it grows to a tree of great size.—The red lens-shaped "Circassian seeds" are curiosities with travelers, and are used for necklaces, and the like. Plant sometimes called "peacock flower fence."

N. TAYLOR.†

ADÈNIA: *Modocca*.

**ADENOCALÝMMA**, (*glandular covering*; referring to leaves, etc.). Sometimes but incorrectly, spelled *Adenocalymna*. *Bignoniaceæ*. More than 50, mostly Brazilian, species of tender climbing shrubs, closely allied to *Bignonia*. Fls. large, yellow or orange, bracteate, racemose, trumpet-shaped: lvs. ternate or bipinnate. Grown in hothouses, requiring considerable moisture. Prop. by cuttings in frames.

**comòsum**, DC. St. rough, punctate: lvs. opposite, trifoliate; petioles thickened at junction with the blades: racemes so densely clothed at first with large bracts as to suggest the aments of the hop-vine; fls. 2 in. across, brilliant yellow, trumpet-shaped; upper lip of 2, and lower lip of 3 rounded, waved lobes. Brazil. B.M. 4210.

*A. nitidum*, Mart. 10 ft.: lvs. trifoliate or unifoliate ten-drilled, the lfts. elliptic-oblong: fls. yellow in axillary and terminal racemes.

N. TAYLOR.†

**ADENOCÁRPUS** (*aden*, gland, *karpos*, fruit; easily distinguished from allied genera by its glandular pod). *Leguminosæ*. Ornamental woody plants cultivated chiefly for their yellow flowers.

Shrubs, rarely small trees, more or less pubescent: lvs. alternate, trifoliate, small: fls. papilionaceous, yellow, in terminal racemes; calyx 2-lipped, the 2 upper teeth free, the 3 lower more or less connate: fr. a glandular pod, oblong or linear, compressed.—About 14 species in S. Eu., Asia Minor, N. and W. Afr., Canary Is. This genus consists of low shrubs, rarely more than 3 ft., of spreading habit, with handsome fls. produced profusely in spring; very attractive when in full bloom.

They require a sunny position and well-drained soil. They are especially adapted for temperate regions, but do not bear transplanting well, and should be grown in pots until planted. They are also handsome greenhouse shrubs, and grow best in a sandy compost of peat and loam.

Propagation is by seeds and greenwood cuttings in spring; sometimes also by layers and grafting.

*A. Branchlets pubescent or tomentose: lvs. persistent, crowded.*

**viscòsus**, Webb & Berth. (*A. Anagýrus*, Spreng. *A. frankenioides*, Choisy). Branchlets pubescent: lfts. linear-oblong, folded: fls. crowded, in short racemes; calyx glandular, the lateral segm. of the lower lip longer than the middle one, exceeding the upper lip. Teneriffe.

**hispánicus**, DC. Shrub, about 6 ft. or more: branchlets velvety-pubescent: lfts. lanceolate, acute, tomentose

beneath: racemes dense, oblong, many-fl'd., short-peduncled; calyx pubescent and glandular; segms. very unequal, those of the lower lip nearly equal, but much longer than those of the upper lip. Spain.

**decòrticans**, Boiss. (*A. Boissieri*, Webb). Shrub or small tree, 15-25 ft.: branches tomentose: lfts. linear, pubescent: racemes short, compact; calyx villous, segms. nearly equal. Spain. R.H. 1883:156. G.C. II. 25:725. Gn. 30:498.—Resembles English gorse, but is thornless. Bark peels naturally. Thrives in poor, sandy soil.

*AA. Branchlets soon glabrous: lvs. deciduous.*

**complicátus**, Gay (*A. divaricátus*, Sweet. *A. parvifolius*, DC.). Much-branched shrub, 1-3 ft.: lvs. deciduous, fasciated; lfts. obovate or oblong-lanceolate, pubescent beneath, often folded: fls. in elongated racemes; calyx pubescent, usually glandular, middle segm. of the lower lip longer than the lateral ones, usually much



exceeding the upper lip. S. Eu., Orient. B.M. 1387 (as *Cytisus divaricátus*). Var. **interinèdius**, Aschers. & Graebn. (*A. intermèdius*, DC.). Branchlets villous: calyx glandular, with very unequal lips. Spain, Portugal, Madeira. Var. **commutátus**, Aschers. & Graebn. (*A. commutátus*, Guss. *A. telonénsis*, DC., not Robert). Racemes usually short; calyx not glandular, with the lips little differing in length. S. Eu., Orient.

*A. foliolòsus*, DC. Branches and lvs. crowded, villous: racemes compact, many fl'd.; calyx villous. Canary Is.—*A. grandiflorus*, Boiss.—*A. telonénsis*.—*A. uermèdius*, DC.—*A. complicatus*, var. *intermedius*.—*A. parvifolius*, DC.—*A. complicatus*, Gay.—*A. telonénsis*, Robert (*A. grandiflorus*, Boiss.). Branches and lvs. glabrous: racemes few-fl'd.; calyx pubescent. S. France, Spain.—*A. telonénsis*, DC.—*A. commutatus*.

ALFRED REHDER.

**ADENÓPHORA** (*gland-bearing*; referring to the cylindrical nectary which surrounds the base of the style). *Campanulacæ*. Campanula-like border perennials.

Herbs, differing from *Campanula* chiefly by the style being surrounded by a cylindrical gland: corolla ball-shaped, 5-lobed: stamens free from corolla, the filaments dilated and ciliate toward base; caps. 3-celled.—About 14 species of hardy herbaceous perennials in Siberia, China and Japan. Fls. blue, nodding, on short pedicels, produced freely in midsummer in slender but stiff, erect panicles or loose racemes.—For cult. see *Campanula*.

Propagation is by seeds or cuttings in spring. The

plants do not take kindly to division or other disturbance of the roots. Many other species than those in the trade are worthy.

**communis**, Fisch. (*A. liliflora*, Schur. *A. Fischeri*, Don. *A. lilifolia*, Ledeb.). Radical lvs. petiolate, ovate-rotund, cordate, crenate-dentate; cauline lvs. sessile, ovate-lanceolate, coarsely serrate; fls. numerous, in a pyramidal panicle; lobes of the calyx triangular; style exserted.

**Lamárckii**, Fisch. Lvs. ovate-lanceolate, sharply serrate, ciliate, otherwise glabrous; fls. racemose; lobes of the calyx lanceolate; style not exserted.

**Potaninii**, Hort. Shrubby; spikes 2-3 ft. high; fls.  $\frac{1}{4}$  in. across, light blue. July, Aug. Intro. 1899.

**polymorpha**, Ledeb. Three ft. lvs. verticillate, the whorls remote, and small fls. which are darker in color than *A. Potaninii*. Aug. Russia. Var. **stricta**, with more erect habit than the type, seems to be more common.

*A. coronopifolia*, Fisch. 1-3 ft.: radical lvs. petiolate, ovate-rotund, cordate, crenately toothed, hairy; upper lvs. sessile, entire or nearly so, glabrous, and linear lanceolate; fls. racemose, 3-10 in a cluster, blue, each fl. on a slender pedicel. June. Dahuria.—*A. denticulata*, Fisch. (*A. tricuspidata*, DC.).  $1\frac{1}{2}$ -2 ft.: upper lvs. sessile, ovate-lanceolate, the lower and radical ones petioled and more or less orbicular; fls. small, blue, pedicellate, in a terminal, loose raceme. July. Dahuria.—*A. Gmelinii*, Fisch. 1-2  $\frac{1}{2}$  ft.: lvs., or at least the upper ones, linear, narrow, entire or nearly so, and quite glabrous; fls. blue, 3-10 in a second racemose cluster which is axillary near the upper part of the st. Dahuria.—Suitable for dry and stony places.—*A. intermedia*, Ledeb., not Sweet (*A. coronata*, DC.). Plant 2-3  $\frac{1}{2}$  ft.: radical lvs. petiolate, cordate, toothed; upper lvs. acutish at base, serrate, crowded; fls. pale blue, racemose, small. May. Siberia.—*A. periplocifolia*, DC. A dwarf (3 in.) perennial suitable for rockeries, with ascending st.: lvs. petiolate, ovate, acute at the apex, slightly cordate at the base, crenately serrate; fls. usually solitary and scapose, pale blue. June. Siberia.—*A. stylosa*, Fisch. 1-2 ft., erect; lvs. petiolate, the lower obovate and sinuate, the upper ovate, acuminate, quite glabrous; fls. few, racemose, the raceme naked, and lax. May. E. Eu.—*A. verticillata*, Fisch. 2-3 ft.: st. simple; lvs. whorled, serrate, the upper ovate-lanceolate, the lower petiole, sub-orbicular; fls. pale blue, small, arranged in irregular clusters near the top of the st., some, along the lower part of the st., in whorls. June. Dahuria.

N. TAYLOR.†

**ADENÓSTOMA** (*aden*, gland, *stoma*, mouth; calyx with five glands at the mouth). *Rosaceæ*. Ornamental woody plants, cultivated chiefly for their handsome white flowers.

Evergreen, somewhat resinous shrubs, rarely small trees; lvs. linear, small; fls. white, about 1-5 in. broad, in terminal panicles; calyx-tube obconical, with 5 short teeth and 5 glands at the mouth; petals 5, stamens 10-15; pistil 1, with the lateral style strongly curved above the base; fr. a small achene, inclosed in the persistent calyx-tube.—Two species in Calif.

The adenostomas are heath-like evergreen shrubs; very handsome when in full bloom. They may be cult. in temperate regions in a sunny position and well-drained soil. *A. fasciculatum* stands many degrees of frost. Prop. is by seeds and greenwood cuttings in spring.

**fasciculatum**, Hook. & Arn. Shrub, 2-20 ft.: lvs. fasciculate, linear, about  $\frac{1}{4}$  in. long; panicles rather dense, 2-4 in. long; fls. nearly sessile. May, June. Ranges northward to Sierra Co.—The characteristic shrub of the chaparral or chamisal regions of the coast ranges of Calif. Hooker & Arnott, Bot. Beechey's Voy. 30. Intro. 1891.

**sparsifolium**, Torr. Shrub or small tree, 6-12 ft., rarely 30 ft., resinous; lvs. alternate; panicles loose; fls. pedicelled, larger,  $\frac{1}{2}$  in. across, fragrant. S. and Low. Calif. Emory Rep. U. S. and Mex. Bound. Surv. 20. Intro. 1891.

ALFRED REHDER.

**ADENÓSTYLES** (from *aden*, a gland, and *stylus*, a style, in allusion to warty glands of the stigmas). *Compositæ*. A little-known group of hardy perennials, grown for their purplish or whitish flowers, perhaps known in America only in botanic gardens.

Leaves alternate or radical, usually broad, the petiole frequently dilated into a stipule-like, st.-clasping base; fls. in medium-sized heads, the fls. all tubular, long, exserted; involucre cylindric or bell-shaped, its bracts small and unequal.—There are only 5 species, all natives of Cent. S. Eu. None is of horticultural importance. May be grown in the open border. Prop. is by seed and division.

**albifrons**, Reichb. A much-branched, hairy perennial, 2-3 ft.: lvs. on the lower surface cottony, bright green above, almost round and deeply cordate; basal lvs. long-stalked; the stalks eared; heads 15-20-fl., purple, rather attractively paniculate or corymbose. Woody mts., S. Eu. July, Aug.

*A. alpina*, Bluff. & Fingeruth. A lower, smooth perennial, with the heads 3-6-fl.; is scarcely known in Amer. It is not so showy as *A. albifrons*. S. Eu.

N. TAYLOR.

**ADÉSMIA** (*not bound*; referring to the free stamens). *Leguminosæ*. More than 100 species of tender herbs, shrubs or sub-shrubs from S. Amer., allied to the peanut. Lvs. abruptly pinnate, ending in a bristle; fls. axillary, solitary, or sometimes racemose and terminal. Some of them are showy.

*A. balsamica*, Bert. Lvs. 1-1  $\frac{1}{2}$  in. long; lfts. 10-16 in pairs; racemes 3-8-fl.; fls.  $\frac{3}{4}$  in. across, golden yellow. Chile. B.M. 6921.—Has the odor of balsam.—*A. boronioides*, Hook. A pretty shrub, warted all over, except the petals and lfts., with large balsamiferous glands; lvs. 1  $\frac{1}{2}$ -2 in. long, made up of from 10-13 pairs of sessile, orbicular, coarsely crenate, dark green lfts.; fls. bright orange-yellow, in terminal racemes. Patagonia. B.M. 7748.—*A. glutinosa*, Hook. & Arn. 2 ft., shrubby; the branches clothed with glutinous hairs; lvs. with 3-4 pairs of hairy elliptic lfts.; fls. yellow, racemose and terminal. Chile.—Neither is in the American trade, but both cult. in botanic gardens.

N. TAYLOR.†

**ADHÁTODA** (native name). *Acanthaceæ*. About 25 species of tender shrubs, distinguished from Justicia by the less-spurred anthers, and often by the habit and calyx, but considered by de Dalla Torre and Harms as a mere section of that genus. Fls. whitish or purplish; calyx 5-cleft, often exceeded by the bracts; corolla long-tubed, the limb prominently 2-lipped; stamens 2. For culture, see *Justicia*.

**cydoniæfolia**, Nees. BRAZILIAN BOWER-PLANT. Lvs. opposite on short petioles, ovate; lower lip broadly obovate, purple. Brazil. B.M. 4962. F.S. 12:1222. R.H. 1873:110.—Cult. in Calif.

*A. Vásica*, Nees. Lvs. ovate-lanceolate, acuminate; fls. white, streaked red or purple. Ceylon. B.M. 861 (as *Justicia Adhatoda*).

N. TAYLOR.†

**ADIANTÓPSIS** (Greek, *like Adiantum*). *Polypodiaceæ*. Like *Adiantum*, but differing in having the sori simple, one to each veinlet and not occupying the ends of several veinlets, as in *Adiantum*.—A small genus, little known in cult.

**pedata**, Moore (*Cheilanthes pedata*, R. Br.). Lvs. cespitose, on long (9-12 in.) sts., about 6 in. either way, the 3 divisions bipinnatifid; sori numerous, placed on both sides of the segm. Jamaica, Cuba.

R. C. BENEDICT.

**ADIÁNTUM** (Greek, *unwetted*). *Polypodiaceæ*. MAIDENHAIR FERN. A large, widely distributed genus of ferns, mainly of tropical countries, some of them popular greenhouse and conservatory plants.

The leaves have usually polished black or purplish stalks, the blades thin and delicate, simple or divided into usually fan-shaped segments, with the outer margins revolute, covering linear sori. Of the one hundred or more species, only one, *A. pedatum*, occurs, commonly in temperate North America. A few others are found in the southwestern states and in Florida. *A. cuneatum* is the most frequently cultivated of the exotic species.

The genus *Adiantum* furnishes some of the most useful and popular species of commercial ferns. They are easy of cult. They need a slightly shaded position, moderately moist atmosphere, and a temp. of 60-



65° F. The soil should be composed of rich loam and leaf-mold in equal parts, and should be kept moderately moist. Some of the most useful ones for general purposes (given under their trade names) are: *A. æmulum*, grows about 12–15 in. high, and has very graceful dark green fronds; *A. bellum*, a dwarf, very compact species, 6–8 in.; *A. cuneatum*, *A. cuneatum* var. *grandiceps*, with long, heavily crested, drooping fronds; *A. cuneatum* var. *variegatum* making a neat specimen; *A. concinnum*, gracefully drooping dark green fronds 15 in. long, with overlapping pinnae; *A. concinnum* var. *lætum*, of upright growth, is 24 in. high; *A. decorum* very useful, 12–15 in., and has young fronds of a pleasing metallic tint; *A. excisum* var. *multifidum*; *A. formosum*; *A. Fergusonii*; *A. fragrantissimum*; *A. pubescens*; *A. tenerum* and var. *roseum*; *A. Wiegandii*; *A. LeGrandii*, very dwarf; *A. mundulum*, a very neat, dwarf species; *A. rubellum*, a dwarf species with mature fronds light green, young fronds of a deep ruby tint. The above may easily be grown from spores, if sown on a compost consisting of half each of finely screened clean soil and leaf-mold or peat, and placed in a moderately moist and shady place in the greenhouse in a temp. of 60° F. To be grown most economically, they should be transplanted in clumps of 3 or 4 plants as soon as the first pinnae have appeared, and, as soon as strong enough, potted off, either in clumps or singly. Some very desirable species to grow into large, tall specimens are: *A. æthiopicum*, *A. Bausei*, *A. Collisii*, *A. Fergusonii*, *A. formosum*, *A. Lathomii*, *A. peruvianum*, *A. princeps*, *A. rhomboideum*, *A. Sanctæ-Catharinæ*, *A. trapeziforme*, and *A. Williamsii*. The following are also recommended for special purposes: for fern-dishes, *A. fulvum*; for cutting, *A. gracillimum*. The following kinds are economically prop. by division, temp. 65° F.: *A. Farleyense*, the different varieties of *A. Capillus-Veneris*, *A. rhodophyllum*, *A. assimile*. Some kinds, as *A. dolabriforme*, *A. cavatum* and *A. Edgeworthii*, form small plants on the ends of fronds, which may be detached and potted separately, and if kept in a close atmosphere will in a short time grow into choice little plants. Temp. 65–70° F. (Nichol N. Bruckner.)

The following directions (mostly for commercial growing) are prepared for this entry by James C. Clark:

Adiantums, when grown in large quantities, are best propagated from spores sown in pots or pans, 6-inch being a good size, pots being preferred to pans as they maintain a more constant and equal moisture. The pots should be filled with two-thirds good drainage (coal-ashes or potsherds are very suitable), top-dressed with one-third sterilized loam mixed with one-tenth part of sharp sand finely sifted and evenly pressed down in the pot, so that the top of the soil will be about  $\frac{1}{4}$  inch below the rim. The pots should then be placed on a greenhouse bench, under shaded glass, and where a temperature of 65° to 70° can be maintained. Then water until they are thoroughly soaked (and to make sure that they are wet, water again; it is impossible to make too wet). Allow to drain for an hour or so and then dust the spores evenly, and as thinly as possible, over the surface and cover immediately with glass. The glass should remain on, and no water should be required or given, unless by dipping, until the spores have developed to the prothallus stage, when it will be advantageous to give a slight watering, using a very fine rose, and raise the glass 8 inches above the pots, supporting so that a free current of air can pass directly over the pots.

At this stage of their development adiantums, like all other fern prothalluses, must never be allowed to become dry. At the same time, great care must be exercised so that there will be sufficient air to prevent damping and yet no direct draft either from the heating pipes or ventilators to cause wilting or drying out of the pots.

As soon as the first real fronds appear (generally in

eight to twelve weeks from time of sowing, according to season of year; eight weeks in spring and summer; twelve weeks in fall or winter), the seedlings should be transplanted in small clumps of three to five seedlings each, into flats or seed-pans, spaced about 1 inch apart, and placed in a close warmhouse, in a night temperature of 65° to 70°, until the seedlings show signs of taking root and making new fronds, when the temperature may be lowered to 60° at night and 65° to 70° in the day. This temperature will be found to suit all adiantums (except *A. Farleyense*), in all stages of their future development.

When the transplanted seedlings are about 1 inch high, they may be placed in small pots and repotted into larger ones as soon as they require it. In potting, a good compost consists of nine parts of loam and one part of well-rotted cow-manure, the pots being provided with good drainage, especially the larger sizes. In potting, the crown of the plant should be placed deep enough so that it will be covered with  $\frac{1}{4}$  to  $\frac{3}{4}$  inch of fresh soil, making the soil only moderately firm (never hard). Place the plants in a greenhouse, spaced so that there will be a free circulation of air all around the plants, the glass moderately shaded from March 15 to November 1, and all shade removed during the winter months, giving as much ventilation (without draft) as possible. The soil should be kept moderately moist at all times and a good atmospheric moisture maintained by wetting down the walks, but at no time should the foliage be wet more than possible. Well-drained, solid beds are better adapted to the growth of adiantums than tables, but, if grown on the latter, a  $\frac{1}{2}$ -inch overhead heating-pipe over each table, say 18 inches above the foliage, will be found of great assistance in overcoming the condensation that is so destructive to the foliage when the plants are grown on tables.

Treated as above, adiantums can be grown into 6-inch pot specimens in one year from time of sowing spores, and when grown rapidly are seldom troubled with insect pests, unless it be green-fly, which can be kept under control by a weekly application of nikoteen, using two ounces to five gallons of water, applied in as fine spray as possible.

Specimen adiantums, in 8-inch pots or larger, can be grown in the same-sized pots for several years, provided they are slightly rested during the winter months by being kept on the dry side and in a lower temperature, say 45° to 55°. In February the plants should be removed from the pots, the drainage examined, a little of the top-soil removed, and then top-dressed with old rotted cow-manure, and the plants returned to a growing temperature and given more water as required. Feed either with liquid manure or dust with pulverized animal manure every second week during the growing season. Some of the finest specimen adiantums in this country have been grown in the same-size pots for five to seven years.

Scale sometimes attacks old specimen adiantums, and there is only one remedy,—rest the plants by keeping to the dry side and in a cool temperature for about a month; then cut off all the fronds clear down to the crowns, and treat the same as old specimen plants.

For amateurs and small growers, all adiantums can be propagated by division of the crown and rhizomes. This is best done in January and February. Wash off all soil and cut the roots off as close to the crowns as possible. Then divide to single eyes. Place the eyes in sharp sand, merely covering them. Place in a situation such as advised for spores and cover with glass: when the first fronds appear, treat exactly the same as recommended for seedlings, when they will make plants about as quickly and equally as good as those grown from spores.

*Adiantum Farleyense*, being a sterile species, must be propagated by division. It requires the treatment recom-

mended for adiantums in general with the exception of a much higher temperature, 65° to 70° at night and 75° to 80° during the day. The variety *Glory of Moor-drecht* has the great advantage of producing fertile spores and it also thrives in the lower temperatures recommended for general adiantums. It gives promise of being one of the most useful varieties for decorations and cut-fronds use, as the fronds are very much hardier than typical *A. Farleyense* and will compare well with such kinds for standing as *A. cuneatum*, *A. hybridum* and *A. Croweanum*.

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A. *Lvs. with a single row of small lfts. on either side, rooting at the apex.*

1. *lunulatum*, Burm. (*A. dolabrifforme*, Hook.). Lvs. 1 ft. long on blackish, wiry, polished stalks; lower lfts. nearly semicircular, all on hair-like stalks. India, Trop. Amer., Austral. G. 6:203.

2. *caudatum*, Linn. (*A. Edgeworthii*, Hook.). Lvs. 6–12 in. long, on short, brownish, densely hairy stalks; lfts. deeply cut into several spreading narrow lobes. Old World. Gn. 68, p. 315.

AA. *Lvs. with usually a single row of large lfts. on either side, not rooting at the apex.*

3. *peruvianum*, Klotzsch. Lvs. 1 ft. or more long, on polished stipes, with obliquely ovate pointed lfts. 2 in. long by 1½ in. wide, on slender stalks; sori 8–10 on either side of the lfts., twice as long as wide. Peru.

4. *macrophyllum*, Swartz. Lvs. 1 ft. long, on rather stout polished stipes, with 4–6 pairs of wedge-shaped sessile lfts. 1½–2 in. long by ¾–1 in. wide; indusium nearly continuous on either side of the lft. Trop. Amer.

5. *Kaulfussii*, Kunze. Lvs. 6–8 in. long, on slender black stalks; lfts. 5–11, 2 in. long, ¾–1 in. wide, with unequal base; indusia very long and narrow, forming an almost continuous marginal band on either side of the lfts. Mex., W. Indies.

6. *platyphyllum*, Swartz. Lvs. 1–2 ft. long, stalks black, glossy, lf.-blades 6–12 in. long, 2–4 in. broad, with a long terminal pinna and 3–6 pairs of lateral pinnae; lowest pinnae sometimes pinnately divided; segm. 3–4 in. long, 1½–2 in. broad; sporangia in nearly continuous line along the margin. Cent. Amer. to Brazil and Bolivia.

AAA. *Lvs. at least bipinnate, the segms. twice as long as broad, with the veinlets all springing from the lower side.*

B. *Lfts. 1½–2 in. long.*

7. *trapeziforme*, Linn. Lvs. 18 in. or more long, with the terminal lft. longer than the lateral; lfts. trapezoidal, ½–¾ in. wide, lobed, and with numerous sori.

A. *Sanctæ-Catharinæ* is a form with deeper lobes. Trop. Amer.

BB. *Lfts. smaller, an inch or less long.*

C. *Stalks polished, smooth.*

8. *polyphyllum*, Willd. Lvs. often tripinnate, with stout black stalks; pinnae 6–8, long, with closely set lfts. which are ¾–1 in. long, the upper margin curved, with 4–6 circular or oblong indusia. S. Amer.

9. *diaphanum*, Blume (*A. setulosum*, J. Smith). Lvs. simply pinnate or usually 2-pinnate at the base; lfts. ½ in. long, ¼ in. wide, with numerous sori placed in the sinuses of the inner and outer edges. Asia to New Zealand.

10. *affine*, Willd. Lvs. bipinnate, with a terminal pinna and several lateral ones; lfts. not exceeding ¾ in. long, ¼ in. wide, the upper edge parallel with the lower, and crenate, bearing numerous rounded sori on the upper and outer margin. New Zealand.

11. *fulvum*, Raoul. Lvs. 15–20 in. long, the stalks erect, dark brown, shiny, rough below with long hairs; the lf.-blades 9–12 in. long, 6–8 in. broad, deltoid, 2-pinnate, the segm. ¾ in. long, ¼ in. broad, dimidiate, lower edge straight, the upper edge parallel with sharp-tooth lobes; the sori uniform, numerous. New Zealand.

CC. *Stalks polished but somewhat woolly.*

12. *intermedium*, Swartz. Lvs. 1 ft. or more long, with a terminal pinna and 1–3 lateral ones on each side; lfts. 1 in. or more long, with interrupted sori on the upper and two-thirds of the outer margins. Trop. Amer.

CCC. *Stalks rough or hairy.*

13. *formosum*, R. Br. Lvs. 1–2 ft. long, two-thirds as broad, mostly tripinnate, with rough, scabrous stalks and rather small, deeply lobed lfts. ½–¾ in. long, with rounded and toothed outer margins. Austral. G. 20:769.



120. Fruiting pinnales of *Adiantum pedatum*. (×1)

14. *pulverulentum*, Linn. Lvs. often a foot long, with a large terminal pinna and several lateral ones, bipinnate; stalks purplish, hairy, as are also the rachises; lfts. ¾–1 in. long, ¼ in. wide, closely placed, the outer edge rounded or truncate. W. Indies.

15. *villosum*, Linn. (*A. rhomboideum*, Swartz). Lvs. large, with a terminal and several lateral pinnae 6–12 in. long, on stout, villous-hairy stalks; lfts. numerous, nearly 1 in. long, ½ in. wide, trapezoidal, with the inner side parallel to the rachis; indusia forming an almost continuous line along the upper and outer margins. W. Indies and S. Amer.

16. *novæ-caledoniæ*, Keys. Lvs. 6–8 in. long and wide, somewhat pentagonal, once pinnate with one or two secondary basal pinnae on the lower side at base; lfts. attached to the rachises by a broad base, nearly 1 in. long, pointed, irregularly incised, bearing 1–4 rounded sori next to the base. New Caledonia.

AAAA. *Lvs. forked, the two branches bearing pinnae from the upper side.*

B. *Stalks polished, smooth.*

17. *pedatum*, Linn. Fig. 120. COMMON MAIDENHAIR of our northern states, with circular lvs. on purplish stalks 1 ft. or more high.—Sometimes transplanted into gardens, requiring a shady, moist and protected place. G. 21:9.

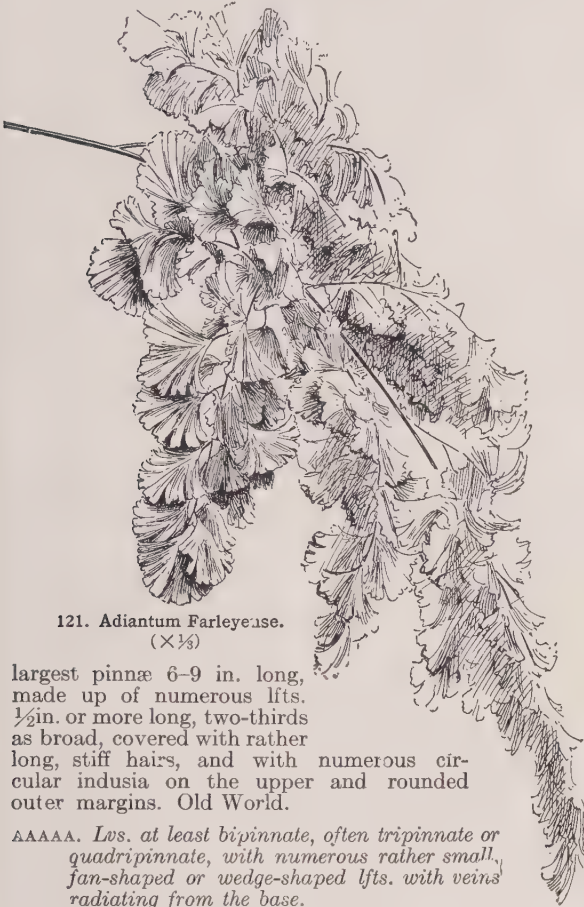
18. *curvatum*, Kaulf. Lvs. forked and with the main divisions once or twice forked; lfts. 1–1½ in. long,



nearly  $\frac{1}{2}$  in. wide, the upper margin rounded and lobed. Brazil.

BB. *Stalks scabrous (or rough).*

19. *hispidulum*, Swartz (*A. pubescens*, Schk.). Lvs. forked, two divisions branching like a fan, with the



121. *Adiantum Farleyense*.  
( $\times \frac{1}{2}$ )

largest pinnae 6-9 in. long, made up of numerous lfts.  $\frac{1}{2}$  in. or more long, two-thirds as broad, covered with rather long, stiff hairs, and with numerous circular indusia on the upper and rounded outer margins. Old World.

AAAAA. Lvs. at least bipinnate, often tripinnate or quadripinnate, with numerous rather small, fan-shaped or wedge-shaped lfts. with veins radiating from the base.

B. *Lfts. an inch or less across.*

c. *Edges deeply cut into a series of narrow lobes.*

20. *Farleyense*, Moore. Fig. 121. Lvs. often reaching 15-24 in. in length, forming a rich profusion of closely overlapping pinnae, light green; lfts. more or less wedge-shaped at base, with curved sides and the outer margin rounded and deeply cut into 10-15 narrow lobes, which rarely bear sori. Barbadoes.—Said to be a garden variety of *A. tenerum*, but apparently a good species. G.C. III. 49:73.

cc. *Edges not laciniately cut.*

21. *tenerum*, Swartz. Lvs. deltoid, 12-24 in. long, two-thirds as wide, the terminal lfts. equally, the lateral unequally, wedge-shaped at base, all of them rhombic and deciduous when dry, with 10 or less small sori on the outer and inner margins. *A. Lathomii*, *A. Victorizæ*, *A. rhodophyllum*, *A. princeps*, *A. acutum*, and *A. Bausei* are horticultural forms. Fla. and Trop. Amer.

22. *Jordanii*, C. Muell. (*A. emarginatum*, D. C. Eaton, not Hook.). Lvs. 1 ft. or more long, 6 in. wide, mostly twice pinnate, with nearly semicircular lfts.; sori elongate, the indusium almost continuous around the margin of the lft. Calif. and Ore.

23. *Williamsii*, Moore. Lvs. triangular, nearly 1 ft. long; lfts. nearly semicircular, 3-4-lobed on the outer

margin, bearing 5-8 sori covered with oblong indusia. Peru.—Similar in habit to the last, but smaller and with more numerous sori.

BB. *Lfts. mostly less than a half inch across.*

c. *Lvs. at least quadripinnate, broader than long.*

24. *Cóllisii*, Moore. Lvs. 1 ft. or more long, very broad, the black rachises apparently repeatedly forking; lfts. rhombic-ovate or cuneate, those toward the outer portions longer and larger than those nearer the base.—Of garden origin, possibly a hybrid.

cc. *Lvs. mostly triangular or oblong, longer than broad.*

d. *Shape of lfts. rhombic, the indusia kidney-shaped or nearly circular.*

25. *concinnum*, HBK. Fig. 122. Lvs. 2-3 pinnate, 12-18 in. long, 6-9 in. wide, on rather stout black stalks; lfts. rhombic-oblong, slightly lobed; sori 4-8 on each lft., usually set close together. Mex. to Brazil. Var. *latum*, Moore. Differs from type by stiff upright habit, and lfts. twice as large and much separated.

26. *aneitense*, Carr. Rootstock wide-creeping, covered with minute dark brown linear scales; lvs. 2-2½ ft. long, the stalks castaneous, rusty hairy above; the lf.-blades deltoid, 1½-2 ft. long and broad, 3-4-pinnate, the segm. rhomboidal, the sori 4-6 to a segm. Aneiteum, New Hebrides.

27. *tinctum*, Moore. Lvs. on stalks 4-6 in. long, the blades 2-pinnate, deltoid, the stalks black, glossy, naked, the segms. rhomboid, 3-4 lines long, the lower edge straight, the inner parallel to the rachis or just overlapping it, the outer edge bluntly lobed, sori round, on ultimate lobes. Costa Rica to Peru.

DD. *Shape of lfts. roundish with obtuse base, small or medium size.*

28. *æthiopicum*, Linn. (*A. assimile*, Swartz). Lvs. 1 ft. or more long on slender stalks, 2-3-pinnate, rather narrow; lfts. roundish or obscurely 3-lobed, the margin finely serrulate; sori 2-3 to a lft., with oblong or kidney-shaped indusia. Afr. and Austral.

29. *excisum*, Kunze. Lvs. 2-3-pinnate, 6-12 in. long, 3-4 in. wide; lfts. about  $\frac{1}{4}$  in. wide, roundish, with the margin cut into small rounded lobes; sori large, 2-4 to each lft.; kidney-shaped or circular. Chile.

DDD. *Shape of lfts. distinctly cuneate at the base.*

E. *Indusia oblong or indistinctly lunate.*

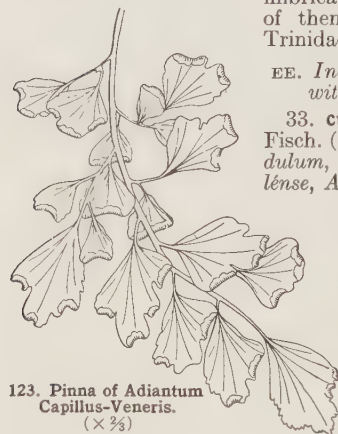
30. *Capillus-Veneris*, Linn. (*A. Fergusonii*, *A. Mairisii*, Moore). Fig. 123. Lvs. 2-3-pinnate, 6-20 in. long, 3-8 in. wide; lfts. nearly  $\frac{1}{2}$  in. wide, more or less irregularly lobed, at the outer margin; sori 1-3 to each lft. with oblong or more or less elongate narrow indusia. Native southward, and widely distributed throughout the Old World.—Exists in many varieties, some of them deeply lobed, like *A. Farleyense*; a compact imbricated form is very effective.

31. *bellum*, Moore. Small, tufted, 3-8 in. high; lvs. bipinnate; lfts. with the outer margin erose and often divided into 2-3 shallow lobes; sori 2-3 to each lft., rather long and broad or somewhat lunate. Bermuda.—A greenhouse species.



122. Pinna of *Adiantum concinnum*. ( $\times \frac{2}{3}$ )

32. *Bessóniæ*, Jenman. Lvs. 11-16 in. long, the stalks in tufts, stiff, black, shiny, with a few pale scales; lf.-blades deltoid, 4-pinnate, the pinnulæ very densely imbricated so that many of them are covered over. Trinidad.



123. Pinna of *Adiantum Capillus-Veneris*.  
( $\times \frac{2}{3}$ )

segm., with rather small rounded indusia. Brazil.—Runs into many forms, of which *A. variegatum* is one. A.F. 18:508. *A. Bårdii* differs from the type in having the fronds 2 ft. or more long. Var. *grandiceps*, Moore. Robust: lvs. numerous from a tufted crown, elongated, with tassel-like growths at the ends. Var. *Croweanum*, Hort. A vigorous hardy form.

34. *Moðrei*, Baker (*A. amabile*, Moore, not Liebm.). Lvs. 2-3-pinnate on long, slender stalks, 6-15 in. long; lfts.  $\frac{1}{4}$ - $\frac{1}{2}$  in. long, rhomboidal, with wedge-like base, deeply lobed; sori of medium size, 4-6 to each lft. Peru.

35. *Wagneri*, Mett. (*A. decorum*, *A. Wiègandii*, *A. elegans*, *A. Owenii*, *A. cyclostrum*, Moore). Lvs. 2-3-pinnate, 6-9 in. long, 4-6 in. wide; lateral lfts. rhomboid, the terminal cuneate, slightly lobed or incised; sori 4-6 to each lft.; very large membranous circular indusia. Peru.—*A. Siebrechtii*, Hort., "supposed to be a cross between *A. decorum* and *A. Williamsii*," has strong, graceful lvs. thickly set with round pinnules of firm texture.

36. *rubellum*, Moore. Lvs. 4-6 in. long, deltoid, bipinnate; texture membranous, bright green, reddish when young; lfts.  $\frac{1}{2}$  in. wide, deltoid or the lower rhomboid, the outer margin deeply lobed and the lobes finely toothed; sori round at the apices of the lobes. Bolivia.

37. *monochlamys*, D. C. Eaton. Lvs. ovate-deltoid, 6-12 in. long, tripinnate; lfts.  $\frac{1}{4}$  in. wide, cuneate at the base, the upper edge rounded, and slightly toothed, with a single sorus or rarely two in a decided hollow at the upper edge. Japan.

38. *venustum*, Don. Lvs. ovate-deltoid, triquadripinnate, 6-12 in. long; lfts. cuneate at the base,  $\frac{1}{4}$  in. wide, with the upper edge irregularly rounded or with 3 indistinct lobes, finely toothed, bearing 1-3 sori in distinct hollows. India.



124. *Adiantum cuneatum*.  
(Frond  $\times \frac{2}{3}$ )

EE. *Indusia* nearly circular, with a narrow sinus.

33. *cuneatum*, Langs. & Fisch. (*A. æmulum*, *A. mindulum*, Moore. *A. versailleuse*, *A. fragrantissimum*, *A. hybridum*, Hort.).

Fig. 124. Lvs. 3-4-pinnate, deltoid, 6-15 in. long, 5-9 in. wide; lfts. numerous, obtuse or broadly wedge-shaped at base, the margin rounded and more or less crenately lobed; sori 3-5 to each

BBB. Lfts. minute, innumerable; lvs. 4-6-pinnate.

39. *gracillimum*, Moore (of horticultural origin). Lvs. 1 ft. or more long, nearly as wide, 4-6-pinnate, with innumerable very small lfts., which are  $\frac{1}{8}$ - $\frac{1}{4}$  in. wide and usually bear a single sorus or rarely two.—Dense, compact forms are in cult. under the name of *A. Le-Grândii*.

AAAAA. Lvs. 3-4-pinnate: st. climbing, several ft. long.

40. *digitatum*, Presl (*A. speciosum*, Hook. *A. palmatum*, Moore). Lvs. 2-3 ft. long on a stalk 18 in. or more long, with palmately lobed lfts. 1 in. or more wide. S. Amer.

*A. grössum*, Mett. Stove: lvs. lanceolate, to  $1\frac{1}{2}$  ft. and 4 in. broad, once-pinnate, leathery. Colombia. G.C.III. 45 51.—*A. roseum*, Backh., an undetermined horticultural name, probably referable to *A. rubellum*.—*A. scutum ramosum*, Hort. A distinct form with fan-shaped lvs. (properly *A. Ghiesbreghtii*, Moore).

L. M. UNDERWOOD.  
R. C. BENEDICT.†

ADLUMIA (from John Adlum). *Fumariaceæ*. A hardy biennial vine, which climbs over high bushes in moist woods: fls. with the petals united into cordate-ovate corolla which ultimately encloses the small, few-seeded pod.—Sow seed in spring in a damp, cool place. Transplant in fall, if possible, if transplanted at all. It does not flower the first season but remains low and bushy. It will not tolerate open sun or windy situation.

*fungosa*, Greene (*A. cirrhosa*, Raf.). CLIMBING FUMITORY. MOUNTAIN FRINGE. ALLEGHENY VINE. Figs. 125, 126. Climbs by the slender young lf.-stalks. Lvs. thrice pinnate; lfts. cut-lobed, delicate: fls. white or purplish, in ample panicles. G.W.F. 13. V. 2:76 and 4:22 (all as *A. cirrhosa*). N. TAYLOR.†

ADODENDRUM: *Rhodothamnus*.

ADONIS (a favorite of Venus, after his death changed into a flower). *Ranunculaceæ*. Hardy annual and perennial herbs planted for their showy flowers.

Flowers solitary, terminal; petals 5-16, yellow or red; carpels many: st. about 1 ft. high, very leafy: lvs. alternate, cut into very narrow divisions: fr. an achene.

The culture is simple in any good soil, light moist earth preferred. They thrive in full sun or partial shade; the perennial species well suited for rockwork and borders. Only a few well-known species, natives of temperate regions of Europe and Asia; perhaps 20 in the genus.

Annuals are propagated by the seeds, which are slow-germinating; the freshest seed is sown in autumn or earliest spring. Perennials may, in like manner, be grown from seed and come to flower the first season,



125. *Adlumia fungosa*.



but division of the roots is to be preferred as the flowers are then more abundant. Very early spring is the best time for dividing.

A. *Annuals: fls. crimson or scarlet.*

B. *St. simple except at top: center of fl. yellow.*

**æstivalis**, Linn. PHEASANT'S-EYE. SUMMER ADONIS. Sts. erect, often branched at top: fls. crimson; petals flat, obtuse, half longer than calyx. June, July. Var. *citrina*, Hoffm., is a garden variety with citron-yellow fls.



126. Flower of *Adlumia fungosa*. ( $\times \frac{3}{4}$ )

**parviflora**, Fisch. Allied to above; not well recognized as a distinct species. Differs in being smaller-fl. and less showy.

**microcarpa**, DC. Apparently a pale-fl. variation of *A. æstivalis*.

BB. *St. branched: center of fl. dark.*

**autumnalis**, Linn. FLOS ADONIS. AUTUMN ADONIS. St. branched: fls. small, crimson, with dark center, globose; petals 6-8, concave, slightly larger than calyx. June-Sept. Gn. 12, p. 131.—Sparingly naturalized.

AA. *Perennials: fls. yellow.*

B. *St. not branched.*

**vernalis**, Linn. (*A. apennina*, Jacq. *A. davurica*, Reichb.). SPRING ADONIS. Fig. 127. St. simple; lower lvs. scale-like, others with lobes numerous, entire: fls. large; petals 10-15, lanceolate, slightly toothed; sepals smooth. Early spring. Gn. 5, p. 519; 39:268. Gn.W. 23:153. G. 29:146; 9:122; 1:249. Var. *alba*, Hort. A form with white fls. J.H. 52:39 (desc.). *A. distorta*, Tenore, from Italy; a form with later fls.

**apennina**, Linn. (*A. vernalis* var. *sibirica*. DC. *A. sibirica*, Patr.). This species is much like *A. vernalis*: fls. larger: lower lvs. sheath-like. April. Siberia.

BB. *St. branched.*

**pyrenæica**, DC. St. branched: petals 8-10, obtuse, smaller than in *A. vernalis*: lower lvs. with long branched petioles; upper ones sessile, the numerous lobes always entire. July. Gn. 39, p. 269. Gn.W. 5:533. *A. Ircutiæna*, DC., a form with some radical lvs.; lobes dentate.

**volgensis**, Stev. (*A. wolgensis*, Hort.). Much like *A. vernalis*, but st. branched: lvs. scale-like at base, petioled or sessile above: fls. like *A. pyrenæica*, but sepals pubescent on under side. April. Volga region.

**amurénsis**, Regel & Radde. A beautiful species, with broad yellow fls.; not much cult. in Amer.; has many Japanese varieties. B.M. 7490. G.M. 40:169; 48:212. Gn. 52:6; 67, p. 207; G.C. III. 29:175 and III. 37:188; J.H. III. 50:299 (fl. pl.). K. C. DAVIS.

**ADÓXA** (Greek, *without glory*, i.e., *humble* or *obscure*). *Adoxææ*, but by some authorities placed in *Caprifoliaceæ* and formerly in *Araliaceæ*. **A. Moschatellina**, Linn., the Moschatel, is the only species. It is an inconspicuous herb 3-5 in. high, bearing tubers beneath the ground, with biterate lvs., and small greenish fls. It occurs in England, Cent. Eu., and northward, and in subalpine and arctic regions in N. Amer. It is scarcely cult. but may occur in rock-gardens, being grown for its musky scent.

**ÆCHMÊA** (from *aichme*, point; referring to the rigid points on the calyx). *Bromeliææ*. Epiphytic herbs, of about sixty species, natives of tropical South America, grown in choice greenhouse collections.

Flower-cluster arising from a cluster or rosette of long, hard lvs. which are serrate; petals 3, tongue-shaped, obtuse or pointed, 2-3 times the length of the spine-pointed calyx-lobes; stamens 6, shorter than the petals; ovary inferior, 3-celled. The fls. are subtended

by (in the axils of) fl.-bracts; the entire head or fl.-cluster is often reinforced or subtended by conspicuous lf.-bracts; in the compound-infl. types, the individual branches are usually subtended by branch-bracts. In some species, as *Æ. Lalindei* and *Æ. Mariæ-Reginæ*, the large colored lf.-bracts are the most conspicuous part of the plant. In others, as *Æ. Veitchii*, the entire head is the showy part. Monogr. by Baker, Journ. Bot. 1879:129, 161, 226. Includes *Canistrum*, *Echinostachys*, *Hohenbergia*, *Hoplophytum*, *Lamprococcus*, *Pironneava*, *Pothuava*; and some of the species have been referred to *Billbergia*, *Cryptanthus*, *Guzmania*, *Tillandsia*, *Chelidonia*, and others.

The æchmeas are closely allied to the billbergias, from which they are distinguished by smaller flowers, which are little exerted from the calyx and not widely expanding, short filaments and small anthers, sharp-pointed sepals and conspicuous sharp-pointed flower-bracts.

For culture, see *Billbergia*.

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A. *Fls. 2-ranked on the branchlets.*

1. **distichantha**, Lem. Lvs. 2-3 ft. long, with a dilated base 4-5 in. long and half as wide, the blade rigid and channelled, edges prickly: scape 1-1½ ft.; fls. in a bipinnate panicle 4-7 in. long and half as wide, the petals tongue-shaped and red-purple, longer than the obtuse-cuspidate sepals; fl.-bract pocket-like, ¼ in. long. Brazil. B.M. 5447. J.F. 3:269.

AA. *Fls. multifarious, — in several or many rows on the spike or branchlets.*

B. *Infl. simple.*

C. *Ovary compressed or flattened.*

2. **Lalindei**, Lind. & Rod.

Large (3-4 ft.), with long and broad spine-edged lvs.: spike very dense, greenish white, from the color of the aggregated calices, the fls. subtended by many deflexed, showy red, long-pointed, entire bract-lvs.; corolla green, not exerted. Colombia. I.H. 30:481. —Striking.

3. **Mariæ-Reginæ**, Wendl. Smaller than the last in all its parts: petals blue-tipped when young, fading to crimson like the bracts, half as long again as the mealy cuspidate sepals; fl.-bracts entire, small, not showy: bract-lvs. toothed. Costa Rica. B.M. 6441. Gt. 49:1477. —One of the best species.

4. **Veitchii**, Baker. Lvs. spotted, serrate: petals pale, a little longer than the sepals; fl.-bracts con-



127. *Adonis vernalis*. ( $\times \frac{1}{2}$ )

spicuous, toothed, scarlet: bract-lvs. greenish, erect, serrate, not encompassing the infl. S. Amer. B.M. 6329. G.Z. 23, pl. 30.—Referred to *Ananas* by Bentham & Hooker.

cc. Ovary terete (cylindrical).

d. Head oblong.

5. *Lindenii*, Koch (*Hoplophytum Lindenii*, Morr.). Lvs. dilated and entire at base, the blade minutely toothed and 2-3 ft. long, the tip broad-rounded and short-cuspidate: petals lemon-yellow, twice as long as sepals. Brazil. B.M. 6565.

dd. Head globose.

6. *caliculata*, Baker (*Hoplophytum caliculatum*, Morr.). Lvs. about 1 ft. long, with an oblong, dilated base, the blade minutely toothed and rounded at the tip, but terminated with a minute cusp: scape shorter than the lvs., with several deciduous lanceolate bract-lvs.; petals tongue-shaped, not  $\frac{1}{2}$  in. long, bright yellow; fl.-bracts small, entire, reddish. S. Amer.

7. *fasciata*, Baker (*Billbergia fasciata*, Lindl. *B. rhodocyanea*, Lem.). Lvs. 1-2 ft. long, with an oblong entire clasping base, the blade strongly toothed and the back marbled with whitish cross-lines, the tip rounded



128. *Æchmea miniata* var. *discolor*. ( $\times \frac{1}{6}$ )

and mucronate: scape 1 ft. high, floccose, the several bract-lvs. pale red and erect; petals  $\frac{3}{4}$  in. long, pink. Brazil. B.M. 4883. B.R. 1130. F.S. 3:207.—Infl. sometimes forked.

BB. Infl. branched (or compound).

c. Fls. pedicellate.

8. *cæruleascens*, Baker. Lvs.  $1\frac{1}{2}$ -2 ft. long, with small prickles: panicle 4-5 in. long, 2-pinnate, with lax few-flid. crowded branches; petals bluish red,  $\frac{1}{2}$  in. long; fl.-bracts none or minute. S. Amer. Gt. 1871: 694.—Produces white berries.

cc. Fls. sessile.

d. Sepals blunt.

e. Floral bracts large.

9. *Weillbachii*, F. Dirr. Lvs. rather short, overtopped by the red-stemmed and red-bracted scape: panicle narrow, 1-pinnate, the fls. rather crowded, blue and red. S. Amer. R.H. 1871:170.

Var. *leodiensis*, André. Lvs. violet and spotted: fls. shorter. Brazil.

EE. Floral bracts minute or wanting.

10. *fulgens*, Brongn. (*Æ. discolor*, Hort.). Lvs. broad, with small distant teeth, with a broad cuspidate end: panicle large, simple above, branched below, glabrous, bearing numerous fls.; petals blue-tipped, ex-

ceeding the rich red calyx; fl.-bracts minute or none: branch-bracts yellowish. S. Amer. B.M. 4293.

11. *miniata*, Baker. Lvs. serrate with numerous close small teeth: panicle branched throughout; fls. numerous; petals blue; ovary red. Var. *discolor*, Hort., Fig. 128, has the lvs. purple or violet-brown on the back. Brazil.

DD. Sepals pointed or awned.

12. *cælestis*, Morr. Lvs. linear, the margins with few minute spines or almost smooth: panicle branched below, simple above; fls. about 10 lines long; sepals white; petals blue. Brazil.

13. *spectabilis*, Brongn. Lvs. linear, the margins armed with stout spines: panicle laxly pyramidal; fls. about  $1\frac{1}{4}$  in. long; sepals pale rose; petals white, purple at apex. Venezuela and Colombia. R.H. 1875:311.

*Æ. aurantiaca*, Baker=*Canistrum aurantiacum*.—*Æ. Bérleii*, Baker. Corolla pale yellow. Honduras.—*Æ. brasiliensis*, Regel. Lvs. much dilated at base, whitish below, black-toothed: petals light blue: calyx and rachis red; panicle branched. Brazil. Gt. 34:1202.—*Æ. bromeliæfolia*, Baker. Dense spike: lvs. whitish below, 3-4 ft. long, serrate or spinescent: fls. light yellow. S. Amer.—*Æ. Cornui*, Carr.=*Æ. nudicaulis*.—*Æ. Drakeana*, André. Lvs. whitish, finely dentate: spike simple and lax; fls. long-tubular, light blue; bracts and ovaries coral-red: berries rose, becoming blue. S. Amer. R.H. 1888, p. 401, desc.—*Æ. exsudans*, Morr.=*Gravisia exsudans*.—*Æ. Fürstenbergii*, Morr.=*Streptocalyx Fürstenbergii*.—*Æ. gigas*, Morr. Floral lvs. crimson: fls. in a dense infl.; sepals white, lepidote; corolla pale green. Brazil. B.M. 8107.—*Æ. glomerata*, Hook.=*Hohenbergia stellata*, Schult.—*Æ. Hystrix*, Morr. Lvs. lepidote, whitish, crowded: spike oblong, dense; fls. purple, tomentose. Guiana.—*Æ. lavandulacea*, C. H. Wright. Fls. distichous, paniculate, the sepals awned, green, the petals deep violet. Grenada. B.M. 8005.—*Æ. macracantha*, Brongn.=*Æ. Schiedeana*.—*Æ. Melinonii*, Hook. Panicle 3-pinnate, dense; petals bright red: lvs. spiny,  $1\frac{1}{2}$ -2 ft. Guiana. B.M. 5235.—*Æ. mexicana*, Baker. Lvs. long and large, fine-toothed: panicle 2-pinnate, long and lax, the peduncles mealy; petals crimson. Mex.—*Æ. miniata*, Hort.=*Billbergia thyr-oidea*(?).—*Æ. myriophylla*, Morr. Allied to *Æ. distichantha*. Lvs. narrow, 2-3 ft., spiny, silvery-sealy on the back: fls. red, the petals fading blue. Trop. Amer. B.M. 6939.—*Æ. nudicaulis*, Griseb. Lvs. long and straight, brown-toothed: bract-lvs. subtending: spike large, brilliant red; petals yellow. Trop. Amer. R.H. 1885:36 (as *Æ. Cornui*, which is a form with shorter and denser spike).—*Æ. paniculigera*, Griseb. Lvs. large and long: panicle 1-2 ft. long, with few-flid. branches; scape tall, reddish, downy; fls. purple. Trop. Amer.—*Æ. Schiedeana*, Schlecht. (*Æ. macracantha*, Brongn.). Lvs. large, rigid, strongly armed: panicle 3-pinnate, pubescent; fls. pale yellow. Mex. Gt. 43 p. 175.—*Æ. serrata*, Mez. Panicle very dense, bipinnate; fls. distichous, sessile; sepals spinulose; petals violet, mucronate. Martinique. R.H. 1307:129.—*Æ. zebrina*=*Billbergia zebrina*.

L. H. B.

GEORGE V. NASH.†

**ÆGLE** (from Latin *Ægle*, one of the Hesperides). *Rutaceæ*, tribe *Citrææ*. A small tree, often spiny, having hard-shelled frs.: lvs. deciduous: fls. pentamerous with numerous free stamens; ovary with 10 or more cells; ovules numerous in each cell; cells of the fr. without pulp vesicles, filled with gum; seeds woolly and in germination the cotyledons remain hypogeous: the first foliage lvs. are opposite.—Only one species is now recognized.

**Mármelos**, Correa (*Cratæva Mármelos*, Linn. *Bèrou Mármelos*, W. F. Wight). Fig. 129. The bael fruit of India. A handsome tree native to N. India, but widely cult. throughout the Peninsula as well as in Ceylon, Burma, Siam and Indo-China. The trifoliate lvs., borne on wingless petioles, are thin in texture, probably owing to the fact that they are deciduous. Although not so hardy as the deciduous trifoliate orange of China and Japan, the bael fruit tree is said to endure a considerable degree of cold (20° F. or lower) in the drier parts of N. W. India. The fr. is greenish yellow, globular, or nearly so, varying from 2-6 (usually 4-5) in. in diam. The fr. of the wild tree is considerably smaller than that of the cult. form. The hard shell,  $\frac{1}{2}$  in. thick, is filled with the pale orange, aromatic pulp in which occur 10-15 long, narrow cells containing the seeds imbedded in transparent tenacious gum. These cells correspond to the segms. of an orange, while the pulp is made up of the pith and the greatly thickened fleshy membranes separating the



cells. Ill. Roxb., Pl. Corom., pl. 143. Wight, Ic., pl. 16. Bedd., Fl. Sylv., pl. 161. Benth. & Trim., Med. Pl., 55. Bonav., Oranges and Lemons of India and Ceylon, Atlas, pl. 242, 243. The ripe fr. is much esteemed by the Hindus, many of whom consider it the best of the citrous frs.; the European residents in India often become very fond of it.



129. *Ægle Marmelos*. ( $\times \frac{1}{4}$ )

Watt says (Dict. of Econom. Prod. of India, 1:123): "The fruit, when ripe, is sweetish, wholesome, nutritious, and very palatable, and much esteemed and eaten by all classes. The ripe fruit, diluted with water, forms, with the addition of a small quantity of tamarind and sugar, a delicious and cooling drink." The famous botanist, Roxburgh, says (Flora Indica, 2:580): "The fruit is nutritious, warm, cathartic; in taste delicious, in fragrance exquisite; . . ."

On the other hand, W. R. Mustoe, Superintendent, Government Archeological Gardens, Lahore, India, writes (in a letter to D. G. Fairchild, dated Lahore, Dec. 3, 1908): "The fruit is greatly prized for eating by the natives, but can scarcely be looked upon as palatable to the white man except as a sherbet; . . ." Sherbet is made from the mashed pulp, which is diluted with a little water, and then strained into milk or soda-water and sugared to taste. Sometimes a little tamarind is added to give a subacid flavor. All Indian medical authorities agree that the bael fruit has a most salutary influence on the digestive system. The ripe fruit is mildly laxative and is a good simple remedy for dyspepsia. The unripe fruit is a specific of the highest value for dysentery, but so mild that it can be given to children without danger. The bael fruit tree is widely cultivated in India, and is found in nearly every temple garden. It is dedicated to Siva, whose worship cannot be completed without its leaves. This promising fruit tree is now being tested at several points in the warmer parts of the United States.

*Æ. Bārteri* Hook. f. = *Balsamocitrus paniculata*, Swingle. — *Æ. decandra*, Naves = *Chaetospermum glutinosa*, Swingle. — *Æ. glutinosa*, Merrill = *Chaetospermum glutinosa*, Swingle. — *Æ. sepäria*, DC. = *Poncirus trifoliata*, Raf.

WALTER T. SWINGLE.



130. *Æglopsis Chevalieri*. ( $\times \frac{2}{5}$ ; fl.  $\times \frac{7}{8}$ )

**ÆGLÓPSIS** (*Ægle*; *opsis*, appearance). *Rutaceæ*, tribe *Citreae*. A small spiny tree, having simple persistent lvs. with short, wingless petioles, and frs. with a thin rather hard shell; the fls. are pentamerous with 10 stamens; ovary 6–7-celled, ovules numerous in each cell; cells of the fr. without pulp vesicles, filled with gum. The seeds are smooth, and in germination the cotyledons remain hypogeous; the first foliage lvs. are opposite. Only one species is known.

**Chevaliëri**, Swingle. Fig. 130. A large shrub or small spiny tree growing near the coast in Côte d'Ivoire, Trop. W. Afr., probably occurring also in Liberia. The spines occur singly alongside of the axillary bud and are long, slender and straight. (See Fig. 130.) The fls. are borne in small, more or less branched panicles composed of 4–40 fls. The fruits are globose or slightly pyriform, deep orange, with a thin, hard shell  $\frac{1}{16}$  in. thick. Inside of this shell are 6 (rarely 5 or 7) cells filled with large sublenticular seeds imbedded in a fragrant mucilage. These cells correspond to the segms. of an orange and are triangular in outline, occupying almost the whole space, the separating membranes being very thin and the pith small. In this respect, the fr. is quite unlike frs. of *Ægle* and *Balsamocitrus*. Ill. Bull. Soc. Bot. Fr. v. 58. Mém. 8d. pl. 2, 3.—This species was only recently brought to light in the collections of the Muséum d'Histoire Naturelle at Paris. It is reported as growing in swamps near the sea. If it is able to resist brackish water it may prove to be a stock of value on which to graft citrous frs. as most, if not all, of the species of *Citrus* are very sensitive to salty soils (alkali). Trees of this species are growing in the greenhouses of the Jardin des Plantes at Paris and in those of the U. S. Dept. of Agric. Young seedlings are being grown for trial as stocks on which to graft other citrous frs.

WALTER T. SWINGLE.

**ÆGOPÏDIUM** (*aix*, goat, and *podion*, a little foot; probably from the shape of the lfts). *Umbelliferae*. GOUTWEED. Coarse, hardy herbaceous perennial, with creeping rootstocks, biternate lvs., sharply toothed, ovate lfts., white fls. in umbels: frs. ovate, glabrous, with equal filiform ribs, and no oil-tubes.

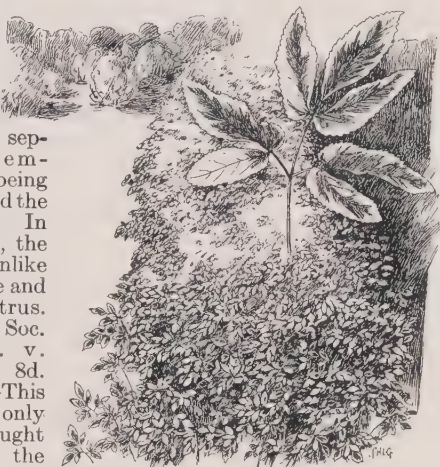
**Podogrària**, Linn., var. *variegatum*, Hort. Fig. 131. Twelve to 14 in.—A rapid-growing variegated form of this European weed, which makes attractive mats of white-margined foliage. Common in yards, and planted as edging and mats against buildings and in shady places. Prop. readily by division, and of simplest cult.

N. TAYLOR.†

**AËRÁNTHUS**: Certain species described under this genus are treated in *Angræcum*.

**AËRIDES** (Greek, *air*-plant). *Orchidaceæ*. Epiphytic hothouse orchids.

Stems leafy, without pseudobulbs: lvs. distichous, coriaceous or fleshy, the persistent sheaths covering the



131. *Ægopodium Podagraria* var. *variegatum*.

st.: fls. borne in simple or compound lateral clusters; sepals about equal, spreading, the dorsal broader than the lateral; petals similar to the dorsal sepal; lip erect, or bent in, attached to the foot of the column, spurred at the base, the spur hollow; pollinia 2.—Species about 30, distributed from Malay Archipelago to India, E. Asia and Japan.

Nearly all the species of this genus are from the East Indies and therefore require the warmhouse treatment, with a minimum of 65° F. in winter. As they have no pseudobulbs, but an erect, evergreen stem, they must never be allowed to become perfectly dry. Ample drainage of charcoal and broken pots is very essential, with a surfacing of moss, preferably sphagnum, renewed each year, the usual peat fiber being omitted. The best-known species is *A. odoratum* and is often seen in collections flowering freely. *A. Fieldingii* is also an interesting plant, as the spikes grow to the length of 18 inches, are dense-flowered, and known as the "fox-brush orchid," the color being a beautiful rose-pink. *A. Lawrenciæ* is another fine plant, from the Philippines but not yet common in gardens.—Propagation is effected only by cutting off the top of the plant and setting it down in another pot, and waiting for the other part to send out shoots. The roots are mostly aerial, and no attempt must be made to confine these to the pots. If the size pot used is large, it should be perforated at the sides to admit of a free circulation of air. (Orpet.)

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## KEY TO THE SPECIES.

- A. Lvs. flat, keeled.  
 B. Middle lobe of the lip incurved between the larger lateral lobes.  
 C. Spur curved.  
 D. Fls. 1½ in. long or less.  
 E. Lateral lobes of the lip white.  
 F. Length of fls. 1 in. or more.  
 G. Lip not spotted or with few spots; fls. crowded, concealing the stem. . . . . 1. *odoratum*  
 GG. Lip usually much spotted; fls. not crowded, revealing the stem. . . . . 2. *virens*  
 FF. Length of fls. less than 1 in. . . . . 3. *quinquevulnerum*  
 EE. Lateral lobes of the lip lemon-yellow. . . . . 4. *suavissimum*  
 DD. Fls. exceeding 1½ in. long. . . . . 5. *Lawrenciæ*  
 CC. Spur straight.  
 D. Raceme much longer than the lvs.; middle lobe of the lip ovate-triangular. . . . . 6. *Leanum*  
 DD. Racemes as long as the lvs.; middle lobe of the lip linear-oblong. . . . . 7. *Savageanum*  
 BB. Middle lobe of the lip spreading, not incurved.  
 C. Sts. long: lvs. numerous, 5 in. or more long.  
 D. Lateral lobes of lip large, usually falcate or lunate.  
 E. Spur short, conic.  
 F. Sepals and petals white. . . . . 8. *falcatum*  
 FF. Sepals and petals tawny yellow. . . . . 9. *Houlletianum*  
 EE. Spur long, cylindric.  
 F. Shape of spur straight. . . . . 10. *Augustianum*  
 FF. Shape of spur recurved or hooked. . . . . 11. *crassifolium*

DD. Lateral lobes of lip smaller or wanting.

E. Racemes drooping or pendulous.

F. Middle lobe of lip entire.

G. The spur straight.

H. The middle lobe of lip cordate, obtuse. . . . . 12. *multiflorum*

HH. The middle lobe of lip deltoid, acuminate. . . . . 13. *Fieldingii*

GG. The spur incurved or hooked. . . . . 14. *maculosum*

FF. Middle lobe of lip serrate; lateral lobes small. . . . . 15. *crispum*

EE. Racemes erect or ascending. . . . . 16. *radicosum*

CC. Sts. short: lvs. few, 4 in. long or less. . . . . 17. *japonicum*

AA. Lvs. terete or semiterete, grooved on the upper surface.

B. Fls. few, white, 2 in. or more across. . . . . 18. *vandarum*

BB. Fls. numerous, less than 1 in. across, the lip violet. . . . . 19. *mitratum*

1. *odoratum*, Lour. (*A. cornutum*, Roxbg.). Fig. 132. Lvs. 6–8 in. long, up to 2 in. broad: racemes nodding, equaling or longer than the lvs.; fls. about 1 in. long, fragrant; sepals and petals white, with a carmine spot



132. *Aerides odoratum* (×½)

at the obtuse apex, the petals narrower than the sepals; lateral lobes of the lip erect, round-oblong, white, or faintly tinged with purple, and somewhat spotted; middle lobe of the lip linear-oblong, denticulate or entire, white, with a median purple line. India to Cochin China. B.M. 4139. Gn. 49, p. 158. F.C. 2:75. O.R. 6:273; 8:217. Var. *birmanicum*, Reichb. f. Fls. smaller, with lines instead of apical spots, and the narrow middle lobe of the lip with few marginal teeth. Var. *purpurascens*, Hort. Racemes larger, and the sepals and petals

tipped with dull amethyst. G.C. II. 16:597. Var. *majus*, Hort. Racemes and fls. larger.

2. *virens*, Lindl. Lvs. up to 10 in. long and 1¼ in. broad: racemes longer than the lvs.; fls. over 1 in. long, fragrant; sepals and petals white, with a bright purple apical spot, broadly oval, obtuse; lip deeply 3-lobed, the oblong lateral lobes much the larger, erect, white, purple-spotted below, the middle lobe oblong, small, incurved, purple, or white with a median purple stripe; spur green-tipped. Java. P.M. 14:197. B.R. 30:41. Var. *Ellisii*, Hort. (*A. Ellisii*, Hort.). Sepals and petals white, flushed with rose, the tips amethyst-purple. Var. *Dayanum*, Hort. Racemes longer, with large bright fls. Var. *Sanderæ*, Hort. A form in which the fls. are pure white.

3. *quinquevulnerum*, Lindl. Lvs. up to 1 ft. long and 1½ in. broad: racemes commonly longer than the lvs.; fls. usually less than 1 in. long; sepals and petals obtuse, oval-oblong, white, tipped with amethyst and with a few purple spots below; lip 3-lobed, the erect lateral lobes triangular-oblong, white, faintly purple-dotted, the middle lobe oblong, deep amethyst, the spur incurved green. Philippine Isls. P.M. 8:241. Var.



**Rœbelinii** (*A. Rœbelinii*, Reichb. f.). Differs in the denticulate petals which shade to green at the base, and in the rose-colored middle lobe of the lip. Philippine Isls.

4. **suavissimum**, Lindl. Lvs. up to 10 in. long and  $1\frac{1}{2}$  in. broad: racemes longer than the lvs.; fls. fragrant, somewhat crowded; sepals and petals white, flushed with lilac, tipped with rose-lilac, the dorsal sepal broadly oval, the lateral larger; lip 3-lobed, the erect lateral lobes rounded-oblong, lemon-yellow, purple-spotted, the middle lobe linear-oblong, paler than the lateral lobes. Malacca. C.O., pl. 6. J.F. 2, pl. 213. Var. **Bal-lantineanum**, Veitch. Blooms a little earlier: racemes shorter, the sepals and petals amethyst-tipped.

5. **Láwrenciæ**, Reichb. (*A. Lawrencianum*, Hort.). Lvs. up to 1 ft. long and 2 in. broad: racemes equaling or longer than the lvs.; fls. over  $1\frac{1}{2}$  in. long, fragrant; sepals and petals white, amethyst-tipped; lip deeply 3-lobed, the denticulate lateral lobes hatchet-shaped, white, the middle lobe oblong, amethyst, the spur green, incurved. Philippine Isls. Gn. 35:485. G.C. III. 20: 629; 30:435. Var. **Amesianum**, Kränzl. A more robust plant, with fls. of a more intense color. Var. **Sanderianum**, Hort. Differs in its narrow lvs. and yellowish fls.

6. **Leånium**, Reichb. f. Lvs. up to 10 in. long and  $1\frac{1}{2}$  in. broad: racemes longer than the lvs.; fls. less than 1 in. long; sepals and petals rose-purple with a white base; lip 3-lobed, the lateral lobes round, incurved, and nearly inclosing the small, ovate-triangular, deep purple middle lobe; spur straight, green-tipped. India.

7. **Savageanum**, Veitch. Lvs. up to 10 in. long and  $1\frac{1}{4}$  in. wide: racemes equaling the lvs.; fls. less than 1 in. long; sepals and petals with the white base dotted with purple, the upper portion crimson; lip crimson-purple, the erect lateral lobes round-oblong, the middle lobe linear-oblong, small, incurved; spur straight, greenish.

8. **falcatum**, Lindl. & Paxt. (*A. Larpéntæ*, Hort. *A. expánsum*, Reichb. f.). Lvs. up to 8 in. long and  $1\frac{1}{2}$  in. broad: racemes equaling or exceeding the lvs.; fls. about  $1\frac{1}{4}$  in. long; sepals and petals white, tipped with amethyst-purple; lip 3-lobed, the spreading lateral lobes falcate, light amethyst, the middle lobe deep amethyst, broadly obovate, notched, denticulate; spur short, greenish. Upper Burma. Var. **Leónæi** (*A. Leónæi*, Reichb. f.). Differs in having the middle lobe of the lip larger and of deeper color, and in the dotting of the lateral lobes and of the base of the sepals and petals. Rangoon.

9. **Houlletianum**, Reichb. f. Resembles *A. falcatum*, but differs in its smaller fls., arranged in shorter and denser racemes, the sepals and petals tawny yellow, tipped with purple, the lip white, striped and spotted with purple, the middle lobe fimbriate. Cochin China. C.O., pl. 3. I.H. 29:455. R.B. 21:205. R.H. 1891:324.

10. **Augustianum**, Rolfe. Lvs. up to 8 in. long and  $1\frac{1}{4}$  in. broad: racemes longer than the lvs.; fls.  $1-1\frac{1}{4}$  in. long; sepals and petals rose, round-oblong, obtuse; lip 3-lobed, the oblong lateral lobes falcate, rounded or truncate at the summit, the broadly oblong middle lobe crenulate, somewhat bilobed at the apex; spur straight. Philippine Isls. G.C. III. 7:233.

11. **crassifolium**, Par. & Reichb. f. Lvs. up to 8 in. long and 2 in. wide: racemes longer than lvs.; fls. loosely arranged,  $1-1\frac{1}{2}$  in. long; sepals and petals rose-purple, paler at the base; lip 3-lobed, the lateral lobes rose-purple, nearly lunate or crescent-shaped, the broadly ovate middle lobe deep rose-purple; spur curved, greenish at the tip. Burma. G.C. II. 8:493. C.O., pl. 1.

12. **multiflorum**, Roxbg. (*A. affine*, Wall. *A. roseum*, Paxt.). Lvs. up to 10 in. long, less than 1 in. broad: racemes longer than the lvs.; fls. about  $\frac{3}{4}$  in. long; basal portion of the oval-oblong petals and dorsal sepal white,

with a few purple spots, the remainder light amethyst, the nearly orbicular lateral sepals white, faintly flushed; lip light amethyst, deeper in the middle, cordate obtuse; spur straight, short. B.M. 4049. Gt. 8:267. J.F. 2:200. Var. **Lóbbii**, Veitch (*A. Lóbbii*, Hort.). Differs from the type in its much-crowded lvs., and in the fls. which are more numerous and more highly colored. I.H. 15:559. Var. **Godefroyanum**, Veitch (*A. Godefroyanum*, Reichb. f.). Lvs. longer: fls. a little larger and more highly colored than in the type. R.B. 17:169.

13. **Fiëldingii**, Lodd. FOX-BRUSH ORCHID. Lvs. up to 10 in. long and nearly 2 in. broad: infl. racemose, sometimes paniculate at the base, longer than the lvs.; fls. about  $1\frac{1}{2}$  in. long, crowded; petals and dorsal sepal white, suffused with rose, or the basal portion sometimes white and dotted with purple, obovate, the lateral sepals white, tipped with pale purple, broadly oval; lip white, suffused with rose, deltoid or trowel-shaped, acuminate, the small lateral lobes inrolled over the mouth of the small white spur which is amethyst, mottled with white. Sikkin and Assam. B.H. 1876:18, 19. A.F. 22:883.

14. **maculôsum**, Lindl. Lvs. up to 10 in. long and nearly 2 in. broad: infl. longer than the lvs., often paniculate at the base; fls. about  $1\frac{1}{2}$  in. long, the sepals and petals white, the upper portion stained and spotted with amethyst, oval-oblong; lip clawed, the blade amethyst, deeper in the middle, ovate-oblong, obtuse, with 2 small white tubercles at the base; spur incurved, short, green-tipped. India. Var. **Schröederi**, Veitch. Differs from the type in its more robust habit, its longer lvs., and the darker markings of the sepals, petals, and middle of the lip. G.C. II. 13:493; 17:341. J.F. 1:54.

15. **crispum**, Lindl. (*A. Broðkei*, Batem.). Lvs. up to 8 in. long and 2 in. broad: infl. several times longer than the lvs., racemose, or sometimes paniculate at the base; fls. about 2 in. long, the sepals and petals white, faintly flushed with rose-purple on the back and on the surface at the apex; lip 3-lobed, the erect, small lateral lobes white, streaked with rose-purple on the surface, round-oblong, the middle lobe deep amethyst, white at the base, broadly ovate, the sides reflexed, serrate; spur small, curved. S. India. B.M. 4427. F.S. 5:438. Gn. 4, p. 85. B.R. 28:55. F.S. 1:42. G.C. III. 36:134. Var. **Lindleyanum**, Hort. Infl. paniculate at the base; fls. larger than in the type, the lip with the lateral lobes greenish and the middle lobe rich amethyst bordered with white. Neigherry Hills. Var. **Wärneri**, Hort. Differs in having the lvs. shorter and narrower than in the type, and in its longer racemes of smaller fls., the middle lobe of the lip deep rose with a white border.

16. **radicôsum**, Reichb. (*A. rubrum*, Hort.). Lvs. up to 10 in. long and  $1\frac{1}{2}$  in. broad: infl. longer than the lvs., racemose, or sometimes paniculate at the base; fls. about  $1\frac{3}{4}$  in. long, the sepals and petals light rose-purple, deeper spotted; lip 3-lobed, the small erect lateral lobes round, rose-purple, the middle lobe deep rose-purple, oblong, acute; spur curved, short. India.

17. **japonicum**, Reichb. f. Lvs. up to 4 in. long, few: racemes longer than the lvs.; fls. about 1 in. long, fragrant; sepals and petals greenish white, the lateral sepals bordered with brownish purple; lip 3-lobed, the lateral lobes small, the middle lobe obovate-spatulate, crenulate, white, with a median dark violet ridge and a few paler spots; spur straight, obtuse. Japan. B.M. 5798. I.H. 29:461.

18. **vandârum**, Reichb. f. (*A. cylindricum*, Hook.). St. slender, round: lvs. terete, grooved on the upper surface, up to 8 in. long: fls. single or in few-fl. racemes, white, about 2 in. long; sepals and petals undulate, the former obovate-oblong, the latter nearly rhomboidal, lip 3-lobed, the lateral lobes linear-falcate, the middle

lobe broadly obcordate; spur subulate. Himalayan region. B.M. 4982. J.H. III. 34:417. O.R. 13:60.

19. *mitrātum*, Reichb. f. St. short, with a few semiterete lvs. 6–15 in. long, deeply grooved on the upper surface: racemes from below the lvs. and shorter than them, ascending or nearly erect; fls.  $\frac{3}{4}$  in. long; sepals and petals white, flushed with mauve at the apex; lip amethyst; spur miter-shaped, short. Burma. B.M. 5728.

*A. Micholitzii*, Rolfe. A recently intro. species, allied to *A. odoratum*. Light rose-purple fls. and a rather short spur. Annam. O.R. 1904:181.—*A. cylindricum*, Lindl. Resembles *A. vandarum* in habit and foliage. Fls. about  $1\frac{1}{2}$  in. across; the sepals and petals waxy white, sometimes tinged rose, the lip white, the side lobes purple-streaked, the middle lobe yellow with a crimson tip. India. G.C. III. 17:393.—*A. Duquesnei*, Hort. Fls. white dotted with rose.—*A. Emericii*, Reichb. Fls. 1 in. long, the sepals and petals white, amethyst-blotched at apex, the side lobes of lip purple-spotted, the middle lobe small, narrowly oblong, acute, amethyst; spur incurved. B.M. 6728.—*A. Thibautianum*, Reichb. Racemes longer than the lvs.: fls. rose with an amethyst lip; spur curved.

GEORGE V. NASH.

**ÆRUA** (said to be from the Arabic name). *Amarantaceæ*. A genus of 10 species of Trop. Asiatic and African herbs or shrubs, allied to *Achyranthes*, with perfect or imperfect fls., the perianth segms. short and hyaline; stamens 5 or 4, sterile filaments intervening; fls. very small, usually in clusters, white or rusty.

*sanguinolenta*, Blume (*A. sanguinea*, Hort.). Lvs.  $1\frac{1}{2}$ – $2\frac{1}{2}$  in. long, opposite or alternate, ovate-acuminate,



133. Opening foliage of *Æsculus Hippocastanum*.

soft-pubescent, pale beneath. Java.—Cult. for its dark red lvs. Not common and at present perhaps confined to botanic gardens.

N. TAYLOR.†

**ÆSCHYNÁNTHUS**: *Trichosporum*.

**ÆSCULUS** (ancient name of some oak or mast-bearing tree). Including *Pavia*. *Hippocastanaceæ*. HORSE-CHESTNUT. BUCKEYE. Trees or sometimes shrubs, cultivated for shade and for the conspicuous bloom of some species.

Winter-buds large with several pairs of outer scales: lvs. opposite, long-petioled, digitate, deciduous; lfts. 5–9, serrate; fls. symmetrical in terminal panicles; calyx campanulate to tubular, unequally 4–5-toothed; petals 4–5, with long claws; stamens 5–9; ovary 3-celled, with 2-ovuled cells: fr. a large 3-valved caps., usually with 1 or 2 large seeds; seeds large, brown, with a large pale hilum.—About 20 species in N. Amer., E. Asia, Himalayas and Balkan Peninsula.

The buckeyes are deciduous trees and shrubs, with large, digitate leaves and red, white or yellow flowers in showy terminal panicles. They are cultivated for their showy flowers and handsome foliage, and some species

make excellent shade trees. The large seeds are not edible.

Some species, as *Æ. Hippocastanum* and *Æ. carnea* are popular shade and street trees. They leaf early and soon give a dense shade. The shrubby species are well adapted for borders of larger groups or as solitary clumps on the lawn, particularly *Æ. parviflora*, with its slender panicles of white flowers; similar in habit and effect but with bright scarlet flowers, are *Æ. discolor*, *Æ. georgiana* and *Æ. splendens*. Most of the species are hardy North, but the Californian and Himalayan species are suitable only for the southern states. They grow best in loamy and moist soil.

Propagation is by seeds to be sown in autumn or stratified, or by side-grafting and budding on common species, and the shrubby forms also by layers; *Æ. parviflora* is propagated also by root-cuttings.

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A. Winter-buds resinous: claws of petals not longer than calyx; stamens exerted.

B. Lfts. sessile: petals 5; calyx campanulate, 5-lobed; stamens 5–8: fr. globular. (*Hippocastanum*).

c. Lvs. glabrous beneath.

1. **Hippocástanum**, Linn. COMMON HORSE-CHESTNUT. Fig. 133. Large tree, 60–80 ft.: lfts. 5–7, sessile, cuneate-obovate, acuminate, obtusely serrate, nearly glabrous: panicles 8–12 in. long, very showy; fls. white, tinged with red,  $\frac{3}{4}$  in. long; fr. echinate. May. N. Greece, Bulgaria. H.W. 3:47. F.E. 13, pl. 13 (habit).—Many garden forms; the most important are: Var. *Baumanni*, Schneid. (var. *flore-pleno*, Lem.), with double white fls. I.H. 2:50. F.S. 7, p. 75. B.H. 4, p. 133. G.M. 44:613. A.G. 32:271 (habit). Var. *Schirnhoferi*, Rosenth., with double yellowish red fls. W.I.G. 1882:101. Var. *pumila*, Dipp., dwarf form. Var. *umbraculifera*, Rehd., with compact round head. M.D.G. 1903:188. Var. *pyramidalis*, Nichols., with compact, narrow, pyramidal head. Var. *laciniata*, Leroy (var. *dissecta*, Hort., var. *heterophylla*, Hort.), lfts laciniate. Var. *incisa*, Dipp. Lfts. short and broad, deeply and doubly serrate to incisely lobed. Var. *Henkeli*, Henkel, is little different, only the lfts. are narrower and the habit more pyramidal. Var. *variegata*, Loud., lvs. variegated with yellow. Var. *Memmingeri*, Bean. Lvs. sprinkled with white.—The horse-chestnut is one of the most popular of shade trees on the continent of Europe, and is also much planted along roads and in parks and private grounds in this country. It is particularly adaptable for bowers and places where seats are desired, as the top stands heading-in and makes a very dense shade. It is the first of all shade trees to burst into leaf. When smaller, more formal trees are desired, var. *umbraculifera* should be planted. The double-fl. forms are to be recommended for the longer duration of their fls. and for the absence of the fr. which is of great, often annoying, attraction to the small boy. In dry situations, the planting of the horse-chestnut should be avoided, as the foliage is likely to suffer, particularly in dry seasons, from drought and heat.



2. *carnea*, Hayne (*Æ. Hippocastanum* × *Pavia*. *Æ. rubicunda*, Loisel., *Æ. intermedia*, André). Tree, 20–40 ft.: lfts. mostly 5, nearly sessile, cuneate-obovate, crenate-serrate, nearly glabrous; panicles 5–8 in. long; fls. varying from flesh-color to scarlet: fr. with small prickles. Garden origin. B.R. 1056. L.B.C. 13:1242. F.S. 2229–30. F.E. 23:607 (habit).—Common in parks and on roadsides. Handsome and desirable; the foliage is darker and of firmer texture than that of the preceding species and resists drought better. Many garden forms, according to the different shades in coloring; one of the best is var. *Briottii*, Nichols. (*Æ. rubicunda* var. *Briottii*, Carr.), with bright scarlet fls. R.H. 1878: 370. Also var. *plantierensis*, Rehd. (*Æ. plantierensis*, André), with yellowish white fls. tinged with pink and fading to pink and with bluntly serrate lfts., is very handsome.

cc. *Lvs. pubescent beneath, at least while young.*

3. *turbinata*, Blume (*Æ. sinensis*, Hort., not Bunge). JAPANESE HORSE-CHESTNUT. Tree, 20 ft.: petioles and young branchlets pubescent; lfts. 5–7, cuneate-obovate, crenate-serrate, pubescent beneath when young; panicles 6–10 in. long, dense and rather narrow, pubescent; fls. yellowish white, with a red spot, less than  $\frac{1}{2}$  in. long; fr. verrucose. June. Japan. G.C. III. 5:717; 31:187. S.I.F. 1:71.—The lvs. are larger than those of the preceding species, but the individual fls. are smaller and less strongly marked with red. Hardy at the Arnold Arboretum.

BB. *Lfts. stalked: petals 4; calyx 2-lipped; stamens 7–9: fr. pear-shaped, smooth.* (*Calothyrsus*.)

c. *Petals nearly equal, oblong-obovate to oblanceolate.*

d. *Corolla about 1 in. long.*

4. *californica*, Nutt. CALIFORNIA BUCKEYE. Tree with broad top, 30–40 ft.: lfts. 5–7, petioled, oblong-lanceolate, cuneate or obtuse at the base, sharply serrate, glabrous, 4–6 in. long; panicles 3–8 in. long, rather dense; fls. white or pale rose-colored, 1 in. long; petals of equal length. Calif. B.M. 5077. R.H. 1855, p. 150. Gn. 49, pp. 490, 492. S.S. 2:71, 72. F.S. 13:1312. G.C. III. 31:186. G.M. 55:577 (habit).

DD. *Corolla much less than 1 in. long.*

5. *chinensis*, Bunge. Tree, to 60 ft.: lfts. 5–7, short-stalked, oblong-obovate to oblong-oblanceolate, acuminate, cuneate at the base, glabrous beneath, except sparingly hairy on the veins, closely serrulate, 4–7 in. long; fls. less than  $\frac{1}{2}$  in. long, white, in elongated cylindric panicles: fr. subglobose, slightly depressed at the apex, with thick walls; seeds 1 in. across or less with the hilum occupying about one-half of the seed. May, June. N. China. G.C. III. 52:346, 347.—Recently intro. by the Arnold Arboretum and probably hardy N.

6. *Wilsonii*, Rehd. Tree, to 80 ft.: lfts. 5–7, stalked, oblong-obovate to oblong-oblanceolate, acuminate, rounded or broadly cuneate at the base, densely grayish pubescent beneath while young, 4–9 in. long; fls. about  $\frac{1}{2}$  in. long, the upper petals with a yellow spot, in cylindric panicles 6–12 in. long; fr. ovoid, somewhat pointed at the apex, with thin walls; seeds  $1\frac{1}{2}$  in. across with the hilum occupying one-third or less of the seed. May, June. W. and Cent. China.—Recently intro. by the Arnold Arboretum, but proved tender in Mass.; probably hardy south of New York, and a tree highly to be recommended for its very large spikes of white fls.

CC. *Petals unequal, about 1 in. long, the upper ones marked red and yellow, oblanceolate, the lateral ones with oval or obovate blade.*

7. *indica*, Colebr. Tall tree, to 60 ft.: lfts. 5–9, obovate-lanceolate, short-stalked, finely serrate, cuneate at the base, glabrous or nearly so beneath, 6–10 in. long; panicle to 15 in. long, narrow; fls. about 1 in. long with white unequal petals, the upper with yellow

blotch, the lower tinged rose. Himalayas. B.M. 5117. G.C. 33:139; 36:206. Gn. 76, p. 399.—A handsome tree with large foliage and showy fls., hardy only in the southern states.

AA. *Winter-buds not resinous: claws mostly longer than the 5-toothed calyx.*

B. *Fls. yellow to scarlet; petals 4; stamens included or somewhat exerted: lfts. petioled.* (*Pavia*.)

C. *Petals villous at the margin (interspersed with glands in the hybrid).*

D. *Color of fls. yellow; margin of petals without glands.*

8. *glabra*, Willd. (*Æ. ohioensis*, Michx. *Pavia glabra*, Spach. *P. pallida*, Spach). OHIO BUCKEYE. Small tree, 15–30 ft.: lfts. 5, oval or cuneate-obovate, finely serrate, smooth; panicles 5–6 in. long; fls. greenish yellow; petals of nearly equal length, their claws as long as the calyx; stamens exerted: fr. echinate. May. Pa. to Ala. and Iowa. B.R. 24:51. S.S. 2:67, 68. F.E. 29:773 (habit). Var. *Bückleyi*, Sarg. (*Æ. glabra* var. *arguta*, Rob. partly). Shrub: lfts. 6–7, obovate-lanceolate, unequally serrate, more acuminate, finely pubescent beneath. Has been confounded with the true *Æ. arguta*, Buckl.

9. *octandra*, Marsh. (*Æ. flava*, Ait. *Æ. lutea*, Wang *Pavia lutea*, Poir.). SWEET BUCKEYE. Large tree, 40–90 ft.: lfts. 5, oblong-obovate or elliptical, cuneate,



134. *Æsculus georgiana*. ( $\times \frac{1}{2}$ )

equally serrate, smooth or pubescent beneath; panicles 4–6 in. long; petals yellow, very unequal, their claws longer than the calyx; stamens 7, shorter than the petals: fr. smooth. May, June. Pa. to Ga. and Iowa. L.B.C. 13:1280. S.S. 2:69, 70. G.W. 7, p. 145 (habit).

DD. *Color of fls. red or yellow tinged more or less with red.*

E. *Margin of petals without glands, villous.*

10. *georgiana*, Sarg. Fig. 134. Shrub, to 6 ft.: lfts. 5, stalked, oblong-obovate, long-pointed, finely and often doubly serrate, pale yellowish green beneath and quite glabrous: fls.  $1\frac{1}{4}$  in. long, in dense panicles 5–6 in. long; calyx narrow-campanulate, red; petals red and yellow; very dissimilar, the lateral ones broad, usually rounded at the base; stamens 7, shorter than the petals, villous below the middle. May, June. Ga. S.T.S. 2:197.—This is the only species of the *Æ. octandra* group with red and yellow fls.: it is very handsome and has proved perfectly hardy at the Arnold Arboretum.

11. *wœrlitzensis*, Koehne. Tree: lfts. obovate-oblong, yellowish green beneath, sparingly hairy along the midrib and bearded in the axils, otherwise quite glabrous, with 17–20 pairs of veins: fls.  $1\frac{1}{4}$  in. long, in

panicles 4-5 in. long; calyx tubular, wider above the middle; petals red, the lateral ones with an oblong-oval or oblong-obovate blade gradually narrowed at the base; stamens as long as the lateral petals. May. Of garden origin. Var. *Ellwangeri*, Rehd. (*Æ. Pavia* var. *Whitley*, Ellwanger & Barry, not Hort. Angl. *Æ. Pavia* var. *atrosanguinea*, Hort.). Lfts. slightly hairy on the whole under surface while young, with 20-27 pairs of veins: fls. darker red; calyx narrower, not widened above the middle. Origin unknown.—Very similar to *Æ. Pavia*, but easily distinguished by the villous margin of the petals.

EE. Margin of petals with hairs and glands: fls. yellow and reddish.

12. *hýbrida*, DC. (*Æ. octandra* × *Pavia*, *Æ. versicolor*, Wender. *Pavia hýbrida*, Spach. *Æ.* or *P. Lyonii*, Hort.). Intermediate between *Æ. octandra* and *Æ. Pavia*. Lfts. pubescent beneath along the veins, short-petioled, minutely crenulate-serrate; calyx narrow-campanulate, red or yellowish red; petals yellow or reddish; stamens shorter than petals, pubescent toward the base. May, June. Garden origin. W.D.B. 2:164 (as *Æ. Pavia*).—Several forms of this hybrid are in cult., varying in the color of the fls. from yellow, slightly tinged with red, to nearly red. Here belong also several forms cult. in gardens as *Æ. discolor* and *Æ. Pavia* var. *arguta*, Lindl., with red fls. (B.R. 993).

cc. Petals only glandular, not villous on the margin, red, or red and yellow.

d. Lvs. glabrous beneath or only slightly pubescent along the midrib.

13. *Pavia*, Linn. (*Pavia rubra*, Poir. *P. Michauxii*, Spach). RED BUCKEYE. Shrub or small tree, 4-20 ft.: lfts. oblong or elliptical, acute at both ends, finely serrate, smooth or pubescent beneath: panicles 4-7 in. long, loose; fls. purplish to dark red; calyx tubular; petals very dissimilar; stamens mostly 8, nearly as long as the petals: fr. smooth. May, June. Va. to Fla. and La. L.B.C. 13:1257. S.T.S. 2:199.—Many garden forms, as var. *humilis*, Mouillef. (*Æ. humilis*, Lodd. *Æ. Pavia* var. *nana*, Dipp. *Æ. Pavia* var. *péndula*, Hort. *Æ. rubra* var. *humilis*, Loud.). Low shrub, sometimes prostrate, 2-4 ft.: lfts. coarsely and unequally serrate, slightly pubescent beneath, chiefly along the veins: fls. red; calyx dark red. B.R. 1018. Var. *atrosanguinea*, Rehd. Fls. very dark red. Var. *sublaciniata*, Wats. (*Pavia atropurpurea*, Spach). Lfts. narrower oblong, deeply serrate: fls. dark red. W.D.B. 2:120. There are also forms with variegated lvs.

DD. Lvs. tomentose or densely pubescent beneath.

14. *discolor*, Pursh (*Æ. Pavia* var. *discolor*, Torr. & Gray. *Æ. octandra* var. *hýbrida*, Sarg., partly). Shrub or small tree, to 30 ft.: lfts. 5, elliptic to oblong-obovate, acuminate, finely crenately serrate, whitish tomentose beneath: panicles 6-8 in. long, rather narrow; fls. 1½ in. long; calyx tubular, deep scarlet like the axis of the panicle; petals very unequal, scarlet and yellow in the typical form; stamens at least longer than the shorter pair of petals: fr. smooth; seeds light yellowish brown. May-June. Ga. to Texas and S. Mo.

B.R. 4:310. S.S. 13:622. S.O.B. 1:39 (as *Æ. Pavia*). Var. *móllis*, Sarg. (*Æ. móllis*, Raf. *Æ. austrina*, Small). Fls. deep scarlet. A very handsome variety with its long and rather slender racemes of bright scarlet fls. It has proved hardy at the Arnold Arboretum. Var. *flavescens*, Sarg. Fls. yellow. This is the yellow-fl. Texan buckeye formerly referred to *Æ. octandra*.

15. *spléndens*, Sarg. A shrub, 8-12 ft.: lfts. 5, lanceolate to oblanceolate, acuminate, finely and often doubly crenulate-serrate, densely hoary pubescent beneath: fls. 1½ in. long in many-fl. panicles 4-8 in. long; calyx tubular, bright red; petals unequal, deep scarlet; stamens usually 7, longer or shorter than the petals: seeds dark chestnut-brown. May, June. Ala.—Apparently the handsomest in flower of all horse-chestnuts. S.F.S. 2:200.

BB. Fls. pure white, small; petals 4-5; stamens more than twice as long as the petals. (*Macrothyrus*.)

16. *parviflora*, Walt. (*Æ. macrostachya*, Michx. *Pavia alba*, Poir.). Fig. 135. Shrub, 3-10 ft.: lfts. 5-7, elliptical or oblong-ovate, nearly sessile, finely serrate, pubescent beneath: panicles 8-16 in. long, narrow: fr. smooth. July, Aug. Southern states. B.M. 2118. Gng. 7:81. G.C. II. 8:653; III. 31:189, 200; 45:123. Gn. 63, p. 299; 75, p. 568. M.D.G. 1897:305. Gn. M. 9:76. A.F. 24:533; 28:724 (habit); 34:190.—One of the handsomest plants for a lawn clump.

*Æ. arguta*, Buckl. (*Æ. glabra* var. *arguta*, Rob.). Allied to *Æ. glabra*. Shrub, 1-5 ft.: lfts. 7-9, lanceolate to obovate-lanceolate, sharply and often doubly serrate, pubescent beneath: fls. light yellowish green. Texas. S.T.S. 2:198.—Not in cult.; the plant that is cult. under this name is *Æ. glabra* var. *Buckleyi*.—*Æ. Bushii*, Schneid. Supposed hybrid of *Æ. glabra* and *discolor*. Tree, to 30 ft.: lfts. oblong-obovate, finely and bluntly serrate, pubescent below: calyx pink; petals pink and yellow, glandular and villous at the margin: fr. slightly tuberculate. Ark. Hardy at the Arnold Arboretum.—*Æ. glaucescens*, Sarg. Related to *Æ. octandra*. Shrub, to 10 ft. Lfts. larger, glabrous and glaucescent beneath: fls. larger: fr. smaller. Ga. S.T.S. 2:196.—*Æ. humilis*, Koehne, not Lodd. Related to *Æ. discolor* and possibly variety. Low shrub: lvs. tomentose beneath: fls. red and yellow. Of unknown origin.—*Æ. marylandica*, Booth. Supposed hybrid of *Æ. glabra* and *octandra*. Of unknown origin.—*Æ. neglecta*, Lindl. Near *Æ. octandra*, but petals veined with purple toward the base of the blade: the lfts. are glabrous beneath. Of unknown origin. B.R. 12:1009.—*Æ. Parryi*, Gray. Similar to *A. californica*. Lfts. small, obovate, canescent-tomentose beneath: calyx 5-lobed. Calif. G.F. 3:356.

ALFRED REHDER.

ÆTHEOPÁPPUS: *Centaurea*.

ÆTHIONÈMA (*aītho*, scorch, and *nema*, filament; probably referring to appearance of stamens). *Cruciferae*. Dwarf, shrubby herbs for the hardy herbaceous border, or rockery. Less common than Iberis.

The genus differs from *Iberis* in having all its petals equal, and from *Lepidium* in having its four stamens longer, winged and toothed. Fls. various shades of pink, purple, or red, in crowded terminal racemes. W. B. Hemslay, in Gn. 9, pp. 108, 109.

Æthionemas dislike moist or stiff soil or shady places; but in light, sandy loam, on dry and sunny slopes, they are compact and branchy, and when once fairly established will last for many successive years without replanting or renewal, while, under the opposite conditions, the plants grow feeble and lanky, and may die after a year



135. *Æsculus parviflora*. (× ¼)



or two. They keep fully as well as the candytufts in water, and can be cut with longer and straighter stems.

Propagation is by seeds in spring or by cuttings in summer; annual and biennial kinds by seeds.

#### A. Perennial.

**coridifolium**, DC. (*Iberis jucunda*, Schott & Kotschy). Branches numerous, thick, 4-6 in. high: lvs. crowded, short, nerveless, linear or linear-oblong, acute or obtuse: fls. rosy lilac, smaller and later than in the next, in dense, short, rounded racemes. Chalky summits of Lebanon and Taurus. B.M. 5952.—Good for edging. *Æ. pulchellum* was sold under this name for many years.

**grandiflorum**, Boiss. & Hohen. Branches 1-1½ ft., prostrate: lvs. usually longer than in *Æ. coridifolium*, more linear and more acute: fls. as large as those of *Arabis alpina*, rose-colored, in slender, elongated racemes; petals 4 times as long as the sepals. Persia. Gn. 9:108. Useful in the rock-garden.

**pulchellum**, Boiss. & Huet. Similar to *Æ. coridifolium*, but more diffuse and trailing. Fls. smaller and brighter-colored; petals 2½ times as long as the sepals. Persia. Gn. 25:320.

**iberideum**, Boiss. St. cespitose, ascending, rough: lvs. glaucous, bunched, oblong or linear-lanceolate, narrowly acute at the base: fls. large and showy, white, racemose, flowering from June to Sept. E. Medit. region.—Not well known in Amer.

#### AA. Annual.

**cappadocicum**, Spreng. (*Æ. Buxbaumii*, DC.). Six to 8 in.: lvs. oblong or linear-oblong, spatulate, glaucous: fls. racemose, the racemes crowded, corolla pale red. June. Orient.

*Æ. diastrophis* Bunge. 10 in. high: fls. pale, rosy lilac. Mts. of Armenia. GN. 63:109.—*Æ. persicum*, Hort. Stout, erect, shrubby, dwarf: fls. deep rose.—Best of dwarfs. Intro. 1892, by J. W. Manning.

N. TAYLOR.†

**ÆXTÓXICON** (Greek, *aix*, goat, and *toxicon*, poison). *Euphorbiaceæ*. Trees, rarely cult. Younger parts covered with deciduous scales: lvs. alternate, simple, leathery: fls. with petals and disk, in short clusters: fr. fleshy, 1-seeded. The single species from the Chilian coast (*Æ. punctatum*, Ruiz & Pav.), and known there as *tique*, *palo muerto*, *acietunillo* and *olivillo*, is listed once in the U. S. Dept. of Agric. inventories of seeds and plants intro.

J. B. S. NORTON.

**AFZÈLIA** (named for Adam Afzelius, of Upsala, and once resident in Sierra Leone). *Leguminosæ*. A small genus of unarmed trees, in Afr. and the Pacific Is.: fls. with vexillum much exceeding calyx and clawed, the lateral and anterior petals scale-like or wanting; perfect stamens 7, staminodia 2. **A. bijuga**, Gray. Tree: lvs. abruptly pinnate, the lfts. mostly in 2 pairs, ovate: fls. in small terminal panicles: pod oblong and flat, 5-8 in. long by 2 in. wide; seeds compressed-orbicular, 1 in. or more in diam. Described from the Fiji Is., but apparently widely distributed in Oceanica. Apparently not cult., but it is the "ift," used in Guam as a cabinet-wood and for general construction purposes.

**AGALLÛCHA**: *Ericacaria*.

**AGÁLMYLA** (*agalma*, ornament, and *kule*, wood; an ornament to the woods in which they grow wild). *Gesneriæ*. A genus of 3 species of tender climbers from Java and Sumatra which may be grown in a basket like *Æschynanthus* (*Trichosporum*). Fls. in axillary bunches, the corolla 5-lobed, oblique, but scarcely 2-lipped: lvs. simple, alternate.

*A. longistyla*, Carr., is considered a synonym of the next, but apparently has a longer style. R.H. 1873:270.—*A. staminea*, Blume. **SCARLET ROOT BLOSSOM**. St. rooting from the lower sur-

face: lvs. alternate, with an abortive one opposite the base of each: petioles 4-8 in. long; blade as long, ovate, serrate: fls. in large axillary sessile fascicles of 12-14; stamens exserted. B.M. 5747. P.M. 15:73. F.S. 4:358.

N. TAYLOR.†

**AGANÍSIA** (Greek, meaning *desirable*). *Orchidacæ*. Epiphytes grown on blocks.

Stems short, finally forming pseudobulbs, arising from a creeping rhizome: lf. 1: fls. few, in an erect raceme from the base of the pseudobulb; sepals and petals nearly alike, spreading; lateral lobes of the lip short or obsolete, the middle lobe broad, spreading, entire or 2- or 3-lobed; pollinia 4.—Species 2; natives of S. Amer. For culture and propagation, see article on Orchids.

**cyanea**, Reichb. (*A. tricolor*, N. E. Br. *Acacallis cyanea*, Lindl.). Pseudobulbs ovoid, up to 2 in. long, 1- or 2-lvd.: lvs. narrowed to a short petiole, up to 6 in. long: raceme of 4-7 fls. over 2 in. wide; sepals and petals pale mauve, especially the latter; lip with a rose-purple reniform limb and a fringed claw. Brazil. Lind. 1:45.—Very rare in cult. Needs a high temp.

**pulchella**, Lindl. Pseudobulbs ovoid, barely 1 in. long, 1-lvd.: lvs. 3-5 in. long, narrowed into a long petiole: raceme of 4-6 fls. about 1¼ in. broad; sepals and petals white; lip with the lower part nearly round, concave, spotted with red, the upper part larger, broadly ovate, yellow in the center. Guiana. B.R. 26:32.—Very rare in cult.

*A. ionóptera*, Nichols. Fls. blue, nodding, the sepals and petals tipped white, the white lip with the lateral lobes red-streaked, the middle lobe transversely oblong, with 2 red bars. Peru. B.M. 7270.

GEORGE V. NASH.

**AGAPÁNTHUS** (*agape*, love, and *anthes*, flower). *Liliacæ*. Conservatory plants, with tuberous rootstocks, blooming from late spring to fall, but mostly in summer.

Plant robust and tall (dwarf forms): scape simple, fls. in 2-bracted umbels, in shades of blue and varying to white; perianth with 6 wide-spreading divisions, nearly regular; stamens 6; pod many-seeded; seeds flat, winged above: foliage usually evergreen, but vanishing early in some of the forms. S. Afr.—Probably only one species, although several have been described.

In this country, agapanthus are usually grown in tubs (the roots are likely to burst pots), and are flowered in summer in the conservatory, window-garden, living-room, or set in protected places in the open. The plant is kept dormant during winter, as in a frame or light cellar, only enough life being maintained to prevent the leaves from falling. When in bloom, give abundance of water. Plants will bloom many years if given a large enough tub, not allowed to become overcrowded in the tub, and supplied with manure-water, sending up many clusters each year. Good results can also be obtained in single pots. It forces well. If kept dormant until spring, plants may be bedded in the open, or massed in vases, for summer bloom.—Propagation is effected by dividing the roots (and rarely by seeds). Old roots break up more easily if soaked in water a few hours. When dormant, the plant will stand a few degrees—usually 10° or less—of frost.

**umbellatus**, L'Her. **AFRICAN LILY**. **LILY-OF-THE-NILE** (although native to Cape of Good Hope region). Fig. 136. Lvs. 2 ft. long and numerous, thick, narrow: scape rising 2-3 ft. from the lf.-rosette, bearing an umbel of 10-30 handsome blue fls.; perianth funnel-shaped, 1½-2 in. long, with short tube. B.M. 500.—One of the best known of half-hardy liliaceous plants. Very variable in the wild, and many of the forms have been intro. to cult. Tall or giant forms: Var. **multiflorus**, Voss. (var. *máximus*, Hort. *A. multiflorus*, Willd.), taller than the prevailing forms, the bright blue large fls. as many as 30-60 in an umbel, the lvs. broader, Var. **giganteus**, Hort., a very robust form (to 4 ft.)

with 150–200 dark blue fls. Dwarf forms: Var. *minor*, Hort., very small, with slender narrow lvs. ( $\frac{1}{2}$  in. or less broad) and deep blue fls. which are 1 in. or less long; var. *Mooreanus*, Hort.,  $1\frac{1}{2}$  ft., lvs. short and upright, fls. dark blue, and as large as in *A. umbellatus* itself;



136. *Agapanthus umbellatus*.

hardy; var. *Leichtlinii*, Hort.,  $1\frac{1}{2}$  ft., fls. bright hyacinth-blue in a very compact umbel. Variegated forms: Var. *variegatus*, Hort., lvs. white with sparse green stripes, rather small; var. *aureus*, Hort., lvs. striped yellow. White-fl. forms: Var. *albidus*, Hort., fls. pure white, rather small but many, the lvs. usually not persisting; var. *Saintpaulii*, Hort., apparently similar to last: fls. smaller than in *A. umbellatus*. Blue-fl. forms of usual habit: Var. *pallidus*, Hort., fls. pale porcelain-blue; var. *Weillighii*, Hort., fls. lavender with indigo-blue lines and margins; var. *Saundersianus*, Hort., fls. dark blue; var. *atrocaeruleus*, Hort., fls. dark violet; var. *præcox*, Hort. (var. *minimus*, Lindl. *A. præcox*, Willd.), is an earlier form, blooming in June or even earlier and by some regarded as a distinct species, the lvs. narrower than in the type, fls. smaller and 30–40 in the umbel, pale blue, with narrow perianth segms., and the peduncle or scape short; var. *flöre pleno*, Hort., a double-fl. blue form, the fls. long-lasting. Very recent introductions are: Var. *globosus* (*A. globosus*, Bull), a dwarf-growing form, producing dense globular umbels on long scapes, the fls. about 1 in. across, the outer segms. lilac-blue shaded white and the inner ones emarginate and darker, the lvs. deciduous; var. *insignis* (*A. insignis*, Bull), tall, the basal part of the arching lvs. milk-white, the fls. very numerous on long slender pedicels and drooping in the very large umbel, pale lavender. Gn. 64, p. 67. G.M. 46, p. 423. G.W. 1903, p. 529, 531; var. *caulescens* (*A. caulescens*, Spreng.), fls. blue, lighter inside, long-pedicelled and the outer ones nodding, the root with thickened fibers; intro. by Carl Sprenger of Naples. Gt. 50:1487.

L. H. B.

**AGAPÈTES** (Greek *agapetos*, beloved or lovable, referring to the beauty of the plant). *Ericaceæ*, subfamily *Vaccinioidæ*. Shrubs sometimes cultivated for their handsome flowers and attractive foliage.

Evergreen plants, often epiphytic and with the sts. thickened at the base: lvs. alternate, or irregularly whorled, short-petioled or sessile, entire or slightly toothed: fls. in axillary fascicles or short racemes, rarely solitary; calyx-tube turbinate, with 5-lobed limb; corolla tubular to campanulate, with 5, usually curved lobes; stamens 10, with short filaments, anthers produced into 2 long beaks opening at the apex by a pore or slit; ovary 5-celled, inferior: fr. a juicy or dry berry with many seeds.—About 30 species from the southern Himalayas to N. Austral., chiefly in the humid mountain forests at elevations of 3,000–6,000 ft.

The several species in cultivation are highly ornamental shrubs with handsome lustrous foliage and showy usually scarlet or bright red clustered flowers. They are sometimes grown in warm greenhouses in Europe, but apparently none of them is in the American trade.

They grow best in a porous soil consisting of peat, leaf-mold, fibrous loam and plenty of sand; the smaller kinds are suitable for growing in baskets on account of

their epiphytic nature. Out-of-doors they could be grown only in warmer temperate regions, in localities in which the air possesses sufficient humidity and in partial shade.

Propagation is by cuttings of half-ripened wood under glass in the warm greenhouse.

*A. buxifolia*, Nutt. Branches and calyx hairy: lvs. obovate-cuneate, crenately serrate, glabrous, about 1 in. long; fls. axillary, 1–2, cylindric, bright red with spreading lobes. Himalayas. B.M. 5012. G.C. III. 27:197.—*A. glabra*, Clarke (Thibaudia glabra, Griff.). Glabrous lvs. oblong-lanceolate, rounded at the base, sometimes elliptic, obscurely crenate, about 5 in. long; fls. several, axillary, tubular, ventricose below the middle,  $\frac{3}{4}$  in. long, white, greenish toward the apex, pink at the base. Himalayas. Gn. 10, p. 539.—*A. macrantha*, Benth. & Hook. (Thibaudia macrantha, Hook.). Plant glabrous: lvs. lanceolate, long-acuminate, 3–4 in. long; fls. in 2–3-fl. clusters, outside of the axils, pendulous, urceolate, 5-ribbed, 2 in. long, yellowish white, marked with red wavy transverse lines. E. India. B.M. 4566. F.S. 6:646. J.F. 1:95. G.C. III. 15:501. R.H. 1852:81. R.B. 26:181.—*A. Moorei*, Hemsl. Lvs. oblong-lanceolate, usually whorled at the end of the branches, entire, glabrous, 2–3½ in. long; fls. in short axillary, 6–9-fl. racemes, cylindric, scarlet or orange-red, 1½ in. long, lobes reflexed, narrow, yellow within. Himalayas. B.M. 7928.—*A. setigera*, D. Don (Thibaudia setigera, Wall.). Lvs. oblong or lanceolate, about 4 in. long, usually whorled: fls. in lateral clusters, deep red, usually hairy,  $\frac{3}{4}$  in. long; pedicels and calyx hairy. Himalayas. Wight Icon. 1180, 1181 (as Vaccinium verticillatum and V. Wallichianum).—*A. speciosa*, Hemsl. Glabrous: lvs. ovate-oblong, subcordate at the base, slightly serrulate, 3–4 in. long; fls. 3–6, axillary, cylindric-urceolate, 5-ribbed, deep crimson, 1½ in. long. Probably from Burma. G.C. III. 41: 237.—*A. variegata*, D. Don (Thibaudia pulcherrima, Wall. A. pulcherrima, Benth. & Hook.). Tall shrub, glabrous: lvs. elliptic-lanceolate, 6–8 in. long; fls. on the old wood in many-fl. dense clusters, cylindric-campanulate, 5-angled, pale red marked dark red, 1 in. long. Himalayas. B.M. 4303. F.S. 3, pt. 7:1–2.

ALFRED REHDER.

**AGÁRICUS.** A genus of fleshy fungi, considered under *Mushroom*.

**AGARÍSTA:** *Leptosyne*.

**AGATHÆA:** *Felicia*.

**ÁGATHIS** (*agathis*, glome; the flowers in clusters). *Pinacæ*. Tender Australian diocious conifers, allied to *Araucaria*, yielding dammar resin.

Leaves coriaceous, not needle-like, usually broad, petioled or almost sessile, opposite or alternate: cones axillary, ovate or globular, composed of persistent, bractless scales. Distinguished from pines and firs by the broad-parallel-veined lvs.—Not uncommon in botanic garden collections where they are grown in the temperate house.

**robústa**, Hook. (*Dammara robústa*, C. Moore. *D. Brównii*, Hort.). Branches somewhat verticillate, horizontal: lvs. broad, ovate-lanceolate, obtuse, short-stalked,  $3\frac{1}{2}$ –4 in. long, 2–3 in. wide: cones oval, 3–4 in. long, 2–3 in. wide: tree reaching 130 ft. in Austral.—Cult. in Calif.

**austrális**, Salisb. (*Dammara australis*, Lambert.). The KAWRI PINE. Tree, 120–150 ft.: lvs. sessile, linear oblong, rarely elliptic, alternate, or opposite on the branchlets,  $1\frac{1}{2}$ –2 in. long,  $\frac{1}{2}$ – $\frac{3}{4}$  in. wide: staminate catkins solitary: cones almost spherical, 2–3 in. diam. New Zeal. G.F. 2:583. Lambert, Pinus 2:44.—Cult. outdoors in Calif., but not very successfully. Kawri gum, much used in the manufacture of varnish, is the partly fossilized resin of *A. australis*. It is found 5–6 ft. below the surface of the ground, in the northern part of New Zeal., where there were vast forests of this tree in ages past.

**orientális**, Lambert. Fig. 137. Tree, 100 ft.: lvs. opposite or alternate, entire, coriaceous, glaucous, 2–4 in. long,  $1\frac{1}{2}$  in. wide, sometimes a little falcate: staminate catkins 2 in. long: cones globular or turbinate, solitary, peduncled, and axillary. E. Indies. Lambert, Pinus 2:43. B. M. 5359.—Cult. outdoors in Calif. and in greenhouses elsewhere. Both this and the preceding intro. by Franceschi of Santa Barbara, Calif. (as *Dammara orientalis*.)

N. TAYLOR.

**AGÀVE** (Greek, *agauos*, admirable). *Amaryllidacæ*. Important decorative and economic plants from hot





VI. A good example of aquatic gardening, with water-lilies and Japanese iris.





American deserts, the most familiar of which is *A. Americana*, the CENTURY PLANT, or AMERICAN ALOE.

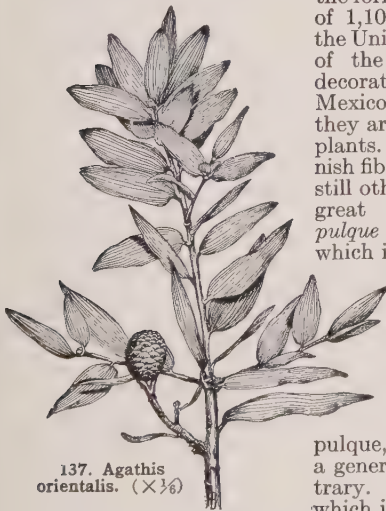
Stem short or wanting; lvs. mostly in a close rosette, usually stiff and more or less fleshy, persisting from year to year, the margins mostly armed with teeth and the apex tipped with a usually pungent spine: fls. in spikes (*Littæa*) or panicles (*Euagave*); perianth 6-parted, more or less funnel-shaped; stamens 6, mostly long-exserted; style 1; stigma capitate 3-lobed; ovary inferior, 3-celled; seeds numerous, flat, thin, black.—Some species flower but once and die, others occasionally, while others flower from year to year. The number of species is fully 300, and more than 325 have been described, largely from the Mexican tableland, although each island of the W. Indies possesses its peculiar species. One of the largest collections is at Kew, where there are 85 named species. The largest collections in the U. S. are at the Botanical Garden of Washington and the Missouri Botanical Garden, where there are about 75 species each. Amateurs often cult. a greater number of species than are described in this account.

The most complete monographs of the genus as a whole are by General von Jacobi, in the *Hamburg Garten Zeitung*, 1864–1865, of which a limited number of reprints with supplements were issued in book form, and by J. G. Baker in the *Gardeners' Chronicle*, 1877, with excellent small illustrations, which was amplified in his *Handbook of the Amaryllideæ*, 1888. Several of the natural groups composing the subgenus *Euagave* have been monographed and illustrated in the Reports of the Missouri Botanical Garden, one of which also contains a monograph of the species known to occur in Lower California. The half-hundreded West Indian species are figured and monographically treated in the eleventh volume of *Memoirs of the National Academy of Sciences*. Engelmann has published a monograph of the species of the United States, first classified on flower characters, in the *Transactions of the Academy of Science of St. Louis*, Vol. III.

Agaves are essentially fanciers' or amateurs' plants. This noble group of plants has never received the attention it deserves, and yet no genus of plants in America furnishes so many suitable decorative plants. Sir Joseph Hooker places it next to the palm and aloe, but

the former is a great family of 1,100 species. While in the United States one thinks of the agaves only as decorative plants, yet in Mexico, their native home, they are the most useful of plants. Many species furnish fiber, others soap, while still others produce the two great Mexican drinks, *pulque* and *mescal*. *Pulque*, which is a fermented drink,

is derived from several species, especially *A. atrovirens*. *Mescal*, which is a distilled drink, is usually not obtained from the same species as *pulque*, although there is a general belief to the contrary. The species from which is made most of the



137. *Agave thierii* (× $\frac{1}{6}$ )

*mescal* used in Mexico is unknown.—The species vary so much in size and form that they can be used in a great many ways. Some of the smaller species are suitable for the house, and even some of the larger species are so used. The larger species are well adapted for vases in large gardens and grounds, along walks, terraces, and the like. These plants, coming, as they do,

from arid or even desert regions, where they have a hard struggle to exist, can be grown with little or no care, but they respond very quickly to good treatment.—The species are propagated in various ways; some produce suckers at the base, or even underground shoots; others give off buds from the stem, which fall off and take root, or may be detached and planted; while not a few produce bulblets in the flower-clusters, and sometimes in great abundance. Nearly all may be produced from seed, but as most of the species flower only after a long interval, and many have not yet been known to flower in cultivation, this latter means of propagation cannot be relied upon. In cultivation, fruit is set very sparingly or not at all without artificial pollination, although this can be accomplished with very little trouble. (J. N. Rose.)

The agaves are not at all difficult to grow. The soil should be principally loam and sand, and if any vegetable soil be given it should be in small quantities. Good drainage and firm potting are necessary. To grow small plants of the large-leaved kinds into good-sized specimens quickly, they should be plunged out in a sunny spot in spring, taking care that the pots are large enough so that they will not require repotting in the fall. Nearly all of the large-growing kinds are easily increased from suckers, which, when the plants are grown in a pot-bound condition, are produced very readily. They should be taken off from the parent plant only when furnished with sufficient roots to give them a start. Some kinds are raised only from seeds, which, when freshly gathered, germinate in a few weeks. (G. W. Oliver.)

The classification of the agaves is very perplexing. This is partially owing to the number of species, to the scarcity of preserved study material, and to the infrequency of flowering in many species. In fact, many species have never been known to flower. The most usable characters for classification are to be found in the leaves, of which the end-spine and marginal prickles are very characteristic, and, although such an arrangement is more or less artificial, it is the most satisfactory in naming a collection. From a botanical point of view, however, the inflorescence shows the true relationship of the species. In this way the genus is usually divided into three groups or subgenera. These are: First, *Euagave*, having a paniculate inflorescence, with candelabra-like branches. Second, *Littæa*, having a dense spike of usually paired flowers. (The section *Littæa* has been considered by some a good genus, but it seems to connect with the first section through certain species.) The third section, *Manfreda*, is very different from the above, and is now considered as a distinct generic type, and so treated here. *Manfredas* are all herbaceous, appearing each year from a bulbous base: the leaves are soft and weak, dying down annually, while the inflorescence is a slender open spike, with solitary flowers from the axils of bracts.

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*zonata*, 19.

prickles: infl. few-branched; fls.  $1\frac{1}{2}$ –2 in.; segms. and ovary  $\frac{3}{4}$  in. each, tube  $\frac{1}{2}$  in.: caps. subglobose, strongly stipitate and beaked. Cent. Amer. (?). Jacq., Obs. Bot. 4, pl. 1. Targioni Tozzetti, Ann. Firenze. 2, pl. 6. B.M. 5097, 5893. Wight, Icon. Pl. Ind. Or. 2024. Rep. Mo. Bot. Gard. 19, pl. 29–34. Proc. Amer. Phil. Soc. 49, pl. 32. Mem. Nat. Acad. 11, pl. 106–109. A form with white-margined lvs. is var. *marginata*, Trel. (*A. vivipara variegata* and *A. superba*, Hort.), Wiesner Festschr., pl. 8, and a variant of this with the body color gray-green is var. *Woodrowii*, Trel. (*A. Woodrowii*, Wats., and *A. Codkei*, Woodrow), Rep. Mo. Bot. Gard. 19, pl. 35. A dwarf form of the unvariegated type is var. *Sargentii*, Trel., Rep. Mo. Bot. Gard. 22, pl. 100–103.

2. *sisalana*, Perr. (*A. anacantha*, Terr. *A. brèves*, Hort. *A. Houlletiana* or *Houlletii*, Hort. *A. lavis*, Hort. *A. ixtli sisalana*, Hort. *A. rigida progressana*, Boyd. *A. rigida sisalana*, Auct. *A. sisala*, Perr. *A. sisalana inermis*, Rivière. *A. sisalana yashguia*, Perr.). Nearly trunkless: lvs. 4 x 60 in., becoming green, with shallow-grooved spine and typically no prickles: infl. ample; fls.  $1\frac{3}{4}$ –2½ in.; ovary, segm. and tube about equal: caps. rare. Yucatan or Chiapas (?). Perrine, Senate Doc. 300, pl. 1, 2, 4. Dodge, Rep. Fiber Invest. 3, 5, 9, with pl. Rep. Mo. Bot. Gard. 7, pl. 54–56. Proc. Amer. Phil. Soc. 49, pl. 32. Mem. Nat. Acad. 11, pl. 113–115.—The yaxci, green agave or sisal hemp most commonly cult. outside of Yucatan: largely distributed to growers from Trop. Fla. where Perrine intro. it about 1835 and, as in some of the W. Indies, it has become naturalize l. It has been crossed by Trabut with *A. vera-crux* under the name “potosina.”

3. *fourcroydes*, Lem. (*A. ixtli elongata*, Auct. *A. ixtlioides*, Lem. *A. longifolia*, Auct. *A. rigida*, *A. rigida elongata* and *A. rigida longifolia* of most writers). Trunk 3–6 ft.: lvs. 3–4 x 60–90 in., gray, with round-grooved spine and slender curved prickles: infl. ample; fls.  $2\frac{1}{4}$ –2½ in.; ovary 1–1¼ in., segm. and tube  $1\frac{3}{4}$  in. each: caps. obovoid, slightly stipitate and beaked. Yucatan. Proc. Amer. Phil. Soc. 49, pl. 32. Wiesner Festschr., 349. Mem. Nat. Acad. 11, pl. 110–112.—The sacci, gray agave or henequen, largely grown for fiber in Yucatan. A form with greenish white median variegation is var. *medio-picta*, Trel.—Wiesner Festschr., pl. 12. The shorter-lvd. but similar chelem of the Yucatan coast is *A. ixtli*, sometimes called *A. silvestris* or *A. prolifera*, and a related plant has been called *A. minima*. A large-lvd. poorer form of *A. fourcroydes* is known as chucumci, and a shorter-lvd. form of this as babi.

4. *decipiens*, Baker (*A. laxifolia*, Baker. *A. latifolia*, Auct. *A. spiralis*, Hort.). Trunk 6–8 ft.: lvs. 2–4 x 36–50 in., green, rather soft and somewhat outcurved, with round-grooved spine and slender prickles from green prominences: infl. ample; fls.  $2\frac{1}{4}$  in.; ovary  $1\frac{1}{8}$  in., segm. and tube  $\frac{3}{4}$  in. each: caps. pyriform. Yucatan. Dodge, Rep. Fiber Invest. 3, 5, 9, pl. Rep. Mo. Bot. Gard. 7, pl. 57–59. B.M. 7477.—The false sisal, extensively naturalized, if not indigenous, in Fla. This and *A. Karwinskii* deserve the name arborescent, in the genus Agave.

The tequila mescals (*A. tequilana*, Web., etc.), grown in W. Mex. for the preparation of a distilled beverage, and the zapupes (*A. Zapupe*, Trel., etc.), grown for fiber in E. Mex., are closely related to the preceding group.

cc. Fls. slenderer, not urceolate.

5. *Karwinskii*, Zucc. (*A. Corderoyi*, Hort. *A. Bakerei*, Ross). Trunk 9–12 ft.: lvs. 1–1½ x 15–30 in., green, with openly grooved spine and stout upcurved prickles: infl. rather ample; fls. 2–2¼ in.; ovary 1 in., segm. and tube about  $\frac{3}{4}$  in. each: caps. oblong, brown, stipitate and beaked. S. Mex. Ross, Icon. Panorm. pl. 2. Rep. Mo. Bot. Gard. 18, pl. 29–31. MacDougal, N. A. Deserts, pl. 23.

#### A. Infl. a candelabrum-like panicle. (1–26.) Subgenus EUAGAVE.

B. Lvs. dagger-like or sword-shaped: spine not decurrent: fls. rather large, greenish, long-lobed, ill-smelling, often followed by bulbils; seeds very large. Trunk often developed.

c. Fls. urceolately contracted in throat.

1. *angustifolia*, Haw. (*A. livida*, Jacq. *A. Jacquiniiana*, Schult. f. *A. ixtlioides*, Hook. *A. Wrightii*, Prain. *A. vivipara*, Auct.). Short-trunked: lvs. 3 x 16–24 in., gray-green, with flat spine and slender-cusped



6. *macroacantha*, Zucc. (*A. macroacantha*, Auct. *A. Bessereriana*, Jacobi. *A. Besseriana*, Auct. *A. pugioniformis*, Zucc. *A. flavescens*, Salm. *A. subfalcata* and *A. linearis*, Jacobi. *A. paucifolia* and *A. oligophylla*, Baker. *A. integrifolia*, Baker?). Nearly trunkless: lvs. 1 x 8-20 in., yellowish gray-green, glaucous, with flat-grooved spine and slender-cusped heavy-based prickles: infl. rather sparse; fls. 2 in.; ovary 1 in., segm. and tube  $\frac{3}{4}$  in. each: caps. oblong, gray, stipitate and beaked. S. Mex. Rep. Mo. Bot. Gard. 18, pl. 18-26.—At one time a great favorite and, like *A. Verschaffeltii*, collected in a large range of forms designated by descriptive varietal names: *viridis*; *candida*, *candicans*, *glauca*; *nigrispina*; *elongata*, *longifolia*; *hystrix* (B.M. 5940), *nana*; *latifolia*, *gigantea*, *major*, *concinna* or *sudburyensis*.

BB. Lvs. lanceolate, large, rather firm than fleshy, scarcely repand: spine not decurrent: fls. rather large, greenish, fetid, often followed by bulbils. Nearly trunkless.

7. *neglecta*, Small (*A. vivipara*, Bartram. *A. recurvata* and *A. rigida recurvata*, Hort.). Lvs. gracefully outcurved, 6 x 36 in., glaucous, with slender round-grooved spine and very minute prickles: infl. ample; fls. 2 in.; ovary 1 in., segm.  $\frac{3}{4}$  in., tube  $\frac{1}{2}$  in.: caps. obovoid, scarcely stipitate or beaked. Trop. Fla. Rep. Mo. Bot. Gard. 7, pl. 60, 61. Dodge, Rep. Fiber Invest. 5, 9. ff. G.C. III. 31, supp. Feb. 1. Bartram, Travels. Map.

8. *miradorensis*, Jacobi. Lvs. rather straight, 3-4 x 30-35 in., glaucous, with slender narrowly grooved spine and, toward the base, very minute prickles: infl. ample; fls.  $2\frac{1}{4}$  in.; ovary 1 in., segm.  $\frac{3}{4}$  in., tube  $\frac{1}{2}$  in. E. Mex. G.W. 5, p. 143.—*A. ananassoides*, *A. Desmettiana*, *A. pallida* and *A. Regeliana*, not now recognized, were based by Jacobi apparently on specimens from Sartorius' ranch, El Mirador, in the state of Vera Cruz, from which, though ascribed to Brazil, *A. miradorensis* is believed to have come. All are close to if not quite the latter, over the accepted name of which *A. Desmettiana* has priority.

9. *vera-crux*, Mill. (*A. bulbifera*, Bonpl. *A. Manguai*, Desf. *A. mexicana*, Lam., which in part is *Furcraea cubensis* and the uses of which in large part pertain to *A. atrovirens*. *A. vera-crucis*, Haw., sometimes spelled *vera-crucis*. *A. vera-crux*, Mill.). Lvs. nearly straight, 6-7 x 50 in., glaucous, somewhat cross-banded, rather fleshy, concave, with short heavy gray spine and oblique rounded deltoid prickles somewhat raised on green prominences: infl. ample; fls.  $2\frac{3}{4}$ -3 in.; ovary  $1\frac{1}{4}$ - $1\frac{1}{2}$  in., segm.  $\frac{3}{4}$ -1 in., tube  $\frac{3}{4}$  in.: caps. oblong, prominently stipitate, scarcely beaked. Mex.(?). G.C. II. 19, p. 149.—The blue aloe, extensively planted and more or less established in Amoy, India, Mauritius and Peru, and, as *A. mexicana*, in Italy. It has been hybridized with *A. sisalana*.

10. *lurida*, Ait. (*A. lepida*, Dietr. *A. lucida*, Schiede). Lvs. thinner, flatter and more curving, with slender spine and smaller scarcely elevated prickles: infl. slighter and sparser. Mex.(?). Zuccarini, Act. Acad. Carol. Leop. 16, pt. 2, pl. 49-51. B.M. 1522(?). Ref. Bot. 307(?).—Less frequently seen than the preceding, with which it is confused. Perhaps including the now scarcely recognized *A. Beaulieuiana*, Jacobi, *A. cyanea*, Hort., *A. cyanophylla*, Jacobi, *A. Haworthiana*, Roem., and *A. polyphylla*, Koch.

BBB. Lvs. short and broad, fleshy rather than hard, repand: spine somewhat decurrent: fls. rather large, yellowish, with lobes often shorter than the tube, and followed by bulbils. Nearly trunkless.

11. *Verschaffeltii*, Lem. Lvs. obovate-oblong, acuminate, 3 x 6-8 in., glaucous, with flexuous or twisted, flat-grooved, red-brown spine and long rusty teeth on large fleshy prominences: infl. rather slight and sparse: fls. about  $2\frac{1}{4}$  in.; ovary  $1\frac{1}{4}$  in., segm.  $\frac{1}{2}$  in., tube

$\frac{3}{4}$  in.: caps. oblong, very stoutly stipitate, beaked. S. Mex. Ref. Bot. 306, 328. Lyon Hort. 1880, 267. Gt. 346. J. Verschaf., Cat. 1866-7, 1869. f. I. H. 15: 564.—Extremely variable, the original introducer announcing "as many varieties as there are plants," and 33 named forms having been catalogued once in the Lyon garden. The more distinct, which have received mostly descriptive specific names, are var. *crenata* (*amiena*, *cochleata*, *elegans*), var. *cucullata* (*Croucheri*, *Simsii*), var. *Leopoldii*, var. *pulverulenta*, var. *quadrata*, var. *Saundersii* (*virginica glauca*), etc., and such minor forms as *albida*, *auricincta*, *compacta*, *lanceolata*, *orbicularis*, *ovalifolia*, *rhomboidea*, *rotundifolia* and *streptacantha*. *A. tehuacanensis*, Karw., is the earliest published name for the species but no description was given. *A. Bonnetii*, Hort., seems to be this, but *A. Bonnetiana*, Hort., is referred to *A. mitriformis*, which accompanies *A. Verschaffeltii* about Tehuacan.—Extensively tried in hybridization, and crosses are reported with *A. attenuata* ( $\times$  *A. Guignardii*), *A. densiflora*, *A. micracantha* or *micrantha*, *A. schidigera*, *A. Tonelliana* or *Tonneliana* or *heteracantha Tonnelliana*, *A. Vanderwinii*, or *Vanderwinneni* ( $\times$  *A. Simonii*  $\times$  *A. grandibracteata*) and *A. xylonacantha* or *xylinacantha*.

12. *Scölymus*, Karw. (*A. coccinea*, Roezl? *A. flaccida*, Jacobi?). Lvs. oblanceolate, rather acute, 3-4 x 12-15 in., green or (when it is *A. potatorum*) slightly glaucous, with nearly straight, flat-grooved, dull brown



138. *Agave Franzosinii*. (No. 20.)

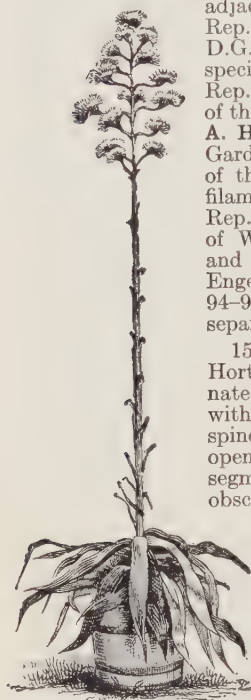
spine and small prickles on moderately low, fleshy prominences: infl. fairly large but loose; fls. 2 in.; ovary  $1\frac{1}{4}$  in., segm.  $\frac{1}{2}$  in., tube  $\frac{1}{2}$  in.: caps. oblong, somewhat stipitate. S. Mex. G.W. 2, p. 603.—Much of the "coccinea" of gardens is *A. macroculmis*, Tod., a member of the subgenus *Littaea*.

BBBB. Lvs. rather oblong, very rigid, gray or glaucous, scarcely repand: spine decurrent: fls. rather large, yellow, rarely followed by bulbils. Nearly trunkless.

13. *applanata*, Jacobi. Lvs. lance-oblong, acute, 4-6 x 40-60 in. when mature but commonly seen of much smaller size, glaucous, with broad open gray or purplish spine and rather large more or less connected prickles: infl. 25-30 ft.; fls.  $2\frac{1}{2}$  in.; ovary  $1\frac{1}{4}$  in., segm.  $\frac{3}{4}$  in., tube  $\frac{1}{2}$  in. E. Mex. G.C. II. 7, p. 717. D.G.Z. 1903, p. 528. Tod., Hort. Pan. pl. 30. Rep. Mo. Bot. Gard. 22, pl. 73, 74.

14. *Párryi*, Engelm. (*A. applanata Párryi*, Mulford. *A. Marcusii*, Hort.). Lvs. oblong, acute, 2-4 x 10-12

in., glaucous, with nearly straight openly grooved spine and smaller prickles: infl. 10–15 ft.; fls.  $2\frac{1}{4}$  in.; ovary  $1\frac{1}{8}$  in., segm.  $\frac{1}{2}$ – $\frac{3}{4}$  in., tube  $\frac{1}{2}$  in.; caps. oblong, beaked but scarcely stipitate. Ariz., New Mex. and adjacent Mex. G.C. II. 12, p. 237. Rep. Mo. Bot. Gard. 22, pl. 91–93. D.G.Z. 18, p. 3.—Closely related species are *A. huachuensis*, Baker, Rep. Mo. Bot. Gard. 22, pl. 87–89, of the Huachuca Mts., with broad lvs.; *A. Havardiana*, Trel., Rep. Mo. Bot. Gard. 22, pl. 84–86, of the great bend of the Rio Grande, with deep-seated filaments, and *A. gracilipes*, Trel., Rep. Mo. Bot. Gard. 22, pl. 98, 99, of W. Texas, with slender pedicels and small seeds, etc. *A. Couësii*, Engelm., Rep. Mo. Bot. Gard. 22, pl. 94–97, on flowering proves scarcely separable.



139. *Agave americana* in flower. (No. 21.)

BBBBB. Lvs. similar, somewhat repand: spine decurrent and the large teeth often confluent: fls. in compact clusters, large, yellow, not followed by bulbils. Trunk elongated but leafy.

16. *Sháwii*, Engelm. Lvs. ovate or lance-ovate, acuminate, 3–5 x 8–20 in., green, glossy, with slender, flexuous, openly grooved spine and large, hooked, connected, garnet-red prickles: infl. 10 ft., congested; fls.  $2\frac{1}{2}$ – $3\frac{1}{2}$  in.; ovary  $1\frac{1}{4}$ – $1\frac{1}{2}$  in., segm. and tube  $\frac{3}{4}$  in.; caps. oblong, thick-walled. S. W. Calif. and adjoining Low. Calif. Trans. Acad. St. Louis 3, pl. 2–4. Rep. Mo. Bot. Gard. 7, pl. 44; 22, pl. 19–21.—Related Low. Calif. species are *A. Orcuttiana*, Trel., Rep. Mo. Bot. Gard. 22, pl. 22, with similar spine and *A. Sebastiania*, Greene, Rep. Mo. Bot. Gard. 22, pl. 23–26, with straight spine; and *A. pachyacantha*, Trel., Rep. Mo. Bot. Gard. 22, pl. 27, 28, and *A. Goldmaniiana*, Trel., Rep. Mo. Bot. Gard. 22, pl. 29–31,—with heavier-based teeth and thin-walled caps. in all.

BBBBBB. Lvs. large, fleshy rather than firm, usually repand: fls. openly paniced, large, yellow, rarely followed by bulbils. Nearly trunkless.

c. Spine large and long-decurrent.

17. *férox*, Koch. Lvs. broadly oblanceolate, wavy, suberect with outcurved concave acuminate tip, 12 x 48 in., green, deeply repand, with large grooved spine and great prickles on high green prominences: infl. 20 ft.; fls.  $3\frac{1}{4}$  in.; ovary  $1\frac{1}{2}$  in., segm. 1 in., tube  $\frac{3}{4}$  in. Cent. Mex. G.C. III. 15, p. 328; III. 20, p. 525; III. 43, p. 379. G.W. 2, p. 603.

18. *mitraefórmis*, Jacobi (*A. coarctata*, Jacobi? *A. Bonnetiana*, Hort.). Lvs. obovate-oblanceolate, acuminate, 12 x 30 in., grayish-zoned, rather repand, with large grooved spine and moderately large gray chestnut-tipped prickles on green prominences: infl. 15–20

ft.; fls.  $2\frac{1}{2}$  in.; ovary  $1\frac{1}{2}$ – $1\frac{3}{4}$  in., segm.  $\frac{1}{2}$  in., tube  $\frac{1}{2}$  in. S. Mex. Karsten & Schenck, Veg. Bilder, pl. 47. Anales Mus. Nac. Mex. 2, pl. j. Publ. Carnegie Inst. 99, pl. 20.—This is *A. tehuacanensis*, Koch, Karwinski's plant of that name being apparently a form of *A. Verschaffeltii*. A yellow-margined, variegated agave, listed under *A. mitraefórmis* by the Belgian dealers about 1876, appears to be *A. atrovirens marginata*. A cross with *A. densiflora* is said to have been effected.

19. *atróvirens*, Karw. Becoming enormous: lvs. lanceolate, 12 x 80–100 in., dark green or (when it is *A. Salmiana*, Jacobi) gray, outcurved-ascending, with large, narrowly grooved spine and moderate gray prickles from low widened bases: infl. 20–30 ft.; fls.  $3\frac{1}{2}$  in.; ovary 2 in., segm. 1 in., tube  $\frac{1}{2}$  in. S. Mex. D. Gart. Mag. 1867, p. 28., f. Contr. U. S. Nat. Herb. 5, pl. 31–33. S.H. 4, p. 281. Pop. Sci. Monthly, 70, p. 210–216. Österr. Gart. Zeit. 1911, p. 252. Prometheus 20, p. 24. Journ. N. Y. Bot. Gard. 8, p. 10. Modern Mex. 17, p. 26–28. Proc. U. S. Nat. Mus. 33, p. 577, etc.—The principal pulque species cultivated on the plains of Apam. Numerous varieties are figured by Segura, El Maguey, 4 ed., pl. 1–9. Vast confusion exists in current literature: the names *A. americana* and *A. mexicana* are often applied to this, and it is difficult to account elsewhere for the many new Latin names given to pulque magueys by Blasquez, and to a number of young garden plants by Jacobi. A yellow-margined variety (also listed as belonging to *A. mitraefórmis*) is var. *marginata*, Trel. A very large and concave-lvd. unvariegated form is var. *cochleáris* (*A. latissima*, Jacobi. *A. Whitakeri*, Hort.). Other important pulque or agua-miel species are: about the City of Mexico, *A. Mapisaga*, Trel. (maguey mapisaga) with narrow small-prickled lvs.; about Durango, *A. compluviata*, Trel. (maguey verde), with green-zoned deeply gutter-shaped lvs., and *A. quiotifera*, Trel. (maguey ceniso), with ashen lvs.; about San Luis Potosi, *A. gracilispina*, Engelm. (*A. potosina*, Web.), with slender spine, and *A. crassispina*, Trel., with stout spine; and about Monterey, *A. melliflua*, Trel. (maguey manso), with elongated ashen lvs., and *A. zonata*, Trel. (maguey verde), with broad green-zoned lvs.

20. *Franzosinii*, Baker. Fig. 138. Lvs. lanceolate, 12 x 80–100 in., roughish, white, recurved-ascending, with large narrowly grooved spine and dark or gray prickles: infl. green, in striking contrast with the lvs.,



140. *Agave americana*, as commonly grown in greenhouses. The yellow-margined form. (No. 21.)

30 or 40 ft.; fls.  $3\frac{1}{2}$  in.; ovary  $1\frac{3}{4}$  in., segm. 1 in., tube  $\frac{3}{4}$  in. Mex. (?) B.M. 8317. G.W. 2, p. 603. G.C. III. 12, p. 177.

cc. Spine little if at all decurrent.

d. Fls. and fr. much as in the preceding. Not bulbiferous.

21. *americana*, Linn. (*A. altissima*, Zumag. *A. europæa*, Vis. *A. ramosa*, Moench. *A. spectabilis*, Salisb.).



Figs. 139, 140. Lvs. lanceolate, 6-8 x 60-80 in., smooth, gray, ascending with outcurved ends, with rather short and stout recurved round-grooved very shortly decurrent spine obliquely flattened at base, and moderately large gray prickles on prominent marginal elevations: infl. 20-30 ft., rather slender; fls.  $2\frac{1}{2}$ - $2\frac{3}{4}$  in.; ovary  $1\frac{1}{4}$  in., segm. 1 in., tube  $\frac{1}{2}$  in. Mex.(?). Established around the Medit. Gt. 24:825; 27, p. 307; 41, p. 269. Penzig, Fl. Litt. Med., pl. 140. Reicheb., Ic. Fl. Germ., pl. 374. B. H. 9, p. 308. R. H. 1875, p. 152. Journ. N. Y. Bot. Gard. 11, pl. 79, 81. Adamovic, Pflanzenw. Dalmat., pl. 1. Abhandl. Hamburg. Kolon. Inst. 6, p. 64. G.W. 8, p. 337. Proc. Am. Phil. Soc. 49, pl. 32.—The plant more commonly cult. in this country as *A. americana* has narrower, more hooked lvs., as in the next, but grayer and with the short recurved spine scarcely decurrent and round at base, var. *Milleri*, Baker (*A. Milleri*, Haw.? *A. virginia*, Mill.? *A. latéviens* and *A. americana latéviens*, Hort.?) Variegated forms of this, frequently grown, are var. *marginata* in yellow- or white-margined forms, var. *striata* variously lined with yellow or white, and var. *medio-picta* with a broad median yellow band. Wiesner Festschr., pl. 6. A reputed hybrid between *A. americana* and *A. densiflora* is  $\times$  *A. massiliensis*, Hort. Deleuil.

22. *picta*, Salm-Dyck (*A. longifolia picta*, *A. mexicana picta*, and *A. Milleri picta*, Hort.). Lvs. linear-lanceolate, ascending with recurved ends, at length 6-8 x 100 in., smooth, dark green with bright white or yellow marginal variegation, slightly glaucous when young, with needle-like, straight, narrowly grooved spine and moderate prickles on somewhat prominent marginal elevations: infl. tall and rather slender; fls. 3 in.; ovary  $1\frac{1}{2}$  in., segm. 1 in., tube  $\frac{1}{2}$  in.: caps. oblong, stipitate and beaked. Mex.(?). G.W. 8, p. 337. Wiesner Festschr., p. 342, pl. 7. Pop. Sci. Monthly, 70, p. 210. Proc. Amer. Phil. Soc. 49, pl. 32.—Green seedlings (var. *viridis*) occur on the Riviera and are in limited cult.

DD. Fls. rather small, yellow, shallow-tubed: caps. thin-walled, small. Not bulbiferous.

23. *marmorata*, Roehl (*A. Todaroi*, Baker. *A. Troubetzkoyana*, Hort. *A. undulata*, Tod.). Lvs. broadly lanceolate, outcurved, 10-15 x 72 in., very rough, green- and gray-banded, with rather short and stout recurved narrowly grooved spine and large rough rusty brown prickles often from prominent marginal elevations: infl. ample; fls. golden,  $1\frac{1}{2}$  in.; ovary  $\frac{3}{4}$  in., segm.  $\frac{1}{2}$  in., tube  $\frac{1}{4}$  in.: caps. short, stipitate. S. Mex.

DDD. Fls. moderately long, creamy, deep-tubed: caps. firm, elongated. Not bulbiferous.

24. *Pálmeri*, Engelm. Lvs. lanceolate, ascending, 3-4 x 18-30 in., blue-green, somewhat glaucous, with long, slender, open-grooved spine and slender, hooked garnet-purple or gray prickles, often on marginal elevations: infl. ample; fls. leathery, 2- $2\frac{1}{4}$  in.; ovary 1 in., segm.  $\frac{1}{2}$  in., tube  $\frac{3}{4}$  in.: caps. oblong, not stipitate. Ariz. and New Mex. Rep. Mo. Bot. Gard. 7, pl. 48-52. Journ. N. Y. Bot. Gard. 5, p. 178.

BBBBBB. Lvs. triangular, thick and stiff, rather small: fls. small, yellow, shallow-tubed, not followed by bulbils. Trunkless.

25. *deserti*, Engelm. Cespitose: lvs. triangular-lanceolate, falcately erect, 2 x 6-12 in., gray, with slender, gray-brown, grooved spine and friable teeth: infl. slender, sparse; fls. yellow,  $1\frac{1}{4}$  in.; ovary flask-shaped,  $\frac{1}{2}$  in., segm.  $\frac{1}{2}$  in., tube  $\frac{1}{2}$  in.: caps. oblong, scarcely stipitate. Colo. desert, Calif. Rep. Mo. Bot. Gard. 7, pl. 33, 34; 22, pl. 41, 42.

26. *Pringlei*, Engelm. Cespitose: lvs. triangular-oblong, ascending, 2 x 6-16 in., gray, with slender, drab, grooved spine and rather firm teeth: fls.  $1\frac{1}{2}$ -2 in.; ovary 1- $1\frac{1}{4}$  in., segm.  $\frac{1}{2}$  in., tube  $\frac{1}{4}$  in. Mts. of N. Low. Calif. Rep. Mo. Bot. Gard. 22, pl. 44.

AA. Infl. spike-like, the fls. usually in pairs though exceptionally clustered on very short branches: bulbils very rarely following the fls. (27-55.) Subgenus LITTEA.

B. Lvs. triangular-lanceolate, thick and stiff, rather small: fls. often clustered on short branches, cup-shaped, small. Trunkless.

27. *utahensis*, Engelm. (*A. Newberryi*, Engelm.). Cespitose: lvs. erect-spreading, 1-2 x 6-12 in., gray, with slender, grooved, gray spine and rather small and friable gray teeth: infl. 5-15 ft., with simple or forked branches 1-2 in. long; fls. 1- $1\frac{1}{4}$  in.; ovary flask-shaped,  $\frac{5}{8}$  in., segm.  $\frac{3}{8}$  in., tube  $\frac{1}{8}$  in.: caps. thin-walled,



141. *Agave attenuata*. (No. 28.)

small, not stipitate. Grand Cañon region. Pop. Sci. Monthly, 1911, p. 11. G.F. 8, p. 384. Rep. Mo. Bot. Gard. 7, pl. 32.

BB. Lvs. moderately large, thin, unarmed or at most very minutely denticulate, neither filiferous nor horny-margined. Trunk well developed in the first: fls. open, rather small.

28. *attenuata*, Salm-Dyck (*A. glaucescens*, Hook.) Figs. 141, 142, 143. Trunk 4-5 ft., sometimes prostrate: lvs. broadly oblanceolate, spreading, with recurved tips, 6-10 x 25-30 in., glaucous, thin, entirely unarmed: infl. 5-10 ft., usually recurving, its very short stalk closely covered by bracts; fls. paired, about 2 in.; ovary flask-shaped,  $\frac{3}{4}$ -1 in., segm.  $\frac{3}{4}$  in., tube  $\frac{1}{4}$  in. Exceptionally produces large bulbils among the caps. after flowering. Mex. F.E. 31, p. 1172 B. B.M. 5333. J. H. III. 42, p. 392. R.H. 1876, p. 149. Erfurter Führer. 7, p. 70. G.F. 10, p. 95. Rep. Mo. Bot. Gard. 9, pl. 31. G.C. III. 8, p. 560; III. 17, p. 455; III. 45, suppl. pl. Pharm. Journ. 70, p. 706.—Varies in a form with sterile base of spike longer and sparsely bracted, and fls. in clusters of 6-8, var. *paucibracteata*, Rep. Mo. Bot. Gard. 11, pl. 7. The varietal names *elliptica*, *latifolia*, *latissima* and *subundulata* have been applied to garden forms. A cross with *A. Verschaffeltii* is  $\times$  *A. Guignardii*, Hort.; a cross with *A. xylonacantha* is listed.

29. *Ellemeetiàna*, Koch. Nearly or quite trunkless: lvs. lanceolate, spreading, 6 x 24 in. or more, glaucous, thin, unarmed: infl. 5-10 ft., erect, the rather short sterile base closely covered by linear bracts; fls. paired,

greenish white,  $1\frac{1}{4}$  in.; ovary flask-shaped,  $\frac{5}{8}$  in., segm.  $\frac{5}{8}$  in., tube nearly suppressed; filaments very long,  $2\frac{3}{4}$  in. E. Mex. G.C. II. 8, p. 748; III. 47, p. 201.



142. Flowers of *Agave attenuata*.

B.M. 7027. Ref. Bot. 163. —With lvs. very minutely denticulate it becomes var. *subdentata*, the distinctness of which from *A. pruinosa* is not clear. Reported crossed with *A. micracantha*.

BBB. Lvs. moderately large, variously fleshy but usually flexible, neither filiferous nor horny-margined, teeth never large; fls. moderate, often with recurved segms. Nearly trunkless.

C. Spine slender and weak.

30. *álbicans*, Jacobi (*A. micracantha albidior*, Salm-Dyck. *A. Ousselghemiàna*, Jacobi). Trunkless, caespitose: lvs. oblanceolate,  $4 \times 12$ – $15$  in., spreading, glaucous, thin, with small, needle-shaped, narrowly grooved spine and close-set, minute, brown prickles connected by a papery margin: infl. scarcely 3 ft., rather few-fl. above the middle; fls. paired, reddish green, nearly sessile,  $1\frac{1}{4}$ – $1\frac{1}{2}$  in.; ovary  $\frac{1}{2}$ – $1$  in., segm.  $\frac{1}{2}$  in., tube  $\frac{1}{4}$  in.; caps. prismatic-ovoid, small. Mex. (?). B.M. 7207. Bull. Soc. Tosc. Ort. 3, p. 303. Lyon Hort. 22, p. 363. [With recurved long black prickles, and fls.  $2\frac{1}{4}$  in. long, it is var. *ctenophora*, Trel. A beautiful form with milk-white mottled variegation is var. *medio-picta*, Trel. (*A. micracantha picta*, *A. micracantha variegata*, *A. Ousselghemiàna alba-picta*, *A. Ousselghemiàna picta*, and *A. álbianca variegata*, Auct.), Wiesner Festschr., pl. 10. Hybrids are reported between this species and *A. maculata* and *A. xalapensis*.

31. *Célsii*, Hook. (*A. Celsiana*, Koch. *A. densiflora glaucophylla*, Hort.?). Lvs. broadly oblong,  $4 \times 12$ – $18$  in. or more, glaucous, with slender weak spine and very irregular close-set, often multiple, prickles, fleshy except at the very tip: infl. about 4 ft., densely fl. at top; fls. reddish or yellowish green,  $1\frac{1}{2}$ – $2$  in.; ovary and segm.  $\frac{3}{4}$  in., tube  $\frac{1}{2}$  in.; caps. small. B.M. 4934. R.H. 1861, p. 335. Gn. 12, p. 213. —A hybrid with *A. Salmiana* is reported.

32. *micracantha*, Salm-Dyck (*A. glaucescens*, Otto?). Caespitose: lvs. broadly lanceolate, spreading,  $3$ – $5 \times 15$ – $25$  in., grayish green, with slender weak spine and small, close-set, dark prickles: infl. about 10 ft., the rather short sterile base densely bracted; fls. brownish green,  $1\frac{1}{2}$  in.; ovary  $\frac{1}{2}$ – $\frac{3}{4}$  in., segm.  $\frac{1}{2}$  in., tube  $\frac{1}{4}$  in. E. Mex. (?). Ref. Bot. 327. Gt. 37, p. 115. —Hybrids are reported with *A. Ellemectiana*, *A. Sartorii*, *A. Verschaffeltii*, *A. xylonacantha* and *A. xylonacantha micracantha*. *A. mitis*, Salm-Dyck, and *A. rupicola*, Regel, are closely related and *A. chloracantha*, Salm-Dyck. (*A. caribaea*, Hort.), differs chiefly in its greener lvs., with pale prickles.

cc. Spine moderate but strong, round-grooved.

33. *polyacantha*, Haw. (*A. abortiva*, Terr.? *A. chiapensis*, Jacobi.? *A. chiapensis porrecta*, Hort. *A. densa*, Hort.? *A. densiflora*, Hort.? *A. multiflora*, Hort. *A. Ottónis*, Jacobi? *A. Salmidyckii*, Baker? *A. uncinata*, Jacobi? *A. Wolkensteinii*, Hort.?). Caespitose: lvs. lanceolate, upcurving,  $2$ – $5 \times 10$ – $24$  or  $36$  in., soon green, with narrow-grooved strong spine and rather small and close-set brown or gray prickles: infl.  $4$ – $5$  ft.; fls. about 2 in.; ovary  $\frac{3}{4}$  in., segm. and tube  $\frac{1}{2}$  in. S. Mex. (?).

B.M. 5006. G.W. 2, p. 604. Journ. Soc. Hort. Bas. Rhin. 3, p. 324. Gn. 12, p. 396. R.H. 9, p. 517. G.C. II. 3, p. 502. Hybrids are reported between *A. chiapensis* and *A. xylonacantha* and *xylonacantha latissima* and with "*Dasylyrion gracilis*," *A. densiflora* and *A. americana* ( $\times$  *A. massiliensis*); *A. densiflora* and *A. geminiflora* ( $\times$  *A. Táylori*),—G.C. II. 8, p. 620; *A. densiflora* and *A. mitriformis*; *A. densiflora* and *A. Verschaffeltii*, and *A. densiflora* and *A. xylonacantha*.

ccc. Spine stout, openly grooved.

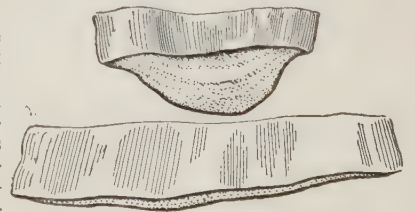
34. *Bottèrii*, Baker. Lvs. oblanceolate, outcurved-ascending,  $6$ – $8 \times 24$ – $30$  in., green, with flat-grooved strong spine and short, broad, blackish close-set prickles: infl. scarcely 5 ft.; fls. reddish or yellowish green, 2 in.; ovary  $\frac{3}{4}$  in., segm. and tube  $\frac{5}{8}$  in. each. Mex. (?). B.M. 6248. G.C. II. 8, p. 264.

35. *xalapensis*, Roezl. Lvs. lanceolate, spreading,  $2$ – $5 \times 10$ – $30$  in., nearly green to decidedly glaucous, with very openly grooved heavy spine and moderately long, heavy, rather close-set red to blackish prickles: infl.  $5$ – $10$  ft.; fls. 2 in.; ovary  $\frac{3}{4}$  in., segm. 1 in., tube  $\frac{3}{4}$  in.; caps.  $\frac{3}{4} \times 1\frac{1}{2}$  in., slightly constricted at base. E. Mex. Monatsschr. f. Kakteenk. 14, p. 151. R.H. 1875, p. 276. Reported hybrids are *A. xalapensis*  $\times$  *filifera* ( $\times$  *A. Románii*, Hort.), *A. xalapensis*  $\times$  *Ousselghemiàna*, *A. xalapensis*  $\times$  *Salmiana*, and *A. xalapensis*  $\times$  *xylonacantha* ( $\times$  *A. Pfersdörffii*, Simon).

BBBB. Lvs. fibrous and often rigid, the sometimes very large teeth connected by a detachable horny margin: fls. moderate, with soon erect segms. At most short-trunked.

c. Teeth rather small: lvs. elongated, rather thin but stiff.

36. *Lecheguilla*, Torr. (*A. multilineata*, Baker. *A. Poselgeri*, Salm. *A. tetragona*, Hort.). Lvs. triangular-oblong, concave, falcately ascending,  $1 \times 16$ – $24$  in., green or bluish but not glaucous, pale-banded ventrally and dark-lined on the back, with flattened gray-brown spine and recurved slender prickles joined by a very narrow straight margin: infl.  $3$ – $12$  ft., glaucous; fls.  $\frac{3}{4}$ – $1\frac{1}{2}$  in.; ovary flask-shaped,  $\frac{1}{2}$  in., segm.  $\frac{1}{2}$  in., tube  $\frac{1}{2}$  in. W. Texas and southward, in a number of forms of which the southernmost, from below San Luis Potosi, with broader lvs. and heavier prickles, is *A. mesotillo*, Hort. It furnishes the greater part of the ittle or lechuguilla fiber of New Mex. usually ascribed to *A. heteracantha*. Pop. Sci. Monthly 70, p. 223. Bot. Bound. 1, pl. 34, 39. Rep. Mo. Bot. Gard. 7, pl. 31; 13. pl. 42. Bull. Univ. Texas 60, pl. 3, 6. —Closely allied forms, frequent in European gardens, are *A. caeruleascens*, Salm-Dyck (a hybrid of which with *A. Victoriae Reginae* is reported), differing chiefly in being very glaucous, and its var. *stenophylla* with lvs. over 4 ft. long; *A. Funkiana*, Koch & Bouché, with flatter, more oblong, rather glaucous lvs., which furnishes the ittle of Jaumave; *A. Nissónii*, Baker, with thin, yucca-like, glaucous lvs.; *A. nigrés-cens* (*A. heteracantha nigrés-cens*, Hort.),



143. Cross-sections of leaf of *Agave attenuata*, dark blue-green, long-triangular, often undulate lvs., sometimes almost or quite unarmed on the margin, when it is the form *inermis*.

37. *lophantha*, Schiede. Lvs. lanceolate, spreading,  $1\frac{1}{2}$ – $2 \times 12$ – $18$  in., green, glossy, with openly grooved brown spine and variously hooked rather small prickles joined by a narrow, nearly straight margin: infl.  $9$ – $15$  ft.



fls.  $1\frac{1}{2}$  in.; ovary  $\frac{3}{4}$  in., segm.  $\frac{5}{8}$  in., tube  $\frac{1}{8}$  in. E. Mex. G.W. 8, p. 337. With prominent and persistent pale band on the upper face it is var. *univittata* (A. *univittata*, Haw. A. *ensifera*, Jacobi? A. *tenuata*, Hort.?). Ref. Bot. 215. B.M. 6655. G.C. II, 7, p. 368.—Crosses of A. *univittata* with A. *xylocantha* are reported, of which  $\times$  A. *perbella*, Hort., is said to be one, A. *pulcherrima*, Hort., in part, seeming to be another writing for the same.

38. *heteracantha*, Zucc. Like A. *lophantha* but lvs. somewhat sinuate and with variously hooked less equal and closer prickles. The median band is often prominent. S. Mex. G.W. 2, p. 605. G.C. II, 7, p. 369. Gt. 19, pl. 639.—Most of what is called A. *heteracantha* is A. *Lecheguilla*.

cc. Teeth often large: lvs. either broad or thick.

d. Margin nearly straight.

39. *Kerchövei*, Lem. Lvs. triangular, spreading, 3–4 x 16–20 in., thick, gray-green, not lined beneath, with channeled gray spine and large spreading triangular teeth joined by a rather wide margin: infl. dense and heavy, 18 ft. S. Mex. G.C. II, 7, p. 527.—Formerly much grown in a number of dissimilar types: var. *Beaucárnei* (A. *Beaucárnei*, Lem., A. *Lemàirei*, Hort., A. *Kerchövei coarctata*, Hort.), with very short lvs.; var. *macrodonta*, with larger and more hooked teeth; var. *distant*, with more separated teeth which have a well-developed accessory basal cusp in f. *diplacantha*, and var. *majör*, with a short branching trunk. Related forms with shorter lvs. and slenderer, sparser infl. are A. *triangularis*, Jacobi (A. *Kerchövei brevifolia*, Hort., A. *horrída triangularis*, Baker), Karsten & Schenck, Veg. Bilder. pl. 46, with prickles much as in A. *Kerchövei*; and its var. *rigidissima* (A. *rigidissima*, Jacobi), with small prickles lacking in f. *subintègra*.

40. *Rozliana*, Baker (A. *horrída lævior*, Hort.). Lvs. ovate-lanceolate, spreading, 2–4 x 12–16 in., rather thick, green, broadly pale-striped above, not lined on the back, with grooved brown and then gray spine and moderately large teeth joined by a moderate margin: infl. not very heavy. S. Mex. G.C. 1871, p. 74; II, 7, p. 528. F. 1870, p. 42.—Presents as extreme forms: var. *Inghami*, Baker (A. *Gilbeyi longifolia*, Hort., A. *Inghami* and A. *Inghami gigantea*, Hort.), with broad, often concolorous lvs. and large prickles, known when dwarfed as var. *Gilbeyi* (A. *Gilbeyi* and A. *horrída Gilbeyi*, Hort.), Gt. 23, p. 89; 27, p. 84. Neubert's Gart. Mag. 50, p. 15. G.C. 1873, p. 1305; and var. *Peacockii* (A. *Killschii*, Hort., A. *Peacockii*, Croucher), B.M. 7757. G.C. 1873, p. 1400, with narrowly triangular-lanceolate lvs., sometimes entire. The names *Regeliàna*, *Regelii* and *Regelii macrodonta*, identified by Jacobi with A. *triangularis*, seem also to have been applied to this; and the now unrecognized A. *artichaut*, A. *horrída nana* and its f. *lævior* and A. *horrída pygmæa* of gardens may belong here. A. *Hanburi*, Baker, suggests a possible hybrid of this.

41. *Ghiesbréchtii*, Koch (A. *Ghiesbréchtii*, Auct. A. *grandidens*, Hort.? A. *grandidentata*, Hort.? A. *fragilis*, Jacobi? A. *squallidens*, Hort.?). Lvs. lanceolate, 3–4 x 10–12 in., upcurved-spreading, little if at all striped, with inrolled spine and moderate prickles joined by a moderate margin. S. Mex. (?). G.C. II, 7, p. 621.—The typical clear green form varies into an equally large or longer-lvd. form with smaller, closer-set prickles, var. *Leguayana*, Baker (A. *Leguayana*, Hort., or, with wider margin, f. *laticincta*), and a more compact and concave lvd., blue-green form, var. *Rohànii*, Baker (var. *obscura*, Jacobi). A cross of A. *filifera* and A. *Ghiesbréchtii* is reported.

42. *horrída*, Jacobi. Lvs. oblanceolate-oblong, spreading, flat, rather thin, about 3 x 12 in., glossy green, neither striped nor lined, with flat-grooved short spine and large irregular prickles often with accessory

cusps, joined by a heavy margin: infl. moderately slender; fls. yellowish or purplish green,  $1\frac{1}{4}$  in.; ovary and segm.  $\frac{3}{4}$  in. each., tube  $\frac{1}{4}$  in. Cent. Mex. B.M. 6511. F. 1870, p. 42.—Forms occur with larger revolute-margined lvs.: var. *Maigretiana* (A. *Maigretiana*, Jacobi. A. *granulosa*, Scheidw.), G.W. 2, p. 593. S.H. 4, p. 299. G.F. 2, p. 115; or with smaller prickles, var. *micracantha*, Baker, Rep. Mo. Bot. Gard. 7, pl. 62, 63. The names A. *DeSmetiana* (A. *DeSmettiana*, Jacobi, being a form or ally of *miradorensis*), A. *Ghiesbréchtii horrida*, A. *Morganii* and A. *Pilgrimii* have been applied in gardens to forms of this or one of the two foregoing, not now recognized.

dd. Margin with prominent fleshy hummocks under the teeth.

43. *xylocantha*, Salm-Dyck, also written *xylocantha*, *xylinacantha* and *xylynacantha* (A. *amurensis*, Jacobi. A. *Köchii*, Jacobi. A. *Köchii amurensis*, Ellem.). Lvs. oblong, concave, tortuously spreading, 2–5 x 12–24 in., rough, dull gray-green, dark-lined beneath, with flexuous channeled gray spine and very large often multiple prickles saddling large green prominences, joined by a moderately heavy margin: infl. rather slender; fls.  $1\frac{1}{2}$  in.; ovary  $\frac{3}{4}$  in., segm.  $\frac{5}{8}$  in., tube  $\frac{1}{8}$  in. E. Mex. B.M. 5660. G.C. II, 7, p. 527. Lyon Hort. 1879, p. 207.—Extensively hybridized, some of its offspring recognizable in their scabrid green-lined oblong lvs. with green prominences going into the bases of the large unequal teeth: with *attenuata* or *attenuata subdentata*, *chiapensis*, *densiflora*, *filifera* ( $\times$  A. *Villàrum*, Hort.,  $\times$  A. *Villæ*, Pirota,  $\times$  A. *hýbrida*, Vill.), *micracantha*, *univittata* (A. *armata*, Hort.? A. *aspera*, Tod.? Terraciano, Primo Contr. pl. 3, 5,  $\times$  A. *hýbrida*, Versch.), A. *xylocantha vittata* and A. *xylocantha hybrida* ( $\times$  A. *perbella*, A. *xylocantha perbella*, Hort.), G.C. II, 7, p. 527, *Verschaffeltii* and *zalapensis* ( $\times$  A. *Pfersdorffii*, Sim.). At one time, several varieties were listed: *cornuta* or *longifolia*, the more typical form, *latifolia macracantha*, variously spelled, *majör*, *Maximiliana*, *torta* and *Vanderdonckii*. A rare form with median variegation is var. *medio-picta*.

BBBBB. Lvs. 3-sided, short and very stiff, the detachable horny margin toothless: fls. as in the preceding. Trunkless.

44. *Victoriæ Reginæ*, Moore (A. *Considerantii*, Duchartre). Lvs. in a globose cluster, triangular-oblong, acutely 3-angled, 1–2 x 6–8 in., dark green, with a short black triangular spine and gray margin decurrent on the edges and keel: infl. 10–12 ft., rather slender but compact; fls.  $1\frac{1}{4}$  in.; ovary  $\frac{5}{8}$  in., segm.  $\frac{5}{8}$  in., tube  $\frac{1}{8}$  in.: caps. small. N. E. Mex. G.C. 1875, p. 484; 1880, p. 788; II, 18, p. 841; III, 1, p. 806. R.H. 1875, p. 429; 1890, p. 392; 1897, p. 100. G.W. 2, p. 592; 10, p. 213. G.Z. 20, p. 88, 135. Peacock, List of Succ. Pl. pl. S.H. 4, p. 287. I. H. 28, pl. p. 413. Lyon Hort. 22, p. 371; 31, p. 146. R.B. 1876, p. 16. G.M. 6, p. 196. Gn. 8, p. 351; 22, p. 448, 460; 48, p. 117. Gt. 1878, p. 74. Journ. N. Y. Bot. Gard. 7, p. 163.—Deleuil is said to have effected a cross with A. *cærulescens*. Differing in its fewer-lvd. more open rosettes and in the triple spines at apex of the lvs. is A. *Nickelsia*, Hort. Both agree with the following filiferous species in having the lvs. white-marked by adherent cuticle, and with the preceding marginate species in their detachable horny border, and in fls.

BBBBBB. Lvs. fleshy-fibrous, toothless (sometimes with minute prickles at base), the margin typically shredding away in fibers, as in *Yucca*: fls. nearly as in the group of A. *micracantha*. Trunkless.

45. *Schöttii*, Engelm. Cespitose: lvs. linear-triangular,  $\frac{1}{4}$  x 6–12 in., with scarcely grooved spine and few long slender threads: infl. 4–6 ft., slender; fls. somewhat curved, yellow, scented as in *Polianthes*,  $1\frac{1}{4}$ – $1\frac{1}{2}$  in.; ovary and segm.  $\frac{3}{8}$  in. each, tube  $\frac{5}{8}$  in.: caps.  $\frac{1}{2}$  x

$\frac{5}{8}$  in. S. Ariz. B.M. 7567. Rep. Mo. Bot. Gard. 7, pl. 29. —With denticulate lf.-bases it is var. *serrulata*, Mulford. Rep. Mo. Bot. Gard. 7, pl. 29. A plant approaching *A. parviflora*, from the Pinal Mts. of Ariz., with concave lvs. 2–4 in. long, fls.  $\frac{5}{8}$  in. long with ovary  $\frac{3}{8}$  in., segm.  $\frac{1}{8}$  in. and tube  $\frac{1}{8}$  in., and ovoid caps., is *A. Toumeyana*, Trel., Rep. Mo. Bot. Gard. 5, pl. 32; 7, pl. 30. A species of the Santa Catalina Mts., Ariz., with lvs. as in *A. Lecheguilla* but filiferous instead of marginate, and fls. nearly as in *Schottii*, is *A. Trelæsei*, Toumey, Rep. Mo. Bot. Gard. 12, pl. 31a, 32, 33.

46. *parviflora*, Torr. Small and compact: lvs. ascending, oblong,  $\frac{1}{4} \times 2$  in., with flat spine and few short coarse outcurved threads, the dilated base denticulate: infl. 2–3 ft., very slender; fls. greenish white,  $\frac{5}{8}$  in.; ovary  $\frac{3}{8}$  in., segm.  $\frac{1}{8}$  in., tube  $\frac{1}{8}$  in.; caps. very small. Ariz. to Sonora Boundary. Pop. Sci. Monthly, 1911, p. 7. Rep. Mo. Bot. Gard. 5, pl. 32, 7, pl. 30.—A similar New Mexican plant with narrowly triangular falcate lvs. and grooved spine is *A. Hartmaini*, Wats. A less dwarf



144. *Agave angustissima*. (No. 48.)

plant with lvs. resembling small forms of the following but denticulate at base, sometimes cult. as *A. parviflora*, is *A. perpléxans*, Trel.

47. *filifera*, Salm-Dyck (*A. pseudofilifera*, Ross & Lanz.). Lvs. somewhat upcurved-spreading, oblong-lanceolate, 1–1 $\frac{1}{2} \times 8$ –24 in., with openly grooved spine and rather sparing thin marginal threads: infl. rather stout and dense, 10–15 ft.; fls. maroon,  $1\frac{1}{2}$  in.; ovary and segm.  $\frac{5}{8}$  in. each, tube  $\frac{1}{8}$  in. E. Cent. Mex. G.C. II. 7, p. 303; III. 21, p. 167. I. H. 7: 243. Lyon Hort. 1879, p. 208; 1900, p. 371; 1909, p. 147. Gt. 36, p. 544. Neubert's Gart. Mag. 39, p. 307. G.W. 6, p. 79; 1907, p. 9. Ref. Bot., 164. Rep. Mo. Bot. Gard. 11, frontisp. Icon. Sel. Hort. Thenensis, pl. 144.—Varies into a number of forms: var. *filamentosa*, Baker (*A. filamentosa*, Salm-Dyck, *A. filifera latifolia*, *longifolia*, *robusta* or *major*, *Bonaparte* or *Littæa filamentosa*), G.C. 34, p. 101, with large lvs.; var. *compacta* (vars. *brevifolia*, *compacta*, *densa*, *depauperata* and *minor*, Hort.), with short broad lvs.; f. *variegata* (*A. filifera superba*, Hort.), in which the dingy cuticular stripes of the type (var. *viridis* or *immaculata*) are brighter and more persistent. Hybrids are reported with *geminiflora* ( $\times$  *A. Táylori*),

*Ghiesbreghtii*, *schidigera* ( $\times$  *A. Leopöldii* II, *A. filifera* *Leopöldii*, J. H. 1893, p. 334), *zalapensis* ( $\times$  *A. Románi*) and *zyloneacantha* ( $\times$  *A. Villárum*).

48. *schidigera*, Lem. (*A. filifera adornata*, *A. adornata*, *A. filifera pannosa*, *A. filifera schidigera*, *A. schiedigera*, *A. schiedigera princeps*, *A. princeps*, *Littæa Rözlui?*). Lvs. narrowly oblong, spreading, about  $\frac{1}{2} \times 12$  in., with flattened spine and rather wide shaving-like marginal threads. Cent. Mex. I. H. 330. B.M. 5641. G.W. 2, p. 592. S.H. 4, p. 297.—A number of closely allied forms are rather frequently mentioned or encountered in cult.: with narrow, often reddened lvs. and stalked fls., *A. Ortgiesiana* (*A. schidigera Ortgiesiana* and *A. maritima*, Hort.); with sessile or nearly sessile fls. and mostly very curly and numerous marginal threads, *A. angustissima*, Engelm. (*A. Bignètii* or *Diguètii*, Hort.). Fig. 144. G.F. 6:5 (adapted in Fig. 144); *A. vestita*, Wats., A. G. 1892, p. 609; and *A. Knightiana*, Drum., B. R. 1145. Actes Soc. Linn. Bordeaux. 16, pl. Reported hybrids are *A. schiedigera* or *princeps* with *filifera* ( $\times$  *A. Leopöldii* II) and *A. schidigera*  $\times$  *Verschaffeltii*.

49. *geminiflora*, Gawl. (*A. Bonaparte*, *A. Bóscii*, *A. geminiflora filamentosa*, *A. júncea filamentosa*, *Bonaparte filamentosa*, *B. flagelliformis*, *B. júncea*, *Dracæna Bóscii*, *D. filamentosa*, *Littæa* or *Littæa* or *Littæa geminiflora*, and *Yucca Bóscii*, Hort.). Lvs. very many, biconvex, long, gracefully recurving, narrowly linear, scarcely  $\frac{1}{4}$  in. wide, with fine marginal threads. W. Mex. (?). Occasionally found in a threadless form, var. *àtricha*. Dict. Sc. Nat. 62, pl. 55. F.S. 7, p. 6. Reichenbach, Icon. 3, pl. 209, 210. Bibl. Ital. 1816, pl. Journ. of Sci. 1817, pl. I. G.W. 7, p. 548. Hybrids are reported with *A. densiflora* ( $\times$  *A. Táylori*, Hort. *A. geminiflora Táylori*, G.C. II. 8, p. 620. Mn. 7), and *A. filifera* (*A. Wrightii*, Drum., B.M. 8271.)

BBBBBB. Lvs. hard-fibrous, closely striate-grooved, at most scabrous margined: fls. rather small with tube and segms. about equal. Trunkless.

50. *striata*, Zucc. (*Bonaparte júncea rigidifolia*, *B. rigida*, *B. rigidifolia*, *B. striata* and *B. tenuifolia*, Hort.). Lvs. many, spreading, rhombically biconvex,  $\frac{1}{4} \times 24$ –36 in., gray, with needle-shaped brown spine: infl. about 10 ft.; fls. greenish,  $1\frac{1}{4}$  in.; ovary  $\frac{1}{2}$  in., protruding into the tube, segm.  $\frac{1}{2}$  in., tube  $\frac{3}{8}$  in. Cent. Mex. B.M. 4950. Gt. 29, p. 24. Jacobi, Versuch, p. 154. G.C. II. 8, p. 556. G.W. 10, p. 213. With lvs. conspicuously recurving it becomes var. *recurva*, Baker (*A. recurva*, Zucc.), G.C. II. 8, p. 556. Jacobi, Versuch, p. 158. *A. paucifolia*, Tod. (*A. Rözlui*, Hort.) differs chiefly in its fewer lvs. one-half wider, Hort. Panorm., pl. 19. The name *striata* has been applied, as a specific name, to variegated forms of *A. americana*.

51. *stricta*, Salm-Dyck (*A. hystrix* or *hýstrix*, *A. striata stricta*, *Bonaparte hystrix*, *B. robusta*, *B. stricta*, *Littæa hystrix*, *Yucca hystrix*, Hort.). Lvs. many, falcately upcurved in a globose cluster, triangularly biconvex,  $\frac{1}{4} \times 10$ –14 in., often pale or purplish, with a flattened triangular spine: infl. 5–10 ft.; fls.  $1\frac{1}{4}$  in.; ovary  $\frac{1}{2}$  in., segm.  $\frac{3}{8}$  in., tube  $\frac{1}{2}$  in. S. Cent. Mex. Jacobi, Versuch, p. 153. Gt. 31, p. 56. Gart. Mag. 40, p. 309. L. de Smet, Cat. 1874, pl.—Known in a number of forms: *purpurea* with purplish, and *rosea* with rosy foliage of the ordinary type; *glauca* (*A. dealbata hystrix*, *A. hystrix glauca* and *glaucescens*, *A. striata glauca*, *Bonaparte glauca*, *B. striata pulverulenta*, *Littæa dealbata*, *L. glauca*, Hort.), with long, and *nana* (*A. dealbata brevifolia*, *compacta minor* and *nana*, etc.), with short, pruinose lvs. A closely related form with flat rhombic lvs. with flatter spine, and short-tubed fls. is *A. echinoides*, Jacobi (*A. striata echinoides*, *A. ensiformis?*, *A. hystrix Richardsii?*, *A. Richardsii?*, *A. striata Richardsii*, *Dasyllirion júnceum?*, Hort.). Gn. 19, p. 372.



52. *falcata*, Engelm. Lvs. moderately numerous, falcately ascending, 3-sided, with slender 3-sided spine: infl. 3-9 ft.; fls. purplish, 1 in.; ovary  $\frac{3}{8}$  in., segm.  $\frac{1}{4}$  in., tube  $\frac{1}{2}$  in. N. Mex.—The "guapilla," furnishing an important part of the itxle of N. Mex.

53. *dasyliroides*, Jacobi. Lvs. moderately numerous, outcurved-ascending, thin and flat,  $\frac{1}{2} \times 10-12$  in., pale, with flattened brown spine: infl. 5-6 ft., recurving; fls.  $1\frac{1}{2}$  in., ovary and segm.  $\frac{5}{8}$  in. each, tube  $\frac{1}{4}-\frac{3}{8}$  in.: caps. slender,  $\frac{3}{8} \times 1$  in. S. Mex. B.M. 5716. G.C. II. 8, p. 557; III. 5, p. 804. Lyon Hort. 22, p. 365. G.W. 10, p. 213.—The more glaucous form is *A. dealbata*, Lem. (*A. dasyliroides dealbata*, Baker). *A. intrépida*, Greenm., of Cent. Mex., is very similar.

BBBBBBBB. Lvs. rather fleshy, long and narrow, unarmed or with minute soft prickles. Trunkless.

c. Fls. moderate, with narrow segm. and slender tube.

54. *yuccafolia*, DC. (*A. Cohniana*, Jacobi. *A. spicata*, Guss.). Lvs. few, recurved, with minute slender spine, concave,  $1 \times 24$  in., glaucous, the dry edge minutely denticulate: infl. 10 ft.; fls.  $1\frac{1}{2}$  in.; ovary and segm.  $\frac{5}{8}$  in. each, tube  $\frac{1}{2}$  in.: caps.  $\frac{5}{8} \times \frac{3}{4}$  in. Mex. Redouté, Lil., pl. 328, 329. B.M. 5213. R.H. 1860, p. 519. Deutsch. Gart. Mag. 1870, 2 pl. Gn. 12, p. 583.—A very similar if distinct plant, from Jalisco, is *A. Houighui*, Hort., and another is *A. yuccafolia cæspitosa*, Terr., Primo Contr., pl. 4.

cc. Fls. rather small, with broad separated segms.

55. *bracteosa*, Wats. Lvs. sigmoidally spreading, 3-sided, gray, narrowly triangular,  $1\frac{1}{2} \times 20$  in., spineless, minutely denticulate: infl. 3-5 ft., the scape densely covered by narrow outcurved bracts; fls.  $1\frac{1}{4}$  in.: ovary  $\frac{3}{4}$  in.; segms.  $\frac{5}{8}$  in., tube nearly suppressed: caps.  $\frac{3}{8} \times \frac{3}{4}$  in. N. Mex. G.C. II. 18, p. 776.

The following names occur as being in cult.: *A. Bakeri*, Hook. f. Resembles a gigantic eremurus in habit. Fls. with pale greenish yellow segms. Mex. (?) Gn. 61, p. 240.—*A. carcharioides*. Allied to *A. Ghiesbreghtii*. Lvs. flatter, narrower and more spiny.—*A. Langlæssei*, André. General habit as of *Furcraea Bedinghausii*. Infl. about 3 ft. high. Mex. R.H. 1901: 349.—*A. littæoides*. Allied to *A. Scolymus*. Stemless: lvs. strongly prickly toothed, terminated by a stout spine: fls. greenish yellow.—*A. Pavoliniæna*. Stemless: fls. green-yellow.—*A. Watsonii*. Allied to *A. horrida*. Distinguished by extremely narrow border of the lf. Probably Cent. Amer.—*A. Weberi*. Distinguished by almost complete absence of marginal teeth. Mex.—*A. Wrightii*, J. R. Drumm. Allied to *A. geminiflora*. Has been cult. under name of *A. Taylori*. Trunk short: margins of lvs. sharp without teeth or prickles; perianth dark green with cream-white borders. Cent. Amer. B.M. 8271.

WILLIAM TRELEASE.

AGDÉSTIS (a mythical hermaphrodite monster, the genus being an anomalous one in its order). *Phytolaccææ*. Tender climbing shrub from Mex. and Guatemala. Cult. in Calif. at one time. A monotypic genus.

*clematidea*, Moc. & Sesse. Lvs. alternate, petiolate, cordate: fls. axillary or in terminal, branched, racemose cymes, white, star-shaped; sepals 4; petals 0.—Grows 40-50 ft. in one season and is covered in Sept. with masses of small white blossoms in dense racemes; very sweet-scented. The red sts. come from a tuber which grows half out of the earth, and which is sometimes 100 and 150 lbs. in weight. These tubers look like solid rocks. They are of a gray granite-color. To do its best, this plant requires very rich soil and an abundance of moisture. Small offsets appear in quantities around the old tubers and furnish good material for prop. On account of its ill-smelling foliage, the agdestis cannot be recommended for veranda decoration; but it is a fine plant for covering unsightly objects and outhouses; to be looked for in extreme South.

N. TAYLOR.†

AGÉRATUM (Greek, *not growing old*, first applied to some everlasting). *Compositæ*. Garden annuals.

Florets all tubular, blue (rarely pink) or white; pappus of separate or united scales; otherwise like *Eupatorium*.—About 30 species, mostly Trop. Am.

herbs. Two in cult., with opposite, ovate, stalked and crenate-serrate lvs. and tassel-like heads in clusters. Mostly loose-growing plants, 1-2 ft. high, but with compact, dwarf, and variegated forms. Easily grown from seed in the open or started in house or hot-bed. They thrive in any garden soil, bloom all summer and, if started late, winter-blooming under glass.

*conyzoides*, Linn. Involucral scales oblong, abruptly acuminate, sparingly if at all hairy on the back, erose and ciliate: lvs. blunt or rounded at base, rarely heart-shaped. In most warm countries, often weed-like.

*Houstonianum*, Mill. (*A. mexicanum*, Sims). Fig. 145. Involucral scales lance-linear, attenuate, entire, ciliate, the back finely, densely, and somewhat viscidly hairy: lvs. usually heart-shaped at base: heads slightly larger than in the last. Mex. B.M. 2524.—The better species and more frequent in cult.

For so-called *A. conspiciuum* and *A. Lassei*, see *Eupatorium glechonophyllum* and *E. Lassei* respectively.

B. L. ROBINSON.

AGLÆIA (Greek, *splendor*; from the order and general appearance). *Meliaceæ*. A genus of more than 100 species of tender trees and shrubs from China, with minute, yellow, fragrant fls., said to be used in perfuming certain teas. Prop. by cuttings.

*odorata*, Lour. Ten to 20 ft.: lvs. alternate, 5-7 pinnate: fls. in axillary, branching panicles. March-May. Wight. *Icones. Ind. Or.* 2:511.—Cult. sparingly in Calif. and under glass in botanic gardens.



145. *Ageratum Houstonianum*. ( $\times \frac{1}{2}$ )

AGLAONEMA (Greek, *bright thread*). *Aracææ*. Green-house herbs grown for foliage and habit.

Low plants with an erect st. and basal shoots: lvs. with a long sheathed petiole, the blade usually oblong or oblong-lanceolate, with a thick costa and few lateral nerves: peduncles in clusters, shorter than the petiole: spathe straight, convolute below, open above; spadix sessile or stalked.—About 15 species, of Trop. Asia and Afr., allied to *Arum*, *Alocasia* and *Dieffenbachia*, and requiring essentially the same treatment as those genera.

These plants are evergreen, often beautifully variegated. Aglaonemas may be divided, or cuttings may be taken from plants that become too tall and weak. In either case the cuttings and divisions should be put into the sand-bed previous to potting, to develop new roots. All of the kinds will succeed in fibrous loam enriched with rotted manure, with the addition of a moderate quantity of leaf-mold, sand, and some crushed charcoal. (G. W. Oliver.)

*pictum*, Kunth. Dwarf: lvs. somewhat unequilateral, oblong or elliptic, ovate (4-7 in. long and 2-3 in. wide), very dark green, blotched with white, the central markings usually extending the whole length of the midrib. spathe white or whitish, 1-1½ in. long. Sumatra. I.H. 29:445.

*nebulosum*, N. E. Br. Somewhat larger: lvs. narrower (5-8 in. long, 1½ in. or less wide), more acuminate, the markings rather more broken and not so continuous along the midrib. I.H. 34:24. A.G. 16:361, and



146. *Aglaonema costatum*. ( $\times \frac{1}{5}$ )

F.E. 7:961 (as *A. pictum*).—This and *A. pictum* are confused in the trade. Both species deserve more attention than they have received in this country.

*costatum*, Veitch. Fig. 146. Very dwarf and compact: lvs. heart-shaped, thick, 3 in. wide, one-third longer than wide, seldom exceeding 5 in. long, dark shining green, with midrib ivory-white and scattering blotches of white. Holds its tufted lvs. through the winter. Moluccas. J.H. III. 63:225.

*A. commutatum*, Schott. Lvs. oblong-lanceolate, obtuse at the base, the apex long-acuminate, intense green, marked with spots of a paler green and of white. E. Indies.—*A. Ræblinii*, Hort., is "a fine decorative plant, with thick, leathery foliage" (Manda).—*A. versicolor*, Hort. Lvs. obliquely oblong, about 4 in. long by half as wide, rounded at the base, the apex acute, irregularly marked with patches of dark velvety green interspersed with paler green and milky blotches. E. Indies.

GEORGE V. NASH.†

AGNUS-CÆSTUS: *Vitex*.

AGRIMONIA (old name, perhaps a corruption of *Argemone*). *Rosaceæ*. AGRIMONY. Hardy perennial herbs, natives of the north temperate zone, with alternate odd-pinnate, aromatic and astringent lvs.: fls. yellow, racemose, with 5 small petals and 5-15 stamens: fr. armed with hooked bristles.—Sometimes cult. as woodland or shrubby plants. Not showy. Prop. by division of rootstocks in spring.

*Eupatoriæ*, Linn. (*A. officinalis*, Lam.). COMMON AGRIMONY. Fig. 147. Petals twice as long as calyx, latter making a small, lightly adhering bur.—Cult. in herb gardens to make a tonic tea, also in wild borders. Native to Eu. Grows 2-3 ft. high, in little clumps, from a short rootstock. Has been confused with our native *A. hirsuta*, Bicknell, which is not in the trade.

*odorata*, Mill. Lfts. narrower than in *A. Eupatoriæ*, pubescent; lobes more deeply crenate-dentate: petals more than twice as long as the calyx. Italy.—Occasionally cult. in Amer.

N. TAYLOR.†

AGROPYRON (Greek, *agros*, field, and *puros*, wheat). *Graminææ*. WHEAT-GRASSES. Perennial grasses, often producing creeping rootstocks.

Spikelets 3- to many-fl., sessile, placed sidewise, singly and alter-



147. *Agrimonia Eupatoriæ*. Flower and bud.

nately on the opposite sides of a continuous rachis, forming stiff terminal spikes; glumes equal, usually firm, many-nerved, acute or awned, sometimes nearly as long as the spikelet; lemmas 5-7-nerved, usually more or less awned, the palea ciliate on the keels.—Species 30 to 40 in the temperate regions of both hemispheres. The genus differs from *Triticum* chiefly in being perennial, and in the entire apex of the glumes.

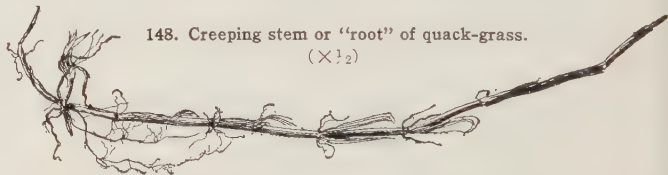
Many of the native species of the western states are important range grasses or furnish nutritious wild hay. One of these, western wheat-grass (*A. tenerum*, Vasey) (Dept. of Agric. Div. of Agrost. 17:297) has been recently introduced into cultivation and is sold by seedsmen of the northwestern states. One species, introduced from Europe, the familiar quack-grass (*A. repens*, Beauv., Fig. 148, also known as couch-grass, quick-grass and quitch-grass), is a troublesome weed in cultivated land, because of its long, creeping rootstocks. Though difficult to eradicate, it has value as a forage plant.

A. S. HITCHCOCK.

AGROSTËMMA: *Lychnis*.

AGRÓSTIS (an ancient Greek name for a forage grass, from *agros*, a field). *Graminææ*. BENT-GRASS. Annual or usually perennial grasses with erect or creeping stems and open panicles of small flowers.

Spikelets 1-fl.; glumes about equal, acute; lemma shorter and more delicate than the glumes, sometimes awned from the back, palea usually shorter than the lemma, often small or wanting.—Species about 100, distributed over the entire world, especially in the north temperate zone. The genus comprises several forage



148. Creeping stem or "root" of quack-grass. ( $\times 12$ )

and lawn grasses and a few ornamental, the panicles being used for bouquets. *A. nebulosa* is excellent for dry bouquets. *A. elegans* of gardens is an Aira.

A. Panicle open but not diffuse: perennial lawn and pasture grasses.

B. Palea present.

*álba*, Linn. RED-TOP. HERD'S-GRASS (locally). Culms erect, 2-3 ft., from a usually decumbent base, producing short rootstocks; sheaths smooth; ligule membranaceous, 2-3 lines long; blades flat, scabrous, rather strongly nerved, acuminate-pointed; panicle oblong or pyramidal, several inches or even a foot in length; spikelets 1-1½ lines long; the glumes scabrous on the keels; lemma awnless; palea one half to two-thirds as long as the lemma. Dept. of Agric., Div. of Agrost. 17:187. Ibid. B.P.I. Bull. 68, pl. 2.—A common meadow and pasture grass, native of Eu., but abundantly escaped in the northern and central portions of the U. S. along roadsides and in waste places. Var. *vulgáris*, Thurb. FINE BENT-GRASS. RED-TOP. A more delicate grass, about 1 ft. high: panicles 1-3 in.; ligule usually 1 line or less. Dept. of Agric. B.P.I. Bull. 68, pl. 3.—This form is commonly used as a lawn grass. Var. *aristáta*, Gray. Similar to var. *vulgáris* but the lemmas bearing an exerted awn from near the base. Infrequent. Var. *marítima*, Mey. Producing long stolons; panicles narrow, contracted. Dept. of Agric. B.P.I. Bull. 68: pl. 4.—A native of the sea-coast of N. Amer. and Eu. A form of this is cult. as a lawn grass under the name of creeping bent and has received the horticultural name *Agróstis álba* var. *stolonífera*, but is not *A. stolonífera*, Linn.



BB. *Palea wanting.*

**canina**, Linn. RHODE ISLAND BENT. BROWN BENT. Slender, erect, cespitose,  $\frac{1}{2}$ –2 ft.: spikelets 1 line long; lemma bearing about the middle an exerted bent awn. Dept. of Agric. B.P.I. Bull. 68, pl. 9. Eu.—Cult. as a lawn grass, and sparingly escaped. Much of the commercial seed under this name is *Agrostis alba* var. *vulgaris*. The seed of *A. canina* may be distinguished by the absence of the palea.

AA. *Panicle diffuse, the main branches scabrous, long and hair-like, naked below.*

B. *Plants annual: palea present.*

**nebulosa**, Boiss. & Reut. CLOUD-GRASS. Fig. 149. Culms branched below, slender, 1 ft.; blades few and small; ligule 2–3 lines; panicles oblong, about half the plant, delicate, the branches verticillate; spikelets  $\frac{1}{2}$  line, long-pedicelled, sometimes awned. Spain.—Cult. for dry bouquets. Sometimes called *A. cupillaris* but is not *A. capillaris* of botanical authors.

BB. *Plants perennial: palea wanting.*

**hiemalis**, B. S. P. (*A. scabra*, Willd.). HAIR-GRASS. TICKLE-GRASS. SILK-GRASS. Culms low and delicate, 1–2 ft.; blades small and mostly radical; panicles very diffuse, the spikelets borne toward the extremities of the branches. Dept. of Agric. B.P.I. Bull. 68, pl. 26.—The panicles break away at maturity and are blown about by the wind. The young panicles are often used for dry bouquets.

*A. minutiflora*. See *Sporobolus minutiflorus*.

A. S. HITCHCOCK.

AGUACATE, ALLIGATOR PEAR, AVOCADO: *Persea*.

**AILANTHUS** (from its native name *Ailanto*, meaning *Tree of Heaven*). Syn., *Pongèlion*. *Simarubaceæ*. Trees chiefly grown for their handsome large foliage.

Large trees: lvs. alternate, odd-pinnate, deciduous: fls. small, in large terminal panicles, polygamous; sepals and petals 5 or 6; disk small, 10-lobed; stamens 10; carpels 5 or 6; fr. consisting of 1–5 distinct oblong samaras with the compressed seed in the middle.—Eight or 9 species in Cent. and S. Asia and in N. Austral.

These trees are sparingly branched, with large pinnate foliage, inconspicuous greenish flowers in upright panicles followed by winged fruits; the foliage exhales a disagreeable odor when bruised. The ailanthus foliage gives a tropical effect when the growth is very strong.

The Chinese species are fairly hardy North; only as young plants are they somewhat tender. They are very rapid growers and stand smoke and dust well. If plants are cut back to the ground after they have become established (in two or three years after planting), they will throw up very strong shoots and make an excellent screen. This practice may be repeated year after year. Sumacs, paulownias, basswoods, mulberries, and other fast-growing things may be treated in this way. The ailanthus foliage is very like that of the cedrela (which see for illustration of differences). The best known is *A. altissima*, which is often planted as a street tree, particularly in cities, as it resists smoke

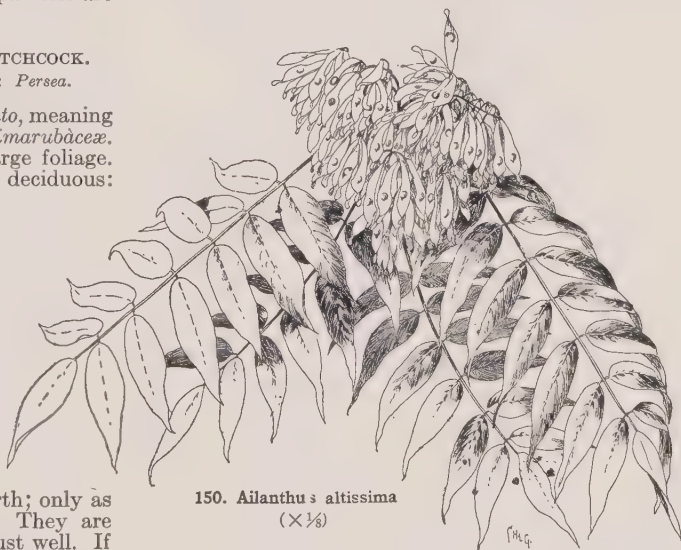
better than many other trees and is not attacked by insects. For street planting, the fertile plant only should be used, because the male exhales a disagreeable odor when flowering, and the pollen is said to cause catarrhal troubles. It grows in almost any soil, but best in a light and somewhat moist one.

Propagation is by seeds which must be sown soon after ripening, and by root-cuttings. It suckers from the roots.

A. *Branchlets and petioles glabrous or only finely pubescent: lfts. glabrous beneath.*

**altissima**, Swingle (*A. glandulosa*, Desf.). TREE OF HEAVEN. Fig. 150. Tree, to 60 ft.: young branchlets minutely pubescent, usually dull yellowish brown: lvs.  $1\frac{1}{2}$ –2 ft. long; lfts. 13–25, stalked, ovate-lanceolate, usually truncate at the base, 3–5 in. long, finely ciliate, with 8–10 pairs of veins, glabrous and glaucescent beneath, near the base with 2–4 coarse teeth, each with a large gland beneath: samaras  $1\frac{1}{2}$  in. long. June, July. China. G.C. III. 2:365. Gn. 24, pp. 63, 65 (habit); 32, p. 330. Mn. 10, p. 152 (habit). M.D.G. 1901:324 (habit). Var. **erythrocarpa**, Rehd. (*A. erythrocarpa*, Carr. *A. rubra*, Hort.). Lvs. darker green above and more glaucous beneath: fr. bright red, very effective in late summer and autumn. Var. **pendulifolia**, Rehd. Lvs. very large, drooping. R.H. 1906, p. 545. Var. **sutchuenensis**, Rehd. & Wilson (*A. sutchuenensis*, Dode). Young branchlets reddish brown, glabrous, lustrous: petioles purplish glabrous: lfts. not ciliate, cuneate at the base, at least in older plants: fr. about 2 in. long. W. China.—In China this species and *A. vilmoriniana* are sometimes planted as the host of a silkworm, *Attacus cynthia*, which produces a coarse silk, inferior to that of the common silkworm. As a shade and street tree, it is now much planted in temperate regions and naturalized in some localities.

**Giraldii**, Dode. Tree; young branchlets finely pubescent; petioles purplish: lvs. 2–3 ft. long; lfts. 33–41, closely set, lanceolate, 4–6 in. long, with 2–4 glandular



150. *Ailanthus altissima*  
( $\times \frac{1}{2}$ )

teeth near the base, undulate at the margin and long-pointed, with 14–15 pairs of secondary veins, dark green above, pale green beneath: panicle 8–12 in. long; fr.  $2\frac{1}{2}$  in. long. W. China.

AA. *Branchlets and petioles, at least in young trees, prickly and pubescent: lfts. pubescent beneath.*

**Vilmoriniana**, Dode (*Pongèlion vilmorinianum*, Van Tieghem. *A. altissima* var. *spinosa*, Bois). Tree, to 50 ft.: lvs. 2–3 ft. long; lfts. 17–35, oblong-lanceolate,

4-6 in. long, with 2-4 gland-bearing teeth near the base, glabrous or pubescent above, glaucescent and pubescent beneath: panicle to 12 in. long: fr. about 2 in. long. W. China. R.H. 1904, p. 445. Gn. 75 p. 632 (habit).—Has proved at least as hardy as *A. altissima* at the Arnold Arboretum.

*A. excelsa*, Roxb. (Pongelion excelsum, Pierre). Tall tree: lvs. 3 ft. long, abruptly pinnate; lfts. 20-28, teeth without glands. India. Can be grown only in tropical regions or in the hothouse.—*A. flavescens*, Carr.=*Cedrela sinensis*. ALFRED REHDER.

**AIÏRA** (an ancient Greek name for Darnel). *Gramineæ*. HAIR-GRASS. Annual grasses with delicate culms and open capillary panicles. Spikelets 2-fld. one or



151. *Ajuga reptans* var. *variegata*. ( $\times \frac{1}{2}$ )

both fls. awned from the middle of the back; palea nearly as long as the lemma.—Species 6, natives of the Medit. region, intro. in the Atlantic states and on the Pacific coast. Cult. for dry bouquets. The species have been confused by florists with *Agrostis* (as *Agrostis elegans*) from which genus they may be distinguished by their 2-fld. spikelets.

**capillaris**, Host. (*A. elegans*, Willd.). Spikelets less than 1 line long, all long-pedicelled.

**caryophyllæa**, Linn. Pedicels mostly shorter than the spikelets. Dept. of Agric. Div. of Agrost. 7:170.

*A. caespitosa*=*Deschampsia caespitosa*.—*A. foliis variegatis*. This name is listed in trade catalogues, but the seedsmen report that all failed. Probably is *Deschampsia caespitosa*.

A. S. HITCHCOCK.

**AIR-PLANT**. In common speech, any plant that grows on the trunk or in the top of another plant is called an air-plant. The proper term is *epiphyte* (that is, *growing on a plant*), which see. In horticulture, the term air-plant is usually applied to epiphytal orchids, tillandsias, and the like. Most of these grow on old bark, perhaps deriving some of their nourishment from the bark, but most of it from the air and rain. Air-plants are not parasites,—they do not derive their support from the juices of the host.

The term is sometimes applied to plants that make roots from leaves or other parts that are severed and allowed to remain out of the earth. Bryophyllum is a leading example, because new plants start from the leaf-edges. The dioscoreas and rajiarias that bear aerial tubers are sometimes known as air-plants. See also *Resurrection Plants*.

**AJÛGA** (not yoked: the calyx not bilabiate). *Labiataæ*. BUGLE-WEED. Hardy herbaceous European perennials, creeping by stolons.

Height 6-12 in.: fls. numerous, in whorls, normally blue or purple, with rosy or white varieties; corolla 2-lipped, the upper lip short, the lower spreading.—Considerably used in rock-gardens and for border planting. Prop. by division in spring or by seeds.

**genevënsis**, Linn. (*A. rugosa*, Hort. *A. alpina*, Hort.). St. erect, pubescent: cauline lvs. oblong-elliptic or obovate, narrowed at the base; lower ones petiolate; floral lvs. ovate or wedge-shaped, coarsely toothed,

sparsely hairy: upper fl.-whorls spicate; lower whorls distant. May, June.

**pyramidalis**, Linn. St. erect: cauline lvs. obovate, hardly petiolate, in a 4-sided pyramid; floral lvs. broadly ovate, the highest often colored; all lvs. entire: fl.-whorls usually all spicate.

**réptans**, Linn. St. prostrate: lvs. ovate or obovate, entire or sinuate, shiny.—A low, dense, fast-spreading creeper, excellent for covering shady slopes. The typical and white-fld. forms are less cult. than the following: Var. **rùbra**, Hort. More valued for its dark purple lvs. than its blue fls. Var. **variegata**, Hort. Fig. 151. Lvs. splashed and edged creamy yellow. Var. **atropurpurea**, Hort. Fls. purplish blue. May.—Useful for carpeting the ground in shady places.

*A. metálica* var. *crispa*, Hort., intro. by Henderson, 1899, is described as dwarf (4-5 in.), with curled, metallic glossy and blue fls. in a pyramidal spike.—A bedding plant, intro. from Germany. None of the varieties are so desirable as the typical form.—*A. Brückbanki*, Hort., "with fine blue fls.," and *A. osmáfera*, Hort., are trade names for blue-fld. bugles that are unknown in hort. or botanical literature, and it is uncertain to what species they are to be referred.

N. TAYLOR.†

**AKEE**: *Blighia*.

**AKÈBIA** (from *Akebi*, its Japanese name). *Lardizabalaceæ*; by some included in *Berberidaceæ*. Twining woody plants.

Glabrous twining shrubs: lvs. half-evergreen, long-petioled, digitate; fls. monœcious, in axillary raceme, the pistillate at the base, the staminate smaller, at the end of the raceme; sepals 3; stamens 6; carpels 3-12, with sessile stigma; fr. a large oblong berry with numerous seeds imbedded in a pulp, opening along the inner suture.—Two species with several varieties in Japan and China.

The akebias are very ornamental, hardy climbing shrubs of graceful appearance, especially adapted for places in which very dense shade is not wanted. They require a sunny position and well-drained soil; also valuable in the cool greenhouse for covering pillars and walls, growing best in a sandy compost of loam, leaf soil and peat. In Japan, the fruit which is very showy but with us rarely produced, is eaten, and the stems are much used for wicker-work.

Propagation is by seeds, by greenwood or hardwood cuttings, and also by root-division and layers.

**quinàta**, Decne. Figs. 152, 153. Climbing 12 ft. or more: young branchlets purplish: lfts. 5, oval or oblong-obovate, entire, emarginate, 1-2 in. long: fls. fragrant, the pistillate purplish brown, about 1 in. broad, the staminate smaller, rosy purple, in early spring: berry oblong, 3-5 in. long, dark purple with glaucous bloom; seeds black. April, May. China, Japan. B.R. 33:28. B.M. 4864. G.F. 4:137 (adapted in Fig. 153). A.G. March, 1891, figs. 5, 7, and plate. G.W. 10, p. 500. Gn. 51, p. 151. R.H. 1853:141. S.Z. 77.—Hardy, handsome, not attacked by insects or fungi. Very graceful and desirable.



152. *Akebia quinata* flowers.

**lobàta**, Decne. (*A. quercifolia*, Sieb. & Zucc.).



Lfts. 3, broadly ovate, coarsely crenate, 1–2 in. long; fls. in long racemes, smaller than those of *A. quinata*. Japan, China. B.M. 7485. A.G. March, 1891, p. 140. G.W. 13, p. 438. S.Z. 1:78. Var. *austrâlis*, Diels. Lfts. oval or ovate to ovate-oblong, entire or nearly so, coriaceous.—Recently intro. from China and probably tender. Var. *clematifolia*, Ito. Lfts. broadly ovate to ovate, entire, of thin texture, to  $3\frac{1}{2}$  in. long. Japan. A supposed hybrid of this and the preceding species is *A. pentaphylla*, Makino, with 3–5 lfts. entire or sparingly crenate.

ALFRED REHDER.

**ALÂNGIUM** (from the Malabar name). Including *Marlea*. *Alangiaceæ*, formerly included in *Cornaceæ*. Trees or shrubs, rarely grown in temperate regions for their handsome large foliage and fragrant fls. A genus of over 20 species of shrubs or small trees of the Old World tropics, with alternate entire or lobed evergreen or deciduous lvs. and small, perfect whitish, often fragrant, fls. in axillary clusters; calyx small, campanulate; petals 4–10, linear, usually laxly reflexed; stamens 4–30; ovary inferior, style simple, elongated; fr. a 1-seeded drupe. Sometimes cult. in Old World gardens, either as stove plants or out-of-doors in warmer regions, but probably not in the American trade.

*A. begoniifolium*, Baill. (*Marlea begoniifolia*, Roxbg.) Tree to 60 ft.: lvs. ovate, entire or slightly lobed, acuminate, usually rounded at base, to 8 in. long; fls.  $\frac{3}{4}$  in. long, in cymes; petals and stamens usually 6. Afr., S. and E. Asia. B.R. 24:61. E.P. IV. 220b, p. 3.—*A. decapetalum*, Lam. (*A. salviifolium* var. *decapetalum*, Wang. A. Lamarckii, Thwait.). 30 ft.: lvs. entire, oblong-lanceolate; fls. fragrant, white, solitary or in 2's or 3's in the axils; petals 10. India. E.P. IV. 220b, 10.—*A. platanifolium*, Harms (*Marlea platanifolia*, Sieb. & Zucc.). Tree: lvs. roundish in outline, 3–5-lobed, to 8–10 in. long; fls. over 1 in. long, in few-fl. cymes, petals and stamens usually 6. Japan, China, E. P. IV. 220b, p. 23. This seems to be the hardest species and is probably hardy as far north as Washington, D. C.

ALFRED REHDER.

**ALBÉRTA** (from Albertus Grotus, commonly known as Albertus Magnus, philosopher of the thirteenth century, who wrote concerning plants). *Rubiaceæ*. Two species of shrubs or trees, one of which has been introduced as a hothouse or greenhouse subject.

Leaves thick, opposite; fls. rose-colored or purplish, in terminal panicles; calyx 10-ribbed and 5-lobed, often colored in fr.; corolla elongated-tubular.

**mâgna**, E. Mey. Bark pale, the young branches reddish brown; lvs. 4–5 in. long, obovate-oblong, obtuse, entire, narrowed into a short, stout petiole; midrib stout; panicle terminal, erect, 6 in. high and nearly as broad at the base; corolla-tube 1 in. long, slightly swelling in upper part, pubescent; lobes 5, small, triangular, recurved. Natal. B.M. 7454. G.C. III. 22:416. Gn. 53:430. The other species is *A. minor*, Baill., from Madagascar.

L. H. B.

**ALBÍZZIA** (after *Albizzi*, an Italian naturalist). *Leguminosæ*. Ornamental woody plants chiefly grown for their handsome foliage and also for their attractive flowers; some are valuable timber trees; closely allied to the acacias.

Trees or shrubs: lvs. deciduous, alternate, bipinnate; lfts. usually small and numerous, oblique; fls. in axillary, peduncled spikes or globular heads; calyx tubular or campanulate, 5-toothed; corolla small, funnelform, with the segm. connate more than one-half; stamens numerous, more or less connate at the base, exserted; fr. a large strap-shaped pod without pulp.—About 25 species in tropical and subtropical regions of Asia, Afr. and Austral.; 1 in Mex.

The albizzias are unarmed trees or shrubs with graceful feathery foliage and yellowish, white or pink flowers in summer. Most of the species can be grown only in subtropical and tropical regions except *A. Julibrissin* which is the hardest species and can be grown as far north as Washington, D. C. *A. lophantha* is sometimes grown as a greenhouse shrub.

For cultivation, see *Acacia*.

*A. Fls. in cylindrical axillary spikes: lvs. sub-persistent.*

**lophántha**, Benth. (*Acácia lophántha*, Willd.). Shrub or small tree, 6–20 ft.: lvs. with 14–24 pinnæ, each with 40–60 lfts., about 5 lines long, linear, obtuse; spikes mostly 2, about 2 in. long, yellowish; fls. distinctly pedicelled. S. W. Austral. B.M. 2108. B.R. 5:361. L.B.C. 8:716.—Sometimes cult. as greenhouse shrub and flowering in spring, and in the open in the S.; it has become naturalized in S. Calif. Often known as *Acacia speciosa*. There is a var. *gigantæa* in the trade.

**montâna**, Benth. Small tree; ferrugineously villous: lvs. with 14–24 pinnæ, each with 40–80 lfts. linear-



153. *Akebia quinata* fruit. ( $\times \frac{1}{2}$ )

oblong, 3–4 lines long, obtuse; spikes cylindric, 2–3 in. long; fls. very short-pedicelled. Java.—Closely related to the preceding species, differing chiefly in its yellowish pubescence and in the short-stalked fls.

AA. *Fls. in globular heads: lvs. deciduous.*

B. *Stamens united only at the base.*

C. *Lfts. ovate or oblong, obtuse.*

D. *The fls. pedicelled, in axillary heads.*

**Lébbek**, Benth. (*Acácia Lébbek*, Willd. *A. speciosa*, Willd.). **LEBBECK TREE**. **SIRIS TREE**. **WOMAN'S-TONGUE TREE**. Fig. 154. Tall tree: lvs. with 4–8 pinnæ, each with 10–18 lfts., obliquely oblong or oval,  $1\frac{1}{2}$  in. long, nearly sessile; fls. greenish yellow, in short-peduncled, axillary heads, 3–4 together. Trop. Asia, N. Austral.—Planted as a yard tree in American tropics.

**occidentâlis**, Brandege. Small tree, 15–25 ft.: lvs. with 8 pinnæ, each with 6–10 lfts., oblique-oval,  $\frac{3}{4}$ – $1\frac{1}{2}$  in. long, glabrous; fls. yellowish, in axillary heads. June, July. Mex., Low. Calif.—Possibly only a variety of *A. Lébbek*, and not indigenous.

DD. *The fls. nearly sessile in fascicled heads forming large terminal panicles.*

**odoratissima**, Benth. (*Acácia odoratissima*, Willd.). Tall tree: lvs. with downy rachis; pinnæ 6–14, each with 16–50 lfts., oblique-oblong,  $\frac{3}{4}$ –1 in. long, glaucous beneath; heads few-fl., numerous, greenish white. E. Indies.

*procëra*, Benth. (*Acácia procëra*, Willd.). Tall tree: lvs. with nearly glabrous rachis; pinnæ 6-10, each with 12-16 lfts., oblique-oblong, 1-1½ in. long, glabrous: heads few-fld., greenish white. Trop. Asia, Austral.

cc. *Lfts. falcate, with the midrib close to the upper edge, acute.*

*Julibrissin*, Durazz. (*Acácia Julibrissin*, Willd. *A. Nemu*, Willd.). Tree, 30-40 ft.: rachis of the lvs. with a small gland at the base; pinnæ 8-24, with numerous lfts., falcate-oblong, ¼ in. long: heads pink, slender-peduncled, crowded on the upper end of the branches. Warmer Temp. Asia from Persia to Japan. Summer. S.F. 1:51. Var. *rôsea*, Mouillef. (*A. rôsea*, Carr.). Fls. bright pink, dwarfier and harder than the type. R.H. 1870:490, 1912, pp. 184, 185. F.S. 21:2199.—This variety is sometimes grown under the name *A. Nemu*.

Var. *môllis*, Benth. (*A. môllis*, Boiss. *Acácia môllis*, Wall.). Lfts. broader, densely pubescent. Himalayas and Abyssinia.



154. *Albizzia Lebbeck.*  
(×¼)

*stipulâta*, Boiss. (*Acácia stipulâta*, DC.). Tall tree: young branches with large, persistent stipules: rachis of the lvs. with many glands, pubescent; pinnæ 12-40, with numerous lfts., oblong-linear, ¼-½ in. long, pubescent beneath: heads in axillary simple or terminal compound racemes. Trop. Asia.

BB. *Stamens connate into a long, narrow tube.*

*fastigiâta*, Oliver (*Zýgia fastigiâta*, E. Mey.). Tree: branches and petioles rusty-pubescent; pinnæ 8-14, each with 16-30 lfts., trapezoid-oblong, ⅓-½ in. long, pubescent beneath: heads in terminal corymbs on the end of the branches. Trop. Afr.

*A. moluccâna*, Miq. Tree: rachis of the lvs. with many glands; pinnæ 14, each with 12-40 lfts., obliquely elliptic-oblong, glaucous and pubescent beneath. Moluccas.—Incompletely known.

ALFRED REHDER.

**ALBÛCA** (*whitish*; the color of the first-described species). *Liliacææ*. Tender bulbs from the Cape of Good Hope allied to *Ornithogalum*, and treated in the same way.

Bulb tunicated: lvs. all radical, flat or terete: fls. large, yellow, white or green, in single racemes: perianth of 3 outer oblong more or less spreading parts and 3 inner shorter connivent segms.; stamens 6, the filaments often winged; stigma 3-lobed: fr. a 3-valved caps.—S. and Trop. Afr. and Arabia.

There are a good number of species of *Albuca* (about 30), but few are much known to cultivation, and none of them is apparently planted to any extent in this country. *Albucæ* are late spring and summer bloomers, producing attractive white or yellow flowers. In mild climates, they may be carried over winter in a frame or with a good protection of litter. Propagation is by

offsets or by seeds. Some of the species are hothouse plants. Allied to *Urginea*, to which the *A. major* of catalogues probably belongs. Numbers of hybrids have been produced.

*aûrea*, Jacq. Two ft.: bracts yellow: fls. 10-30, pale yellow, upright: lvs. very narrow, flat. June.

*Nélsonii*, N. E. Br. Three to 5 ft.: fls. 1½ in. long, in a large cluster or spike, almond-scented, pure white with a red-brown stripe down the middle of each segm. (but pure white under glass): lvs. long, grooved or concave at base, flat above, pointed. July, Aug.—Probably the best species yet intro. The bulbs are lifted in autumn; or they may be potted up for greenhouse use. It is an excellent plant when well grown. B.M. 6649. L. H. B.

**ALCHEMÍLLA** (from an Arabic name). *Rosacææ*. Hardy herbaceous perennials, suitable for rock-gardens and front rows of borders.

Low (6-8 in.): lvs. palmately lobed or compound: fls. small, greenish or yellowish, in clusters; petals 0; stamens 1-4; pistils 1-4, becoming achenes included in the persisting calyx.—Species 30 or more in Cent. and S. Amer., Afr., India and elsewhere, largely in mountains.

Plants of easiest culture. Propagation is effected by division or by seeds. *A. arvensis* and *A. pratensis* of Europe are naturalized in North America. The *A. major* of catalogues is probably a form of one of the species.

*alpina*, Bieb. Lvs. digitate, 5-7-cut; lfts. usually 7, lanceolate-cuneate, obtuse, serrate at apex, silky hairy beneath, shiny. Eu.

*sericea*, Willd. Lvs. larger than in *A. alpina*, 5-7-nerved, digitate; lfts. 7, lanceolate, acute, deeply serrate from the middle to apex, downy beneath. Caucasus.

*vulgâris*, Linn. (*A. montâna*, Schmidt). **LADY'S MANTLE**. Lvs. 7-9-nerved, 7-9-cut; reniform, plicate-concave. North temperate zone. L. H. B.†

**ALCHÓRNEA** (in memory of Stanesby Alchorne). *Euphorbiacææ*. **DOVEWOOD**. Tropical shrubs or trees with alternate, entire or dentate lvs.: fls. usually dioecious, in elongated slender catkin-like infl.; staminate calyx 4-lobed; stamens 8.

One species, *A. ilicifolia*, Muell. Arg., is rarely grown in greenhouses, and is listed by U. S. Dept. of Agric. as intro. from Austral. It is a tall, handsome shrub with thick, holly-like lvs. The wood is useful.

J. B. S. NORTON.

**ALDER:** *Alnus*.

**ALECTORÛRUS** (Greek, apparently cock's-tail). *Liliacææ*. An anthericum-like plant, summer-blooming and suitable for outdoor culture; hardy in England. Blooms well in pots. One species, *A. yedoensis*, Makino, of Japan (known also as *Anthericum yedoense*, Maxim., and *Bulbinella yedoensis*, Matsum.), is now intro. to gardens. It is a perennial glabrous herb with a short and thick rootstock: lvs. 6-11, 2-ranked, 20 in. or less long: fls. many, small, pale rose, racemose along panicle branches on a scape or st. surpassing the lvs.; perianth bell-shaped, segms. 6; stamens 6, in some fls. exerted and in others only equaling the segms.; ovary 3-lobed. In Japan it is known as Keibi-ran. B.M. 8336. G.C. III. 48:352.

L. H. B.

**ALÉCTRYON** (Greek name for the chanticleer). *Sapindacææ*. **TIROKI**. Tall trees, one of which is grown in California.

Leaves alternate, pinnate, stipulate, the lfts. entire or toothed: fls. mostly unisexual, in axillary or terminal panicles, the petals wanting, containing a small lobed disk; stamens 10 or less: fr. a hard woody caps., the seeds arillate, with spiral cotyledons.—Some 16 species in Malaya and the Pacific Isls.



**excelsum**, Gaertn. Evergreen, 30-60 ft., with unequally pinnate lvs. 4-12 in. long, the lfts. 4-6 pairs and 2-4 in. long, ovate-lanceolate and acuminate, nearly or quite entire; fls. greenish, in a much-branched panicle: fr. globose, woody; seed large, jet-black and shining, sunk in a large scarlet aril. New Zeal.—Said to have been in cult. in Calif. for more than 40 years and to have been sometimes sold for *Nephelium Litchi* (to which it is closely related). In New Zeal. it yields a tough elastic timber used for tools and yokes, and the natives extract oil from the seeds.

L. H. B.

**ÁLETRIS** (Greek word for *female slave* who ground corn; alluding to apparent meanness of the fls.). *Liliacæ*. Hardy small herbs, sometimes grown in borders.

Leaves thin, flat, lanceolate, grass-like, in a spreading cluster, all radical: fls. small, in a spiked raceme, terminating a slender scape 2-3 ft. high; perianth not woolly, but wrinkled and roughened with many points that give a mealy appearance; perianth 6-cleft; stamens 6, inserted at the base of the lobes; style 3-cleft.—The aletris are about 8 in number, in moors, barrens, and grassy places in N. Amer., E. Asia and Japan. They are fibrous-rooted, very bitter herbs, with fls. on a naked scape 1-2 ft. high. July, Aug. They prefer a moist but sunny situation. Prop. slowly by division; or seeds may be used. A plant once catalogued as *A. japonica* is undetermined.

**farinosa**, Linn. Fls. tubular, white; lobes lanceolate-oblong. N. Amer. L.B.C. 12:1161.

**auræa**, Walt. Fls. bell-shaped, fewer and shorter than in *A. farinosa*, yellow; lobes short, ovate. S. E. N. Amer. B.M. 1418 (erroneously as *A. farinosa*).

L. H. B.

**ALEURÏTES** (Greek, *farinose* or *floury*). *Euphorbiacæ*. Tropical trees grown for the oils they yield or sometimes for shade and ornament.

Leaves alternate, palmately veined, 3-5-lobed, the long petioles with 2 glands at the apex: fls. usually monœcious, in lax terminal cymes; sepals 2-3, valvate; petals 5; stamens 8-20, the inner row monadelphous; 1 ovule in each cell of the 2-5-celled ovary: fr. large, drupaceous, with thick-shelled seeds.—Four species, with milky juice, natives of E. Asia and Pacific Isls. *Jatropha* and *Hevea*, are related genera. Page 3565.

All of the species are cultivated in tropical countries for the drying oil derived from the seeds. These oils are similar to linseed oil, but dry quicker, harder and more waterproof but less lightproof and elastic. The seeds of *A. moluccana* yield 60 per cent of oil (kekuna, kelun or bankul oil), which is used for burning or in varnishes. The seed or oil is also used to some extent as food and the wood is worked. The tree is grown for shade. It is said to be easily grown in the tropics up to 2,000 feet altitude. It is easily propagated from seeds, which sprout in four to five weeks. The oil (wood-oil, tung-oil) of the seeds of the wood-oil trees (*A. cordata*, *A. Fordii*) is much used, especially in China and Japan, for treating woodwork, cloth, and the like, and for burning. Its importation to this country is on the increase, where it is used in varnishes and other products, paints, soaps, linoleum, and so on. *A. Fordii*, which is the hardier species, has been extensively introduced into the southern states by our Department of Agriculture and is reported to be doing very well.

*A. cordata* is a fine smooth-barked tree, good for shade and will stand high temperature, but not much below freezing. *A. Fordii* is a very ornamental tree.

The wood-oil trees are usually grown on dry, thin soil not suited to general farming. They are grown from seeds, and begin to produce nuts in three to six years. The seedlings are raised in a bed and transplanted when about a foot high or are planted where they are to stand. They may also be propagated from hardwood cuttings, which root readily. An average tree is said to yield

twenty to fifty pounds of nuts with about 24 per cent of oil. The oil is pressed from the seed after roasting. The seed is poisonous. See Circ. 108, U. S. Bu. Pl. Ind.

#### A. Pubescence stellate.

**moluccana**, Willd. (*A. triloba*, Forst.). CANDLE-NUT. CANDLEBERRY TREE. VARNISH TREE. Tree with long spreading branches: lvs. large, ovate-acuminate, short-lobed, rusty pubescent below: paniculate cymes 4-5 in. long of many small fls.; stamens 15-20; ovary 2-celled: fr. 2-3 in. thick; seeds large, rough and walnut-like.—Probably native of Malay region but now widely cult. and wild in the tropics. In wooded valleys up to 3,000 ft. Mem. Torr. Bot. Club. 8:117. Blanco Flor. Filip. 220.—Also known as Belgaum walnut, Indian walnut, kukui and various other native names.

**trispérma**, Blanco (*A. saponaria*, Blanco). BANUCALAG. Differs from *A. moluccana* in having 7-10 stamens, a 3-4-celled ovary, lvs. more entire and seeds smooth. Philippines.—Intro. once by U. S. Dept. of Agric. The seed used for the drying oil. Other native names are balocanad, baguilumbang, calumbang, balucanag. Blanco Flor. Filip. 296.

#### AA. Pubescence not stellate.

**cordata**, R. Br. JAPAN WOOD-OIL TREE. Twenty-five to 30 ft. high: lvs. broadly ovate, acuminate, 3-5-lobed or toothed: petals oblong,  $\frac{3}{4}$  in. long, hairy at base; stamens 8-10; ovary 3-4-celled: fr. warty; seeds about the size and shape of large castor beans. S. E. Asia and adjoining isls.; cult. especially in Japan, south of 40°, and in Formosa.

**Fördii**, Hemsl. (*A. cordata*, Muell. Arg., in part). CHINA WOOD-OIL TREE. Ten to 25 ft. high: lvs. ovate-cordate: petals 1 in. or more long, orbicular ovate, somewhat hairy; stamens 8-10; ovary about 4-celled: fr. smooth: panicles of reddish white fls. in spring; fr. ripe in Sept. Cent. Asia.—Extensively cult. for the oil. Perfectly hardy in Cent. Fla. and resistant to drought.

J. B. S. NORTON.

**ALEXANDERS**. Name applied to *Smyrniium Olusatrum* (Umbelliferae), the blanched leaf-stalks of which were once used as a salad and pot-herb, but now out of cultivation because of the superior value of celery. It is a biennial, native to Europe, with ternately dissected pinnate radical leaves, and small yellow flowers in umbels. Seed is sown in late summer or in autumn, and the plants transplanted in rows as they come up in spring. The plants are blanched by being banked with earth.

**ALFÁLFA, LUCÉRNE** (*Medicago sativa*, Linn.). A deep-rooted perennial forage plant of the *Leguminosæ*. The plant grows one to four feet high, bears pinnate leaves with three ovate-oblong toothed leaflets, and small head-like racemes of purple clover-shaped flowers. It is native to Europe. In the arid parts of the United States it is the staple hay and forage plant, and it is also grown to a considerable extent in the East. Two to six mowings may be made each year from established meadows. Fifteen to thirty pounds of seed are sown to the acre; and the seed is preferably sown alone, without another crop. Alfalfa should not be pastured the first year. In two or three years it becomes thoroughly established and productive, and it should continue for many years. June-grass often runs it out in a cool, moist climate. Alfalfa often becomes a weed in waste places. See Cyclo. Amer. Agric. II, for full account.

**ALFILARIA**. Spelled also *Alfilera* which is the West American, and *Alfilarilla*, the Spanish-American for *Erodium cicutarium*, L'Her. *Geraniacæ*. A hairy annual with pinnate lvs., sometimes used for pasture in dry regions. See Cyclo. Amer. Agric. II, p. 197.

**ÁLGA**, plural **ALGÆ**. A general name for chlorophyll-bearing thallophytes. They are flowerless plants, allied to the fungi, and generally inhabit water. Those occurring in salt water are known as seaweeds. None is cultivated. The green "moss" on flower-pots is made up of algæ.

**ALGARÔBA** is the fruit of *Ceratonia siliqua*.

**ALHÂGI** (its Mauretanian name). *Leguminosæ*. Shrubs grown for their profusely produced red flowers.

Spiny plants: lvs. alternate, oblong, small, deciduous, entire; fls. papilionaceous, red, small, in few-fld. axillary racemes; calyx campanulate, 5-toothed; pods



155. *Allamanda cathartica* var. *Hendersonii*. ( $\times \frac{1}{4}$ )

terete, contracted between the seeds.—Three closely related species from Greece and Egypt to the Himalayas.

These plants are low, much-branched shrubs with small and sparse, pale foliage and numerous small red flowers toward the end of the branches. Only the following species, which produces the Persian or alhagi manna, is but very rarely met with in collections. It may be cultivated in temperate regions in dry and sunny positions and propagated by seeds and by green-wood cuttings under glass with slight bottom heat; as a desert plant, it is impatient of too much moisture, and needs special attention, particularly in the seedling state.

**camelòdrum**, Fisch. **CAMEL'S THORN**. Low, spiny shrub, glabrous or nearly glabrous: lvs. oblong, obtuse,  $\frac{1}{2}$ – $1\frac{1}{4}$  in. long; fls. red, about  $\frac{1}{3}$  in. long, on few-fld. axillary racemes, forming panicles at the end of the branches. Summer. Caucasus to the Himalayas.—Easily distinguished by its glabrousness from the other species, which are more or less pubescent. The other species are *A. græcorum*, Boiss., *A. maurorum*, Medic.

ALFRED REHDER.

**ALÍSMA** (derivation doubtful). *Alismaceæ*. A genus of 2 species of hardy aquatics, with small white or pale rose fls. on scapes with whorled, panicle branches. Perennial by a stout proliferous corm. Useful in ponds. Prop. by division or seeds. According to N. Amer. Flora 17:43, 1905, the native water-plantain is not the same as the Old World species, to which, exclusively, should be applied the name here taken up for the species which has hitherto been considered cosmopolitan, and is now so treated.

**Plantão-aquática**, Linn. (*A. Plantão* of authors. *A. subcordatum*, Raf.). **WATER-PLANTAIN**. Lvs. variable, but usually broadly cordate-ovate, thinner and narrower when growing under water: panicle 1–2 ft. long. Common in swales and still waters in U. S.; also in Eu. and Asia.

*A. natans*, Linn., is now referred to the monotypic genus *Elisma* (*E. natans*, Buch.). It is native to Eu., and is offered in foreign catalogues. Fl. white, single, on a long peduncle: floating lvs. elliptic and obtuse. See *Elisma*.

N. TAYLOR.†

**ALKÁNNA, ÁLKANET**: *Anchusa*.

**ALKEKÉNGI**: *Physalis*.

**ALLAMÁNDA** (Dr. Allamand, Leyden). *Apocynaceæ*. Tropical shrubs, mostly climbers, grown in green-houses and conservatories, and in the open far south.

Leaves entire, whorled: fls. terminal, large and funnel-shaped, with a flat spreading or reflexed limb, the tube inflated below the throat in which there are 5 hairy scales; stamens 5, the filaments very short; ovary 1-loculed: the fr. (seldom seen in conservatories) a large spiny globular or oblong pod.—About a dozen species in Brazil and 1 in Cent. Amer.

With the exception of *A. violacea* and *A. neriifolia*, all the forms in cultivation are probably forms of one variable species. The original name for this is *A. cathartica*, and the plants known in the trade as *A. grandiflora*, *A. nobilis*, *A. Schottii*, *A. magnifica*, *A. Williamsii* are all referred to it as varieties. For garden purposes they are distinct, but botanically the differences are so slight as not to justify their being retained as species. *A. violacea* is readily distinguished by the color of the flowers, and *A. neriifolia* by the swollen base of the corolla.

The allamandas comprise several of the finest climbing plants in cultivation and are general favorites wherever grown. They are of very easy culture, thriving well under the ordinary conditions of a stove or warm greenhouse. A mixture of two parts of strong turfy loam and one part of sharp sand, leaf-mold and charcoal, suits them best. Cuttings root readily in a close case in sandy soil in a temperature of 70° F. at almost any time of the year, but spring is by far the best time, as the young plants have a long season of growth ahead of them and make better plants than those rooted later. Both old and new wood may be used for propagation; the young growth should be taken off with a heel if possible, whilst pieces of the previous season's wood, which has been well ripened, may be cut up into lengths with two or three joints, in spring; the stems which are removed during the annual pruning may be used for this purpose. All the species make most excellent pot-plants, but in order to obtain them at their best they should be planted out in a well-drained border. When well established, either in pots or borders, they should be fed liberally with natural or artificial manures, during the whole of the growing season, as all the species without exception, are gross feeders. After growth has ceased in late autumn or winter, the plants should be kept nearly, but not quite dry at the roots until February or March, when they should be cut back as far as is necessary, and started in a moist position in the greenhouse. Any repotting that they require should be done before the new growths are more than 6 inches long. The weaker kinds, as *A. violacea*, *A. cathartica* var. *grandiflora* and var. *Williamsii*, are best grafted on the strong-growing var. *Hendersonii*. Spring and summer.

*A. Plant* bushy, or little climbing: fl. swollen at base.

**neriifolia**, Hook. A dwarf bush or half climber: sts. terete, woody below, covered with down when young: lvs. petiolate, 2–5 in a whorl, elliptic or ovate-acuminate, rich dark green above, pale dull green below, midrib and principal veins softly pilose; petiole very short: infl. short, 1–3 in. long; fls. yellow on short pale green terete stalks up to  $\frac{1}{2}$  in. long; bracts  $\frac{1}{2}$  in. long,



green; calyx spreading, lobes unequal, light green, elliptic-ovate,  $\frac{1}{2}$  in. long; corolla rich golden yellow, striped inside the tube with reddish brown; tube 2 in. long, spreading upward with a swollen bulbous greenish base; limb  $1\frac{1}{2}$  in. diam., lobes orbicular or oval, obtuse  $\frac{1}{2}$  in. long. Brazil. B.M. 4594.

AA. Plant mostly tall climbing, in greenhouses usually trained on rafters: fl. not prominently enlarged at base.

B. Fls. purple.

**violacea**, Gardn. (A. *Blanchetii*, A. DC.). A slender-growing climber: sts. long, slender, terete, green tinted with red on side exposed to the sun, hairy: lvs. usually in 4's, almost sessile, elliptic, 4-6 in. long, dull green and covered with hispid hairs: infl. up to 1 ft. long, loosely fld.; bracts small,  $\frac{1}{4}$  in., lanceolate, pale green; fls. in pairs, terminating each branch of the cyme; pedicel  $\frac{1}{2}$  in. long, hairy; calyx  $\frac{2}{3}$  in. diam., campanulate, lobes  $\frac{1}{2}$  in. long, elliptic-ovate, inner pair smaller than the rest, and lanceolate; corolla bright reddish purple, tube 2 in. long, narrow and constricted in the middle, upper part purple-red, middle part greenish yellow, and lower part reddish brown, limb spreading 2-2 $\frac{1}{2}$  in. diam., lobes orbicular, throat rich dark reddish purple shading to yellowish white at the base. Brazil. B.M. 7122.—A fine handsome species, quite distinct from all other species and varieties in the color of its fls. It is a poor grower on its own roots, but thrives well when grafted on *A. cathartica* var. *Hendersonii* or var. *Schottii*.

BB. Fls. yellow.

**cathartica**, Linn. Lvs. and calyx glabrous: plant tall-climbing: lvs. rather small, obovate, usually in 4's, and more or less wavy-margined, thin, acuminate: fls. golden yellow, white-marked in the throat, the lobes acuminate on one angle, 3 in. or less across, the tube gibbous or curved. S. Amer. B.M. 338. P.M. 8:77.—The type first described, but now rarely seen in cult.

Var. **nobilis** (A. *nobilis*, T. Moore). A strong, tall climber, with purple twigs: lvs. and calyx more or less hairy: lvs. in 3's or 4's, large, acuminate, very short-stalked: fls. very large (4-5 in. across), nearly circular in outline of limb, bright, clear yellow, with magnolia-like odor. Finest fls. in the genus. Brazil. B.M. 5764.

Var. **Schöttii**, (A. *Schöttii*, Pohl). Strong-growing, suitable for rafters: young shoots and petioles slightly pubescent, the older sts. warty: lvs. in 3's or 4's, broadly lanceolate and acuminate: corolla large, rich yellow, the throat darker and beautifully striped. Brazil. B.M. 4351. *A. magnifica*, Hort., is a form of this.

Var. **Hendersonii** (A. *Wardleyana*, Lebas. A. *Hendersonii*, Bull). Fig. 155. Tall and vigorous, free-flowering, excellent for roofs: glabrous: lvs. large, elliptic-ovate, thick and leathery, in 3's or 4's: fls. large, yellow-orange, with 5 light spots in the throat, the corolla of thick substance, purplish on the exterior when in bud. Gn. 29:400. I.H. 12:452.—The commonest allamanda in this country. Intro. from Guiana by Henderson & Co., St. John's Wood, England, and distributed by Bull about 1865.

Var. **grandiflora** (A. *grandiflora*, Hook.). St. thin and wiry: lvs. thin, ovate-lanceolate, pointed, usually in 3's: fls. somewhat smaller than those of var. *A. Hendersonii* but larger than *A. cathartica*, lemon- or primrose-yellow. Brazil. Gn. 39:192. P.M. 12:79.—Thrives well when grafted on forms of *A. cathartica*. Plant rather bushy.

Var. **Williamsii**, Hort. Habit slender, easily trained into bush form or a dwarf climber: sts. terete, slender, wiry, dull green, bright red on side exposed to the sun, covered with short hairs: lvs. elliptic shortly petiolate, usually in 3's or rarely in 4's, rich dark green above, pale dull green below, hairy on both sides, especially along the midrib on the lower side; petiole  $\frac{1}{2}$  in. long, hairy: infl. rather short; fls. in pairs at each joint of the cyme; bracts much reduced, barely  $\frac{1}{10}$  in. long, acute;

calyx erect, not spreading, sepals unequal, lanceolate, or elliptic,  $\frac{1}{2}$  in. long, green; corolla yellow, tube only slightly curved 2 $\frac{1}{2}$  in. long, narrow and stalk-like in lower half, then broadening out and becoming campanulate in upper half, upper side of the pouch suffused with reddish brown, limb spreading, 2 in. diam., lobes ovate, obtuse,  $\frac{3}{4}$  in. long, throat deeper shade of yellow and stained with reddish brown. Garden origin. Gn. 40:468.

L. H. B.

C. P. RAFFILL.

ALLEGHENY VINE: *Adlumia*.

ALL-HEAL: *Brunella vulgaris*.

ALLIGATOR PEAR, AGUACATE: *Avocado*, *Persea*.

**ALLIUM** (ancient Latin name of garlic). *Liliaceæ*. Bulbous plants, mostly cultivated in the open, but a few of them grown under glass as florist's flowers; and comprising also the onions and their allies.

Leaves flat, channelled, or terete and hollow: fls. in a simple umbel, from a 1-2-lvd. usually scarious spathe; stamens and perianth segms. 6, the perianth parts distinct or nearly so, 1-nerved, and often becoming dry and persistent; style slender, the stigma either entire or parted.—Strong-scented plants, with fls. white, yellow, or in shades of purple and rose. There are 250-300 species in temperate parts of the northern hemisphere. Numbers of species, particularly the Asian, are frequently seen in botanic gardens and choice collections, but only *A. Moly* and *A. neapolitanum* are common in this country among the ornamental species, and no attempt is made to describe all the species here that are mentioned in garden literature. For the vegetable garden members of the genus, see *Chives*, *Garlic*, *Leek*, *Onion*, *Shallot*. In parts of the northeastern states *Allium vineale* is a bad weed; it has a slender scape sheathed below with hollow thread-shaped lvs., and greenish rose-colored fls. (or bulblets in the place of fls.).

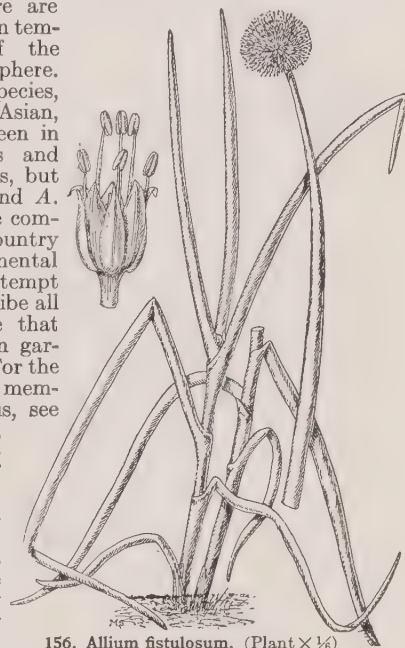
No special treatment is required by the alliums. Most of the cult. forms are hardy spring bloomers, and may be treated the same as other hardy border bulbs. Propagation is by offsets and by the bulblets in the umbel; also readily by seeds.

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156. *Allium fistulosum*. (Plant  $\times \frac{1}{6}$ )

A. Group I, comprising the vegetable-garden species.

B. Lvs. terete and hollow.

c. Plant caespitose (in tufts or clumps) and perennial.

1. *Schœnôprasum*, Linn. CHIVES or CIVES. Lvs. 4-6 in., very many, slender and awl-shaped: scapes equaling the lvs.; fls. light purple, small and many in a globular head. Eu.

—The lvs. are used for seasoning, growing readily as the herbage is cut. Var. *sibiricum*, Hartm., is a large form in northern N. Amer.

cc. Plants not in mats, treated practically as annuals (except perhaps No. 6).

2. *Cêpa*, Linn. COMMON ONION. Tall, with large tubular lvs.: scape glaucous, much overtopping the lvs., swollen near middle; fls. white or bluish in a large globular head-like umbel: bulb not making many off-sets, distinctly rounded at top and bottom. Var. *bulbellifera*, Bailey, has bulbels in the



157. *Allium Moly*. (Plant  $\times \frac{1}{4}$ )

place of fls.—the top, tree or Egyptian onion. Var. *multiplicans*, Bailey, has dividing bulbs,—the multiplier onion. Persia and adjacent regions.

3. *fistulôsum*, Linn. WELSH ONION. Fig. 156. Differs in having no distinct bulb, but only an enlarged base or crown: lvs. usually more clustered. Siberia. B.M. 1230.

4. *ascalonicum*, Linn. SHALLOT. Smaller, 1 ft.: lvs. many, awl-shaped: fls. lilac: bulbs long and pointed, each one soon separating into many cloves or parts adhering to a common disk. Syria.

BB. Lvs. not hollow, more or less plane.

5. *sativum*, Linn. GARLIC. Plant 12 in. or less: lvs. very narrow, keeled: fls. purple, often replaced by bulbels: bulbs small, breaking up into many small ones that are more or less covered with the dry scales. Eu.

6. *Pôrrum*, Linn. LEEK. Stout plant, 2 ft. or more: lvs. very broad and strongly conduplicate or keeled: scape arising the second season; fls. white or blush: bulb simple and scarcely more than an enlargement of the stalk. Eu.

AA. Group II. The garden alliums, mostly exotic.

B. Fls. yellow.

7. *Môly*, Linn. Fig. 157. Lvs. flat, broad: fls. numerous, in a dense umbel, in early spring. S. Eu. B.M. 499.—Well known, and a favorite for massing; common in rock-gardens. Hardy in the N.

BB. Fls. white or whitish.

c. Lvs. very broad, obtuse.

8. *victoriâlis*, Linn. Tall: lvs. ovate or broad-oblong, short: fls. greenish white, in large heads. Spring. Siberia. B.M. 1222.—Hardy.

cc. Lvs. narrow, acute or tapering.

9. *neapolitanum*, Cyr. Fig. 158. Lvs. long and rather narrow, loose-spreading, shorter than

the scape: fls. large, pure white, with colored stamens on long pedicels. Eu.—Needs protection if grown outdoors. Much used for cut-flowers in winter and spring. The most popular species. A. *Hermétii grandiflorum*, recently intro. from Holland, is a clear white odorous variety, well adapted for forcing.

BBB. Fls. pink, rose, or lilac.

c. Segms. with recurved tips.

10. *acuminâtum*, Hook. Scape 4-10 in.: lvs. 2-4, not longer than the scape, very narrow: umbel many-flid., perianth segms. a third longer than the stamens, the inner ones serrulate. W. Amer.

cc. Segms. not recurved.

11. *rôseum*, Linn. Scape 12-18 in.: lvs. narrow, with inrolled tips: fls. few (10-12), on long pedicels in an open umbel. S. Eu. B.M. 978.

12. *senescens*, Linn. Scape 1-2 ft.: lvs. narrow, erect, often twisted: fls. rather small, numerous, in a rather dense head. Eu. B.M. 1150.

13. *Éllisii*, Hook. f. Lvs. 4-5, 1 ft.,  $2\frac{1}{2}$  in. wide, glaucous green: scape 1 ft., very stout, being  $\frac{2}{3}$  in. diam.; fls. rose with white toward the base, wide-spreading,  $1\frac{1}{2}$  in. or more long and stiff and erect in fr. Persia. B.M. 7875.

14. *albopilôsum*, C. H. Wright. Very robust: lvs. strap-shaped,  $1\frac{3}{4}$  in. wide, 18 in. or less long: scape 1 ft. as many as 80-flid.; fls. deep lilac with metallic sheen, the segms. nearly 1 in. long, rigid after flowering. Persia. etc. B.M. 7982. G.C. III. 34:40.—Probably the largest-flid., and most imposing garden species.

AAA. Group III. Native alliums, sometimes advertised.

The species in Group II, comprise those that are likely to be in general cultivation. Aside from these there are various native species, mostly from western America, which are offered by dealers in American plants. These are recorded below.

B. Bulbs clustered, narrowly oblong: scape terete.

c. Lvs. elliptic-lanceolate, 2 or 3.

15. *tricôccum*, Ait. COMMON WILD LEEK. Fig. 159. Fls. greenish white on scape 4-12 in. high in early spring. Grows in clumps. New Eng. to Wis. and N. C.

cc. Lvs. linear, flat or channelled.

16. *cérnum*, Roth. Fls. rose-colored or white, in open, nodding umbels. Alleghanies and W.

17. *validum*, Wats. Fls. rose-colored or nearly white, in dense erectish umbels: scape 1-2½ ft., very stout. Nev., Calif., Ore.

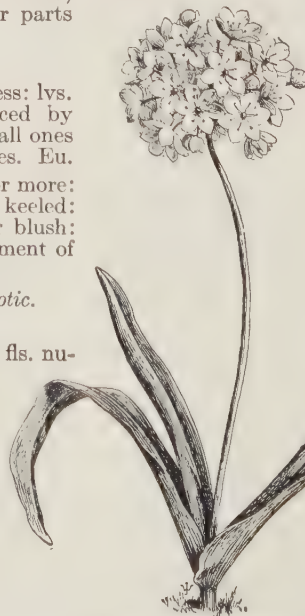
18. *hæmatochiton*, Wats. Fls. deep rose, in a small, erect umbel: bulb-coats deep red: scape 1 ft. or less high. Calif.

BB. Bulbs usually solitary, globose to ovate: scape terete or nearly so.

c. Coats of bulbs fibrous.

19. *reticulâtum*, Fraser. Scape 3-8 in.; fls. white to rose, with thin segms. W. Amer. B.M. 1840, as *A. stellatum*.

20. *Geyeri*, Wats. A foot high, stouter: fls. rose, with broad acute strongly nerved segms. W. Amer.



158. *Allium neapolitanum*. ( $\times \frac{1}{4}$ )



CC. Coats of bulb not fibrous.

D. Lvs. 2 or several.

E. Ovary with only 3 crests, or none at all.

21. *scapòsum*, Benth. Fls. white, red-veined, in a loose, few-flid. umbel: bulbs dark: scape 1 ft. or more. W. Amer.

22. *mádidum*, Wats. Fls. white or nearly so, in a many-flid. umbel: bulbs white: scape less than 1 ft., angled. Ore.

23. *Cùsickii*, Wats. Fls. rather numerous, nearly white: lvs.  $\frac{1}{4}$  in. wide: scape 3-4 in. Ore.

24. *Bolánderi*, Wats. Fls. rose, few, the segms. serrulate: scape 4-10 in. Calif.

25. *unifòlium*, Kellogg. Lvs. several, narrow and flat: scape stout, 1-2 ft.; fls. rose, 10-30, the segms. ovate-lanceolate, exceeding stamens and style. Calif.

EE. Ovary distinctly 6-crested: fls. usually rose-colored.

F. Scape usually more than 6 in. high (in the wild).

26. *stellàtum*, Fraser. Bulb-coats reddish: scape 6-18 in.; pedicels  $\frac{1}{2}$ - $\frac{3}{4}$  in. long; stamens and styles exserted. W. Amer. B.M. 1576.

27. *Sánbornii*, Wood. Bulb-scales white: scape 12-24 in.; pedicels shorter; umbel densely many-flid.; stamens and styles exserted. Calif.

28. *attenuifòlium*, Kellogg. Lvs. channelled: scape slender, 6-15 in., leafy below; umbel dense; fls. nearly white. W. Amer.

FF. Scape usually less than 6 in. high (in the wild).

29. *serràtum*, Wats. Lvs. very narrow: filaments broadened at the base. W. Amer.

30. *Bidwelliæ*, Wats. Scape 2-3 in.; umbel few-flid., the pedicels  $\frac{1}{2}$  in. long; filaments filiform. Calif.

159. *Allium tricoccum*. ( $\times \frac{1}{2}$ )

DD. Lf. solitary, linear or filiform: scape 2-5 in. high: caps. 6-crested.

31. *fimbriàtum*, Wats. Lf. filiform and revolute: scape 3 in.; fls. deep rose, stigma 3-cleft. S. Calif.

BBB. Bulbs mostly solitary: scape stout, 2-winged: lvs. 2, broad.

C. Stamens not exserted.

32. *falcifòlium*, Hook. & Arn. Fls. rose, the segms. minutely glandular-serrate and twice longer than stamens: scape 2-3 in. W. Amer.

33. *ánceps*, Kellogg. Fls. white, with purplish veins, the segms. little longer than stamens. Calif., Ore.

CC. Stamens exserted.

34. *platycàule*, Wats. Fls. rose, the segms. long-acuminate: scape 3-5 in. Calif. B.M. 6227 (as *A. anceps*)

L. H. B.

**ALLOPLECTUS** (*diversely plaited*; referring to appearance of the calyx). *Gesneràcæ*. Tender tropical evergreen shrubby plants, with tubular

yellowish axillary fls. and opposite lvs.; one of each lf. in the pair smaller than the other, their under surfaces usually reddish or purplish. To be grown in the warm-house with similar treatment as that for *Gesnera*.

*rèpens*, Hook. Trailing by means of roots thrown out between the pairs of lvs.: lvs. ovate, coarsely serrate, hairy or smooth: calyx pale green, blotched with purple; corolla yellow, tinged red, gaping; tube swollen at the base; limb of 4 spreading segms., the uppermost being twice cut. E. Indies. B.M. 4250.

*sparsiflorus*, Mart. Erect: lvs. ovate-oblong, acute entire; petiole and nerves beneath often red: calyx of 5 cordate or triangular dark blood or purple sepals, forming a striking contrast to the yellow club-shaped densely hairy corolla; limb of corolla of 5 equal segms. Brazil. B.M. 4216, erroneously as *A. dichrous*.

*Schlímii*, Planch. & Lind. Fig. 160. Lvs. acuminate, rounded or subcordate at base, oblong, green above, violet or purple-violet beneath: fls. axillary, in pairs or sometimes more numerous, the calyx spotted with green; corolla yellow-scarlet below, shading upward into a delicate violet above. Trop. S. Amer. F.S. 8:827.

A. *Forgétii*, Hort. Corolla pale yellow, spurred on the back. Peru.

N. TAYLOR.†

**ALLSPICE.** The dry berry of the Pimento (*Piménta officinális*, Lindl.), an evergreen tree of the *Myrtàcæ*. The tree grows in the West Indies. Jamaica yields much of the product. The fresh berry is about the size of a pea. It is borne in clusters. The word allspice is also applied to various plants with aromatic fragrance, as *Calycanthus*. See *Pimenta*.

**ALMOND.** A name given to the tree and fruit of *Prúnus communis*, Fritsch. (*Amýgdalus communis*, Linn.), of the *Rosàcæ*. It is also applied to certain dwarf ornamental trees or bushes, as flowering almond (see *Prunus*).

The almond has been cultivated from time immemorial. It is thought to be native to the Mediterranean basin. Some inquirers have supposed it to be the original of the peach, but this idea is evidently untenable. The flowers are peach-like and handsome (Fig. 161). The almond rut of commerce is the pit or stone of a peach-like fruit (Fig. 162). The fleshy part, which is so thick and edible in the peach, is thin and hard, and it splits at maturity. There are two general tribes or races of almonds,—the bitter and the sweet. The former has a bitter kernel, which is used in the manufacture of flavoring extracts and prussic acid. It is grown mostly in Mediterranean countries. Of the



160. *Alloplectus Schlimii*. ( $\times \frac{1}{2}$ )

sweet or edible almonds, there are two classes,—the hard-shell and the soft-shell. The former is of little value, and is not grown to any extent. The soft-shell type produces the edible almonds of commerce. Some of the thinnest-shelled forms are known as Paper-shells.



161. Flower of common almond.

It was once thought that almond-growing could be successfully practised in the peach-growing sections of the East, but late spring frosts, and other difficulties, have caused the effort to be abandoned commercially. Individual almond trees are occasionally seen, and they frequently bear profusely. They are nearly as hardy as the peach. The commercial cultivation of the almond on this continent is confined to western America, and the remainder of this account is therefore written from the Californian standpoint.

L. H. B.

Almond-growing in California has received the attention of horticulturists for half a century, and during the whole of its course the industry has been marked by vicissitudes which, it must be admitted, are not yet ended. Two chief sources of difficulty are now clearly discerned to have attended the effort from its beginning, and present knowledge may enable planters to avoid, in the future, errors that have led to much disappointment and loss—the vestiges of which still encumber the ground, though clearing is proceeding rapidly. Thus far the almond tree has yielded more firewood than any other single fruit tree which has been largely planted in California, and yet planting has continued, planting and uprooting keeping pace, so that about 1,500,000 trees are annually reported by the county assessors, of which number about two-thirds may be counted of bearing age. The California almond product for a series of years is estimated as follows:

1905.....	2,125 tons	1909.....	1,650 tons
1906.....	900 "	1910.....	2,750 "
1907.....	750 "	1911.....	1,700 "
1908.....	3,000 "	1912.....	3,000 "

Irregularity in production is mainly due to the occurrence or absence of spring frosts. In spite of these facts, the almond will remain an important California product, through the satisfactory performance of trees enjoying favorable environment, which is being generally accepted as a safe guide for current planting.

The two chief sources of failure with the almond are the sterility of many varieties without cross-pollination, and the extreme propensity of the tree for early blooming, with the consequent destruction of the bloom or the young fruit by temperature very little below the freezing point. These two evils have been singularly associated historically, and only lately have they been shown to be independent factors and both of them demanding the closest attention from planters. At first it was thought that the wide planting of self-sterile varieties by themselves was the cause of disappointment, because, after years of chopping-out or grafting-over old unproductive trees to the Prune d'Agen, for which it is an excellent stock, it was observed, by chance, that the Languedoc variety adjacent to Drake's seedling, of local origin, was heavily laden with nuts when it was sterile without such association. Attention was then directed to the growth of seedlings, and a large lot of seedlings of the bitter almond, grown by A. T. Hatch, exhibited such satisfactory bearing habit and such striking variation toward new types of the soft-shell sweet almond that the growth of new selected California seedlings was seized upon as a panacea for the previously ex-

perienced troubles with the almond. These new varieties were conceived to be not only self-fertile but hardy, and large plantations were made without due regard to the frosty character of the locations. Low valley lands of great area, and some extent of high plateaux, were planted. Fine, large trees grew only to lose their crops year after year by frosts from February to April, until the growers cast the trees upon the wood-pile. As a deduction of the experience of several decades, we have arrived at what seems now to be the proper conception of the situation of the almond in California, which is, that the most prolific varieties must be chosen, must be associated for purposes of cross-pollination, and must be planted in places of least liability to frost. There is a factor of some moment in the late-blooming habit of some varieties, which will be considered presently.

The soil best suited to the almond is a light, well-drained loam. The tree makes a strong and rapid root-growth, and is more tolerant of drought than any other of our leading deciduous fruit trees. For this reason, as well as to avoid frost, it is often desirable to place the almond on the higher and drier lands of the valley—providing the soil is not heavy and too retentive of surplus water in the rainy season. The root is most intolerant of standing water, and will quickly die if exposed to it. Because of its thrift in light, dry soils, the almond root is used rather largely as a stock for the Prune d'Agen, and to some extent for the peach in the dry valleys.

Almond trees are grown by budding into seedlings grown from either the sweet or the bitter hard-shell almonds, the bud being set during the first summer's growth of the seedling, and then either planted out as a dormant bud the following winter or allowed to make one season's growth on the bud in the nursery. The tree grows so rapidly, both in root and top, that only yearling trees are used.

At transplanting, the young trees are cut back so as to form a low head with only about a foot of clear trunk. They are allowed to make free growth during the following summer, and in the following winter are cut back so as to encourage branching on the main limbs within a foot of their attachment to the trunk. At the same time, the branches are reduced to four or five in number, symmetrically arranged around the stem and at good distance from each other, so that they shall not unduly crowd each other as they enlarge. Another full growth during the following summer and another cutting back the following winter give the trees the vase-form on the outside, with enough interior branches to fill the



162. Almond nuts. ( $\times \frac{1}{2}$ )

inside of the tree without crowding. Thus the tree is systematically pruned after each of its first two years' growth in the orchard. After that, shortening-in of the branches usually ceases, and the third summer's growth is allowed to stand for fruit-bearing, with only thinning-out of growth to prevent crowding. This thinning-out has to be done from time to time in later years, otherwise the tree becomes too thick, and interior branches dwindle for lack of light. The amount of thinning varies in the different climates of the state: the greater the heat, the denser the tree for its own protection. With the proper adjustment of heat and light, fresh bearing wood may be encouraged in the lower part of



the tree, otherwise it becomes umbrella-shaped, with the fruit wood at the top and bare poles below.

The almond is the earliest bloomer of our common fruits. It puts forth flowers sometimes as early as January, but the usual date is about February 10 for the earliest bloomers in the warmer parts of the state, with the later bloomers at intervals thereafter until April 1. Records of full bloom of a number of varieties widely grown in California, which have been kept at the University of California substation, situated in the Sierra foot-hill region, show the following succession: Commercial, February 27; Sultana and Paper-shell, March 10; King and Marie Duprey, March 11; IXL, March 12; Languedoc, March 19; Nonpareil, March 20; Routier Twin, March 24; Pistache, March 25; Drake and Texas, April 2. Obviously the late bloomers have greater chance of escaping frost, and there is at present some disposition to make this a consideration in selecting varieties for planting. The dates just given show an extreme variation in time of blooming. Some years the intervals are much shorter, but the relation seems to be constant. The crop ripens from August 15 to October 1, according to locality. Early maturity does not follow early blooming—that is, as with other fruits, the first to bloom are not necessarily the first to ripen.

Not less than twenty-five varieties of almonds have been grown to a greater or less extent in California. Varieties of foreign origin have almost wholly given place to selected seedlings of local origin, and of these a very few constitute the main crop at present. These are named in the order of their acreage, as follows: Nonpareil, Ne Plus Ultra, IXL, Drake, Texas Prolific, Languedoc. Of these, the first three occupy not less than three-fourths of the acreage.

In handling the crop, the local climate modifies methods somewhat, and the growth-habit is also involved. In regions very free from atmospheric humidity in the summer, the hull opens readily and discloses a clean, bright nut, which can be marketed without treatment. Where this is not the case, and the nut is more or less discolored, bleaching in the fumes of sulfur has to be practised. The nut must be dry before sulfuring, or the fumes will penetrate and injure the flavor of the kernel. Sulfured nuts also lose largely in power of germination. The practice is to gather the nuts, dry for a few days in the sun, then spray with water very lightly or with a jet of steam, so that only the surface of the shell is moistened, and then sulfur, and a light color can be secured without penetration of the fumes. The nuts can usually be gathered from the ground as they naturally fall, or can be brought down by shaking or the use of light poles. Some varieties are more easily harvested than others, and the same variety falls more readily in some localities than in others. A greater or less percentage, according also to variety and locality, will have adhering hulls, and for clearing them, locally-invented machines, called almond-hullers, are used. Early rains in some localities are apt to stain the nuts. Such stains cannot be removed by sulfuring, and the nuts have to be crushed and the product marketed as kernels for the use of confectioners. Machinery is also used for this operation, and a considerable fraction of

the product reaches the market in this form because of the demand for candied and salted almonds.

The standard of excellence in the almond, from a commercial point of view, as learned by the experience of California producers, is that the kernel must be as smooth, symmetrical and plump as possible. The twinning of kernels, welcome as it may be to searchers for philopenas, results in misshapen kernels, which are very objectionable to the confectioners, who are very large users of almonds. Constancy to single kernels is therefore a good point in a variety.

Large proportion of kernel to shell by weight is also, obviously, an important point to almond-buyers. At the same time, the shell may be so reduced in strength as to break badly in shipping in sacks and in subsequent handling. Incomplete covering also exposes the kernel to the sulfur and to loss of flavor. The ideal is such degree of thinness of shell as can be had with complete covering of the kernel and durability in handling.

Careful comparison of the proportion of kernel weight to gross weight of the popular California varieties, as compared with a leading imported variety, was made by a committee of the California Horticultural Society, with the following result: From one pound of each of the following varieties the net weight of kernels in ounces was: Imported Tarragona, 6 $\frac{2}{3}$ ; California Languedoc, 7 $\frac{1}{2}$ ; El Supremo, 7 $\frac{1}{2}$ ; Drake, 8 $\frac{3}{4}$ ; IXL, 9; Commercial, 9 $\frac{1}{4}$ ; La Prima, 9 $\frac{1}{2}$ ; Princess, 9 $\frac{1}{2}$ ; Ne Plus Ultra, 10; King, 10; Paper-shell, 11; Nonpareil, 11 to 13.

EDWARD J. WICKSON.



163. Bearing habit of the almond.

ALMOND, DEMERARA: *Terminalia Catappa*.

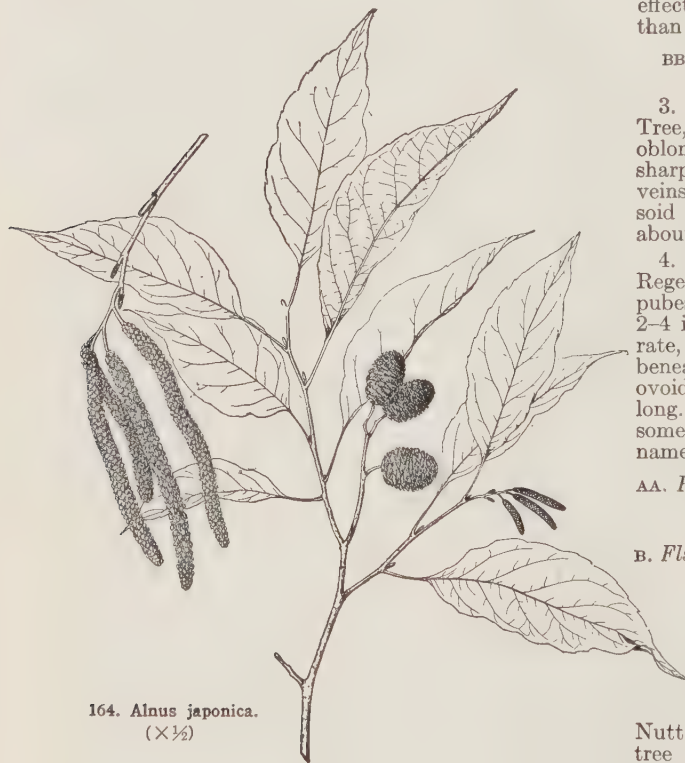
ALMOND, FLOWERING: *Prunus*.

ÁLNUUS (the ancient Latin name). *Betulaceæ*. ALDER. Ornamental woody plants grown chiefly for their foliage; some species are valuable as timber trees.

Trees or shrubs: lvs. alternate, deciduous, short-petioled, usually serrate or dentate: fls. monœcious, apetalous, in catkins; staminate ones elongated, each bract with 3 fls.; stamens 4 in each fl., with short filaments not divided at the apex; pistillate catkins short, each bract with 2 fls.; styles 2; the pistillate catkins developing into a ligneous, generally ovoid cone with persistent, 5-lobed scales: fr. a small nutlet.—About 30 species in the northern hemisphere, in Amer. south to Peru. Monograph by Winkler in Engler's *Pflanzenreich*: *Betulaceæ* 101 (1904).

The alders are deciduous trees or shrubs with medium-sized leaves and pendulous staminate catkins in spring before the leaves; the short pistillate catkins developing into woody cones about  $\frac{1}{2}$  to 1 inch long and usually arranged in small racemes. The profuse male catkins are pleasing in early spring. The wood is valuable for its durability in water; of the native species, *A. rubra* is the most important timber-tree; in the Old World, *A. glutinosa* and *A. japonica*. Most species are suitable for planting on damp soil, where they grow rapidly, but *A. cordata* prefers a drier situation; also *A. japonica*, *A. incana* and *A. tinctoria* grow well in drier situations.

Usually propagation is by seeds gathered in the fall and well dried; sown in spring with but slight covering, and kept moist and shady, they germinate soon; a slight covering with moss, taken off when the seedlings appear, will be useful. At the end of the same year or the following spring, the seedlings are transplanted, usually into rows 1 to 2 feet apart and 6 inches from each other. After two years, they may be planted where they are to stand. The shrubby species, also *A. glutinosa*, grow from hardwood cuttings placed in moist and sandy soil, also from layers, and *A. incana* from suckers. Rarer kinds are grafted on common potted stock in early spring in the propagating-house; grafting out-of-doors is rarely successful.



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A. Pistillate catkins terminal, inclosed during the winter in the bud, opening in spring: fr. with broad membranous wing: winter-buds sessile with 2 or more unequal scales. (*Alnobetula*.)

B. Lvs. ovate or elliptic, with 5-10 pairs of veins.

1. *viridis*, DC. (*A. Alnobetula*, Hartig. *A. undulata*, Willd.). EUROPEAN GREEN ALDER. Shrub, 2-6 ft.: lvs. elliptic or ovate, to round-ovate, acute, usually narrowed at the base, sharply serrulate, 1-2½ in. long, glutinous while young, bright green above, pale green and glabrous beneath or pubescent on the veins: staminate catkins 2-3½ in. long; pistillate catkins with glabrous or ruberulous peduncles: cones 3-4, oblong,

slender-peduncled. March, April. Mts. of Eu. L.B.C. 12:1141. H.W. 2:14.

2. *Mitchelliana*, Curt. (*A. viridis* of most American authors). AMERICAN GREEN ALDER. Shrub, 2-10 ft.: young branchlets glabrous or sparingly pubescent: lvs. elliptic or ovate-elliptic, acute or obtuse, rounded or subcordate at the base, 1½-3 in. long, densely serrulate, glutinous while young, with impressed veins above, reticulate beneath and glabrous: staminate catkins 2-3 in. long; pistillate catkins with pubescent peduncles: cones 3-6, oblong, slender-peduncled. March, Apr. Mts. of N. E. Amer., west to Brit. Col., south to N. C. —Hardy shrub with handsome bright green foliage, very aromatic when unfolding and of very pleasant effect in spring with its long male catkins; handsomer than the preceding species.

BB. Lvs. ovate-oblong to ovate-lanceolate, with 12-24 pairs of veins.

3. *yasha*, Matsum. (*A. firma* var. *yasha*, Winkl.). Tree, to 30 ft.: young branchlets pubescent: lvs. ovate-oblong, 2-4 in. long, acute, usually rounded at the base, sharply and irregularly serrate, with 12-18 pairs of veins, pubescent on the veins beneath: cones 1-3, ellipsoid or sub-globose, ¾ in. long, on slender peduncles about 1 in. long. Japan. J.C.T. 16:2.

4. *pendula*, Matsum. (*A. firma* var. *multinervis*, Regel). Tree, to 30 ft., or shrub: young branchlets pubescent: lvs. oblong-lanceolate, acute or acuminate, 2-4 in. long, irregularly and often nearly doubly serrate, with 18-24 pairs of veins, pubescent on the veins beneath, at maturity nearly glabrous: cones 3-5, ovoid, about ½ in. long, in pendulous racemes, 1-2 in. long. Japan. S.I.F. 2:12. J.C.T. 16:3. —Very handsome alder, still rare in cult.; the plant cult. under this name is usually the preceding species.

AA. Pistillate catkins axillary, appearing in autumn: winter-buds with 2 equal scales, stalked. (*Gymnothyrsus*.)

B. Fls. opening in the fall from catkins of the same year: lvs. not plicately folded in the bud.

5. *maritima*, Nutt. (*A. oblongata*, Regel, not Ait. nor Willd.). Tree, to 30 ft.: lvs. cuneate, oblong or obovate, shining above, pale green beneath, glabrous, remotely and crenately serrate, 2-4 in. long: cones 2-4, large, on short, stout peduncles. Del., Md. S.S. 9:458. G.F. 4:269. Nutt., N. Amer. S. 1:10. —Ornamental shrub or small tree with handsome shining foliage, attractive in autumn with its male catkins.

BB. Fls. opening in early spring before the lvs., from catkins formed the previous year and remaining naked during the winter.

C. Lvs. not plicate in the bud, green beneath, veins arching: cones 1-6, long-stalked.

6. *japonica*, Sieb. & Zucc. (*A. firma*, Hort., not Sieb. & Zucc.). Fig. 164. Tree, 50-80 ft.: lvs. cuneate, oblong-lanceolate, acuminate, sharply and irregularly serrulate, glabrous at length, bearded in the axils of the veins beneath, 2-6 in. long: cones 3-6, peduncled. Japan. G.F. 6:345 (adapted in Fig. 164). S.I.F. 1:19. —Tall, pyramidal tree with dark green foliage; the largest and perhaps the most beautiful of all alders.

7. *cordata*, Desf. (*A. cordifolia*, Ten. *A. tiliacea*, Hort.). Small tree, 20-50 ft.: lvs. cordate, ovate or roundish, acuminate, 2-4 in. long, bearded in the axils beneath, glandular when young: cones 1-3, ovoid, about 1 in. long, peduncled; nutlets with narrow wing. Italy, Caucasus. L.B.C. 13:1231. G.C. II. 19:285. —Round-headed tree with handsome, distinct foliage, changing orange-yellow in autumn, resembling that of a linden or pear, therefore sometimes called *A. tiliifolia* or *A. pyrifolia*, in gardens. Not quite hardy N.



cc. *Lvs. plicate in the bud, the veins going straight to the points of the larger teeth: cones 4-10, short-stalked or sessile.*

d. *Under side of lvs. glaucous, not bearded: cones sessile or short-stalked.*

8. *incana*, Willd. Shrub or tree, to 60 ft.: branches pubescent; lvs. oval or oblong-ovate, acute,  $1\frac{1}{4}$ -4 in. long, doubly serrate, pubescent or nearly glabrous beneath: cones 4-8, mostly sessile,  $\frac{1}{2}$  in. long. Northern hemisphere, in different varieties. H.W. 2:13.

Var. *glauca*, Ait. (*A. glauca*, Michx.). Shrub, to 12 ft.: lvs. often nearly glabrous beneath. N. Amer., Eu. Em. 251.

Var. *vulgaris*, Spach. Tree, to 50 ft.: lvs. usually densely pubescent beneath: cones 1 in. long. Eu., Asia.

Var. *pinnatifida*, Spach (var. *laciniata*, Hort.). Lvs. pinnately lobed or cleft, with dentate lobes.

9. *tinctoria*, Sarg. (*A. incana* var. *tinctoria*, Hort.). Fig. 165. Tree, to 60 ft.: young branchlets glabrous or slightly pubescent: lvs. broadly ovate, 4-6 in. long, membranaceous, coarsely doubly serrate, slightly lobed, glaucous and rufously pubescent on the veins beneath. Japan. G.F. 10:473 (adapted in Fig. 165). S.I.F. 1:19 (as var. *glauca*).—Handsome ornamental tree of very vigorous growth, with large foliage.

10. *rubra*, Bong. (*A. oregana*, Nutt.). Tree, 40-50 ft.: lvs. oblong-ovate, 3-5 in. long, crenate-serrate, slightly lobed, revolute on the margin, nearly glabrous beneath; petioles and veins orange-colored: cones 6-8, oblong. W. N. Amer. S.S. 9:454. Nutt., N. Amer. S. 1:9.

dd. *Under side of lvs. green or brownish green, usually bearded.*

#### E. Cones upper sessile.

11. *rugosa*, Spreng. SMOOTH ALDER. Shrub, to 25 ft.: young branchlets pubescent or nearly glabrous: lvs. ovate or broadly elliptic to obovate, acute or obtuse, 2-5 in. long, doubly serrate and often slightly lobed, beneath covered more or less with brownish pubescence or glabrous: cones 4-10, the upper sessile, the lower short-stalked, ovoid, about  $\frac{1}{2}$  in. long. E. N. Amer. Mx. 3:4. Var. *serrulata*, Winkl. (*A. serrulata*, Willd.). Branchlets glabrous or nearly so: lvs. usually obovate,

obtuse, finely and doubly serrulate, glabrous or nearly glabrous beneath. Em. 248.—By most European botanists this variety is considered a distinct species, but, though the extreme forms seem quite distinct, they are connected by all kinds of intermediate forms. In flower, *A. rugosa* is easily distinguished from *A. incana*



166. *Alnus glutinosa*. ( $\times \frac{1}{2}$ )

by the pistillate catkins which are upright in *A. rugosa*, nodding in *A. incana*.

#### EE. Cones all distinctly peduncled.

12. *glutinosa*, Gaertn. (*A. vulgaris*, Hill. *A. rotundifolia*, Mill. *A. communis*, Desf.). BLACK ALDER. Fig. 166. Tree, to 70 ft.: lvs. orbicular or obovate, rounded or emarginate at the apex, 2-5 in. long, irregularly obtusely serrate, with 5-7 pairs of veins, nearly glabrous beneath, glutinous when unfolding: cones distinctly peduncled. Eu., N. Afr., Asia, naturalized in some localities in N. Amer. H.W. 2:12. H.T. 130.—A vigorously growing tree with dark green, dull foliage, valuable for planting in damp situations. Commonly planted in many forms: Var. *abrea*, Versch. Lvs. yellow. I.H. 13:490. Var. *denticulata*, Ledeb. (*A. oblongata*, Willd.). Lvs. usually cuneate, serrulate. S. Eu. Var. *barbata*, Callier (*A. barbata*, C. A. Mey.). Lvs. ovate, acute, pubescent on the veins beneath. Caucasus. Var. *imperiælis*, Desf. Lvs. deeply pinnately lobed with lanceolate or nearly linear lobes. Var. *incisa*, Willd. (var. *oxyacanthifolia*, Spach). Lvs. small, deeply incised, like those of *Crataegus oxyacantha*. Var. *laciniata*, Willd. Lvs. pinnately lobed; lobes oblong. Var. *rubrinervia*, Dipp. Lvs. large and shining, with red nerves and petioles: pyramidal tree of vigorous growth, very handsome.

*A. acuminata*, HBK. Tree: lvs. usually ovate and pubescent beneath, doubly serrate. Cent. Amer., north to Ariz.—*A. cremastogyne*, Burkill. Tree: young branchlets glabrous; lvs. oblong-obovate, glabrous, sharply serrate, 3-4 in. long: cones cylindrical, solitary on slender peduncles, about  $1\frac{1}{2}$  in. long. W. China.—Recently intro., probably not hardy N.—*A. firma*, Sieb. & Zucc. (*A. Sieboldiana*, Mats.). Allied to *A. yasha*. Tree: lvs. ovate, or ovate-oblong, acute, rounded at the base, with 10-15 pairs of veins, 3-5 in. long: cones about 1 in. long, solitary on a peduncle  $\frac{1}{2}$ -1 in. long. Japan. S.I.F. 2:12.—*A. fruticosa*, Rupr. (*A. viridis* var. *sibirica*, Regel). Allied to *A. viridis*. Shrub: lvs. broadly ovate or elliptic-ovate, usually rounded at the base, nearly doubly or sinuately serrate. Siberia, Corea.—*A. hirsuta*, Turcz. (*A. incana* var. *hirsuta*, Spach). Allied to *A. tinctoria*. Tree: young branchlets, and petioles tomentose: lvs. suborbicular to elliptic, acutish, denticulate and slightly lobed, ferruginously tomentose beneath. Japan, Manchuria.—*A. jorullensis*, HBK. Allied to *A. acuminata*. Lvs. oblong-lanceolate, coarsely dentate. Cent. Amer.—*A. mollis*, Fernald. Closely allied to *A. crispa*. Shrub or small tree: branchlets pubescent: lvs. pubescent beneath, 2-4 in. long. N.E. Amer., west to Lake Winnipeg, south to Mass.—*A. nitida*, Endl. Tree, to 100 ft.: lvs. ovate to ovate-oblong, short-acuminate, not plicate, 3-4 in. long, entire or remotely serrulate, bright green and lustrous



165. *Alnus tinctoria*. ( $\times \frac{1}{2}$ )

above, glabrous; male catkins very slender, to 6 in. long; cones 2-4, peduncled. Himalayas. B.M. 7654.—*A. oblongifolia*, Torr. Tree, 20-30 ft.; lvs. oblong-ovate, cuneate, doubly serrate, 2-3 in. long; strobiles  $\frac{1}{2}$ -1 in. long, peduncled. N. Mex. and Ariz. S.S. 9:457.—*A. occidentalis*, Dipp.—*A. tenuifolia*—*A. orientalis*, Decne. (*A. barbata*, Hort., not C. A. Mey. *A. firma*, Hort., not Sieb. & Zucc. *A. macrophylla*, Hort.). Allied to *A. cordata*. Tree; lvs. ovate-oblong, obtusely or crenately serrate, 2-5 in. long, glabrous, with 8-10 pairs of veins; cones ovoid, glutinous,  $\frac{1}{2}$ -1 in. long; nutlets without wing. Asia Minor.—*A. pubescens*, Tsch. (*A. glutinosa* × *incana*). Lvs. roundish-ovate or obovate, irregularly serrate, pubescent beneath. Natural hybrid.—*A. rhombifolia*, Nutt. Tree, 60-80 ft.; lvs. cuneate, oval or ovate, 2-3½ in. long, finely serrate, yellowish green and puberulous beneath; strobiles oblong, peduncled. W.N. Amer. S.S. 9:456.—*A. Sieboldiana*, Mats.—*A. firma*—*A. sinuata*, Rydb. (*A. sitchensis*, Sarg.). Allied to *A. viridis*. Shrub, 3-16 ft.; lvs. slightly lobed, serrulate, glabrous, thin. W. N. Amer. S.S. 14:727.—*A. Späthii*, Callier (*A. japonica* × *subcordata*). Tree; lvs. ovate-lanceolate, sharply lobed, serrulate, purple when unfolding. Of garden origin. *A. subcordata*, C. A. Mey. Tree, 30-50 ft.; lvs. ovate or oblong-ovate, rounded at the base, 2-6 in. long, crenately or doubly serrate, glabrous or sometimes pubescent beneath; cones about 1 in. long; nutlets with a narrow wing. Caucasus.—*A. tenuifolia*, Nutt. (*A. incana* var. *virescens*, Wats. *A. occidentalis*, Dipp.). Small tree, occasionally 30 ft.; lvs. ovate, 2-4 in. long, slightly lobed and doubly serrate, green and nearly glabrous beneath. W. N. Amer. S. S. 9:455.

ALFRED REHDER.

**ALOCASIA** (name made from *Colocasia*). *Aracææ*. Warmhouse foliage plants, with green, veined and mottled, large hanging leaves.

Stem thick, short or assurgent, densely marked with lf.-scars: lvs. with long sheathed petioles, the blade, when young peltate, when old usually sagittate-cordate, the basal lobes commonly more or less united; spathe with the tube much shorter than the blade, ovoid or oblong, convolute, the blade oblong, usually boat-shaped; spadix shorter than spathe.—Stove foliage plants from E. Asia, comprising about 40 species, in addition to many hybrids. Related to Caladium and Colocasia, from which separated by technical



167. *Alocasia Sanderiana*.

fr. characters. See Monogr. by Engler in De Candolle's *Monographiæ Phanerogamarum*, Vol. II.

The species of *alocasia* grown in greenhouses have foliage of great beauty and coloring and rank high amongst ornamental foliage plants. The leaves are remarkable for their coloring, markings, size and shape, some of them being of a rich metallic coloring while others are green and green-and-white with prominent veining. *Alocasias* are propagated by suckers or cuttings of the rhizomes, placed in small pots containing a mixture of light fibrous peat and sand in equal proportions, and plunged in a close frame or propagating-box with bottom heat. They may also be grown from seeds sown in 4-inch pots, in a light peaty soil in a temperature of 75° F. The month of March is the best time for propagating and potting. The evergreen species (as *A. cuprea*, *A. longiloba*, *A. Lowii*, *A. Regina*) thrive best in a compost of two parts fibrous peat and sphagnum moss and one part lumps of fibrous loam, to which should be added a sprinkling of silver sand and a few nodules of charcoal to keep the whole sweet. The herbaceous species (as *A. macrorrhiza*) do best in good fibrous loam to which one-third of well-rotted cow-manure or pulverized sheep-manure has been added. Perfect drainage of the pots is absolutely necessary, and, in potting, the evergreen species should be coned up 2 or 3 inches above the rim of the pot, and finished off with a surfacing of live sphagnum moss. The season of active growth begins about the first of March, when plants should be given a temperature of 70° at night, with a rise of 15° by day, and the atmosphere must be

kept in a humid condition. They should be given a position free from drafts and direct sunlight. They require an abundance of water at the roots as the leaves develop, and are greatly benefited by an occasional watering of clear liquid sheep- or cow-manure. To secure the best development of the leaves, heavy syringing should be avoided, but frequent spraying on all fine days with an atomizer sprayer is very beneficial. Towards winter the humidity of the atmosphere and the supply of water to the roots should be reduced with the evergreen species, and gradually withheld altogether as the leaves mature, with the herbaceous species. The temperature during winter should not fall below 60°. (E. J. Canning.)

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*morte-fontainensis*, 13.  
princeps, 1.  
*Pucciana*, 13.

*Putzeyssii*, 8.  
*Regina*, 13.  
*Sanderiana*, 2.  
*Sedenii*, 13.  
*Thibautiana*, 9.  
*Van Houttei*, 13.  
*variegata*, 11.  
*Veitchii*, 10.  
*Villeneuvei*, 4.  
*violacea*, 13.  
*zebrina*, 3.

A. Lvs. distinctly notched or undulate on the margin.

1. *princeps*, Nichols. Lvs. sagittate, the basal lobes narrow and spreading, the margins deep-sinuate; upper surface olive-green, with darker veins, the under lighter colored, with brown veins and margin; petioles brown-spotted, slender. E. Indies.

2. *Sanderiana*, Bull. Fig. 167. Lvs. long-sagittate, with deeply notched margin, the basal lobes wide-spreading, deep glossy green with metallic reflection, with prominent white margins and veins; petioles brownish and striped. Philippines. Gng. 6:84. G.Z. 28, p. 267. J.H. III. 45:173.—One of the best of recent introductions. Runs into various forms, and has entered largely into cult. hybrids.

AA. Lvs. plain and entire on the margin.

B. Markings chiefly on the petioles, the blades green.

3. *zebrina*, Koch & Veitch. Lvs. triangular-sagittate, the margin somewhat repand, the front lobe oblong-triangular, cuspidate, the basal lobes obtuse; petioles beautifully marked with large zigzag bands of green. Philippines. F.S. 15:1541-2.

4. *Villeneuvei*, Lind. & Rod. Lvs. sagittate-ovate, the veins of lighter green and prominent, basal lobes very unequal; petioles spotted with chocolate-brown. Large. Borneo. I.H. 34:21.—Named for de Villeneuve, Brazilian ambassador to Belgium.

BB. Markings or coloration chiefly on the lf.-blades.

c. Veins and midrib light yellow.

5. *Lindenii*, Rod. Lvs. cordate-ovate, long-pointed, 8-12 in. long, bright green, with yellowish veins curving off from the midrib and vanishing near the margin; petioles nearly white. New Guinea. I.H. 33:603.—Bruised lvs. emit a strong odor.

cc. Veins and midrib white or silvery.

d. Midrib and primary nerves not bordered.

6. *longiloba*, Miq. (*A. gigantea*, Hort.). Petioles 2 ft., greenish white, mottled purple; blade sagittate, 18 in. long, the basal lobes very long and erect, the upper surface green, with silvery or gray bands along veins and midrib, the under surface light purple. Java.

7. *Löwii*, Hook. Petioles 2-3 ft., rose-color; blade narrow-ovate, 18 in. long and a third as wide, long-pointed, the basal lobes long-acute, upper surface olive-green, with very distinct silvery bands, under surface rich purple. Borneo. H.F. III. 9: pl. 6. F.S. 21:2204. B.M. 5376. A.F. 11:559 (as var. *grandis*).



DD. *Midrib and primary nerves bordered with pale or gray-green.*

8. *Putzëysii*, N. E. Br. Much like *A. longiloba*: lvs. broader (oval-sagittate), dark metallic green, prominently veined and bordered white, the petioles pale red-purple, under surface dark purple. Sumatra. I.H. 29:439. G.C. II. 19:501.—More brilliant than *A. longiloba*, and has wider spaces between the veins.

9. *Thibautiana*, Mast. Petioles 3 ft., greenish; blade 2 ft. long and 18–20 in. broad, ovate-cordate, the basal lobes broad and rounded, olive-green, with broad silvery



168. *Alocasia cuprea*. ( $\times \frac{1}{2}$ )

veins and rib, the under surface deep purple. Borneo. G.C. III. 17:485. I.H. 28:419. G.Z. 25, p. 265.

10. *Veitchii*, Schott. Resembles *A. Lowii*, Hook., in shape and ground-color, but the midrib and primary veins are bordered with gray-green, the secondary veins whitish and the petiole green-striped. Java. B.M. 5497 (as *A. Lowii* var. *picta*).

ccc. *Veins white and lf. blotched and mottled.*

11. *macrorhiza*, Schott. Large, reaching 10 or 15 ft.: lf.-blades 3 ft. long, long-sagittate and pointed, the lobes short and obtuse, margin often somewhat wavy, the midrib very broad and conspicuous, the blotches or patches of green and white (in the var. *variegata*, G.W. 15, p. 339, which is the common form) very striking. Ceylon. I.H. 8:305.—One of the commonest species. Lvs. sometimes almost white.

cccc. *Veins dark or purple, or the lf. dark-colored.*

12. *cuprea*, Koch (*A. metallica*, Schott). Fig. 168. Petioles 2 ft. or less long, green; blade ovate and peltate, 18 x 12 in., notched at the base and cuspidate at the point, dark metallic green with darker rib and veins, the under side rich purple. Borneo. B.M. 5190. I.H. 8:283. G. 19:413. F.S. 21:2208–9. Lowe, 60. Gn. 50:336.—One of the best, and common.

13. *Regina*, N. E. Br. Lvs. thick, ovate-cordate, obtuse or cuspidate, the basal lobes short and nearly or quite obtuse, the ribs and veins beneath pubescent, somewhat fleshy, dark green above with darker veins and brown-purple beneath; petioles terete, pubescent spotted purple. Borneo. I.H. 32:544.—Several cult. varieties and hybrids are in the trade in this country: *A. argyrea*, Sander, lvs. large, dark green with a silvery sheen, hastate-lanceolate (G.W. 15:342); hybrid of *longiloba* x *Pucciana*; *A. bataviensis*, petiole dark purple, lf.-blade dark green; *A. Chantrieri* (raised by Chantrier Bros., Mortefontaine, France), hybrid of *cuprea* x *Sanderiana*, with long wavy lvs., purple below and

prominently white-veined (I.H. 35:64. R.H. 1887, p. 465); *A. Chelssonii*, cuprea x *longiloba*, with lvs. purple below and green above; *A. gigas*, much like Villeneuvei; *A. intermedia*, hybrid by Veitch 25 years ago (G. 2:61. G.W. 15, p. 341. F. 1869, p. 80); *A. La Salliana*; *A. Luciana*, Thibautiana x *Putzeysi*, with lvs. dark green above and whitish veins and margins, purple beneath (I.H. 34:27); *A. mortefontaineensis*, Lowii x *Sanderiana*; *A. Pucciana*, *Putzeysi* x *Thibautiana*; *A. Sedenii*, cuprea x Lowii, with ovate-peltate lvs. purple beneath and white-veined above (I.H. 24:292); *A. Van Horstii*.

The following names are also in our trade: *A. illis-tris*=*Colocasia antiquorum*; *A. Jenningsii*=*Colocasia affinis*; *A. Johnstonii*=*Cyrtosperma Johnstonii*; *A. Marshallii*=*Colocasia Marchallii*; *A. violacea*=*Colocasia antiquorum*(?).

The following may be expected to appear in the American trade: *A. Augustiniana*, Lind. & Rod. Lvs. peltate and wavy, green above and below, with pale nerves, the petioles brown-spotted; allied to *A. zebrina*. I.H. 33:593. New Guinea(?).—*A. Curtisii*, N. E. Br. Petioles 3 ft. or less, purple-barred; lf.-blade 20 in. or less, and half as wide, shining green and gray-ribbed above, deep purple beneath. Penang.—*A. Desmetiana*, Hort. Lvs. elongated, heart-shaped and sinuate; petiole spotted.—*A. eminens*, N. E. Br. Lvs. peltate, the blade 2 ft. or less long and nearly half as broad, purple beneath, green and light-veined above; petioles 5 ft. or less, barred. E. Indies.—*A. grandis*, N. E. Br. Large: lvs. 2 ft. or less long, ovate-sagittate, half as broad, black-green below, bright green above; petioles 4 ft. or less, blackish. E. Indies.—*A. guttata*, N. E. Br., var. *imperiensis*, N. E. Br. Lvs. sagittate, acute, 1½ ft. or less long and half as broad, purple beneath, brown-green and dark-blotched above. Borneo. I.H. 31:541.—*A. indica*, Schott. 6 ft. or more, stout and fleshy: lvs. often 3 ft. across, ovate-cordate, bright green on both sides. E. Indies. F.S. 21:2206 (as *A. plumbea*).—*A. Margaritæ*, Lind. & Rod. Lvs. slightly peltate, wavy, shining, green with blackish midrib, the veins and brownish petioles pubescent. New Guinea. I.H. 33:611.—*A. marginata*. Said to have come from Brazil. Lvs. 2 ft. or less long and very broad, slightly wavy, rounded and short-pointed, pale green, striped and mottled with purple; petioles brown-marked.—*A. Micholitziana*, Hort. Lvs. arrow-shaped, velvety, the margins wavy, the midrib white. Malaysia. G.C. III. 51: Suppl. May 25, p. XVI.—*A. odora*, Koch. Forming a trunk: lvs. sagittate-ovate, the margin slightly undulate, up to 3 ft. long, on long petioles. J.H. III. 42:393.—*A. plumbæa*, Hort.—*A. grandis*(?).—*A. reversa*, N. E. Br. Dwarf and compact, the petioles 6 in. long, blade less than 1 ft. long, bright green, with rib and nerves olive-green. B.M. 7498. Philippines.—*A. Rodigasiana*, André. *A. Thibautiana* x *A. Regina*.—*A. Sanderiana* var. *gandavensis*, Rod. Lvs. wavy-margined, purple and blotched beneath. I.H. 43:65.—*A. scabriuscula*, N. E. Br. Lvs. spreading, not deflexed, sagittate and not peltate, shining green above and paler beneath. Borneo.—*A. sinuata*, N. E. Br. Lvs. sagittate and sinuate, dark green above with lighter areas, and whitish green below. Philippines.—*A. spectabilis*, Hort. G.22:171.—*A. Watsoniana*, Hort.—*A. Putzeysi*.—*A. Wavriniana*, Mast. Lvs. erect, toothed, not sagittate, lanceolate and long-pointed, dark green; petioles purple-spotted, winged. G.C. III. 23:243. F.E. 10:886. Gn. 55:183. Celebes.

L. H. B.

GEORGE V. NASH.†

ALÔE (Arabic name). *Liliaceæ*, tribe *Alotnææ*. Acaulescent or variously caulescent perennial succulents.

Leaves often large, usually crowded in rosettes or along end of st.: fls. red or yellow, often paler-striped, straight, tubular (Fig. 169), with short straight limb, equaled or surpassed by the stamens.—Afr., especially in the Cape region, 1 species about the Medit. and extensively naturalized in all warmer parts of the world, and 1 in China. Plants of the coolhouse, best planted out in a well-drained place in summer, when they flower prettily.

The generic or scientific name *Aloe* is a Latinized form of an Arabic name. As an English word it is pronounced in two syllables, thus Al-oe. Popularly this word is loosely used, the common American *aloe* being *Agave americana*, the commonest "century plant." The "bitter aloes" of commerce is a resinous juice much used as a laxative. The best quality is called "Socotrine or Zanzibar aloes," a product of *A. Perryi*, which was known by the Greeks of the fourth century B.C. to come from the island of Socotra. The "Barbadoes



169. Flowers of an *aloe*.

aloes" is the product of *A. vera*, a species much planted in the West Indies. Genera allied to Aloe are *Apicra*, *Gasteria*, *Haworthia*, *Pachidendron*, and *Phylloma*. The group is difficult for the botanist, there being few authentic specimens in the herbaria, because of the large size of the plants, the infrequent flowering, and the difficulty of suitably drying them. Monograph by Alwin Berger in *Das Pflanzenreich*, 1908, hft. 33.

Propagation is by seed, which usually is not true to name, and by suckers or cuttings well dried-off. Branching for this purpose may be induced by searing the crown of old plants. Hybrids between the different species and with related genera are easily secured and interesting.

Aloes are much cultivated as decorative plants, being amongst the most popular of desert and succulent plants for their stiff, harsh and rugged habit. Fig.



170. A good pot plant of aloe, showing the offsets.

170. They are often grouped about large public buildings, where they emphasize certain architectural features. Large collections are to be seen only in botanic gardens and in the collections of a few fanciers. The largest dealer has nearly one hundred kinds, but grows only five or six kinds in quantity.

Old plants of Aloe will keep healthy for several years in the same pots without a renewal of soil, and flower freely at the same time. The soil most suited to their needs is sandy loam three parts, lime rubble and broken brick one part, with a little decayed manure to strengthen the mixture. Very firm potting is necessary. Drainage is a more important item than soil, and must be perfectly arranged to enable the surplus water to run freely from the soil. Broken bricks are preferable to pieces of pots, large pieces for the bottom of the pot or tub, and smaller pieces above, till the last layer is quite fine. Some of the species need freer rooting conditions than others. *A. ciliaris* will grow from 5 to 7 feet in a season. *A. abyssinica* is of robust growth, and differs from most others in the color of the flowers, which are pure yellow, the others being mostly orange and orange-scarlet. *A. plicatilis* makes an ornamental tub plant when 4 or 5 feet high. Except during the period in which the species are in active growth, they need very little water, the principal idea being to keep the soil sweet and porous even when in growth. At all times the air of the house should be as dry as possible, full sunshine not hurting them. Propagation is by seeds, suckers and cuttings. The arborescent kinds should be rooted after they have completed growth. Dust over the cut part of the cutting with powdered charcoal and dry in sunshine before putting it in to root. Insert singly in as small pots as they will go into, and plunge in a sand-bed. Very little moisture is necessary while rooting. (G. W. Oliver.)

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A. *Lvs. clustered, rather few and thin, flaccidly erect, linear, concave, smooth, finely serrulate: st. very short: infl. unbranched; fls. oblong or narrowed upward; stamens included. (1-4.)*

B. *Raceme short; pedicels elongated; fls. with distinct segms.*

C. *Lvs. 2-ranked.*

1. *Codperi*, Baker (*A. Schmidtiana*, Regel). Somewhat cespitose: *lvs.* 1-2 x 12-40 in., faintly striate, somewhat white-blotched; *infl.* 1-2 ft. high; *fls.* nodding, 1¼-1½ in. long, yellowish or greenish white, rosy at base, with distinct green-tipped segm. Cape. B.M. 6377. *Gt.* 970. *Lyon Hort.* 22, p. 305. Wood & Evans, *Natal Pl.* 41.

CC. *Lvs. spirally arranged.*

2. *micracantha*, Haw. *Lvs.* ½ x 18 in.: *infl.* 1 ft. high; *fls.* nodding, 1¼-1½ in. long; red, the distinct segm. green above or tipped and lined with green. Cape. B.M. 2272. *Salm, Aloe* §21, f. 1.

3. *minima*, Baker. *Lvs.* ¼ x 6-8 in.: *infl.* 6-12 or even 30 in. high; *fls.* spreading, ¾-1¼ in. long, greenish white or the distinct segm. rosy tinged. Cape. Hook. *Icon.* 2423. Wood, *Natal Pl.* 338.

BB. *Raceme elongated; pedicels short; fls. spreading or ascending: lvs. spirally arranged.*

4. *kniphofioides*, Baker. *Lvs.* ¼ x 12-15 in.: *infl.* 2 ft. high; *fls.* ascending, 1¼ in. long, pale red, with very short segm. and long tube. Cape. Hook. *Icon.* 1939.

AA. *Lvs. spirally rosulate (3-ranked in A. variegata), fleshy, acute or pungent: stamens little protruded. (5-26.)*

B. *Plants small: lvs. 3-8 in. long: st. never tall: infl. racemose; pedicels long; fls. nearly cylindrical.*

C. *The lvs. bristle-tipped, soft-toothed and warty: raceme rather short.*

5. *aristata*, Haw. (*A. longiaristata*, R. & S.). *Lvs.* erect, triangular-lanceolate, ¾ x 3-4 in., with a whip-



like apical thread, white-warty in transverse lines on the back and with rather small close white marginal teeth: infl. 1-1½ ft. high; fls. 1¼ in. long, reddish yellow, the moderately long tube somewhat constricted above the base. Cape. Gt. 1883, p. 151. Salm, Aloe §15, f. 7. Lyon Hort. 22, 307. Berger 61.—In aspect resembling *Haworthia*. Varies in a nearly smooth-lvd. form, var. *leiophylla*, Baker, and a gray-lvd. form with 2-ranked tubercles, var. *parvifolia*, Baker. Hybrids are: *A. × prorúmpens*, Berger, *A. × Begúnii*, Hort., *A. × perfectior*, Berger, *A. × Chludmii*, Beguin, *A. × Lap-axii*, Radl., *A. × Quéhlii*, Radl., *A. × Nowátnyi*, Radl., *A. × Bedinghausii*, Radl., and *A. × Simoniána*, Deleuil. All are known or believed to be crosses with species of the related genus *Gasteria*.

cc. The lvs. not bristle-tipped, rather coarsely toothed, sometimes warty.

d. Teeth pale, racemes rather long.

6. *humilis*, Haw. (*A. perfoliata humilis*, Linn.). Lvs. suberect, rather incurved, triangular-lanceolate, ¾ x 4 in., gradually acute, somewhat striate, sharply white-tuberculate, at least on the back, and with rather close large white marginal teeth: infl. 1½-2 ft. high; fls. 1½ in. long, red or yellowish, the green-tipped segms. distinct nearly to the base. Cape. Salm, Aloe §15, f. 1.—With somewhat the habit of *Haworthia*. Varies from the narrow green-lvd. type into glaucous forms of this, with rather thicker lvs., var. *incurva*, Haw. (*A. incurva*, Haw.), B.M. 828, Salm, Aloe §15, f. 3, and rather thin, more concave lvs., var. *echinata*, Baker (*A. echinata*, Willd.), Salm, Aloe §15, f. 2., Berger 64, 65, and one with purplish lvs., var. *macilenta*, Baker; as well as a broader-lvd. glaucous large form, var. *suberecta*, Baker (*A. suberecta*, Haw. *A. acuminata major*, Salm-Dyck), which is sometimes white-mottled, var. *semiguttata*, Haw.; a moderately large broad-lvd. form, var. *acuminata*, Baker (*A. acuminata*, Haw., *A. suberecta*, Haw.), B.M. 757; and a small blue-glaucous form with closer prickles and smaller warts, var. *subtuberculata*, Baker (*A. subtuberculata*, Haw.). Hybrids are: *A. × insignis*, Brown (*A. humilis × A. drepanophylla*), *A. × spinosissima*, Hort. (*A. humilis echinata × A. arborescens pachythyrsa*), *A. × cyanea*, Hort. (*A. humilis incurva × A. arborescens frutescens*), *A. × Todari*, Borzi, (*A. Todari præcox*, Borzi), *A. × Grusonii*, Henze, Monatschr. Kakteenk. 11, p. 57. (*A. humilis × A. Schimperii*), *A. × Hénzei*, Hort. (*A. Grusonii × A. variegata*), and perhaps *A. × latecoccinæa*.

7. *virens*, Haw. Lvs. curved, spreading, triangular, about 1 x 8 in., somewhat mottled or also lined, not warty, with rather distant, coarse, white, marginal teeth: infl. about 2 ft. high; fls. 1½-2 in. long, red, the tube longer than the paler green-tipped sometimes very short segm. Cape. B.M. 1355. Salm, Aloe §15, f. 8. Berger 62, 63. Journ. et Fl. des Jard. 1832, 20.

dd. Teeth dark: racemes short.

8. *pratensis*, Baker. Acaulescent: lvs. erect-spreading, 1-2 x 4-6 in., acute, striate, with large chestnut or blackish pickles on the margin and toward the top of the back: infl. 1½ ft. high; fls. 1¼-1½ in. long, yellowish red, the distinct segm. green-tipped. Cape. B.M. 6705. Berger 67.

9. *glauca*, Mill. (*A. rhodacantha*, DC.) Shortly caulescent: lvs. erect-spreading, 1½-2 x 6-8 in., acuminate, somewhat white-lined, with close strong reddish prickles on margin and back at apex: infl. 2-2½ ft. high; fls. 1¼ in. long, red, the nearly distinct segm. somewhat paler and green at tip. Cape. Salm, Aloe §17, f. 2. DC., Pl. Gr. 44. B.M. 1278.—This pale-lvd., always strongly armed species varies in a distinctly caulescent less glaucous form with even larger prickles, var. *muricata*, Baker (*A. muricata*, Schult., *A. glauca spinosior*, Haw.).

ccc. The lvs. not bristle-tipped or warty, minutely toothed or merely rough-edged: pedicels rather short.

10. *variegata*, Linn. (*A. punctata*, Haw.). At length with a leafy st. 6-9 in. high: lvs. green, ascending, in 3 close oblique ranks, about 1 x 2-5 in., triangular, v-shaped, abruptly acute, crossed by bands of elongated white blotches, edged and keeled by cartilaginous warty, or toward the tip serrate rather than toothed, white borders: infl. about 1 ft. high; fls. 1¼-1½ in. long, red, the green-nerved segms. rather shorter than the nearly cylindrical tube. Cape. B.M. 513. DC., Pl. Gr. 21. Salm, Aloe §20, f. 2. Berger 68. G.Z. 4:92. Wien. Ill. Gart. Zeit. 1904, p. 122. Gt. 29, p. 25. Mordaunt, Hb. 2:90. Lyon Hort. 21, p. 62; 22, p. 307. Deutsch. Tiefsee-Exped. 2:124. F.E. 8:98.—In habit resembling *Haworthia*. Varies in a form with broader lvs. with smaller less banded blotches, var. *Haworthii*, Berger. Hybrids: *A. × smaragdina*, Hort. (*A. variegata × Gasteria candicans*?), *A. × Rebütii*, Hort. (*A. variegata × Gasteria*, sp.), *A. × Desmetiana*, Hort. (*A. variegata × humilis echinata minor*), *A. × imbricata*, Hort. (*A. variegata* or *A. serrulata ×*?), *A. × mortolensis* (*A. variegata × Gasteria acinaciformis*).

11. *serrulata*, Haw. (*A. perfoliata serrulata*, Ait.). Fig. 171. At length short-std.: lvs. somewhat glaucous, rather spirally arranged and spreading, 2 x 8 in., ovate, nearly flat above, with scattered elongated white blotches and serrulate white margin and keel: infl. 1½ ft. high; fls. 1½-2 in. long, red, the green-nerved segms. scarcely equaling the somewhat constricted tube. Cape. B.M. 1415. Salm, Aloe §20, f. 1. Berger 68. Hybrids: *A. × Höyeri*, Radl. ("*A. serrulata × Lomatophyllum borbonicum*"?).

BB. Plants moderately large: lvs. 6 or 8 to mostly 12-20 in. long, smooth: st. never tall: infl. usually branched on strong plants; fls. saccate at base, then constricted, or in the last two less saccate, and widened above the constriction; filaments little if at all exerted.

c. The lvs. unarmed: infl. compoundly corymbose, with very short racemes.

12. *striata*, Haw. (*A. paniculata*, Jacq. *A. albocincta*, Haw.). Nearly simple: lvs. upcurved-spreading, 4-6 x 15-20 in., triangular-oblong, pale or reddish, somewhat pruinose, striate, with entire white cartilaginous margin: infl. 2-3 ft. high, ample; fls. 1¼ in. long, red or yellowish, the pale-tipped segms. much shorter than the tube. Cape. Jacq. Fragm. 62. G.C. III. 36:423. Berger 69.—Varies in a form with red-margined lvs., var. *rhodocincta*, Hort. (*A. Hanburiana*, Naudin), G.W. 3, p. 553, and a form with white-blotched lvs., var. *oligospila*, Baker, B.M. 5210. Hybrids: *A. × Schimperii*, Tod., Hort. Pan. 16; *A. × Bortiana*, Terr.; *A. × Schænlandii*, Baker; *A. × Páxii*, Terr.; *A. × Lynchii*, Baker, G.C. III. 29:199; *A. × Derbétzii*, Hort.; *A. × leptophylla*, Brown, B.M. 7624, Berger 70, and a narrower-lvd. form of it, var. *stenophylla*, Baker. Unnamed hybrids with *A. saponaria* are known, and *A. × Schimperii* has been recrossed with *A. striata*.

cc. The lvs. toothed: infl. simply corymbose, or unbranched when poorly developed.

d. Racemes short.

13. *saponaria*, Haw. (*A. perfoliata saponaria*, Ait. *A. saponaria minor*, Haw. *A. disticha*, Mill. *A. × maculosa*, Lam. *A. umbellata*, Salm-Dyck. *A. umbellata minor*,



171. Aloe serrulata. (No. 11.)

DC.). Cespitosely clustered: lvs. ascending or spreading, lance-oblong, acuminate, 2 x 6–8 in., often reddish, glaucous, faintly striate, with pale blotches more or less in transverse bands, the large, marginal, confluent teeth brown: infl. 1½–2½ ft. high, commonly branched; fls. 1½–1¾ in. long, red, the paler more or less green segms. much shorter than the tube. Cape. Wood & Evans, Natal Pl. 100. B.M. 1460. DC., Pl. Gr. 98, Salm, Aloe §23, f. 1. Berger 71, 72. Lyon Hort. 22, p. 305. Lam., Encycl. 236.—Varies in a dwarf form with lvs. scarcely 4 in. long, var. *brachyphylla*, Baker, and a larger greener-ivd. form, var. *latifolia*, Haw. (*A. latifolia*, Haw. *A. saponaria major*, Linn. *A. umbellata major*, DC.) Salm, Aloe §23, f. 3. B.M. 1346.

DD. *Racemes more elongated.*

14. *macracantha*, Baker. Simple, becoming caulescent: lvs. recurving, lance-oblong, 3–5 x 12–18 in., striate and irregularly somewhat white-blotched, with large, yellow-brown, distinct marginal teeth: infl. 1–2 ft. high; fls. 1¾ in. long, greenish yellow or orange, the segms. half as long as the tube. Cape. B.M. 6580.

15. *zebrina*, Baker (*A. platyphylla*, Baker. *A. Lugardiæna*, Baker. *A. Baumii*, Engl. & Gilg. *A. bamangwalensis*, Schoenl.). Somewhat clustered: lvs. erect-spreading with recurved acute tips, 2½ x 6–12 in., lance-oblong, often reddish, dull, at first pruinose, striate and with elongated pale blotches more or less in transverse bands, the sinuate margin with confluent large red- or brown-tipped teeth: infl. 3–4 ft. high; fls. 1¼ in. long, red, the nerved segms. shorter than the tube. Trop. Afr. Baum, Kunene-Sambesi Exped., 90. G.C. III. 35: 226. B.M. 7948. Berger 75.

16. *macrocarpa*, Tod. Cespitose: lvs. spreading, gradually pointed, 2 x 8–15 in., broadly triangular-oblong, pale, striate, mottled in transverse bands, with irregular, small, confluent, brown-tipped marginal prickles: infl. 2 ft. high; fls. 1 in. long, light red, the nerved segms. shorter than the tube. Trop. Afr. Tod., Hort. Pan. 9. Berger 76.—A larger Abyssinian form, with fls. becoming 1¼ in. long, is var. *major*, Berger.

17. *Græni*, Baker. Lvs. spreading, concave, acute, 3 x 15–18 in., lance-oblong, glossy green, striate and with elongated pale blotches confluent in irregular cross-bands, the sinuate margin with confluent, moderately large, frequently paired, brown upcurved teeth: infl. 1½–4 ft. high; fls. 1–1½ in. long, dull red, the segms. much shorter than the tube. Natal. B.M. 6520.

18. *obscura*, Mill. (*A. perfoliata obscura*, Ait. *A. saponaria obscura*, Haw. *A. picta*, Thunb. *A. picta major*, Willd. *A. maculata*, Desf.). Lvs. in a compact rosette, 2½–3 x 8 in., triangular-lanceolate, green, striate and with scattered small pale blotches, the sinuate, narrowly cartilaginous margin with rather short and close red-tipped teeth: infl. simple or forked, 2½–3 ft. high; fls. 1¼ in. long, red, the nerved segms. about equaling the tube. Cape region. DC., Pl. Gr. 97. B.M. 1323. Salm, Aloe §23, f. 2. Dillenius, Eltham. 15. Allgem. Deutsch. Gart. Mag. 6:17. Hybrid: *A. x pseudopicta*, Berger.

19. *commutata*, Tod. Lvs. as in *A. saponaria* but with somewhat recurved apex and weaker green-based prickles, 1½–2 x 6 in.: infl. few-branched, 3 ft. high; fls. campanulately widened, 1½ in. long, light red, the nerved segms. shorter than the tube. Cape region(?). Tod., Hort. Pan. 18. Berger 77.—Varies in a form with the reddish lvs. scarcely ½ in. wide and more conspicuously white-banded, var. *tricolor*, Berger (*A. tricolor*, Baker). B.M. 6324.

20. *grandidentata*, Salm.-Dyck. Lvs. recurved-spreading, 2½–3 x 12–18 in., lance-oblong, pale, striate and with elongated pale blotches confluent beneath into transverse bands, the sinuate margin with rather distant, large, smoky teeth: infl. 2–3 ft. high; fls. 1½ in.

long, rosy, the segms. about equaling the campanulately widened tube. Cape region. Salm, Aloe §23, f. 4. Berger 77.

BBB. *Plants rather large: lvs. 15–30 in. long, smooth: st. rarely tall (6 ft. in one form of A. Eru): infl. usually simply paniced or subcorymbose; fls. not saccate.*

21. *vèra*, Linn. (*A. perfoliata vèra*, Linn. *A. elongata*, Murr. *A. barbadensis*, Mill. *A. vulgaris*, Lam. *A. flava*, Pers.). Cespitose, the sts. at length 1–1½ ft. high: lvs. suberect or spreading, gradually narrowed from the base, pale, 2–3 x 12–20 in., irregularly white-blotched and narrow when young and 2-ranked on offsets, the repand margin with weak pale prickles: infl. 2–3 ft. high, often simple; fls. 1 in. long, yellow, the segms. about equaling the oblong tube. Medit. region and intro. generally through the tropics. Fiori & Paoletti, Fl. Ital. 1, p. 206. Sibthorpe, Fl. Græca, 341. Salm, Aloe §18, f. 2. Stephenson & Churchill, Med. Bot., 109. Bentley & Trimen, Med. Pl. 282. Berger 84.—The source of “Barbados aloes.” Varies in a large Arabian form with broader lvs., taller infl., and fls. shading into orange, var. *officinalis*, Baker (*A. officinalis*, Forsk., *A. rubescens*, DC.), DC., Pl. Gr. 15; a smaller Asiatic form with red-tinged fls., var. *chinensis* (*A. indica*, Royle. *A. chinensis*, Baker), B.M. 6301; and a hardier garden form of this, var. *Lânzæ*, Berger (*A. Lânzæ*, Tod.), Tod., Hort. Pan. 39. Berger 84.

22. *agavefolia*, Tod. Little caulescent or cespitose: lvs. recurved-spreading, concave, gradually narrowed, rather thin, 3–6 x 18–20 in., with scattered, small, oblong, pale blotches, the margin with large triangular hooked prickles: infl. 3 ft. high, paniced; fls. 1–1½ in. long, dull red, the green, pale-margined segms. about equaling the constricted tube. Trop. Afr. Tod., Hort. Pan. 23.

23. *abyssinica*, Lam. (*A. vulgaris abyssinica*, DC. *A. abyssinica Peacockii*, Baker. *A. Peacockii*, Berger & Schum. *A. Campèri*, Schweinf.). Scarcely clustered, acaulescent: lvs. at first ascending, gradually narrowed, rather sharp-pointed, 4–6 x 12–30 in., pale, not mottled, with rather small, confluent, deltoid, reddish marginal prickles: infl. 3 ft. high, dichotomously few-branched; fls. 1¼–1½ in. long, yellow or orange, the segms. rather shorter than the slightly narrowed tube. Trop. Afr. Salm, Aloe §18, f. 1. DC., Pl. Gr. 27. B.M. 6620. Berger 87, 88.

24. *èlegans*, Tod., differs mainly in having more elongated racemes.

25. *Èru*, Berger (*A. abyssinica*, Baker). St. branched, scarcely 2 ft. high: lvs. recurving, very fleshy, 1½–3 x 16–34 in., pale, somewhat glossy, with elongated white blotches, the repand margin with large reddish-tipped teeth: infl. 3–6 ft. high, dichotomously branched; fls. campanulate, scarcely ¾ in. long, yellow or orange, the segms. longer than the slightly constricted tube. Trop. Afr.—Several minor forms occur—*maculata*, *erecta*, *glauca*, *pârvi-punctata*,—and two large forms have been described, var. *cornuta*, Berger (*A. spicata*, Baker, *A. albopicta*, Hort.), Benth. & Trimen, Med. Pl. 284, and var. *Hoókeri*, Berger (*A. abyssinica*, Hook.), B.M. 7712, respectively short-std. and with a trunk 6 ft. high.

26. *Pèryi*, Baker. Trunk about 1 ft. high, simple: lvs. spreading, gradually narrowed or acuminate, 2–2½ x 15 in., pale green or reddish, somewhat striate but not mottled, the margin with rather small and close brown-tipped prickles: infl. 1½ ft. high, somewhat paniced; fls. 1 in. long, reddish becoming yellow, the green-tipped segms. much shorter than the slightly constricted tube. Socotra. B.M. 6596.—This is now held to be the source of “Socotra aloes,” long attributed to *A. succotrina*.



AAA. *Lvs. rather numerous, spirally arranged on a lengthened st., acute or pungent.* (27–39.)

B. *The lvs. rather separated, not armed on the back.*

C. *St. weak: lvs. thin, finely prickly on the margin, distinctly separated, with perfoliate striate sheaths: infl. short, racemose.*

27. *ciliaris*, Haw. St. elongated, scrambling, more or less verticillately branched: lvs. elongated lanceolate, striate, coarsely white-denticulate, spreading, about 1 x 3–6 in.: infl. 6–8 in. high; fls.  $1\frac{1}{2}$  in. long, bright red, the greenish segms. much shorter than the cylindrical tube; stamens little protruding. Cape. Salm, Aloe §25, f. 1. Berger 9, 97. Henslow, S. Afr. Pl. p. 269. —Varies into a smaller-lvd. form with nearly entire lf.-bases and smaller fls., var. *Tidmarshii*, Schoenl., and a form with broader lvs., var. *Flanaganii*, Schoenl. Hybrids: *A. x de Lätii*, Radl. (*A. ciliaris* x *succotrina*).

28. *striatula*, Haw. (*A. Macdonanii*, Baker. *A. aurantiaca*, Baker). Resembling *A. ciliaris*: lvs. longer, narrowly triangular, minutely denticulate: fls. from reddish becoming yellow or orange, with longer segms. and long-protruding stamens. Cape. Monatsschr. f. Kakteenk. 16, p. 4. Berger 99, 100.

cc. *St. stouter: lvs. rather fleshy and close: infl. taller, paniced.*

29. *Hildebrandtii*, Baker. St. slender, elongated: lvs. lanceolate-attenuate, 2 x 6–9 in., somewhat thick, glaucous, sometimes white-blotched as are the short sheaths, with rather small yellow marginal teeth: infl.  $1\frac{1}{2}$  ft. high, nearly sessile; fls. 1 in. long, red with more or less yellow- or green-marked segms. about equaling the somewhat constricted tube. Trop. Afr. B.M. 6981. Berger 104.

30. *inermis*, Forsk. (*A. Lüntii*, Baker). St. short: lvs. recurved-spreading, gradually narrowed, 2 x 12 in., fleshy, very pale green or reddish, blade and sheath mottled with white at least when young, entire: infl. 2–3 ft. high, open; fls. 1 in. long, rosy, with green-lined yellowish segms. shorter than the somewhat constricted tube. Arabia. B.M. 7448. Berger 105.

BB. *The lvs. more fleshy, with short, nearly concealed sheaths: infl. often paniced.*

c. *Racemes elongated: lvs. not armed on back.*

31. *Kirkii*, Baker. St. short: lvs. crowded, lanceolate-acuminate, 2 x 9–12 in., somewhat thick, glossy, green or reddish, with rather coarse confluent reddish marginal teeth: infl. 2 ft. high; fls.  $1\frac{1}{2}$  in. long, light red with yellowish base and greenish segms. shorter than the cylindrical tube. Zanzibar. B.M. 7386.

cc. *Racemes short: lvs. more or less armed on back as well as margin.*

d. *Erect: lvs. elongated.*

32. *sorðria*, Berger. Lvs. elongated, triangular,  $2\frac{1}{2}$  x 18 in., dull green, brown-striate, with variable whitish marginal teeth alternately larger and smaller: infl. about 2 ft. high; fls.  $1\frac{1}{2}$  in. long, light red, with segms. longer than the tube. Cape.

DD. *Prostrate: lvs. short and broad: infl. often forked.*

33. *mitrifórmis*, Mill. (*A. xanthacantha*, Salm-Dyck). Fig. 172. Lvs. upcurved, ovate, acute, 2–3 x 4–6 in., glaucous, somewhat prickly toward the tip beneath, with large and strong yellow or brown marginal teeth: infl. 1 ft. or more high; fls. 2 in. long, bright red with recurving, paler, nearly distinct segms. Cape. DC., Pl. Gr. 99. B.M. 1270. Salm, Aloe §24, f. 3. Berger 108. —Very polymorphic, the broad-lvd. typical form, with dorsal teeth on the keel only, varying into a form with smaller marginal teeth, those on the back continuing to the apex, var. *pachyphýlla*, Baker; another, in which they stop short of the apex, var. *xanthacantha*, Baker (*A. xanthacantha*, Willd.). Salm, Aloe §24, f. 4; and a

third with acuminate lvs., var. *Commelinii*, Baker (*A. Commelinii*, Willd. *A. mitrifórmis humilior*, Haw.), Salm, Aloe §24, f. 5: narrower-lvd. forms with short and broad yellow teeth, var. *flavispina*, Baker (*A. flavispina*, Haw.), Salm, Aloe §24, f. 2; or long subulate white teeth, var. *albispina*, Berger (*A. albispina*, Haw.): and a variant of the type with scattered teeth over the back of the broad lvs., var. *spinulosa*, Baker (*A. spinulosa*, Salm), Salm, Aloe §24, f. 6. Berger 109.

34. *nóbilis*, Haw. (*A. mitrifórmis spinosior*, Haw.). Lvs. lance-deltoid, 2 x 4–6 in., green, somewhat prickly toward the tip beneath, with large, strong, confluent, white marginal teeth: infl. 2 ft. high; fls.  $1\frac{1}{2}$  in. long, red, with recurving distinct segms. Cape. Salm, Aloe §24, f. 7. Berger 109.



172. *Aloe mitriformis*. (No. 33)

35. *dístans*, Haw. (*A. mitrifórmis angustior*, Lam. *A. perfoliata brevifolia*, Ait. *A. brevifolia*, Haw. *A. mitrifórmis brevifolia*, Sims. *A. mitrifórmis humilior*, Willd.). Branched and prostrately spreading: lvs. ascending, broadly ovate, acute, 2 x 3–3½ in., glaucous, somewhat mottled below and prickly toward the tip beneath, with strong, dark-tipped yellow marginal teeth: infl.  $1\frac{1}{2}$  ft. high; fls.  $1\frac{3}{4}$  in. long, red, with recurving greenish segms. about as long as the cylindrical tube. Cape. Salm, Aloe §24, f. 1. B.M. 1362. Berger 107.

AAAA. *Lvs. numerous, elongated, succulent, acute or pungent, spirally crowded at end of the prominent, sometimes tall trunk.* (36–49.)

B. *Stamens scarcely protruded: fls. narrow: lvs. smooth*

c. *Trunk scarcely 4 ft. high: infl. usually racemose.*

36. *succotrína*, Lam. (*A. soccotrina*, DC. *A. perfoliata soccotrina*, Ait. *A. socotrína*, Steph. & Church. *A. vera*, Mill.). Scarcely caespitose, the dichotomously branched st. at length 3–4 ft. high: lvs. falcately upcurved, gradually narrowed, pale or glaucous, sometimes white-blotched toward the base,  $1\frac{1}{2}$ –2 x 15–20 in., the margin serrate with small connate white prickles: infl. 2 ft. high; fls.  $1\frac{1}{4}$  in. long, light red, the

distinct segms. green-nerved. Cape. DC., Pl. Gr. 85. Salm, Aloe §22, f. 1. B.M. 472. Stephenson & Churchill, Med. Pl. 110. Berger 113.—Varies in a form with more armed, broader, shorter and straighter lvs., var. *saxigena*, Berger.

37. *purpurascens*, Haw. (*A. sinuata*, Thunb.? *A. perfoliata purpurascens*, Ait. *A. socotrina purpurascens*, Ker. *A. ramosa*, Haw.). Cespitose, nearly caulescent: lvs. upcurved, gradually tapered, green, sometimes more or less striate, and white-dotted on the back below,  $2\frac{1}{2}$  x 18–20 in., the margin with moderately long connate hooked purplish teeth: infl. 3 ft. high; fls.  $1\frac{1}{2}$  in. long, light red, the distinct segms. paler and green-nerved. Cape. Salm, Aloe §22, f. 2. B.M. 1474. Berger 113. Winkler, Pharm. Waarenk. 182.

cc. Trunk finally 10–20 ft. high: not cespitose.

d. Infl. a simple or forked raceme.

38. *arborescens*, Mill. (*A. perfoliata arborescens*, Ait. *A. arborea*, Medikus. *A. fruticosa*, Lam.? *Catevala arborescens*, Medikus. *A. arborescens Milleri*, Berger). Trunk simple, finally 10–15 ft. high, clothed at top with the withering lvs.: lvs. sinuately spreading, gradually narrowed, dull green, 2 x 24 in., the repand margin with rather long cartilaginous white prickles: infl. elongated; fls. about  $1\frac{1}{2}$  in. long, red, with distinct segms. Cape(?). B.M. 1306. Bot. Repos. 468. Berger 115.—Varies into numerous forms: green-lvd., with shorter trunk and long lvs., var. *Ucriæ*, Berger (*A. Ucriæ*, Terr.), Salm, Aloe §26, f. 3. G.W. 10, p. 13. Berger 116, 117; or shorter lvs., var. *viridifolia*, Berger, —Berger f. 117; or glaucous or blue-lvd., with branched infl., var. *natalensis*, Berger (*A. natalensis*, Wood & Evans), Berger 115; or simple infl. with normal fls., var. *frutescens*, Link. (*A. frutescens*, Salm-Dyck), Berger 120; or fls. 2 in. long, var. *pachythyrsa*, Berger. Berger 118, 119.

39. *pluridens*, Haw. (*A. Atherstonei*, Baker). Trunk unbranched, finally 8–10 ft. high: lvs. as in the preceding but glossy and somewhat striate,  $2\frac{1}{2}$  x 16 in.: infl. branched; fls.  $1\frac{1}{2}$  in. long. Cape. Berger 121.

dd. Infl. a candelabrum-like forking panicle, with upcurved nearly sessile fls.

40. *africana*, Mill. (*A. africana angustior*, Sims. *A. Bolusii*, Baker. *Pachydendron africanum*, Haw. *P. principis*, Haw. *P. angustifolium*, Haw.). Trunk simple, finally 20 ft. high: lvs. few, rather separated, sinuately spreading or recurved, triangular-oblong, glaucous,  $2\frac{1}{2}$ –3 x 20–24 in., with rather large triangular horny marginal teeth: infl. 2 ft. high; fls.  $1\frac{1}{2}$  in. long, yellow, with segms. shorter than the oblong tube. Cape. Salm, Aloe §27, f. 2. B.M. 2517. Berger 128.

41. *candelabrum*, Berger, differs chiefly in having the fls. red. Cape.

bb. Stamens much longer than the rather ample short perianth: not cespitose.

c. The lvs. smooth, toothed: infl. racemose or forked.

42. *rubroviolacea*, Schweinf. Not branched, scarcely 3 ft. high: lvs. spreading, acuminate triangular, purplish-pruinose, 4 x 24 in., the reddish margin with rather distant curved dark-pointed moderate teeth: infl. often forked, 2 ft. high; fls.  $1\frac{1}{2}$  in. long, light red, the segms. rather longer than the tube. N. Afr. B.M. 7882. Berger 122, 123. Hybrids: *A. rubroviolacea* x *A. supralævis*.

43. *Salmдықiāna*, Schult. Branching, low: lvs. arcuately spreading, gradually tapered, glaucous, 3 x 30 in., the yellowish margin with rather large cartilaginous teeth: infl. 2–3 ft. high, paniculate; fls.  $1\frac{1}{4}$ – $1\frac{1}{2}$  in. long, red, the green-tipped segms. nearly distinct. S. Afr. Salm., Aloe §27, f. 1. Berger 125, 126.—Varies in a less dense form with stouter trunk, var. *fulgens*, Berger (*A. fulgens*, Tod.), Tod., Hort. Pan.

33. Hybrids: *A. x Winteri*, Berger (*A. Salmдықiāna* x *A. arborescens frutescens*), *A. x Varvarii*, Borzi (*A. Salmдықiāna* x *A. cæsia*?).

44. *drepanophylla*, Baker. Trunk slender, simple, 9–12 ft. high: lvs. very narrowly lanceolate-attenuate, glaucous,  $1\frac{1}{2}$  x 24–36 in., the cartilaginous margin minutely denticulate: infl.  $1\frac{1}{2}$  ft. high; fls. scarcely 1 in. long, from red becoming whitish, green-lined, with nearly distinct segms. Cape. Berger 127.

45. *speciosa*, Baker. Taller, 18–25 ft. high, branching: lvs. very numerous, spreading, gradually tapered, blue, the rosy margin with minute prickles: fls.  $1\frac{1}{4}$  in. long, from rosy becoming whitish, green-nerved, the segms. about equaling the tube. N. Afr. Berger 124.

cc. The lvs. often armed on one or both faces, toothed: st. nearly simple: infl. paniculately forked.

46. *supralævis*, Haw. (*A. Galpinii*, Baker. *Pachydendron supralæve*, Haw.). Not branched, 3–6 ft. high: lvs. numerous, upcurved, lanceolate, glaucescent, 4–6 x 20–30 in., prickly on the back only, the marginal teeth rather large, reddish brown: infl. 3 ft. or more high; fls.  $1\frac{1}{8}$  in. long, red-orange, becoming yellowish, with segms. longer than the tube. Cape. Salm, Aloe §27, f. 6. Berger 129, 130.—Varies in a form with few if any prickles on the backs of lvs., var. *erythrocarpa*, Berger. Berger 130.

47. *férox*, Mill. (*A. perfoliata férox*, Ait. *A. muricata*, Haw. *A. horrida*, Haw. *A. pseudoférox*, Salm-Dyck. *A. subférox*, Spreng. *Pachydendron férox*, Haw. *P. pseudoférox*, Haw.). Exceptionally forked, 3–10 ft. high: lvs. numerous, curved, lanceolate, glaucous, becoming reddish, 4–5 x 28 in., more or less prickly on both faces, the purplish margin with rather large reddish-brown teeth: infl. 4 ft. high; fls.  $1\frac{1}{4}$  in. long, greenish yellow, with smoky-tipped segms. longer than the rather narrow tube. Cape region. B.M. 1975. Berger 131, 132. Salm, Aloe §27, f. 5.—Varies in a whiter-lvd. form with brighter yellow black-tipped fls., var. *xanthostachys*, Berger.

ccc. The lvs. smooth, prickly-margined: trunk very large, dichotomously branched, not cespitose: infl. tripartite.

48. *dichotoma*, Linn. (*Rhipidodendron dichotomum*, Willd.). Stout flat-topped tree, 25–30 ft. high, repeatedly forked as in *Dracæna Draco*: lvs. nearly flat, recurved-spreading, lanceolate, glaucous, 2–3 x 6–10 in., the yellowish-brown margin minutely prickly: infl. 1 ft. or more high; fls. very stout,  $1\frac{1}{4}$  in. long, yellow, with broad, nearly distinct segms. Cape. G.C. 1873, p. 712; 1874, p. 567. Berger pl. 1. and f. 135.—Varies in a smaller-fl. form with shorter stamens, var. *montana*, Berger (*A. montana*, Schinz).

49. *Bainèsii*, Dyer. Large flat-topped tree, 30–60 ft. high, copiously branched: lvs. concave, recurved-spreading, elongated, green, 2–3 x 24–36 in., the pale margin with rather small teeth: infl. 1 ft. or more high; fls.  $1\frac{1}{4}$ – $1\frac{1}{2}$  in. long, yellowish red, with segms. shorter than the tube. Cape region. G.C. 1874, p. 568. B.M. 6848. Berger 136, 137.—Varies in a broader-lvd. form with minute marginal prickles, var. *Bárberæ*, Baker (*A. Bárberæ*, Dyer. *A. Zeyheri*, Hort.), G.C. 1874, p. 568.

AAAAA. Lvs. rather few, strictly oblong, succulent, 2-ranked, minutely prickly near the very obtuse tip only: st. stout, evident: infl. unbranched; fls. oblong; stamens scarcely protruded.

50. *plicatius*, Mill. (*A. disticha plicatilis*, Linn. *A. linguiformis*, Linn. *A. flabelliformis*, Salisb. *Kumara disticha*, Medikus. *Rhipidodendron distichum*, Willd. *R. plicatile*, Haw.). Somewhat repeatedly forking, 3–10 ft. high, not cespitose: lvs. flat or 2-edged as in *Gasteria*, ascending, glaucous,  $1\frac{1}{2}$  x 8–16 in., the narrow cartilaginous margin minutely somewhat denticulate



upward: infl. 1-3 ft. high; fls.  $1\frac{1}{2}$  in. long, red, with segms. scarcely equaling the tube. Cape. B.M. 457. DC., Pl. Gr. 75, Jacq., Schoenbr. 423. Salm, Aloe §28, f. 2. Medic. 4. Berger 139, 140.

*A. Cameronii*, Hemsl. Fls. almost cinnabar-red, passing into yellow toward the top. E. Trop. Afr. B.M. 7915.—*A. Campylo-stiphon*, A. Berger. Pale yellow fls. E. Trop. Afr.—*A. Chabaudii*, Schoenl. Allied to *A. stricta*. Lvs. bordered with small prickles; outer segms. of fls. pale brick-red with whitish wings at apex. Trop. Afr. G.C. III. 38:102.—*A. decora*, Schoenl. A dwarf species having red fls. tipped with green. S. Afr. G.C. III. 38:3865.—*A. Lästii*, Baker. Fls. pale yellow, greenish at top. Zanzibar.—*A. laxiflora*, Hort. Very lax arrangement of fls. which are orange-red in lower part and yellow at apex. Cape Colony. G.C. III. 39:130, desc.—*A. Marlothii*, A. Berger. Extremely spiny lvs. and nearly horizontally spreading fl.-spikes. British Bechuanaland.—*A. Orpenae*, Schoenl. Lvs. lined with white spots and markings on both surfaces: fls. red, tipped with white. S. Afr. G.C. III. 38:3865.—*A. pallidiflora*, A. Berger. A stemless plant: lvs. armed on margins with sharp spines: fls. pale flesh-color. S. Afr. B.M. 8122.—*A. pendens*. A shrubby species: fls. drooping, dull yellowish red. S. Arabia. B.M. 7837.—*A. rubrolutea*, Schinz. Unbranched st. 8 ft. high or more: lvs. armed or margins with brown denticled and somewhat hooked spines: fls. bright red. Trop. S. W. Afr. B.M. 8263.

WILLIAM TRELEASE.

**ALONSÒA** (Alonzo Zanoni, Spanish official at Bogota). *Scrophulariaceae*. ALONSOA. Tropical American plants, cultivated as annuals in the open, or grown for the attractive winter bloom in pots.

Flowers showy: plant of good habit: corolla very irregular and turned upside down by the twisting of the pedicel, bringing the larger lobe uppermost; stamens 4: lvs. (at least below) opposite or in 3's.—About a dozen species, many of which have been in gardens at one time or another.

Alonsoas are tender, and need protection from frost. Seeds are usually started under glass in the North, although plants bloom well from seeds sown directly in the open. Use only finely prepared soil. For winter bloom, plants are propagated by cuttings or seeds, the latter being sown in late summer.

*incisifolia*, Ruiz & Pav. (*A. urticæfolia*, Steud. *Celsia urticæfolia*, Sims, B.M. 417). Fig. 173. About 2 ft. high, erect: lvs. ovate to oval-lanceolate, long-tailed, deeply cut-toothed: fls. nearly  $\frac{1}{2}$  in. across, very irregular (somewhat hood-shaped), scarlet, with protruding organs, on slender axillary peduncles; upper limb of corolla 2-4 times longer than calyx; anthers 2-3 times shorter than filaments. Also a white-fl. variety. Peru.—A greenhouse shrub.

*Warscewiczii*, Regel (*A. incisifolia* var. *Warscewiczii*, Boiss. *A. grandiflora*, Hort. *A. compacta*, Hort.). Fls. large, the plant herbaceous or nearly so and treated as a garden annual: lvs. cordate or cordate-lanceolate, double-toothed: calyx-lobes blunt; upper lobes of corolla 4-5 times as long as calyx, and anthers 3-4 times shorter than the crooked filaments, the fls. light cinnabar-red or scarlet-red (and a white variety). Peru.—

Apparently the commonest alonsoa in gardens, 2-3 ft., readily grown from seeds as a half-hardy subject; July till autumn; useful also for winter bloom. Plant very bushy, with mostly reddish brown branches.

*acutifolia*, Ruiz & Pav. (*A. myrtifolia*, Roehl). Plant stout but bushy, 20-30 in.: lvs. broad-lanceolate, sharply simple-toothed: pedicels single, glandular hairy (as also the calyx); fls. larger than *A. Warscewiczii*, the limb or lip 3-4 times as long as the calyx; anthers long, several times exceeding the filaments; color of fls. cinnabar-red. Peru. Var. *candida*, Voss (*A. albiflora*, Hort.), fls. white. Grown as a garden annual, and also in pots for winter bloom.

*linearis*, Ruiz & Pav. (*A. linearifolia*, Steud. *A. lini-flora*, Hort.). Plant bushy and much branched, 12-20 in.: lvs. linear, pointed, entire or finely toothed, often fasciated or crowded: fls. scarlet. Peru. Var. *gracilis*, Hort. (*A. pumila*, Hort.), is a smaller graceful form. Cult. as garden annual and also in pots indoors.

*A. caulilata*, Ruiz & Pav. Lvs. less cut than in *A. incisifolia*: fls. smaller: st. 4-angled. Peru.—*A. intermedia*, L.B.C. 1456=*A. linearis*.—*A. liniifolia*, Roehl. Plant  $1\frac{1}{2}$  ft. or less high: lvs. lanceolate or narrower, entire: fls. bright scarlet. Peru.—*A. Mathewii*, Benth. Lvs. lanceolate, toothed: fls. scarlet, in terminal racemes. Peru. Greenhouse.

L. H. B.

ALŌYSIA: *Lippia*.

**ALPINE PLANTS.** In gardening, a term used to designate those plants that thrive in imitated alpine conditions,—in cool places of short-growing season and abundant cold-water supply in the growing and blooming period, and soil conditions approaching those of mountains; in practice, alpine-gardening is a form of rock-gardening.

The cultivation of alpine plants in some parts of the United States must always be attended with difficulty. Wherever, as in the coastal plain region of the Atlantic seaboard, the summers are long, dry and hot, it is almost impossible to cultivate many of the most desirable alpiners.

A study of the natural environmental habitats of alpiners is the very best way to arrive at really valuable ideas upon their cultivation. Excluding all those alpiners of apparently little definite habitat preference, such as the snowdrop, daffodil, poet's narcissus, trailing myrtle, Christmas rose, and Scotch pink, all of which are true alpiners, but also tolerant of quite ordinary garden conditions, there is a large class, some hundreds of species, that will grow only in situations approximating their native habitat. These plants, some of which are perhaps the most beautiful flowers in cultivation, grow usually in a region having long, rigorous winters, a growing season averaging 100 to 120 days, and a constant supply of moisture which, on account of its source in the snow above the vegetation-line, is always nearly ice-cold.

It is true of most of these alpiners that they grow among the rocks, and, as we shall see presently, this is a factor that must be reckoned with. Many of them grow in the open sun and are exposed to violent, often bitter, winds. Others again are on north-facing slopes, where the sun rarely, if ever, reaches them. A partial list of alpiners given below will show the preference of some of the more common species with regard to the exposure to sunlight.

*Localities in the United States and Canada where alpine gardens may be tried with a fair measure of success.*

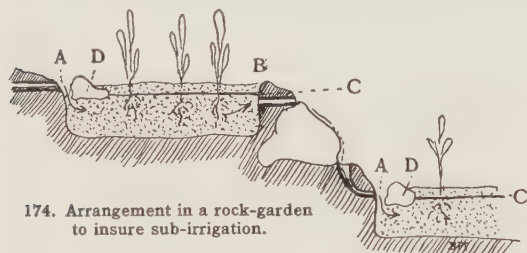
One of the basic requirements of most true alpiners is a short growing season. The Atlantic seaboard from Nova Scotia southward, east of the "fall line" (the flat, usually somewhat sandy, regions between the eastern fringe of the Alleghanies and the sea, such as southern Long Island, southern New Jersey and all south of it except parts of Virginia, North Carolina, South Carolina, and Georgia), has an active growing



173. *Alonsoa incisifolia*. ( $\times \frac{1}{4}$ )

season of 170 days and upward. This is computed by adding the days from the last frost of spring to the first frost of autumn. At New York, the season is 210 days, at Philadelphia, 220 days, and of course constantly increasing southward.

On account of this long growing season and also because of the dry, hot character of the winds, it is almost impossible, without great expense, to maintain an alpine garden in this region. The same is true of the coastal part of the Pacific coast, and in the Mississippi Valley up to about St. Louis. This is, of course,



174. Arrangement in a rock-garden to insure sub-irrigation.

a general statement, and peculiarly favorable local conditions within the areas specified may be found, where the attempt can be made. But it is extremely doubtful whether any really good alpine garden can be maintained within this area permanently without a great maintenance expense, in the way of constantly supplying new plants, keeping the garden regularly cooled down by water and the like.

As one goes back from the coast, even a few miles, there is a marked change in the climate, and particularly noticeable is the constantly diminishing length of the growing season. Near Hartford, the Highlands of the Hudson, northern New Jersey and Pennsylvania, the growing season averages from 138 to 120 days, more or less. As a general rule it may safely be stated that anywhere east of the Mississippi where elevations of 1,000 feet or greater are found, an alpine garden is permissible except in the southern Alleghanies, where greater elevations must be sought. This length of the growing season is easily computed for all parts of the country, as indicated above; and wherever we find an active growing season of 100 to 140 days, it would be profitable to make an alpine garden. In the East it will be found that the short season is almost always correlated with elevations in excess of 1,000 feet and in the West at several times that altitude.

#### Position of the alpine garden.

So far as our purpose is concerned, there are three classes of alpine plants: (a) those that require full sunlight, (b) shade-inhabiting species, and (c) those that are apparently indifferent as to exposure. To meet all these conditions within a single garden is not always possible, and a selection of plants must therefore be made, unless one is fortunate enough to have a situation that combines these requisites. As a general rule it is better at some distance from a dwelling, stable, or garage, both architecturally and culturally. No class of plants is quite so wild as alpenes, and the more secluded the garden, and the greater the suggestion of sequestered nature the better. A screen of evergreens or other trees, and a northward-facing slope, insuring good drainage, is perhaps the best all-round combination that one could desire. If the garden is at a slight elevation above the immediate surroundings, so much the better; although this is not absolutely essential. Southern or western exposures are to be avoided unless the garden is at least 4,000 feet above the sea in the East, and from 6,000 to 8,000 feet in the West. It should also be arranged so that drainage will not be entirely down through the soil as in ordinary gardens, but rather so

that the water can trickle from the roots of those above to those below. This is often best attained by a judicious use of rocks, which will be considered later.

#### Making the garden.

Having decided that one lives within the area in which it is safe to begin the installation of an alpine collection, the next most important consideration is to give the plants the requisite local condition. Nearly all of them require good rich soil, at least 18 inches deep, preferably deeper. Even those species that grow in the crevices of the rocks in their native habitat do so not because they "like" such situations, but most probably because no more favorable place is available.

In preparing the soil, it is well to remember that at least one-third of the mixture should be fine rotted leaf-mold mixed with equal parts of loam and sand. The latter is quite necessary in order to insure perfect drainage. It has been stated that some alpenes will thrive in situations that approximate our bogs in having a high humic acid content. But most of the species thrive where the drainage is good and the soil is sweet, not sour.

If for no other reason than to insure perfect drainage, it is best to construct the garden in a series of terraces with walks of more or less irregular outline between, as taste and convenience dictate. Avoid all semblance of formality in the arrangement of these terraces, as artificiality or formalism in the alpine garden are quite the least desirable features to be sought.

The terraces, or any modification of them, are best held in place by a more or less free use of rocks. The placing of these requires great skill and taste, as their purpose must be twofold—to add a sense of naturalness to the garden and to make suitable pockets in which to grow the plants. While it is true that many alpenes, such as *Thalictrum aquilegifolium*, *Clematis recta*, *Aconitum lycoctonum*, *Digitalis ambigua*, *Polemonium caeruleum*, *Gentiana asclepiadea*, and *Delphinium elatum*, with many others, can be grown without the use of rocks, it is true, on the whole, that most alpenes grow better and seem more at home when rocks are part of their environment. Just what part the rocks play in the home economy of the plants is not very well understood, but the readiness with which they conduct the water to the roots, and their tendency to keep the soil cool both suggest themselves as possible benefits.

For such species as *Phlox Douglasii*, *Cassiope Mertensiana*, *Polemonium montrosense*, and all plants of their type whose natural home is at elevations from 10,000 to 12,000 feet, care must be taken to insure almost constant sub-irrigation of cool water. In their native habitats, such plants have their roots constantly in the icy water of the substratum, and any conditions that do not approximate this will make failure almost certain.

An arrangement for insuring this sub-irrigation is figured in Fig. 174, diagrammatically. The pocket of soil in the rocks having been filled with the proper soil mixture, the water may be let in at a, with a rock just in front of the pipe to insure the water's downward passage (d). With the bottom made water-tight by concrete or rocks and clay, and the outlet regulated at b, a definite water-level can always be maintained at c. The outlet can be arranged as indicated to flow either over the surface of the rock below or in a pipe behind it. If the water for this plan comes from a cool spring, so much the better. The smallest stream of water is sufficient, as it is not the water itself with which one is aiming to supply the plants, so much as the cooling of the soil, rocks and atmosphere that ensues from a gentle flow of water through and around the soil and rocks.

Such measures are not necessary for all alpenes, but a few species must be grown under conditions approximated by these methods. The expense of installing and maintaining such construction, however, is relatively great.



as compared with the simple arrangement of the rocks in pockets, overhanging ledges, nooks, and so forth, which is all that is required for the great majority of alpinists. A common and particularly undesirable method of procedure is to tumble a great mass of rocks together, usually utterly without form or definite purpose except to look "artistic," then pile soil amongst them and plant the whole mass. If the idea is constantly kept in mind that the rocks are for use primarily, that they are cultural necessities, and that plants naturally grow between, and among, and often half underneath them,—then the final result is likely to be beautiful, because they are useful and have been placed with an eye to their sole *raison d'être* in the alpine garden, which is to be a home for alpine plants.

In placing the rocks, indeed in the arrangement of the garden generally, it is better to avoid situations in which the drip from overhanging trees or other objects will fall on the plants. No plants are specially benefited by drip, and alpinists, particularly those having tomentose leaves, will suffer from such treatment.

#### *Plants for the alpine garden.*

Unfortunately, very few American dealers carry anything like an adequate stock of alpine plants, and only the commonest and best-known species are to be found in the American trade. This has had the effect of restricting the popularity of alpine gardening in this country, and, furthermore, all the alpine gardens of any size have had to seek in Europe for the large variety of species that constitute a well-stocked collection. Many European firms, particularly in England and France, have specialized in alpinists. At least 1,000 species are offered by one continental dealer alone. A common but altogether unsatisfactory method, and one that has resulted in numberless failures, is the attempt to import plants direct from these dealers. The time of transit, the highly specialized character of the cultural requirement of alpinists, and the lack of attention during transit, all operate to make such shipments costly and usually unsuccessful.

The best and most satisfactory method is to buy seeds of the plants to be cultivated. The initial cost is less than one-fifth and the personal satisfaction in having grown one's stock of plants more than offsets the time spent in this work. The seeds should be imported early in the spring or even in the late winter for those with greenhouse facilities. Sow the seeds in pans or boxes in a light soil of leaf-mold and sand in about equal parts. It is best partially to shade the seeds and very young seedlings for a few days. Pot up when the seedlings are stout enough to stand the transfer, which of course, varies with different species. If it is inconvenient

to place them in their permanent home the first year, they may be repotted and then the pots plunged in ashes in the frame. With proper shading from the intense sunlight, and a plentiful supply of cool water so that the ashes are kept moist and cool, they will grow very well under these conditions for the first year. Many of the species can be grown always with this treatment if one has no garden ready for them. The shading for these frames is easily made of ordinary plasterer's lath, the strips being placed about one inch apart and the whole shade arranged so as to be about 2½ feet above the surface of the ground.

Of all the genera cultivated as alpinists, the most important are the gentians, saxifrages, sedums, a few dwarf primulas and the pinguiculas. These are much better known abroad than in North America, but many of the best of them can be grown in this country. Among the gentians, Correvon of Geneva classifies them for cultural purposes as follows:

1. Calcareous-soil gentians requiring sun: *alpina*, *angustifolia*, *Clusii* and *Kochiana*.
2. Sphagnum-moss species: *bavarica*, *Rostarii*, *septemfida*.
3. Marshy-ground species: *angustifolia* (also in group 1) *asclepiadea*, *Pneumonanthe*.
4. Peaty sand and sandstone with peat in it: *alba*, *Bigelovii*, *ciliata*, *frigida*, *Parryi*, *pumila*, *Wallichiana*.
5. Of indifferent habitat preference: *brevidentis*, *crucifera*, *dahurica*, *decumbens*, *macrophylla*, *Oliveri*, *Saponaria*, *scabra*, *straminea*, *Weschniakowii*.

Among the saxifrages only the dwarf, usually perennial, kinds are grown as alpinists. In moist, rocky places in the alpine garden the following species of pinguicula will be useful: *P. vallisnerifolia*, *P. grandiflora*, with purple and blue flowers and *P. alpina* with white flowers. *P. vulgaris* and *P. lusitanica* may be grown in general situations in the "alp."

It is often necessary to make a definite selection of species for a sunny or shady place, as most of our alpinists cannot be grown without reference to the amount of sunlight. For those who can arrange only for a rather sunny situation, in which the amount of shade is not sufficient to keep the soil and rocks cool, the following will be found helpful:

#### ALPINES FOR SUNNY SITUATIONS.

NAME	Color of flowers	Height	Time of flowering
<i>Acron species</i> . . . .	Grown for gray foliage	Creeping, 3-4 in.	
<i>Acantholimon glumaceum</i> . . . . .	Rose	3 in.	Summer
<i>Achillea argentea</i> . . . . .	White	4 in.	Summer
<i>A. rupestris</i> . . . . .	White	3 in.	Summer
<i>A. umbellata</i> . . . . .	White	6 in.	Summer
<i>Æthionema</i> , various sp. . . . .	Pink	About 1 ft.	Summer
<i>Ajuga reptans atropurpurea</i> . . . . .	For purple foliage	9 in.	
<i>Alyssum</i> , various sp. . . . .	Yellow and white	6 in.	Spring
<i>Androsace</i> , various sp. . . . .	White and rose	3-6 in.	Spring and summer
<i>Arenaria montana</i> . . . . .	White	6 in.	Spring and summer
<i>Armeria</i> , various sp. . . . .	Rose and white	6-12 in.	Summer
<i>Aster alpinus</i> , vars. . . . .	Various, not yellow	About 9 in.	Summer and early autumn
<i>Callandrinia umbellata</i> . . . . .	Red	6 in.	Summer
<i>Dwarf campanulas</i> . . . . .	White, blue and purple	3-12 in.	Spring and early summer
<i>Ceratostigma plumbaginoides</i> . . . . .	Blue	8 in.	Autumn
<i>Corydalis lutea</i> . . . . .	Yellow	6 in.	Spring
<i>Cyananthus lobatus</i> . . . . .	Blue	4 in.	Summer
<i>Dianthus</i> (Alpine pinks) . . . . .	White to rose	5-12 in.	Spring and summer
<i>Draba aizoides</i> . . . . .	Yellow	3 in.	Spring
<i>Dryas octopetala</i> . . . . .	White	Creeping	Late spring



175. Alpine-gardening,—good rock-work in a cool and protected place.

ALPINES FOR SUNNY SITUATIONS, continued.

NAME	Color of flowers	Height	Time of flowering
<i>Erigeron Villarsii</i> ..	Pale violet	12 in.	Summer
<i>Erodium</i> , various sp.	White and red	6-10 in.	Summer
<i>Gentiana</i> , various sp.	Blue	6-18 in.	Spring and summer
<i>Gypsophila</i> , dwarf sp.....	White to pink	6-12 in.	Summer
<i>Hedera conglomerata</i> <i>H. minima</i> .....	(Both grown for evergreen foliage)	6-8 in.	
<i>Iberis</i> , various sp..	White	6 in.	Summer
<i>Iris</i> , dwarf bearded sp.....	Various	6-15 in.	Spring and early summer
<i>Leontopodium alpinum</i> .....	White	6 in.	Summer and autumn
<i>Linum flavum</i> .....	Yellow	12 in.	Summer
<i>Macrotomia chioi-des</i> .....	Yellow	10 in.	Summer
<i>Morisia hypogaea</i> ...	Yellow	3 in.	Spring and early summer
<i>Nepeta Mussinii</i> ...	Blue	12 in.	Summer and autumn
<i>Nocca alpina</i> .....	White	3 in.	Spring and summer
<i>Papaver alpinum</i> , vars.....	Various	6 in.	Spring
<i>Platycodon</i> , various sp.....	Blue	8-15 in.	Spring
<i>Saponaria ocymoi-des</i> .....	Red	Creeping	Summer
<i>Silene</i> , various sp...	White and red	5-15 in.	Summer and autumn
<i>Tunica Saxifraga</i> ..	Pinkish white	3-5 in.	Summer
<i>Veronica incana</i> ...	Blue	6 in.	Summer
<i>V. cupressioides</i> ....	Ornamental foliage	10 in.	
<i>Zauschneria</i> , vari-ous sp.....	Scarlet	12-18 in.	Autumn

The foregoing list is, of course, not a complete one, but it will serve as a guide for the beginner. Many of these will also stand a partially shaded place, some of them prefer such situations, but all of them will grow in the open sunlight if the pitch of the ground is not too great toward the south or southwest.

ALPINES FOR SHADY SITUATIONS.

NAME	Color of flowers	Height	Time of flowering
<i>Adonis</i> , various sp..	Yellow	6-12 in.	Spring.
<i>Anchusa myosoti-flora</i> .....	Blue	12 in.	Summer
<i>Anemone alpina</i> ....	White	18 in.	Summer
<i>A. sylvestris</i> .....	White	12 in.	Spring
<i>Aquilegia glandulosa</i>	Blue and white	12 in.	Early summer
<i>A. cærulea</i> .....	Blue and white	15 in.	Summer
<i>Arenaria balearica</i> .	White	2-4 in.	Summer
<i>Auricula</i> , various sp.	Various	4-7 in.	Spring
<i>Dodecatheon</i> sp.....	White to purple	12 in.	Spring and early summer
<i>Eomecon chionantha</i>	White	18 in.	Summer
<i>Epimedium</i> , various sp.....	Ornamental foliage	6-12 in.	
<i>Erinus</i> , various sp..	White and rose	3 in.	Spring and summer
<i>Galax aphylla</i> .....	White	12 in.	Summer and autumn
<i>Helleborus niger</i> ...	White	12 in.	Winter
<i>Iris cristata</i> .....	Blue	4 in.	Spring
<i>Linaria Cymbalaria</i>	Lilac	3 in.	Summer
<i>L. pallida</i> .....	Violet	2 in.	Summer
<i>Omphalodes verna</i> ...	Blue	6 in.	Spring
<i>Ourisia coccinea</i> ....	Red	9 in.	Spring and early summer
<i>Parnassia palustris</i> .	White	6 in.	Summer
<i>Polemonium humile</i>	Blue	6 in.	Spring and summer
<i>Polygonum affine</i> ...	Rose	6 in.	Summer
<i>Primula Sieboldii</i> , various forms...	Various	6-9 in.	Spring
<i>Ramondia pyrenaica</i>	Blue	4 in.	Spring
<i>Rodgersia</i> , various sp.....	Ornamental foliage	3-6 in.	
<i>Saxifraga Geum</i> (and allies).....	Various	12-18 in.	Spring and summer
<i>Shortia galacifolia</i> ...	White	6 in.	Spring
<i>Soldanella alpina</i> ...	Blue	4 in.	Spring
<i>Thalictrum minus adiantifolium</i> ...	Ornamental foliage	6-12 in.	
<i>Trillium</i> , various sp.	White and pink or purple	6-8 in.	Spring

ALPINES FOR SHADY SITUATIONS, continued.

NAME	Color of flowers	Height	Time of flowering
<i>Uvularia grandiflora</i>	Yellowish green	12 in.	Summer or late spring
<i>Vancouveria hexan-dra</i> .....	Ornamental foliage	6-8 in.	
<i>Viola</i> , various sp...	Blue and white	3-4 in.	Spring
<i>Waldsteinia fragari-oides</i> .....	White	3-6 in.	Spring

To these may be added the native species that grow naturally in America at elevations in excess of 1,500 feet, such as *Copis trifolia*, *Cornus canadensis*, *Clin-tonia borealis*, *Tiarella cordifol a*, *Trillium grandiflorum*, *Claytonia caroliniana*, *Dalibarda repens*, *Polemonium VanBruntiae*, various terrestrial habennarias, *Mitella nuda*, *Arenaria granlandica*, and many others.

The plants both for shaded and sunny situations will grow better if there is a liberal top-dressing of leaf-mold and sand, about half and half, applied each spring. It will be noted that all the plants listed in both lists are perennials. Most natural alpiners are of this type, the shortness of the growing season precluding the possibility of the full development of an annual.

For those who wish to go into the growing of alpiners more extensively, a partial list of the alpine genera together with an indication of the number of species that are to be found in the principal European trade catalogues is appended. Many additions will suggest themselves as the alpine gardener becomes better acquainted with those listed below and their relatives:

LIST OF THE CHIEF ALPINE GENERA.

The figures indicate approximately the number of species in each genus that are alpiners.

Achillea, 5.	Epimedium.	Pedicularis, 5.
Aconitum, 6.	Erigeron.	Petasites, 2.
Adenostyles, 2.	Eriophorum, 2.	Petrocallis.
Ethionema.	Eryngium.	Phaca, 4.
Aira.	Euphrasia.	Phleum, 2.
Ajuga.	Festuca, 2.	Phyteuma, 10.
Alchemilla.	Galium, 5.	Pimpinella.
Allium.	Gaya.	Pinus.
Allosurus.	Gentiana, 17.	Plantago, 3.
Alsine, 6.	Geranium, 3.	Poa, 5.
Alyssum, 2.	Geum, 3.	Polygala, 2.
Androsace, 7.	Globularia, 2.	Polygonum, 2
Anemone, 6.	Gnaphalium, 4.	Potentilla, 14.
Anthemis.	Gymnadenia.	Primula, 12.
Aposeria.	Hedysarum.	Ranunculus, 14.
Aquilegia, 3.	Hellebthemum.	Rhinanthus.
Arabis, 7.	Helleborus.	Ribes, 2.
Arctostaphylos, 2.	Hieracium, 10.	Rosa, 3.
Arenaria, 5.	Horminum.	Rubus.
Aretia.	Hieracium, 10.	Rumex, 3.
Armeria.	Hypericum.	Sagina.
Aronicum, 3.	Hutchinsia.	Salix, 12.
Artemisia, 4.	Iberis.	Saponaria.
Asplenium, 6.	Imperatoria.	Saussurea, 2.
Astrantia, 6.	Juncus, 6.	Saxifraga, 30.
Atragne.	Kobresia.	Scabiosa.
Azalea.	Laserpitium.	Scirpus.
Betonica.	Lasiagrostis.	Sedum, 7.
Braya, 2.	Leontodon, 4.	Selaginella, 2.
Bupleurum, 2.	Lilium.	Sempervivum, 5.
Calamintha.	Linnæa.	Semecio, 8.
Calluna.	Listera.	Sesleria, 3.
Campanula, 8.	Lonicera.	Sibbaldia.
Cardamine, 2.	Lomatogonium.	Silene, 6.
Carex, 20.	Luzula, 5.	Soldanella, 4.
Centaurea, 3.	Lychnis.	Sorbus.
Cerastium, 3.	Malaxis, 2.	Soyeria.
Cerinth.	Montia.	Stachys.
Cirsium.	Möhringia.	Stellaria.
Cropis, 5.	Myosotis.	Thalictrum, 6.
Crocus.	Myricaria.	Trifolium, 6.
Daphne.	Nardus.	Valeriana, 7.
Dianthus, 5.	Nigritella.	Veronica, 6.
Doronicum, 2.	Oxyria.	Viola, 5.
Draba, 6.	Oxytropis, 7.	Wulfenia.
Dryas.	Pæderota, 2.	
Epiobium, 4.	Papaver, 2.	

The literature on alpine-gardening, in English, is very meager. Any good book of the flora of high moun-tain regions,—and there are a dozen or more excellent



works on the flora of the Alps,—will aid in the way of suggesting new species that may be grown. A good but rather out-of-date book on the making and culture of alpine gardens is A. Kerner's "Die Cultur der Alpenpflanzen." A useful work containing many cultural hints is H. S. Thompson's "Alpine Plants of Europe, with Cultural Hints." The first International Congress of Alpine Gardens met at Naye, Switzerland, in 1904. As yet nothing except administrative reports of this convocation has been published.

N. TAYLOR.

**ALPÍNIA** (Prosper Alpinus, an Italian botanist). *Zingiberaceæ*. Stove herbs, cultivated both for leaves and the racemes or panicles of flowers.

Many-stld. leafy plants, with ginger-like rhizomes: fls. in spikes or panicles terminating the leafy sts., often showy; calyx wide-tubular or nearly bell-form, the tube short and the 3 points or parts erect; corolla of 3 parts; stamens reduced to 1 pollen-bearing organ, and 1 or more staminodia, one of the staminodia being showy and longer than corolla and notched or toothed: fr. a 3-celled caps.—About 150 species in Polynesia, Japan,

*tricolor*, Sand. St. erect: lvs. oblong-acuminate, 10 in. long,  $1\frac{1}{4}$  in. wide, green with white or creamy yellow stripes. Solomon Isl. G.C. III. 33:249 (suppl.).

AA. *Foliage green, not striped.*

**nùtans**, Roscoe (*Zerúmbet speciosum*, Wendl.). SHELL-FLOWER. Striking plant, reaching 10–12 ft., with long, lanceolate glabrous long-veined lvs.: fls. orchid-like, yellow with pink, sweet-scented, in a long, drooping, terminal, spike-like raceme. E. Indies. G.C. III. 19:301. I.H. 43, p. 259. B.M. 1903. P.M. 13:125. R.H. 1861:51.—Fine for foliage masses, and an old favorite. Said to grow 20 ft. high in S. Calif. in rich soil and with plenty of water, and to bloom continuously.

**mùtica**, Roxbg. Fig. 176. A handsome strong species: lvs. very short-stalked or sessile, long-lanceolate and pointed: fl. with large bright yellow lip veined crimson, the outer segms. oblong and white. *A. mutica*, Hook. f., B.M. 6908, is probably not the *A. mutica* of Roxburgh. E. Indies. Excellent free-flowering species.

**Allùghas**, Roscoe. Strong,  $3\frac{1}{2}$ –7 ft.: lvs. sessile or nearly so, lanceolate or linear-lanceolate, short-acuminate,  $1\frac{1}{2}$  ft. or less long, 3–4 in. broad: fls. small, crowded, greenish white, the lip cuneate, pink, emarginate. India. Spring.

**calcaràta**, Roscoe. Slender, 3–5 ft.: lvs. sessile, narrowly linear-lanceolate and attenuate-acuminate: fls. medium in size, greenish white, the lip variegated with red and yellow on a lighter ground. India. Fall.

Many kinds of these interesting ornamental plants are likely to find their way into choice collections. Some of them are as follows: *A. gigantèa*, Blume, reported in S. Calif., very tall, even to more than 20 ft., with very large nodding panicle.—*A. japonica*, once catalogued in U. S., but not known whether it was the *A. japonica* of Thunberg.—*A. longepetiolata*, coming from W. Trop. Afr., of robust habit, 6 ft.: lvs. elliptic, the uppermost linear, wing-petioled: fls. white or rose in terminal panicle, purple-spotted.—*A. magnifica*, Roscoe=*Phaëmeria magnifica*.—*A. Nieuwenhuisii*, Valet. (*A. borneensis*, Valet.), distinct species, 4–6 ft.: lvs. 2 ft. or less long: fls. purple-lipped, in panicles 12 in. long: fr. large. Borneo.—*A. officinarum*, Hance. Supplying the "radix Galangæ minoris" of pharmacists, once used as an aromatic stimulant by Arabs and Greeks: rhizome thick, creeping, the st. tuberous at base: lvs. narrowly lanceolate, long-acuminate: fls. white in simple spike, the lip red-nerved. China. B.M. 6995.—*A. pumila*, Hook. f. Lvs. from rootstock, 6 in. or less, on petioles 2–4 in.: fls. in short spike, 1 in. long, pink, the lip recurved, on a very short scape. China. B.M. 6832. *A. Schumanniana*, Valet. (*A. fimbriata*, Gagn.). 3–5 ft.: lvs. lanceolate, 18 in. long,  $1\frac{1}{2}$  in. broad: fls. purple in spikes, handsome. Formosa.—*A. zingiberina*, Hook. f. 4–5 ft.: lvs. oblanceolate, oblong, cuspidate, 12 in. or less long, 3 in. broad: fls. greenish, the lip white veined crimson, in panicles. Siam. B.M. 6944.

L. H. B.

**ALSEUÓSMIA** (*alsos*, grove, and *euosme*, fragrance). *Caprifoliaceæ*. A group of 4 species of tender New Zealand shrubs, usually glabrous. Lvs. alternate or opposite, with minute tufts of hair in the axils of the veins beneath: fls. fragrant, green or red, axillary, solitary or in clusters; corolla tubular or funnel-form: fr. a purple, many-seeded berry.—Perhaps not cult. outside botanic gardens.

*A. macrophylla*, A. Cunn. NEW ZEALAND HONEYSUCKLE. 6–10 ft.: lvs. 3–6 in. long, elliptic or oblanceolate, acute, serrate, or entire, petiolate: fls. in small axillary clusters, drooping,  $1\frac{1}{2}$  in. long, creamy with dull red streaks; corolla lobes recurved, toothed, the tube cylindric. B.M. 6951.

N. TAYLOR.

**ALSIKE**: Clover and *Trifolium*.

**ALSÏNE** (Greek for *grove*, where some species grow). *Caryophyllaceæ*. A few species of Alsine are in the market, mostly for rock-gardening. There is much difference among botanists as to the standing of the genus Alsine. Some persons refer it to *Arenaria*, others make it a tenable name to replace *Stellaria*, and Pax in Engler and Prantl's *Pflanzenfamilien* retains it for about sixty species, mostly in the temperate and cold parts of the northern hemisphere, and distinguishes both *Arenaria* and *Stellaria*; for the purposes of this *Cyclopedia* it seems to be desirable to follow the Index Kewensis disposition; and the few cultivated species are therefore accounted for under *Arenaria*.



176. *Alpina mutica*.

and E. India. Some of the cult. forms have undoubtedly been referred to *Alpinia* without knowledge of the botanical characters, and their botanical position is therefore doubtful. Monogr. in Engler, *Pflanzenreich*, hft. 20 (1904).

*Alpinia* contains many handsome species, but only a few are common in cultivation. They are tropical plants and require a moist air and a temperature of 55° to 60° F. A mixture of two parts loam, one part leaf-mold, and one part dried cow-manure forms an excellent compost. While growing, they need an abundance of water, and the large-growing kinds require large pots or tubs. After flowering, allow them to rest in heat, but do not dry them off. The plants are propagated by division in the spring. *A. nutans* is grown for its handsome flowers and attains a height of 12 or 13 feet. *A. vittata* is popular on account of its variegated foliage. *A. mutica* has very showy flowers, but is apparently little known in the trade. (Robert Cameron.)

A. *Foliage striped: plants of doubtful botanical position.*  
**vittata**, Bull (*Amònum vittatum*, Hort.). Lower: lvs. distichous, lanceolate, with pale green or creamy yellow bars or stripes between the nerves: fls. red, in axillary spikes. S. Sea Is. A.F. 8:787. Gn. 4, p. 25.

**álbo-lineàta**, Hort. A plant 3–4 ft. high, with broad bands of white and pale green on the elliptic-lanceolate lvs.

**Sánderae**, Sand. St. ascending: lvs. very short-stalked and 5 in. or less long,  $1\frac{1}{4}$  in. or less broad, tapering both ways, rich shining green, regularly and closely striped in broad bands of white leading from the midrib to the margin. New Guinea. G.C. III. 33:248 (suppl.). 1903. Probably a variegated form of *A. Rafflesiana*, Wall.

**ALSÓPHILA** (Greek, *grove-loving*). *Cyatheaceæ*. Tree ferns, grown in choice large conservatories, and in the open in warm countries.

Alsophilas have simple or forked free veins, round sori, and no indusia. Numerous species are found in the tropical regions of both hemispheres. The species of *Alsophila* are very similar in appearance to the tree ferns placed in the genus *Cyathea* and are probably not generically distinct.



177. Pinna of *Alsophila australis*

Of the different species of *alsophila*, only one is in general commercial use. *A. australis* is a very graceful and rapidly growing tree fern, with finely divided fronds of a pleasing shade of light green, with the stipes thickly covered with light brown, hairy scales. It is grown from spores, which can be obtained only from old and large specimens, and which, like the spores of most commercial ferns, will germinate very freely if sown on a compost consisting of finely screened soil, leaf-mold and sand in equal parts. To develop a good crown of fronds in old specimen plants which may look starved, the stem may be covered to any thickness consistent with good appearance with green moss, which may be attached with thin copper wire, and which, if kept continually moist, will soon be thickly covered with fine roots. *Alsophilas* should be grown in a temperature of 60° F., and the soil should never be allowed to become very dry. (Nichol N. Bruckner.)

*A. Lvs. bipinnate; rachises merely fibrillose.*

**Rebéccæ**, F. Muell. Lvs. ample, from 8 in. or so high; pinnae 12–15 in. long, with 20–30 pinnules on each side, which are 2–3 in. long and serrate or crenate throughout. Austral. G.Z. 28, p. 2.

**AA. Lvs. tripinnatifid or tripinnate; rachises armed with spines.**

**B. Segms. long, strongly curved; pinnules tapering to a slender point.**

**excélsa**, R. Br. Lvs. coriaceous, with more or less woolly rachises; pinnae 6–10 in. wide, with crowded pinnules, which are provided with about 20 pairs of segms. which are strongly curved and more or less enlarged at the ends. Norfolk Isl. and Austral.—Said to have a trunk 60–80 ft. high.

**Coöperi**, F. Muell. Smaller than the last: rachises with pale brown scales; pinnae spear-shaped, with linear pinnules 4–5 in. long. Queensland.

**lunulâte**, R. Br. Lvs. rather thick, herbaceous, from smooth rachises; pinnules close, 5–6 in. long, with 20–30 pairs of segms., which are finely serrate throughout.

**BB. Segms. ½ in. or less long.**

**austrâlis**, R. Br. Fig. 177. Rachises straw-colored; lvs. ample, with primary pinnae 18 in. long, 6–10 in. wide; pin-

nules deeply pinnatifid, with segms. broadest at the base, ovate-oblong and sharply serrate. Tasmania and Austral.

**fêrox**, Presl. (*A. aculeata*, J. Smith). Rachises brownish: pinnae 12–18 in. long; pinnules narrow, 3–4 in. long, ½–½ in. wide, with 15–18 pairs of segms. which are narrow and slightly serrate. Trop. Amer.

**AAA. Lvs. quadripinnatifid.**

**oligocârpa**, Fee. Fig. 178. Rachises smooth, grayish straw-colored; pinnules 1½–2 ft. long, the segms. ligulate, deeply pinnatifid, with blunt lobes; sori median, 4–6 on the lower lobes. Colombia.

*A. Baroûmba*, Hort. Recently intro. Not so elegant as *A. Loubetiana*, but of interest for its majestic dimensions. Congo Free State.—*A. congoensis*, Hort. Large, handsome fronds, with prominent yellow midrib: pinnae deeply and regularly cut.—*A. incana*, Hort. A magnificent tree fern with black spiny petioles. Congo. R.B. 34:172.—*A. Loubetiana*, Hort. A decorative tree fern with broad lvs.: rachis hairy brown. S.H. 4:453.

L. M. UNDERWOOD.

R. C. BENEDICT.†

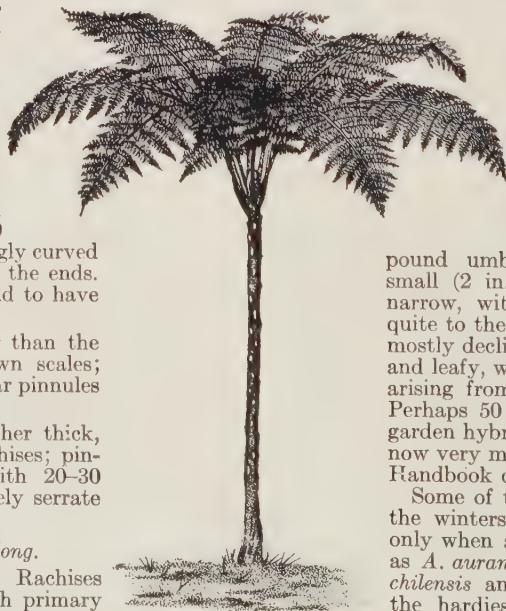
**ALSTÔNIA** (Dr. Alston, once professor of botany at Edinburgh). *Apocynaceæ*. Two trees of this genus are introduced in southern Florida and southern California for outdoor planting.

Corolla-tube cylindrical, usually swollen at the base, the parts spreading, usually twisted in the bud; anthers inclosed in the tube.—Between 30 and 40 species of trees or shrubs of E. India and Austral., with small white fls. in terminal cymes, and simple entire lvs. in whorls or opposite. *A. scholaris*, R. Br., is the devil-tree or pali-mara of India, the bark of which is medicinal. Trees yield caoutchouc.

**macrophýlla**, Wall. A tall tree, with milky juice: lvs. 6–12 in. long, 2½–3 in. wide, oblanceolate or elliptic-lanceolate, obtusely acuminate, nerves 16–20 pairs: cymes numerous, the fls. small; corolla-tube glabrous, the throat villous; ovary glabrous. Malaya.

**scholaris**, R. Br. Tree, 50–90 ft.: lvs. 4–8 in. long, 1–1½ in. wide, coriaceous, usually 4–7 in a whorl, obovate or elliptic-oblong, white beneath; with 30–60 veins: fls. pubescent, subcapitate, ovary hirsute. Wight Icones Ind. Or. 2:422. Rheede Hort. Malab. 1:45.—Intro. by Montarioso Nursery, Santa Barbara, Calif., in 1910. Tropics.

N. TAYLOR.†



178 *Alsophila oligocarpa*.

**ALSTREMERIA** (Baron Alstremer, friend of Linnæus). *Amaryllidaceæ*. **ALSTREMERIA**. Coolhouse and stove plants, with tuberous roots, treated as bulbs; and some of them also grown in the open for summer bloom.

Showy tall or slender plants with the red, purple or yellow blossoms in simple or compound umbels terminating the st.: fls. small (2 in. or less long), comparatively narrow, with 6 segms., parted nearly or quite to the ovary, often irregular; stamens mostly declined; stigma 3-cleft; sts. slender and leafy, weak, or even disposed to climb, arising from a root of thickened fibers.—Perhaps 50 species in S. Amer. There are garden hybrids. The alstremerias are not now very much grown. Monogr. by Baker, Handbook of the Amaryllideæ.

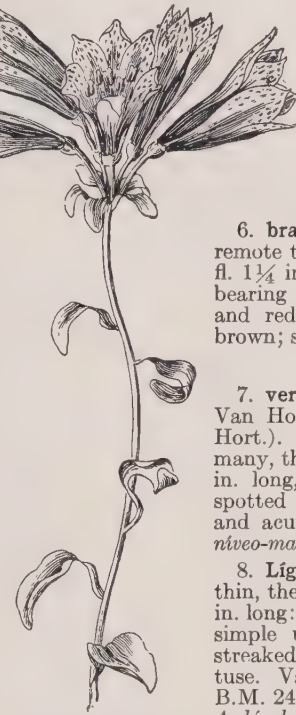
Some of the alstremerias have survived the winters in Washington of late years only when a heavy mulch has been given, as *A. aurantiaca* and its form *A. aurea*, *A. chilensis* and its forms. Evidently among the hardiest are *A. brasiliensis* and *A. pulchella*, although some of the others have



not been tried. For outdoor planting, alstroemerias are at their best in a partly shaded position, and at all times during their growth the roots must have an abundance of water. In fact, there is little use in attempting their cultivation out-of-doors when these conditions cannot be given.—In colder climates, the alstroemerias can be grown very successfully by planting out in spring, and, as soon as they die down, lift, and keep over winter in a place from which frost is excluded. An annual lifting, or, when grown in pots, an annual shaking-out, should be given, because they increase to such an extent that the younger and smaller crowns are apt to take the nourishment from the large flowering crowns. The largest ones ought to be separated from the smaller ones, and either grown in pots or planted outside when the proper time arrives. In this way the genus will become much more popular than it now is either for cutting or for the decoration of the border.—The best soil is largely composed of vegetable humus; when this is not to be had old well-decayed cow- or stable-manure should be incorporated with the soil. When they are planted outside, the tubers should be put deep in the ground, and the soil should be well worked for at least 15 inches. The tubers are slightly egg-shaped, attached to a common stem; the roots are from the ends of the tubers, and also from near the growing points of the crowns.—For greenhouse work one of the best is *A. Pelegrina* var. *alba*. The roots may be potted up in autumn in large pots, and treated as other tender late winter tuberous or bulbous plants are treated. See *Bulbs*. Some of the Van Houtte hybrids are extremely pretty, but, with the others, they are rather unsuitable for pot culture, owing to the peculiar formation of the roots.—The species are easily raised from seeds, which should be sown rather thinly in deep pans, and allowed to remain without pricking off or shifting for the first season; also by division of the roots. (G. W. Oliver.)

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179. *Alstroemeria pulchella*. ( $\times \frac{1}{2}$ )

A. Lvs. of fl.-st. (or scape) broad, oblong or oblong-spatulate.

1. *pulchella*, Linn. f. (*A. psittacina*, Lehm.). Fig. 179. Sterile st. a foot or less long, with aggregated petioled lvs.: flowering st. 2-3 ft., with scattered lvs.: fls. in a simple umbel, on pedicels 1-1½ in. long, long funnel-shaped, the segms. unequal, dark red and tipped with green and spotted inside with brown; stamens nearly as long as limb. Brazil. Fig. 179 is of the *A. psittacina*, B.M. 3033.—An old garden plant.

2. *chilensis*, Cree. CHILIAN LILY. Stout, 2-4 ft.: lvs. scattered, obovate or spatulate, or the upper becoming lanceolate, twisted at the base, fringed, somewhat glaucous: fls. large, rose or red (or varying to whitish), the two lower segms. longer and straighter; umbel with 5 or 6 2-fld. peduncles. Chile.

AA. Lvs. of fl.-st. lanceolate (at least the lower ones).

B. Fls. purplish or red.

3. *Pelegrina*, Linn. Fl.-st. stout, a foot or less high: lvs. about 30, thin, ascending, 2 in. or less long and ½ in. or less wide; fl. 2 in. or less long; lilac, the outer segms.

broad and cuspidate, the inner ones spotted red-purple: umbel few-rayed, normally simple, but becoming compound in cult. Also a pure white variety (*A. alba*, Hort.). *A. quillotensis*, Hort., is a robust cult. form. Chile. B.M. 139. Gn. 46, p. 472. L.B.C. 13:1295.

4. *hæmantha*, Ruiz & Pav. (*A. Simsii*, Spreng.). Fl.-st. 2-3 ft.: lvs. crowded and thin, somewhat stalked, 3-4 in. long and ¾ in. or less wide, the upper becoming linear, glaucous beneath: fls. 2 in. or less long, bright red tipped green, the inner ones with red-purple spots on a red-yellow ground; umbel very compound, the branches 4-6 in. long. A white-fl. variety is cult. Chile. B.M. 2353 (as *A. pulchella*).

BB. Fls. yellow or yellowish.

5. *aurantiaca*, Don (*A. aurea*, Hort.). Fl.-st. 2-4 ft. high: lvs. nearly 50, thin, somewhat petioled, slightly glaucous below, 3-4 ft. long and ½ in. wide: fls. 10-30, in a compound umbel, the perianth bright yellow, outer segms. tipped green and inner ones spotted brown.—There is a form with pale, unspotted fls. Chile. B.M. 3350 (as *A. aurea*). Gn. 26: 540. *A. lutea*, Hort., is probably a form of this species.

6. *brasiliensis*, Spreng. St. 3-4 ft.: lvs. remote thickish, oblong-lanceolate, 2 in. long: fl. 1¼ in. long, in a 5-rayed umbel (each ray bearing 1-3 fls.), the segms. oblong-spatulate and reddish yellow, the inner ones spotted brown; stamens shorter than segms. Brazil.

AAA. Lvs. of fl.-st. linear.

7. *versicolor*, Ruiz & Pav. (*A. peruviana*, Van Houtte. *A. sulphurea* and *A. tigrina* Hort.). Fl.-st. short (1 ft. or less high): lvs. many, the lower ones about 1 in. long: fls. 1 in. long, in a nearly simple umbel, yellow spotted purple, the segms. all oblanceolate and acute. A marginate 1-fl. form is var. *niveo-marginata*. Chile.

8. *Ligtu*, Linn. Fl.-st. 1½-2 ft.: lvs. 20-30, thin, the lowermost becoming lanceolate, 2-3 in. long: fls. 1½ in. long, in a nearly or quite simple umbel, whitish, lilac or pale red, streaked purple, the inner segms. often obtuse. Var. *pulchra*, Baker (*A. pulchra*, Sims, B.M. 2421. *A. Flös-Martini*, Ker, B.R. 731. *A. bicolor*, L.B.C. 15:1497), has narrower and longer lvs., and all the segms. acute or cuspidate. Chile. Common and variable in cult.

*A. Hookeri*, Lodd., is a form of *A. Ligtu*. The *A. Ligtu* of B.M. 125 is *A. caryophyllacea*, Jacq., with long-clawed, very unequal segms. in two sets or lips, red and red-striped. Brazil.

9. *violacea*, Phill. St. 1-2 ft.: lvs. scattered and spreading, 1 in. or less long, those on sterile shoots larger, ovate-oblong and 5-nerved: fls. on forked pedicels in a 5-rayed umbel, 1½-2 in. long, bright lilac, the outer segms. obovate, truncate and with a short cusp, the inner oblong-acute, spotted. Chile.

10. *revoluta*, Ruiz & Pav. Fl.-st. 1 ft. or more: lvs. crowded, linear, 1½ in. or less: fls. 6-12, purplish, ¾ in. or less, the segms. oblanceolate-clawed, reflexed or spreading from the middle in full bloom, the inner segms. yellowish and spotted. Chile. L. H. B.

ALTAMIRANO (named for Dr. F. Altamirano, late Director of the Instituto Medico Nacional, of the City of Mexico). *Crassulaceæ*. Low, much-branched perennials with the habit and foliage of *Sedum*, but with the petals united into a distinct tube. On account of the tubular fls., some of the species were first described

as Cotyledon, with which they have little else in common. None of the species is especially attractive, but all of them develop at the base or on the branches curious rosettes of lvs. Twelve specimens are known, of which 5 have been grown in Washington greenhouses and the New York Botanical Garden. *A. elongata*, Rose, has puberulent sts. and lvs. and white fls.; *A. calcicola*, Rose, is more or less glaucous, with turgid lvs. and greenish-yellow fls.; *A. Göldmanii*, Rose, is glabrous, with linear lvs. and pale yellow fls.; *A. Bâtesii*, Rose, is glabrous, with linear lvs. and fls. purplish or becoming so; *A. scopulina*, Rose, is glabrous, with linear lvs. and pure white fls. J. N. ROSE.

**ALTERNANTHERA:** *Telanthera*.

**ALTHÆA** (Greek, *to cure*). *Malvaceæ*. Tall annual, biennial or perennial herbs, grown in the open garden. The flowering shrubs known as altheas are forms of *Hibiscus syriacus*.

Flowers axillary, solitary, or racemose in the axils or at the summit of the st., with 6-9 bracts below the calyx, but otherwise as in Malva.—About 15 species in the temperate regions of the world.

*officinalis*, Linn. **MARSH MALLOW**. Fig. 180. Erect, 3-4 ft., downy: lvs. ovate, often heart-shaped or 3-lobed, frequently undivided, tomentose: fls. 1 in. across, bluish or rose, clustered in the axils of the lvs. Perennial,



180. *Althæa officinalis*. (Plant  $\times \frac{1}{10}$ ). Marsh Mallow.

in marshes. E. Eu., and occurring in this country as an escape.—Root used for mucilage and for other purposes; also medicinal. The root of commerce has its brown outer covering removed. Rarely cult., but occasionally escaped in marshes near the coast.

*rosea*, Cav. **HOLLYHOCK**, which see for culture. St. strict and spire-like, hairy: lvs. large and rough,

rounded-heart-shaped, wavy-angled or lobed: fls. large and nearly sessile, in a long wand-like raceme or spike, in many forms and colors. Biennial. China. B.M. 3198.

*ficifolia*, Cav. **ANTWERP HOLLYHOCK**. Biennial, 3-6 ft.: lvs. 7-lobed, toothed: fl. lemon-yellow or orange, large, in terminal spikes, showy, single or double. Eu.—Grown in Calif.

*cannabina*, Linn. Perennial, 5-6 ft., branching: lvs. digitately 5-parted, upper ones 3-parted, the lobes narrow and strongly toothed: fls. not large, rose-colored, on many-fld. axillary peduncles that are longer than the lvs. Eu.—Grown sometimes as a border plant. It yields a fiber.

L. H. B.

**ALUM - ROOT:**  
*Heuchera*.

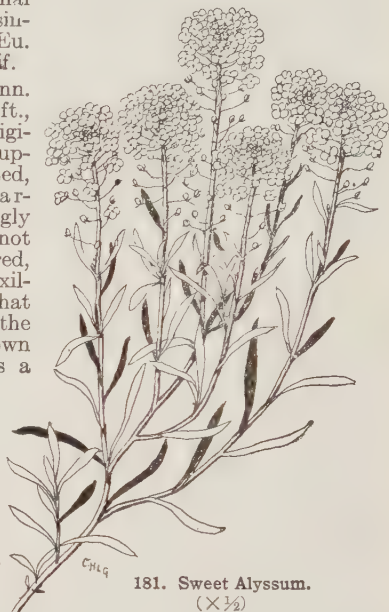
**ALÝSSUM**  
(classical name).

*Crucifæræ*. Low plants with many small clustered flowers, grown in the open and often used in rock-gardens.

Plants branching, often tufted: fls. white or yellow, sometimes varying to rose; filaments often notched: fr. a small orbicular pod, with 1 or 2 wingless seeds in each of the 2 compartments; valves of pod nerveless, flattened at the margins.—As many as 100 species in middle Eu., Medit. region and the Caucasus.

The sweet alyssum is one of the commonest annuals, grown both in the open and forced in benches, beds or pots. It is of the easiest culture, either indoors or out. The compact varieties are most prized for pot culture. Under glass, it requires temperature of a carnation house. It will stand considerable frost in the open, and may be sown early; it blooms all summer, and until killed by winter. Useful for window-gardens and baskets. For winter bloom, sow seeds late in August or in September. When blooms begin to fail, cut back the plant, and it will bloom again.

The perennial alyssums require no special treatment. They are usually propagated by dividing the roots; also by cuttings and seeds.



181. Sweet Alyssum.  
( $\times \frac{1}{2}$ )

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A. Fls. white; annuals or perennials.

1. *maritimum*, Lam. (*A. odoratum*, Hort.). **SWEET ALYSSUM**. Fig. 181. A low, spreading, light green annual, with lanceolate or linear entire lvs., tapering to the base, and small honey-scented fls. in terminal clusters, which become long racemes. Eu. Many cult. vars.: var. *Benthamii* or *compactum*, a dwarf and compact form, not over 6 in. high; var. *variegatum*, with pale white-edged lvs.; var. *giganteum*, robust, broad-lvd.; var. *procum-*



bens, of spreading habit; and various horticultural forms with trade names.

2. *spinosum*, Linn. A woody-stemmed little perennial, with lanceolate acute silvery lvs., spiny fl. branches, and very small numerous fls. Eu.—Rockwork; 3–6 in. A rose-colored form is reported.

3. *pyrenæicum*, Lapeyr. Dwarf, shrubby, not spiny: lvs. obovate, tomentose: fls. white with brown anthers. Pyrenees. Perennial.

4. *podolicum*, Bess. (*Schivereckia podolica*, Andr. & Bess.). Dwarf: lvs. in rosette, lanceolate, 2-toothed on margins: fls. white, short-pedicelled; petals entire. Early spring. S. Russia. Perennial.

AA. Fls. yellow or orange: perennials.

B. Lvs.  $\frac{1}{2}$  in. or less long.

5. *serpyllifolium*, Desf. (*A. alpestre*, Linn.?). Dwarf (3–4 in. high), somewhat woody at the base, with rough-hoary lvs., and pale yellow fls. in racemes. Eu. Intro. 1892.

BB. Lvs. mostly 1 in. or more long.

6. *saxatile*, Linn. GOLDEN-TUFT. Fig. 182. A foot high, woody at base: lvs.

oblongate or ovate-lanceolate, entire or wavy, hoary-tomentose: fls. golden yellow, numerous, in little compact clusters. Eu. B.M. 159. A.F. 5:37.—Common in rockwork, making a spreading mat, blooming in early spring. There are many forms of this standard rock plant. Var. *compactum*, Hort., dwarf. Var. *florè-plèno*, Hort., double-fl. Var. *variegatum* Hort. (*A. variegatum*, Hort.), has parti-colored foliage, very attractive.

7. *gemonense*, Linn. Less hardy than the last: lvs. lanceolate, grayish, velvety: fls. lemon-yellow: st. woody at base. Eu.

8. *rostratum*, Stev. (*A. Wierzbickii*, Heuff.). About 20 in.: lvs. 2 in. long, broad-oblong, pointed, hairy: fls. deep yellow, in dense heads, in summer. Asia Minor.

9. *argenteum*, Vitm. Fig. 183. Dwarf and dense grower, 15 in. or so: lvs. oblong or spatulate, silvery beneath, some of the tufted fls. yellow, in clustered heads, all summer, beginning later than those of *A. saxatile*. Eu.

10. *montanum*, Linn. Tufted alpine, 2–3 in. high, more or less herbaceous, pubescent: lvs. obovate: fls. yellow, fragrant, in a simple raceme. Eu.

11. *Moellendorffianum*, Asch. Sts. ascending: lvs. with stellate hairs on both sides, from spatulate to subovate, obtuse: fls. yellow, in elongated many-fl. racemes, the pedicels nearly horizontal and bractless: fr. nearly orbicular. Bosnia.

Many other species of *Alyssum* are likely to be found in choice rock-garden collections. *A. alpestre*, Linn. 3 in., grayish: fls. yellow, in simple raceme.—*A. atlanticum*, Desf.=*A. montanum*.—*A. Bertholdii*, Desv.=*A. argenteum*.—*A. cuneifolium*, Tenore=*A. montanum*.—*A. dasycarpum*, Steph. Annual: fls. yellow.—*A. diffusum*, Tenore=*A. montanum*.—*A. macrocarpum*, DC. Shrubby, somewhat spiny, 8 in.: lvs. oblong, silvery: fls. white.—*A. orientale*, Ard. 1 ft.: lvs. lanceolate, toothed, downy: fls. yellow, in corymbs.—*A. tortuosum*, Rupr. 6 in., st. twisted: lvs. narrow, hoary: fls. yellow, in corymbs.

L. H. B

ALÝXIA: *Gynopogon*.

AMAGLÝPTUS: *Hemiraphis*.

AMANITA: *Mushroom*.

AMARABÒYA (native name). *Melastomaceæ*. A genus of only 3 species of tender shrubs from Colombia, which are showy both in foliage and flower. Lvs. large, opposite, sessile, with 3 prominent nerves, brownish red beneath: fls. large, cymose; petals usually 6; stamens 12–15. For cult., see *Pleroma*. Not known to be in American trade. Considered by some as a section of the much larger genus *Blakea*.

*A. amabilis*, Linden. Lvs. 10–12 in. long, 8 in. broad: fls. white, margined carmine; stamens white; style red, exserted. I.H. 34:9. —*A. princeps*, Linden. Fls. carmine; stamens white; styles white. I.H. 34:4. —*A. splendida*, Linden. Fls.  $6\frac{1}{2}$  in. across; petals narrower at the base than in the other species; stamens yellow; style red, exserted. I.H. 34:34.—Perhaps the showiest of all the *Melastomaceæ*.

N. TAYLOR.†

AMARÁNTUS (Greek, *unfading*, in allusion to the lasting character of the calyx and floral bracts). *Amarantaceæ*. AMARANTH. Coarse annual plants, grown for colored foliage and the showy flower-clusters; related to the cockscomb.

Plants tall and erect or spreading or even prostrate: lvs. alternate, entire, petioled: fls. very small congested in terminal or axillary spikes or glomerules, each fl. subtended by 3 chaffy bracts; petals 0; sepals 3–5, persistent; stamens 2–5: fr. a small 1-seeded utricle.—Some 45–50 species, mostly weedy plants, widely distributed. Some of the pigweeds are of this genus, as *A. retroflexus*, sometimes known as beet-root and red-root; *A. hybridus*; *A. græcizans* (*A. albus*), one of the tumble-weeds; *A. spinosus*; *A. blitoides* and *A. Palmeri*, spreading eastward along railroads.

The amarantus are usually planted as open-air annuals, and they require no special treatment. They thrive best in a hot and sunny place. In very rich soil the leaves become very large but usually lack in bright coloring. Seeds may be sown in the open or in frames. The dwarf and compact varieties, which often have beautifully variegated foliage, may be grown in pots or used for bedding. Give plenty of room.

A. Lvs. linear-lanceolate, long and drooping.

*salicifolius*, Veitch. Graceful pyramidal habit, 3 ft.: lvs. 5–8 in. long and  $\frac{1}{4}$  in. wide, wavy, bronze-green, changing to orange-red. Philippines. G. C. I. 1871: 1550. F.S. 19:1929.

AA. Lvs. broad, mostly ovate.

B. Spikes drooping.

*caudatus*, Linn. LOVE-LIES-BLEEDING. Fig. 184. Tall, robust and diffuse (3–5 ft.): lvs. ovate to ovate-oblong,

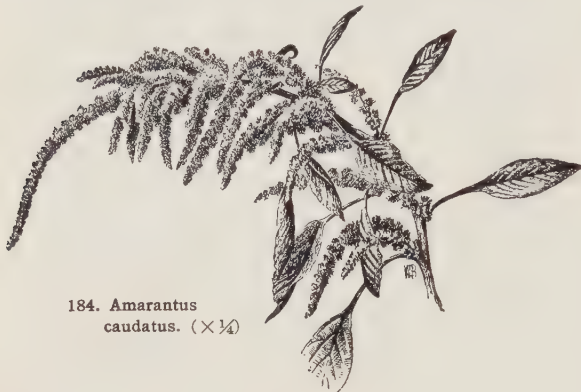


183. *Alyssum argenteum*. (Plant  $\times \frac{1}{2}$ )



182. *Alyssum saxatile*. ( $\times \frac{1}{4}$ )

stalked, green: spikes red, long and slender, naked, in a long and drooping panicle, the terminal one forming a long, cord-like tail. Also vars. with yellowish and whitish panicles. Tropics. G.W. 6:709.—Common, and an old favorite. Var. *atropurpureus*, Hort. Foliage blood-red. Var. *albiflorus*, Hort. Spikes white or greenish white. Var. *gibbosus*, Hort. Plant not large: fls. red, clustered in more or less separated fascicles or heads.



BB. Spikes erect.

*hypochondriacus*, Linn. PRINCE'S FEATHER. Tall and glabrous: lvs. oblong-lanceolate, acute: spikes blunt, aggregated into a thick, lumpy terminal panicle, of which the central part is elongated: bracts long-awned.—An old garden plant, with the heavy heads variously colored, but mostly purple. Lvs. usually purple or purple-green. Trop. Amer. Cult. in many forms and sometimes a weed in old grounds. Considered by some to be a form of *A. hybridus*, Linn. (*A. hybridus* var. *hypochondriacus*, Rob.). Var. *sanguineus*, Hort. (*A. cruentus*, Hort., not Willd.). Entire plant blood-red. Var. *virescens*, Hort. Lvs. green above, purplish beneath. Var. *viridis*, Hort. Plant green, except the floral parts. Var. *racemosus*, Moq. Lateral fl.-branches elongated, light-colored. There are other garden forms.

*paniculatus*, Linn. (*A. hybridus* var. *paniculatus*, Uline & Bray). St. usually pubescent: lvs. oblong-ovate to ovate-lanceolate, broader than in the last: spikes thinner than in the last, acute or acutish, and in an open, more graceful terminal panicle: bracts sharp-pointed but not long-awned. Trop. Amer.—Common, and sometimes a weed. Var. *speciosus* (*A. speciosus*, Sims, B.M. 2227). Stout, large, erect plant (3½–4½ ft.), with sts. and lvs. reddish or purple-green: panicle dark red-purple; handsome. Var. *cruentus*, Moq. (*A. cruentus*, Linn., not Hort.). Lateral fl.-branches spreading-nodding, blood-red. Var. *sanguineus*, Moq. Lateral branches long, slender, often nodding at the tip: fls. and some or all the lvs. blood-red. Var. *flavescens*, Voss. Panicles large and branched, yellowish or greenish.

*gangeticus*, Linn. Usually a lower plant, 3 ft. or less and often only 1 ft., with thin, ovate-pointed lvs., and fls. in short, glomerate, interrupted spikes, both terminal and axillary. Tropics.—Very variable. Cult. by Amer. Chinese (Fig. 185) as a pot-herb under the name of hon-toi-moi, with green lvs. (Bailey, Bull. 67, Cornell Exp. Sta.). Various dwarf and compact bedding forms are common. Used more for foliage than for fl.-panicles. Var. *melancholicus*, Voss (*A. melancholicus*, Linn.). Lvs. variously colored, sometimes mostly in two colors (*A. bicolor*, Hort.), and also in three colors (*A. tricolor*, Hort.): lvs. long-petioled, broadly to narrowly lanceolate. Here belong the JOSEPH'S COAT group of the bedding amaranths.

Many Latin-form names are in the catalogues, probably all of which are referable to above species or are hybrids of them: as *A.*

*splendens*, a form of *A. gangeticus* var. *melancholicus*; *A. speciosus aureus*, to *A. paniculatus* var. *flavescens*; *A. Héndert*, probably a hybrid with *A. salicifolius*, or a var. of it, with long-drooping, brown lvs., and tall, pyramidal stature; *A. Górdonii*, or Sunrise, with bronzy banded lvs. and brilliant scarlet lvs. on top; *A. superbus*, lvs. blood-red above and crimson beneath, probably one of the melancholicus forms; *A. Dissii*, Spreng., with lvs. and fls. bright colored, and suggested as a var. of *A. spinosus*, which is a smooth weedy species with 2 spines in the axils of the narrow-ovate or rhomb-ovate lvs. —*A. Huttonii*, Veitch=Celosia. L. H. B.

**AMARYLLIS** (classical name). *Amaryllidaceæ*. Summer- or autumn-blooming bulbous plant (March and Apr. at the Cape), the leaves usually appearing later.

Plant stout, producing many strap-like lvs.: fls. large, fragrant in a few- to several-fl. umbel; perianth with a short ribbed tube, the divisions oblong or lanceolate, the filaments distinct and no scale between them; stamens on the throat of the tube: fr. a globose caps., opening irregularly.—One species, from Cape of Good Hope. In gardens, the hippeastrums (winter and spring bloomers) are known as Amaryllis.

In dealing with the culture of amaryllis, it is customary to speak of the genus in its horticultural sense,—to include hippeastrum and related things. Such is the understanding in the following cultural directions. There are two widely differing methods of cultivating the amaryllis to produce showy flowers in the spring months,—the border method and the pot method. Any one trying both of these methods will soon come to the conclusion that they differ not only in method, but in flower-producing results. The first method is to plant the bulbs in a prepared border after they are done flowering, say about the middle of May. The border should have perfect drainage, and, if convenient, be on the south side of a house or wall, fully exposed to the sun during the greater part of the day. The bulbs are set out in rows, necessarily with as little disturbance of the roots as possible, because, if they are bulbs that have undergone similar treatment the previous year, by the middle of May they have made a considerable number of new roots; besides, the foliage also has gained some headway, and may be considered as in actual growth. In planting, carefully firm the soil around the old balls, give one watering, and on the succeeding day, after the surface of the soil has been raked over, cover to the depth of 2 inches with half-decayed cow-manure. With frequent waterings during the summer and the removal of weeds, they will need no more attention until the approach of cool weather, when they should be lifted, sized, and potted; however, at this season, if wet weather has predominated, some of the bulbs will be in a semi-dormant state, while the majority will yet be in active growth. Here is the drawback to this method: The roots are large and fleshy, they



185. Amaranthus gangeticus. (X 1/4)

take up considerable room in a 6- or 7-inch pot, and the soil cannot be evenly distributed amongst them, neither can it be made as firm as it should be. The result is the partial decay of the roots and leaves, and in the spring, when the flower scapes appear, they are developed at the expense of the bulb, through having insufficient roots to take up nourishment from the soil. The flowers are small, few in number, and do not show what the plant is capable of. Partly to ameliorate these



conditions, the bulbs in active growth at lifting time may be heeled-in on a greenhouse bench until they gradually ripen, taking care that some of the soil is retained on the roots; otherwise the ripening process is altogether too rapid, so that the roots and leaves suddenly lose their robust nature, become flabby, and eventually die. For this method, it can be said that a larger number of bulbs can be grown with less trouble than by the pot method, but neither bulbs nor flowers compare in size with those kept in pots the year round. For the purpose of merely increasing stock, the outdoor method is to be preferred.—Most of the kinds are naturally evergreen; potting under those conditions is best done either after the plants have made their growth in the fall or after they have finished flowering in April. When done in the fall, they are allowed to remain rather dry during the winter; this will keep the soil of the original ball in a sweet condition until the time arrives to start them into growth, which may be anywhere after the first of January, or even earlier if necessary. They will winter all right, and keep their foliage, in a brick frame in which the temperature is not allowed to fall below 45° F. By the beginning of February, in a structure of this sort, they will be showing flower-scapes, and should then be taken to a position in which more heat and light can be given. A weak solution of cow-manure will much help the development of the flowers. When in bloom, a greenhouse temperature, with slight shade, will prolong the flowering period. After flowering, the greatest care should be taken of the plants, as it is from that period till the end of summer that the principal growth is made. A heavy loam, enriched with bone-dust and rotted cow-manure, suits them well.—The seeds of *hippeastrums* should be sown as soon as ripe, covered very lightly with finely sifted leaf-mold, and, if this shows a tendency to dry too quickly, cover with panes of glass until germination takes place. As soon as the first leaves are developed, they should be potted in the smallest sized pots and kept growing.—In the propagation of varieties, it will be found that the large bulbs make two or more offsets each season; these should not be detached until it is certain that they have enough roots of their own to start with after being separated from the parent. If a well-flowered specimen clump is desired, the offsets may be allowed to remain attached to the parent; they will, in most cases, flower the second year under generous treatment.—*Amaryllis Belladonna* and the plant known as *A. longifolia* (really a *crinum*) are hardy in the District of Columbia; *A. longifolia* thrives even in damp, heavy soils, with no protection, and flowers abundantly each year. *A. Belladonna* needs a warm, sheltered spot, with deep planting. This popular autumn-blooming plant succeeds best where it can remain out-of-doors all the year. It seems to thrive in fairly rich sandy loam. A position facing south near the wall of house or by the side of a greenhouse seems to suit its requirements. In rather dry soils where frost does not penetrate deeply, it is not necessary to lift the tubers each year. (G. W. Oliver.)

**Belladonna**, Linn. **BELLADONNA LILY**. Fig. 186. Scape 2-4 ft., with a 2-lvd. dry spathe or involucre just underneath the umbel: fls. on short pedicels, lily-like, short-tubed, and flaring, with pointed segms. 2-3 in. long, and 6 deflexed stamens, fragrant, normally rose-red; scape solid: lvs. strap-shaped, canaliculate and acute. B.M. 733. Gn. 33:268; 47, p. 46; 49, p. 276; 54, p. 414. G.C. III. 24:315.—An old favorite, with many Latin-named garden forms. There are varieties ranging from white to red, and varying in shape and size of fls., many of them receiving Latin descriptive names. Var. *purpurea*, Hort. Fls. purple, at least on the limb. Var. *pallida* (*A. pallida*, Red.), has pale flowers. Var. *blanda*, Voss (*A. blanda*, Gawl. B.M. 1450), is a large form, with white fls., fading to blush. Var. *rosea perfecta*, Hort. Excellent blooms, satiny rose and white-

striped: fls. late, at the time the lvs. appear; the segms. pointed. Gt. 45, p. 443. Var. *spectabilis tricolor*, Hort. Fls. showy, in large umbels, rose-color, white inside, highly perfumed. Gt. 45, p. 358. Var. *máxima*, Hort. Strong grower, with many large rose-colored fls. G.M. 45:303. Var. *Párkeri* (*A. Párkeri*, Hort.). Probably hybrid of *Brunsvigia Josephinæ* and *Amaryllis Belladonna*: umbel circular, with as many as 30 blooms; fls. deep rose with white and orange at base inside, and orange on outside of tube: 3 ft., handsome: also a white-fl'd. form. G.C. III. 50:211. Gn. 75, p. 460.

See *Brunsvigia* for *A. gigantea* and *A. orientalis*; *Crinum* for *A. longifolia* and *A. ornata*; *Hippeastrum* for *A. alvica*, *A. equestris*, *A. fulgida*, *A. Johnsonii*, *A. Leopoldii*, *A. pardina*, *A. procea*, *A. Regina*, *A. reticulata*, *A. vittata*; *Lycoris* for *A. aurea*, *A. Hallii*, and *A. radiata*; *Nerine* for *A. Nerine*; *Sprekelia* for *A. formosissima*; *Sternbergia* for *A. lutea*; *Vallota* for *A. purpurea*; *Zephyranthes* for *A. Atamasco*, *A. candida* and *A. erubescens*. The following trade names probably belong to other genera, most likely to *Hippeastrum*: *A. crocea*, *A. Graveana*, *A. macrantha*, *A. refulgens*. L. H. B.

**AMASÓNIA** (after Thomas Amason, early American traveler). *Verbenacæ*. About a half-dozen species of under-shrubs of Trop. Amer. Fls. yellow or sulfur-colored in racemose or paniculate clusters; calyx 5-cleft; corolla 5-cleft, almost 2-lipped. May be treated as warmhouse species of *Clerodendron*.

**calycina**, Hook. f. (*A. punicea*, Hort. not Vahl. *Taligalea punicea*, Hort.) Lvs. 6-12 in. long, elliptic, acuminate, coarsely irregularly toothed or sinuate, glabrous, except the floral ones: fls. 1½-2 in. long, drooping; calyx nearly 1 in. long, red. B.M. 6915. Gn. 27:130. R.B. 20:13.

*A. erecta*, Linn. A slender, sparingly branched shrub: lvs. alternate and whorled, 4-5 in. long, oblong, crenate-serrate, dark green above, paler beneath: fls. white, racemously paniculate; bracts scarlet. Guiana.

N. TAYLOR.†



186. *Amaryllis Belladonna*.

**AMBRÓSIA** (a classical name). *Compositæ*. About fifteen species of weedy evil-smelling herbs, mostly American. The common ragweed is *A. artemisiæfolia*, Linn. The kingweed of western wheatfields, and also of low waste places, is *A. trifida*, Linn. Probably none is cultivated, the listed *Ambrosia mexicana* probably being of some other genus, very likely an *artemisia*.

**AMBROSÍNIA** (*Giacinti Ambrosini*, an Italian). *Aracææ*. A dwarf perennial tuberous herb of Italy and Algeria.

Spathe boat-shaped, lying on the earth, the mouth gaping; spadix included: fr. a many-seeded berry.—Half-hardy; planted in the open or in pots, and blooming in the fall. A single species.

**Bássii**, Linn. Three or 4 in.: lvs. 2 or 3, overtopping the spathe, the lf.-blade ovate or ovate-elliptic, obtuse, often retuse: spathe ¾ in. long, tipped with a brown tail, divided lengthwise, the anthers being in one compartment (which has a hole to admit insects), and the solitary ovary in the other, thus preventing automatic close pollination. B.M. 6360.—There is a narrow-leaved form (var. *angustifolia*, Guss.), a spotted-leaved form (var. *maculata*, Engler), and a form with pale green reticulations (var. *reticulata*, Engler). Propagation is by seeds started inside or in frames, or by division in spring.

L. H. B.

**AMELANCHIER** (said to be a Savoy name). *Rosa-ceæ*. SHAD-BUSH. JUNE-BERRY. Ornamental woody subjects chiefly cultivated for their profuse white flowers appearing in early spring; some species also grown for their fruits.

Deciduous shrubs or small trees: winter-buds conspicuous, pointed, with several imbricate scales: lvs. alternate, petioled, serrate: fls. in racemes terminal on short branchlets, rarely solitary; calyx-tube campanulate, adnate to the ovary, with 5 persistent lobes; petals 5; stamens 10-20; styles 2-5; ovary inferior, 2-5-celled, each cell with 2 ovules and subdivided: fr. a berry-like pome, juicy, with a cavity at the top.—About 20 or 25 species, most of them in N. Amer., 2 in Mex., 4 in Eu., and W. Asia, and 1 in E. Asia. The species are closely related and often difficult to distinguish,



187. *Amelanchier alnifolia*.  
( $\times \frac{1}{2}$ )

especially as numerous spontaneous hybrids apparently occur. For a detailed treatment of the species of E. N. Amer., see Wiegand in *Rhodora* 14, p. 117 (1912). In trade catalogues, they are sometimes confused with *Aronia*, which is easily distinguished by its compound corymbose infl., 5-celled mealy fr. and by the midrib of the lvs. being glandular above.

The amelanchiers are deciduous shrubs or trees with simple, suborbicular to oblong serrate leaves, rather small white flowers in racemes followed by purplish or bluish black berry-like fruits. They are very desirable for ornament, producing a profusion of white flowers in early spring, and range from shrubs only a few feet high, as *A. humilis* and *A. stolonifera*, to trees attaining 40 feet in height, as *A. canadensis* and *A. laevis*. The latter species is perhaps the most beautiful, the white color of the pendulous loose racemes being enhanced by the red bracts and the bronzy red color of the unfolding leaves; the other species are pure white when blooming, the young leaves being covered by a whitish tomentum.

*A. humilis* and *A. stolonifera* and also *A. sanguinea* seem to be the best for fruit, which ripens later than the others; there is also a large-fruited form of *A. laevis*. See *Juneberry*.

All the species mentioned below are hardy North and thrive upon a variety of soils and succeed well in dry climates; some, as *A. sanguinea*, *A. humilis* and *A. rotundifolia* show a preference for calcareous soil and grow well in dry situations, while others, as *A. oblongifolia* and *A. Bartramiana* prefer moist and swampy soil.

Propagation is by seeds sown soon after ripening or stratified and sown in spring and the stoloniferous species also by suckers; rare kinds are sometimes budded in summer on a common species or on *Crataegus*.

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<i>alnifolia</i> , 4.	<i>grandiflora</i> , 2.	<i>oxyodon</i> , 4.
<i>Amelanchier</i> , 1.	<i>humilis</i> , 3.	<i>pumila</i> , 4.
<i>arguta</i> , 11.	<i>japonica</i> , 8.	<i>rotundifolia</i> , 1, 2.
<i>asiatica</i> , 8.	<i>laevis</i> , 10.	<i>sanguinea</i> , 2.
<i>Bartramiana</i> , 11.	<i>oblongifolia</i> , 7.	<i>sinica</i> , 8.
<i>Botryopium</i> , 7, 9.	<i>obovatis</i> , 7.	<i>spicata</i> , 2, 3, 5, 6.
<i>canadensis</i> , 2, 4, 7,	<i>oligocarpa</i> , 11.	<i>stolonifera</i> , 5.
8, 9, 10.	<i>ovalis</i> , 1, 5, 6.	<i>vulgaris</i> , 1.
<i>florida</i> , 4.		

A. Fls. in racemes: lvs. folded in bud; petioles slender.

B. Styles free, very short, not exceeding the calyx-tube.

1. *rotundifolia*, Dum.-Cours., not Roem. (*A. Amelanchier*, Sarg. *A. vulgaris*, Moench. *A. ovalis*, Medikus, not Borkh.). SERVICE-BERRY. Upright or spreading, rather stiff-branched shrub, 2-8 ft.: young branchlets tomentose: lvs. oval to obovate, serrate from near the base, subcordate at the base, usually rounded at the apex, 1-2 in. long, woolly beneath when young: racemes many-fl.; petals linear-oblongate, obtuse or emarginate: fr. bluish black, bloomy. May; fr. in Aug., Sept. Cent. and S. Eu. B.M. 2430. H.W. 3, p. 87. G.C. II. 9:793. M.D.G. 1900:497 (habit). J.H. III. 54:395.

BB. Styles more or less connate at the base, about as long as the stamens.

C. Teeth of lvs. about  $\frac{1}{4}$ - $\frac{7}{8}$  in.; lvs. rather coarsely serrate; veins usually straight and close together.

D. Apex of lvs. acute or acutish; blade densely woolly beneath when young.

2. *sanguinea*, DC. (*A. rotundifolia*, Roem., not Dum.-Cours. *A. canadensis* var. *spicata*, Sarg., in part. *A. spicata*, Rob. & Fernald, not Koch). Slender shrub: sts. solitary or few together, to 8 ft. high: lvs. orbicular-oval to oval-oblong, rounded or subcordate at the base,  $1\frac{1}{2}$ - $2\frac{1}{2}$  in. long, serrate nearly to the base: fls. on a loose, usually nodding raceme; petals  $\frac{1}{2}$  in. long; summit of ovary densely woolly: fr. rather large, nearly black, bloomy, juicy and sweet. Maine to Minn. and Ala. May; fr. in Aug., Sept. B.B. 2:238 (as *A. rotundifolia*).—Var. *grandiflora* (forma *grandiflora*, Wiegand). Fls. large; petals  $\frac{3}{4}$  in. long and nearly  $\frac{1}{4}$  in. wide.

3. *humilis*, Wiegand (*A. spicata* of many writers, not Koch). Stiffly upright shrub, 1-4 ft., stoloniferous and forming patches: lvs. oval-oblong or oval, subcordate or rarely rounded at the base, 1-2 in. long, serrate to below the middle: racemes many-fl., rather dense and upright; fls. small; petals oblong-obovate, about  $\frac{1}{2}$  in. long; fr. nearly black, bloomy, juicy and sweet. May; fr. in Aug. Vt. to Alberta, south to N. Y. and Iowa.

DD. Apex of lvs. rounded or truncate: blade very soon glabrous.

4. *alnifolia*, Nutt. (*A. canadensis* var. *alnifolia*, Torr. & Gray). Fig. 187. Shrub with rather stout upright branches, to 10 ft.: lvs. broadly oval to oval-truncate or subcordate at the base, 1- $1\frac{3}{4}$  in. long,



coarsely and sharply toothed rarely below the middle, floccose-tomentose at first, very soon becoming glabrous: racemes many-fl'd., upright, short and dense, slightly tomentose at first; fls. rather small; petals oblong to narrowly oblong,  $\frac{1}{2}$ – $\frac{1}{2}$  in. long; sepals short: summit of the ovary woolly; fr. nearly black, bloomy. May; fr. in July. Mich. to Ore. and Wash. S.S. 4:196. S.F. 1:185; 5:415. G.M. 52:143 (habit). Var. *florida*, Schneid. (*A. florida*, Lindl. *A. oxyodon*, Koehne). Lvs. and racemes glabrous or nearly so from the beginning. B.R. 19:1589. Var. *pumila*, Schneid. (*A. canadensis* var. *pumila*, Nutt.). Glabrous like the preceding var., but very low and stoloniferous.

CC. Teeth of lvs. 7–15 to  $\frac{1}{2}$  in.; lvs. finely and closely serrate.

D. Lvs. tomentose when young.

E. Apex of lvs. obtuse, rounded or sub-acute.

F. Top of ovary woolly; lvs. generally oval.

5. *stolonifera*, Wiegand (*A. spicata*, Brit. & Brown, in part, not Koch. *A. ovalis* of many authors, not Medikus). Upright stoloniferous shrub, 1–4 ft. high, forming patches: lvs. oval, rarely oval-oblong or orbicular, rounded at the base or rarely subcordate, 1–2 in. long, finely serrate, usually quite or nearly entire on the lower third, glabrous above, densely white-tomentose beneath when young: racemes short, dense, upright, tomentose or nearly glabrous; fls. small; petals obovate-oblong, about  $\frac{1}{2}$  in. long; top of ovary woolly; fr. purplish black, bloomy, juicy and sweet. May, a few days later than *A. laevis*; fr. in July. Newfoundland and Maine to Va.

6. *ovalis*, Borkh. (*A. spicata*, Koch, *Crataegus spicata*, Lam.). Bushy shrub with numerous sts., to 12 ft.: lvs. oval to obovate, sometimes oval-oblong,  $1\frac{1}{2}$ – $2\frac{1}{2}$  in. long, serrate to the base, white-tomentose beneath when young: racemes upright, woolly; petals obovate,  $\frac{1}{2}$  in. long; top of ovary woolly; fr. bluish black, with the sepals upright and slightly spreading. M.D.G. 1900: 496.—This is possibly a hybrid between the preceding and the following species; much cult. in Eu.

FF. Top of ovary glabrous or nearly so: lvs. generally oblong.

7. *oblongifolia*, Roem. (*A. canadensis* var. *oblongifolia*, Torr. & Gray. *A. Botryopium*, Brit. & Brown, in part. *A. obovalis*, Ashe.). Shrub, with slender upright sts. growing in rather dense clumps, but not stoloniferous, to 25 ft.: lvs. oblong to obovate-oblong, usually rounded at the base, and rounded or acute at the apex,  $1\frac{1}{4}$ – $2\frac{1}{2}$  in. long, very finely serrate nearly or quite to the base, white-tomentose beneath when young: racemes short, dense and upright, silky-tomentose; petals obovate-oblong to oblanceolate or linear, about  $\frac{1}{2}$  in. long; top of ovary glabrous or sometimes slightly woolly; fr. nearly black, with bloom, sweet. May, with *A. laevis*; fr. in June. Maine to S. C.—S.S. 4:195. Em. 2:503 (lower figure). B.M. 7619. G.C. III. 21:333. D.G.M. 1900: 497 (habit).—This differs from all other species except *A. ovalis* and *A. Bartramiana* in having the sepals on the immature fr. upright or only slightly spreading; in the other species they are recurved.

EE. Apex of lvs. very acute or shortly acuminate.

8. *asiatica*, Endl. (*A. canadensis* var. *asiatica*, Miq. *A. japonica*, Hort.). Shrub or tree, to 40 ft., with slender spreading branches: lvs. ovate to oblong-elliptic, acute, rounded or subcordate at the base, 2–3 in. long, finely serrate all around, densely white or yellow tomentose beneath when young: racemes rather dense, nodding, woolly, top of ovary woolly; fr. bluish black. May; fr. in Sept. Japan, Korea. S.Z. 1:42. S.I.F. 1:47. Var. *sinica*, Schneid. Lvs. less tomentose, often finally glabrous, smaller, usually serrate only above the middle. China.

9. *canadensis*, Medikus (*A. Botryopium*, Borkh. *A. canadensis* var. *Botryopium*, Torr. & Gray. *A. canadensis* var. *tomentula*, Sarg.). SERVICE-BERRY. Bushy tree, fastigiate branched: st. solitary or few, sometimes shrubby: lvs. generally obovate, less often ovate, oval or oblong, acute or acuminate, usually cordate at the base,  $1\frac{1}{2}$ – $3\frac{1}{2}$  in. long, sharply serrate quite or nearly to the base, densely white-tomentose beneath when young, less so above, tomentum usually partly persistent: racemes rather dense, nodding, silky-tomentose; petals linear or linear-oblong, about  $\frac{1}{2}$  in. long; top of ovary glabrous or slightly hairy; fr. maroon-purple, tasteless. May, early, before the lvs.; fr. in June. Maine to Iowa, Mo. and south to Ga. and La. S.S. 4: 194. B.R. 14:1174. Gn. 73, p. 239 (habit; may be *A. oblongifolia*).—This is the only species with the lvs. tomentose on both surfaces when young.

DD. Lvs. quite glabrous.

10. *laevis*, Wiegand (*A. canadensis*, Gray, not Medikus). Irregularly branched tree, with spreading



branches, to 40 ft., sometimes shrubby: lvs. oval-ovate to ovate-oblong, short-acuminate, subcordate or rotundate at the base, rarely broadly cuneate,  $1\frac{1}{2}$ – $2\frac{1}{2}$  in. long, sharply serrate nearly to the base, quite glabrous and purplish when young: racemes slender, many-fl'd., drooping, glabrous or nearly so, lower pedicels very long, in fl. about 1 in., in fr. sometimes 2 in. long; petals oblong-linear, about  $\frac{1}{2}$  in. long; top of ovary glabrous; fr. purple or nearly black, bloomy, juicy and fairly sweet. May; fr. in June. From Newfoundland to Mich. and Kans., south to Ga. and Ala. Em. 2:503 (upper figures). H.T. 242. M.D.G. 1900:494, 495. G. 16:48; 34:343 (habit). G.M. 44:306 (habit).—This is the most graceful and the handsomest species in bloom, differing from all other species in the purplish young foliage and the drooping racemes.

AA. Fls. solitary or 2 or 3 at the end of the branchlets; petals broad, obovate: lvs. imbricate in the bud, flat when unfolding; petioles short, less than  $\frac{1}{2}$  in. long.

11. *Bartramiana*, Roem. (*A. oligocarpa*, Roem. *A. arguta*, Nutt.). Fig. 188. Shrub, to 8 ft.: lvs. elliptic

to elliptic-oblong, acute or rounded at the apex, cuneate at the base,  $1\frac{1}{4}$ –2 in. long, sharply serrate to below the middle or nearly to the base, glabrous when young; fls. 1–3, pedicels glabrous,  $\frac{1}{2}$ –1 in. long; petals about  $\frac{1}{2}$  in. long; top of ovary woolly; fr. purplish black, bloomy. May; fr. in July and Aug. Swamps. Labrador to Mich. and Minn., south in the mts. to Pa. G.F. 1:247 (adapted in Fig. 188).

*A. Cusickii*, Fernald. Shrub, to 10 ft.: lvs. suborbicular, about  $1\frac{1}{2}$  in. long, glabrous or nearly so; fls. large, petals oblong, about  $\frac{3}{4}$  in. long; fr. scarlet, finally black. Ore. and Wash. to Idaho.—Not in cult., but ought to be intro., as it has the largest fls. of all.—*A. ulahensis*, Koehne. Dwarf shrub with small obovate lvs. scarcely 1 in. long, pubescent on both sides; racemes short, with very small fls. Utah and Ariz.—Not in cult.; the plant cult. under this name belongs to another species, to which could not be determined.

ALFRED REHDER.

**AMÉLLUS** (for the river Mella). *Compósitæ*. Nine or 10 Cape of Good Hope annual and perennial herbs allied to Aster. Lvs. hairy, oblong, opposite below; heads solitary and terminal or lateral; fls. blue-rayed; pappus single. *A. Lychnitis*, Linn., sometimes grown as an evergreen glasshouse plant, has linear-lanceolate hoary lvs. and showy blue or violet fls. Summer bloomer, a few inches high.

**AMHÉRSTIA** (Countess Amherst and her daughter, Lady Amherst, promoters of botany in India). *Leguminosæ*. A monotypic genus comprising *A. nobilis*, Wall., one of the noblest of flowering trees, native to India, where it reaches a height of 40 ft. and more. Fls. gaudy red, 8 in. long, with wide-spreading petals, the upper ones gold-tipped, and colored petal-like bracts, in long, hanging racemes; lvs. pinnate, nearly 3 ft. long. The tree first flowered in Eng. in 1849. It requires hothouse treatment. The fls. last only 2 or 3 days. Demands rich, loamy soil, and abundant moisture during the growing season, after which the wood must be ripened firm. Propagation is by seeds, more often by cuttings of half-ripened wood under a glass, with bottom heat of about 80°. Thrives well in the open in Jamaica. B.M. 4453. F.S. 5:513–516.

N. TAYLOR.†

**AMIÁNTHIUM**: *Zygadenus*.

**AMÍCIA** (named for J. B. Amici, Italian physicist, born 1786). *Leguminosæ*. Woody plants, one of which is known in cultivation as a half-hardy greenhouse subject, or in the open in warmer regions.

Straggling pellucid-dotted shrubs, or sub-shrubs, with alternate abruptly pinnate lvs. and few lfts.: fls. rather large, papilionaceous, yellow, in axillary or terminal racemes or rarely solitary; calyx with 2 very large upper segms. and very small lateral segms.; stamens equal: fr. very narrow, compressed, jointed.—About 5 species in the mts. of Mex. to Bolivia.

**Zygomeris**, DC. Eight feet, pubescent: lfts. 2 pairs, orbiculate or wedge-shape, mucronate: fls. large, pale yellow with purple on the keel; pod 2-jointed. Mex.—Intro. in S. Calif.; unusual in greenhouses. L. H. B.

**AMMÔBIUM** (Greek, *living in sand*). *Compósitæ*. Hardy herb, cult. as an everlasting or immortelle.

Florets perfect, yellow, surrounded by a dry, silvery white involucre, and subtended by chaffy scales; pappus of 2 bristles and 2 teeth.—Two or 3 Australian species. Commonly grown as an annual, but seeds are sometimes sown in Sept., and the plant treated as a biennial. Of easiest culture, the seeds being sown where the plants are to grow. In the N., sow seeds in spring. Cut the fls. before they are fully expanded, and hang in a dry, shady place. They will then remain white.

**alatum**, R. Br. Three ft. or less high, erect and branched, white-cottony, the branches broadly winged: early root-lvs. ovate at the ends and long-tapering below (javelin-shaped); st.-lvs. small and distant, entire or nearly so; heads 1–2 in. across, the involucre becoming pearly white, petal-like; fls. all tubular. V. 2:62.

Austral. A large-headed form is var. **grandiflorum**, Hort. L. H. B.

**AMMÓCHARIS** (*ammos*, sand; *charis*, beauty). *Amaryllidaceæ*. Greenhouse bulb, cultivated for late winter and spring bloom.

Allied to *Brunsvigia*, but the perianth regular, the tube cylindrical and straight, ovary flask-shaped and narrowed to a neck.—Two species in Cape of Good Hope region (by some regarded as forms of one species): *A. falcata*, Herb., with limb 4 times length of tube, and *A. coranica*, Burchell, B.R. 139:1219 (as *Amaryllis*), with limb only twice as long.

**falcata**, Herb. Bulb ovoid, sometimes 6–9 in. diam., with brown tunics: lvs. 1–2 ft. long, 1 in. wide, strap-shaped, spreading, produced in spring before the bloom: fls. 20–40, in an umbel, bright red, fragrant.—*A. falcata* requires rich, loamy soil. It starts to grow in the spring. Give plenty of water during growing season in summer. It can be cult. out-of-doors. When perfected and finished in autumn, the bulb may be put under the greenhouse bench; keep moderately dry in sand or earth; may be potted in January, after which it will soon throw out its fine, fragrant blooms.

L. H. B.†

**AMMONIACAL CARBONATE OF COPPER**: *Fungicide*.

**AMMÓPHILA** (Greek, *ammos*, sand, and *philein*, to love). *Graminææ*. Perennial grasses, with long, creeping rootstalks and spike-like panicles: spikelets 1-flid., awnless, the rachilla prolonged behind the palea as a hairy bristle; lemma firm, about as long as the glumes, hairy at the base; palea as long as lemma—Species 1 or 2, on the sandy seacoast of Eu., the Atlantic Coast of N. Amer. and the shores of the Great Lakes.

**arenaria**, Link (*A. arundinacea*, Host). BEACH-GRASS. MARRAM-GRASS. SEA SAND-REED. PSAMMA. One to 3 ft.: blades long, somewhat involute: panicle pale, several in. or as much as a ft. long. Dept. Agric., Div. Agrost. 7:167; 14:11. Sand-dunes along the seacoast.—On account of the long, hard, branching rootstocks, it has been much used as a sand-binder in Eu. and certain parts of Amer., especially Cape Cod and Golden Gate Park in San Francisco.

A. S. HITCHCOCK.

**AMÔMUM** (Greek-made name, referring to the qualities as antidote for poisons). *Zingiberaceæ*. Hothouse ginger-like herbs with narrow entire leaves, grown for the habit and foliage and for the flowers in dense cone-like spikes.

Amomums are aromatic tropical and subtropical plants, spreading by means of hard rhizomes and forming dense masses of handsome erect or spreading annual sts. and linear, lanceolate or elliptic lvs.: fls. in dense cone-like spikes or racemes, half hidden in the floral-bracts; calyx funnel-shaped, split down one side, only slightly toothed; corolla-tube cylindrical, little longer than the calyx, the upper lobe curved, the 2 lower spreading and narrow; lip (staminode) large and petal-like, mostly obovate-cuneate; fertile stamen with a narrow or a very slender filament: fr. ovoid, with a thick and fleshy exterior.—About 50 species in tropics of Asia, Afr. and Pacific Isls., allied to *Alpinia* and *Elettaria*. The “grains of paradise” are amomum seeds, of several species, probably mostly of *A. Granum-Paradisii* and *A. Melegueta*; they are used, or have been used, for flavoring beverages. Cardamons (aromatic tonic seeds) are secured from species of *Amomum* and from *Elettaria*.

Some of the amomums are extremely handsome as foliage plants, apart from their flowers. Many of the species have been confused with and included with the genus *Alpinia*, but may be readily distinguished from the flower-clusters, being borne on erect-solitary peduncles arising from the base of the leafy stem or direct



from the rhizome, the inflorescence in *Alpinia* being always terminal on the leafy shoots. They thrive in an open soil, rich in humus and with abundance of water during the growing period. They require a rest of several months and to be kept on the dry side, but not so dry in the case of the evergreen species as to cause the leaves to shrivel.

**Cárdamon**, Linn. **CARDAMON**. Plant, 4-8 ft.: lvs. thick, spicy, lanceolate: fls. brownish, in a recumbent compound spike. E. Indies.—Produces many of the cardamon seeds of commerce. Not to be confounded with *Elettaria Cardamomum* (which see). Sometimes seen in growing collections of economic plants. Forms very large clumps.

**Meleguêta**, Roscoe. Plant 4-5 ft., the rhizome slender: lvs. lanceolate, acuminate, glabrous, 6-9 in. long and 1 in. or less broad, narrowed at base and nearly sessile on sheath: fls. solitary, 3-4 in. long, short-peduncled; upper corolla-lobe 2-3 in. long; lip 2 in. or less broad, pure white or tinged pink: caps. flask-shaped, 3 in. long, red or orange when ripe. Trop. Afr.

**Gránum-Paradisii**, Linn. (*A. grandiflorum*, Smith. *A. Afzèlii*, Roscoe). Plant 4-5 ft.: sts. red at base, rhizome slender: lvs. lanceolate, acuminate, glabrous, 4-8 in. long and 1½ in. or less broad at middle, wedge-shaped at base and short-stalked on sheath: fls. 3-4 in the spike, the peduncles 2-6 in. long, white; corolla-lobes 2 in. long; lip 2 in. or less long, yellow at the throat: caps. ovoid, pubescent, 2-3 in. long, much grooved. Guinea. B.M. 4603.

**angustifolium**, Sonn. (*A. madagascariense*, Lam. *A. Daniellii*, Hook. f. *A. Clusii*, Hanb. *A. erythrocarpum*, Ridl.). Plant, 10-15 ft., the rhizome stout: lvs. oblong-lanceolate, acute, thin and glabrous, the lower ones 1 ft. or more long and 3 in. broad, nearly sessile: fls. several in spike, yellow, tinged red; upper corolla-lobe oblong, 1½ in. long; lip about as large as the lobe, deflexed. W. and E. Afr. B.M. 4764, 5250.

**hemisphæricum**, Baker. Sts. densely tufted, 10-12 ft.: lvs. distichous, short-petioled above the sheathing base, 1½ ft. long and 3 in. broad, cuspidate, green above and claret-brown beneath: fls. very numerous, in a globose head, the outer bracts large and empty, obtuse, tinged brown, the inner bracts nearly as long as the fl.; lobes of calyx and corolla green; lip strap-shaped, emarginate, red-brown in middle and yellow at edge. Straits Settlements. B.M. 7592.

**magnificum**, Benth & Hook. f. A species of large dimensions, reaching, when planted out in a rich soil, up to a height of 20 ft.: rhizomes branching freely, stout, dark brown, green when young: lf.-st. erect, arching at top, terete: lvs. distichous shortly petioled, lanceolate or elliptic, 1-2 ft. long, acute, glabrous, upper side green, (red when young) lower side suffused with reddish brown: peduncle stout, solitary, 2-5 ft. high; infl. a globose head with large bright scarlet and green bracts, outer bracts 3 in. long, ovate, or ovate-lanceolate; fls. numerous, densely crowded near the center of the head; sepals lanceolate, an inch long, primrose, tinted with red; petals lanceolate, slightly longer than the sepals, yellow, tinted with red; lip longer than the corolla-lobes, red, with a margin of yellow. Mauritius. B.M. 3192 (as *Alpinia*).

**vitellinum**, Lindl. Stemless, glabrous, 2 ft.: lvs. oval: fls. in oblong loose sessile spike, yellow; lip oblong. E. Indies(?).

**vittatum**, Bull, not Hance. A handsome dwarf evergreen species with each leading shoot bearing 2-4 erect or spreading elliptic lvs. 4-5 in. in length, alternately striped with silvery white and dark green on the upper side, and dull green on the lower. Habitat unknown.

—Habit neat and compact, and similar in general appearance to some of the calatheas. Easily prop. by division of the rhizomes.

L. H. B.

C. P. RAFFILL.

**AMÓRPHA** (Greek *amorphos*, deformed; the fls. are destitute of wings and keel). *Leguminosæ*. FALSE INDIGO. Ornamental plants grown for their foliage and flowers.

Shrubs, sometimes suffrutescent: lvs. alternate, odd-pinnate, deciduous, with entire small lfts: fls. in dense terminal spikes, small, papilionaceous, but without wings and keel; calyx campanulate with 5 nearly equal teeth or the lower ones longer; standard folded around the stamens; stamens connate at the base, exserted: pod short, indehiscent, slightly curved, with 1-2 seeds.

—Ten to 15 closely related species in N. Amer., south to Mex. Conspectus of all the known species by Schneider in Bot. Gaz. 43:297 (1907).

Amorphas are low or medium-sized shrubs with graceful pinnate foliage and small blue or purple flowers, in dense upright spikes.

Most of the species are hardy as far north as Massachusetts; farther north they must be considered as only half-hardy. They grow well in

sunny and somewhat dry situations but *A. fruticosa* prefers moist soil; they are well adapted for the borders of shrubberies.

Propagation is usually by seeds; also by greenwood cuttings under glass in early

summer, or by hardwood cuttings, placed in sheltered situations early in fall and left undisturbed till the following autumn. They may be grown, also, from layers and suckers.

*A. Lowest pair of lfts. close to the st.: plant grayish or whitish pubescent, suffrutescent.*

**canescens**, Nutt. **LEAD-PLANT**.

Low shrub, 1-3 ft., densely white-canescent: lvs. 2-4 in. long; lfts. 21-49, nearly sessile, oval or ovate-lanceolate, acutish, 4-7 lines long: fls. blue, the spikes crowded into terminal panicles: pod tomentose. June. Southern states. Mn. 5:707. B.M. 6618. R.H. 1896: 280.—Handsome free-flowering shrub of dense habit, well adapted for rockeries and borders of shrubberies in sunny and well-drained situations.

**herbacea**, Walt. (*A. pubescens*, Willd. *A. pumila*, Michx.). Low shrub, 2-4 ft., grayish pubescent: lvs. 2-6 in. long; lfts. 11-37, elliptic to oblong, rounded at both ends, 4-6 lines long, pubescent or glabrous above, beneath dotted with dark glands, short-petioled: fls. varying from violet-purple to white spikes in terminal clusters: pod glandular. N.C. to Fla. L.B.C. 7:689.

*AA. Lowest pair of lfts. remote from the st.: plant glabrous or nearly so, rarely yellowish pubescent.*

*B. Calyx with the lower lobes elongated and pointed: pod curved on the back: young growth finely tomentose.*

**fruticosa**, Linn. **BASTARD INDIGO**. Fig. 189. Shrub, 5-20 ft.: lvs. 6-10 in. long; lfts. 11-21, oval or elliptic, ½-1½ in. long, mostly obtuse and mucronulate: spikes dense, 3-6 in. long, usually in panicles; fls. dark purple: pods stout, glandular. From Wis. and Pa. south. B.R. 5:427.—Interesting ornamental shrub of spreading habit, with fine feathery foliage; remarkable for the unusual color of its dark violet-purplish fls. A very



189. *Amorpha fruticosa*. ( $\times \frac{1}{4}$ )

variable species; of the many varieties, the following are probably the most important: Var. *crœco-lanata*, Mouillef. (*A. crœco-lanata*, Wats.). Covered with yellowish brown pubescence. W.D.B. 2:139. Var. *albiflora*, Sheldon. With white fls. Var. *cærulea*, Mouillef. With pale blue fls. Var. *péndula*, Dipp. (*A. péndula*, Carr.). With recurved or pendulous branches. Var. *humilis*, Schneid. (*A. humilis*, Tausch). Low form with smaller and narrower lvs. B.M. 2112 (as *A. nana*). Var. *crispa*, Kirchn. Lvs. with crisp margin.

*tennessensis*, Shuttlw. Shrub, 5-20 ft.: lvs. 6-8 in. long; lfts. 13-55, elliptic-oblong to oblong-ovate,  $\frac{1}{4}$ - $\frac{3}{4}$  in. long, obtuse; spikes clustered, to 6 in. long; fls. violet-purple; pods slender, glandular. Tenn.

BB. Calyx with all the lobes very shallow and rounded: pod straight on the back: young growth glabrous, bloomy and purplish.

*glabra*, Poir. (*A. montana*, Boynt.). Glabrous shrub, to 6 ft. high: branches purplish: lvs. 3-6 in. long; lfts. 9-19, ovate or oval to oblong-ovate, 1-2 in. long, obtuse, rounded at the base: spikes clustered,  $2\frac{1}{2}$ -6 in. long; fls. blue; calyx-lobes very short and obtuse: pods nearly straight on the back with few glands. Spring. N. C. to Ga. and Ala.

*A. californica*, Nutt. Allied to *A. fruticosa*. Only very young branches pubescent: lfts. 11-17, oval to elliptic-oblong, obtuse, broadly cuneate at the base: spikes 2-4, to 12 in. long. Calif.—*A. californica*, Hook. & Arn.—*A. hispidula*.—*A. caroliniana*, Croom (*A. glabra*, Boynt., not Poir.). Allied to *A. fruticosa*. Lfts. numerous, elliptic-oblong, about  $\frac{1}{2}$  in. long, glabrous: racemes several, 4-8 in. long; pods: nearly straight on the back. Summer. N. C. to Fla.—*A. glabra*, Boynt., not Poir.—*A. caroliniana*.—*A. hispidula*, Greene (*A. californica*, Hook. & Arn., not Nutt.). Allied to *A. fruticosa*. Branchlets and petioles with prickly glands and pubescent: lfts. 17-25, ovate to oblong, villous: spikes solitary, to 7 in. long; pods very glandular. Calif.—*A. laevigata*, Nutt. Allied to *A. fruticosa*. Glabrous: lfts. 9-21, remote, elliptic to elliptic-oblong, obtuse or emarginate, cuneate at the base, 1- $1\frac{1}{4}$  in. long: racemes solitary or several, to 12 in. long: pod straight on the back, very glandular. Spring. Ark., Texas. Var. *pubescens*, Gray (*A. texana*, Buckl.). More or less pubescent. Texas.—*A. microphylla*, Pursh (*A. nana*, Nutt.). One ft. high: lfts. small,  $\frac{1}{2}$  in. long, crowded, glandular beneath: spikes usually single. From Minn. and Iowa west to Rocky Mts.—*A. montana*, Boynt.—*A. glabra*.—*A. nana*, Nutt.—*A. microphylla*; see also *A. fruticosa*, var. *humilis*.—*A. paniculata*, Torr. & Gray. Shrub, to 12 ft. high; grayish tomentose: lfts. 11-17, ovate-oblong or elliptic-oblong, 1-2 in. long: racemes long and slender, panicle. Texas.—*A. pubescens*, Willd.—*A. herbacea*.—*A. pumila*, Michx.—*A. herbacea*.—*A. texana*, Buckl.—*A. laevigata* var. *pubescens*.—*A. virgata*, Small. Allied to *A. fruticosa*. Perennial, 2-6 ft., sparingly branched: lfts. broad, coriaceous: spikes single or few. Southern states.

ALFRED REHDER.

**AMORPHOPHALLUS** (Greek-made name). *Araceæ*. Giant aroids from the eastern tropics, grown as curiosities in hothouses.

Leaves ample; petioles smooth or warty and variously spotted; blade ample, 3-parted, the divisions pinnatifid: spadix long; spathe (or "flower") funnel- or bell-shaped at the base, springing from the great bulb-like tuber in advance of the lvs., the latter usually pedately compound: differs from *Arum* and related genera by technical characters. Monogr. by Engler in De Candolle's *Monographiæ Phanerogamarum*, Vol. 2, 1879.

*Amorphophallus* are propagated by offsets of the tubers. These offsets are miniature tubers which grow out of the parent tuber. They are taken off at the time of potting, placed in pots just large enough to accommodate them, in a soil composed of loam, leaf-mold and sand in about equal proportions and kept in a temperature of 65° to 70°. They are rarely, if ever, propagated by seeds in northern gardens, and for this reason, together with their disagreeable odor when in flower, they are not commonly grown. The flowers are like a huge calla except that the spathe and spadix are of a dark chocolate color. The odor is supposed to attract carrion-loving insects, which pollinate the flowers in their native home and bring about the production of seeds. Towards the end of March the plants should be taken from their winter quarters and placed on the

stages of a moderately warm greenhouse and kept moist, where, if the tubers are strong enough, they will soon flower. The leaves begin to grow immediately after the flowering season. Toward the end of May, they should be planted out in the open ground, or they may be used in subtropical bedding.

Plants should be lifted in the fall, before frost, and potted in any good, rich soil, and placed in a warm greenhouse to ripen off the leaves, after which they may be stored away under the greenhouse stages, or in any convenient place where the temperature does not fall below 50°, giving just sufficient moisture to keep the tubers from shriveling. (E. J. Canning.)

**Rivièri**, Dur. **DEVIL'S TONGUE**. **SNAKE PALM**. Fig. 190. Scape (sent up in early spring) preceding the lvs., 3-4 ft., dark-colored and speckled with light red: lf. often 4 ft. across, pedately decomposed, the

petiole mottled, standing on a stalk like an umbrella: spathe rosy, calla-like, with a long-projecting and slender, dark red, slightly curved spadix, the whole "flower" often measuring 3 ft. long. Cochin China. R.H. 1871, p. 573. Gn. M. 5:232. G.W. 14, p. 173. V. 7:116.—The best-known species in American gardens. Has a strong and disagreeable odor.



190. Flower-stem and bit of leaf of *Amorphophallus Rivièri*.

**campanulatus**, Blume. **STANLEY'S WASH-TUB**. Scape lower (2 ft. or less); spathe nearly or quite 2 ft. broad and 15 in. high, with a horizontal, spreading fluted border (not calla-like), red-purple on the margin and grayish, spotted white lower down, and becoming purple in the center; spadix 10-12 in. high, the purple top enlarged and convoluted: lf. much as in *A. Rivièri*: tuber weighing 8-10 lbs., shape of a flat cheese. An old garden plant from E. Indies. B.M. 2812 (as *Arum campanulatum*). F.S. 15:1602-3. G.C. 1872: 1720, 1721; III. 5:755. G.W. 13; p. 9.

**giganteus**, Blanc. "Fl. larger than *A. campanulatus* (often 2 ft. across) and much more pleasing in color, shading from deep red to cream-color toward the center. The club-shaped spadix is dark maroon, with yellow and red base. After flowering, the foliage-st. appears,—a stout st. of deep green color, mottled with gray. After growing at the rate of several inches a day, it expands into a large palm-like lf., of a rich, dark green color, often measuring 5 ft. across." Blanc, 1892, received "under this name from India." *A. campanulatus*(?). Probably not the *A. giganteus* of Blume.

**simlense**, Blanc. "Fl. 15 in. long, the inside of peculiar golden color, spotted purple; the back is metallic brown. Fine palm-like foliage." The cut in Blanc's catalogue shows a spathe produced into a long foliaceous summit, and a long, slender, recurved spadix. Probably of some other genus: perhaps *Sauromatum*.

*A. Afzelii*, Hort. (*Corynophallus Afzelii*, Schott.)=Hydrosme leonensis.—*A. Eichenleri*, Hook. f. Spathe 2 in. across, purple and white: spadix 5 or 6 in. high, thick, brown: lf. single, much divided. W. Afr. B.M. 7091.—*A. Eliottii*, Hook. Spathe short and broad, dull pink with pale green spots: lvs. tripartite, 18 in. broad. B.M. 7349.—*A. Lacourii*, Linden. (*Pseudodracontium Lacourii*, N. E. Br.). Petioles barred with yellow; blades much cut, green, spotted white. Cochin China. I.H. 25:316.—*A. leonensis*, Lem. Spathe 6 in. long, pear-shaped, the tube bell-shaped, white, dilated into the dark purple limb which is striped and spotted with white; lvs. about 1 ft. wide, tripartite. B.M. 7768.—*A. Leopoldianus*, Nichols. (Hydrosme Leopoldiana, Mast.). Spathe reddish, long acuminate on one side, with undulate margins; spadix 2-3 ft., terete,



recurved; lf. 2-3 ft. across. Congo. I.H. 34:23; 42, p. 380.—*A. nivosus*, Lem., I.H. 12:424 = *Dracontium asperum*.—*A. onophyllus*, Prain. Spathe 6-7 in. long, the tuber broadly ovoid, white, striped and spotted, the limb brown-purple with yellow spots; lvs. tripinnatifid. Andaman Arch. B.M. 7327.—*A. Prainii*, Hook. f. Tuber 6-10 in. diam., not bulbiferous; lvs. 3-5 ft. tall, the petiole green, mottled gray-white on red; spathe-tube 2 in. long, pale green spotted white, the limb 6-8 in. across, yellow, purple-brown inside at base. Perak.—*A. Rêx*, Prain. A larger plant than *A. campanulatus*, the tuber 1 ft. across; lvs. 5-6 ft. tall, the petiole purplish, marked gray and green; spathe campanulate, 12-18 in. across, pale red-purple; spadix with an appendage 10-14 in. long. Java.—*A. sativus*, Blume. Petiole 2-3 ft. tall, rugose, rough, white marked, each division of the blade pinnate-parted, the costa thick, white. Molucca Isls.—*A. Schweinfurthii*, N. E. Br. Spathe broad, reddish brown. E. Afr.—*A. Titānum*, Beccari. One of the most remarkable species known. Tuber 5 ft. in circ.: lf.-stalk 10 ft.: lf.-blade 45 ft. in circ.: spathe 3 ft. in diam.; spadix 6 ft. high. Bloomed at Kew in 1890, the tuber dying thereafter. Sumatra. B.M. 7153-5. G.C. III. 5:748 (as *conophallus*).—*A. variabilis*, Blume. Lvs. pinnatisect: spathe erect, 5 in. long, white inside, spotted outside, the margin rosy. Java and Philippines. G.C. II. 6: p. 680, 681 (as *Brachy-spatha*). J.H. III. 33: 493; 63: 283.—*A. viridus*, N. E. Br. Spathe green externally, suffused with purple and spotted, internally lurid purple. Siam. B.M. 6978.

L. H. B.  
GEORGE V. NASH.

**AMPELOPSIS** (Greek *ampelos*, vine, and *opsis*, likeness). *Vitaceae*. Ornamental woody vines with handsome deciduous foliage and some species with ornamental fruits, used for covering trellis-work, pergolas, arbors, low walls and the like.

Shrubs, climbing by tendrils: branches with close lenticillate bark and white pith and with tendrils opposite the lvs.: lvs. alternate, petioled, simple, lobed, digitate, pinnate or bipinnate; fls. small, greenish, perfect, in dichotomous long-peduncled cymes opposite the lvs. or terminal; calyx indistinct; petals 5, or rarely 4, expanding; stamens as many as petals, short; ovary 2-celled with a slender style, adnate to a distinct cup-shaped disk, entire or crenulate at the margin; fr. a 1-4-seeded berry.—About 20 species in N. Amer., Cent. and E. Asia. By some botanists united with *Vitis*, which is easily distinguished, even in the winter state, by its shredding bark and brown pith, also by the panicu-



191. *Ampelopsis heterophylla* var. *amurensis*. ( $\times \frac{1}{4}$ )

late infl. and the petals cohering into a cap and falling off as a whole; more closely related to *Parthenocissus*, which differs chiefly in its disk-bearing tendrils and the absence of a distinct disk in the fl.; still more closely to *Cissus*, which differs in the fleshy sts., usually 4-merous fls. and 4-lobed disk. Monogr. by Planchon in De Candolle, *Monographiæ Phanerogamarum*, 5:447-463.

The members of this genus are shrubs, climbing, with twining tendrils, not clinging by disks to its support, of medium height, with variously divided, rarely simple foliage, small greenish flowers, in peduncled cymes, followed by blue or yellow pea-sized berries. Most of the species are hardy North, but *A. japonica*, *A. megalophylla* and *A. arborea* are only half-hardy, while *A. cantoniensis* and *A. leuoides* can be grown only in warmer temperate regions. Page 3565.

They are not particular as to the soil and situation but grow best in fresh and loamy land. Where only a light covering is desired, species like *A. japonica*, *A. aconitifolia* and *A. arborea* should be planted; *A. heterophylla* var. *amurensis* makes a rather dense covering and is well suited for the covering of parapets, low walls and rocks; *A. megalophylla* is a very strong grower, with bold foliage. Some species, as *A. heterophylla* and particularly its var. *amurensis* are very ornamental in autumn with their bright blue profusely produced berries.

Propagation is by seeds and by hardwood or greenwood cuttings. All species may be propagated by cuttings with a good eye, placed in sandy soil under bell-glasses in September.

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#### A. Lvs simple or lobed.

##### B. Under side of lvs. whitish: lvs. of firm texture.

1. *humulifolia*, Bunge. Lvs. broadly ovate, 3-5 lobed, sometimes only slightly so, 3-5 in. long, truncate or subcordate at the base, acute or acuminate, bright green and lustrous above, glaucescent and glabrous or hairy beneath: cymes slender peduncled: fr. few and small, usually pale yellow with bluish cheek, or pale yellow or entirely pale blue. N. China.—This species has been always confused with *A. heterophylla*, from which it is easily distinguished by the firmer texture of lvs., their pale whitish under side and the color of the frs. It is very hardy and the foliage has the appearance of that of a true *Vitis*.

2. *micans*, Rehd. (*Vitis repens*, Veitch, not Wight & Arn.). Shrub, climbing to 20 ft.: young growth purplish: branchlets glabrous: lvs. triangular-ovate and not lobed or broadly ovate and slightly 3-lobed, subcordate or sometimes truncate at the base, short-acuminate, the lobes acute, coarsely crenate-serrate, dark green and with a velvety sheen above, glaucescent below, 2-4 in. long: cymes long-stalked and rather dense: fr. dark blue. Cent. China.—Has proved hardy at the Arnold Arboretum. Var. *cinerea*, Rehd. (*A. heterophylla* var. *cinerea*, Gagnep.). Lvs. grayish pubescent on both sides or only below, often deeply 3-5-lobed.

##### BB. Under side of lvs. green: lvs. membranous.

3. *cordata*, Michx. (*Vitis indiana*, Willd. *Cissus Ampelopsis*, Pers.). Nearly glabrous: lvs. cordate, roundish-ovate, not or slightly 3-lobed, acuminate, acutely serrate, pale green beneath, usually pubescent on the veins: cymes loose, slender-stalked: berries bluish or greenish. From Ill. and Ohio south. Mn. N. 2:6.

4. *heterophylla*, Sieb. & Zucc. (*Vitis heterophylla*, Thunb.). Branchlets glabrous or hairy: lvs. cordate, 3-5-lobed, with rounded sinuses, sometimes slightly 3-lobed, lobes serrate or incised, shining green beneath and usually glabrous or sometimes hairy,  $1\frac{1}{2}$ -3 in. long: cymes on stalks  $\frac{1}{2}$ -2 $\frac{1}{2}$  in. long: fr. changing from pale lilac to verdigris color and finally bright blue or

sometimes finally whitish. July, Aug.; fr. Sept., Oct. E. Asia. B.M. 5682 (as var. *humulifolia*). Gt. 1813: 765. Gn. 10, p. 451. Var. *élegans*, Koch (*A. tricolor*, Hort. A. *Sieboldii*, Hort. *Vitis heterophylla* var. *variegata*, Nichols.). Lvs. smaller, blotched and striped with white; flushed pink when young; slow-growing and tenderer. Gn. 54, p. 5.—A handsomely colored form, adapted for planting in vases and baskets. Var. *citruloides*, Schneid. (*A. citrullodes*, Lebas). Lvs. deeply lobed with rather narrow sinuately lobed segms. Var. *amurénsis*, Planch. (*A. brevipedunculata*, Koehne. *Vitis brevipedunculata*, Dipp.). Fig. 191. Branchlets and petioles usually hairy; lvs. slightly 3-lobed, 2-4 in. long, lobes crenately serrate, hairy beneath, at least on the veins; cymes rather dense; fr. darker blue.—The variety is a stronger grower than the type and strikingly beautiful in autumn with its variously colored berries; it is well adapted for covering low walls, rocks and trellises.

AA. Lvs. 3-5-parted or digitate, at least partly, with usually lobed segms.

B. Segms. of the lvs. pinnately lobed or only serrate; the lower lvs. sometimes only lobed.

5. *aconitifolia*, Bunge (*A. dissécta*, Carr. *A. aconitifolia* var. *dissécta*, Koehne. *A. affinis* var. *dissécta*, Hort.). Branchlets glabrous; lvs. 5-parted, the segms. pinnately lobed with rather narrow-toothed or entire lobes, 2-3 in. long, green beneath, glabrous or hairy on the veins; berries small, orange when fully ripe, sometimes bluish before ripening. Summer; fr. in autumn. N. China. R.H. 1868, p. 10; 1883, p. 318. Gn. 5, p. 523. G. 1:396.—Very handsome vine with finely divided foliage. Var. *palmiloba*, Rehd. (*A. palmiloba*, Carr. *A. tripartita*, Carr. *A. rubricaulis*, Schneid.). Lvs. usually 3-parted, the lower ones often only 3-lobed, segms. often rather broad, coarsely toothed, rarely pinnatifid. R.H. 1867, p. 10. J.H.S. 28:87 (form with rather narrow segms.).

6. *Delavayana*, Planch. (*A. heterophylla* var. *Delavayana*, Gagnep. *Vitis Delavayana*, Franch.). Young growth hairy and usually purplish; lvs. cordate at the base, partly 3-lobed and partly 3-parted, 2-5 in. long, segms. coarsely crenately toothed, dark green and nearly glabrous above, light green and pubescent beneath or sometimes glabrous, the middle segm. elliptic-oblong, cuneate, the lateral ones very unequal; cymes on peduncles 1 in. or less long; fr. dark blue or bluish black. Cent. China. J.H.S. 28:102.—A strong-growing vine, hardy.

BB. Segms. of the lvs. pinnate; the pinnæ separate from the winged rachis.

7. *japónica*, Makino (*A. serjaniæfolia*, Bunge. *Vitis serjaniæfolia*, Maxim. *A. napiformis*, Carr. *A. tuberosa*, Carr.). Roots tuberous; plant glabrous; lvs. 3-5-parted or digitate, chartaceous, shining and dark green above, the divisions pinnate, with winged rachis, the pinnæ separate from the wings; berry small, blue, punctate. Japan. N. China. Gt. 16:531. R.H. 1870, p. 17. Gn. 6, p. 365. I.T. 5:176.—Very handsome vine with its lustrous and dark green, finely cut foliage, but somewhat tender.

AAA. Lvs. bipinnate or pinnate; lfts. distinctly stalked.

B. Lfts. usually  $\frac{1}{2}$ -1 in. long, very coarsely toothed.

8. *arborea*, Koehne (*A. bipinnata*, Michx. *Vitis bipinnata*, Torr. & Gray. *Cissus stans*, Pers.). PEPPER VINE. St. erect or somewhat climbing; lvs. bipinnate, 4-8 in long; pinnæ and lfts. on each segm. usually 5; lfts. broadly ovate or cuneate-obovate, coarsely toothed,  $\frac{1}{2}$ -1  $\frac{1}{2}$  in. long, veins beneath and rachis usually hairy; berries dark purple. Summer; fr. in autumn. Southern states, Mex. B.B. 2, p. 2409.—Handsome vine with bright green finely cut foliage; not hardy N.

BB. Lfts. usually 2-4 in. long, crenate-serrate.

9. *megalophylla*, Diels & Gilg. (*Vitis megalophylla*, Veitch). Climbing to 30 ft., glabrous; lvs. long-petioled, 6-15 in. or sometimes longer, the larger ones bipinnate; the lower pinnæ with 3-9 lfts., the lowest pair often 3-lvd.; lfts. petioled, ovate or ovate-oblong, 2-5 in. long, rounded or subcordate at the base, membranous, remotely serrate, pale or glaucescent beneath, veins nearly straight, ending in the teeth; fr. bluish black, in loose cymes. W. China. J.H.S. 28:16, 86, 97. Gn. 65, p. 45.—Strong-growing vine, hardier and larger in every part than the following.

10. *cantonensis*, Planch. (*Vitis cantoniensis*, Seem.). Lvs. long-petioled, similar to the preceding species but smaller; lfts. 1-3 in. long, cuneate or rounded at the base, sometimes nearly sessile, chartaceous, remotely and often indistinctly crenate-serrate, veins arching; fr. violet or pale violet. S. China to Malay. Penins.

*A. Davidiana*, Mott. = *Vitis Piasezkii*.—*A. dumetorum*, Hort. = *Parthenocissus vitacea*.—*A. Engelmannii*, Hort. = *Parthenocissus quinquefolia* var. *Engelmannii*.—*A. Græbneri*, Bolle = *Parthenocissus quinquefolia* var. *hirsuta*.—*A. hederacea*, DC. = *Parthenocissus quinquefolia*.—*A. Henryana*, Hort. = *Parthenocissus Henryana*.—*A. heptaphylla*, Buckl. = *Parthenocissus heptaphylla*.—*A. himalayana*, Royle = *Parthenocissus himalayana*.—*A. hirsuta*, Don = *Parthenocissus quinquefolia* var. *hirsuta*.—*A. Höggii*, Hort. = *Parthenocissus tricuspidata*.—*A. incansans*, Hort. = *Parthenocissus tricuspidata*.—*A. japonica*, Hort. = *Parthenocissus tricuspidata*.—*A. leoides*, Planch. (Vitis leoides, Maxim.). Allied to *A. megalophylla*. Lvs. usually pinnate, sometimes the lower lfts. 3-leaved; lfts. 5-7, ovate-oblong, 2-4  $\frac{1}{2}$  in. long, rounded or broadly cuneate at the base, remotely serrate. S. Japan. Tender. J.H.S. 28:95, 96.—*A. Löwii*, Hort. = *Parthenocissus tricuspidata* var. *Lowii*.—*A. macrophylla*, Hort. = *Parthenocissus vitacea* var. *macrophylla*.—*A. muralis*, Hort. = *Parthenocissus quinquefolia* var. *murorum*.—*A. orientalis*, Planch. (*Vitis orientalis*, Boiss.). Allied and very similar to *A. arborea*; petioles longer; lvs. ovate-elliptic, quite glabrous; petals and stamens 4. Orient. G. C. 1871:1615.—*A. pubescens*, Schlecht. = *Parthenocissus quinquefolia* var. *hirsuta*.—*A. quinquefolia*, Michx. = *Parthenocissus quinquefolia*.—*A. radicansissima*, Schelle = *Parthenocissus quinquefolia* var. *murorum*.—*A. radicansissima*, Hort. = *Parthenocissus quinquefolia* var. *hirsuta*.—*A. Roylei*, Hort. = *Parthenocissus quinquefolia* var. *murorum* and *P. tricuspidata*.—*A. St. Paulii*, Hort. = *Parthenocissus quinquefolia* var. *St. Paulii*.—*A. sempervirens*, Hort. = *Cissus striata*.—*A. Thomsonii*, Hort. = *Parthenocissus Thomsonii*.—*A. tricuspidata* and *A. Veitchii*, Hort. = *Parthenocissus tricuspidata*.—*A. virginiana*, Hort. = *Parthenocissus quinquefolia*.

ALFRED REHDER.

AMPELOPOVITIS: *Vitis*.

AMPHICARPÆA (Greek, alluding to the two kinds of pods). Spelled also *Amphicarpa*. *Leguminosæ*. HOG PEANUT. A genus of 6-8 species of herbaceous perennial vines of E. N. Amer. and India, considered by some to contain also the species now credited to *Falcata*. Fls. of 2 kinds, the upper axillary, racemose and showy, the lower apetalous, fertile, and borne in the lower axils.—Not in the American trade and cult. only in botanic gardens. The only common species are *A. monoica*, Ell. (*Falcata comosa*, Auct.), and *A. Pücheri*, Torr. & Gray. Both are pubescent or glabrate vines, with trifoliate lvs., white or purplish fls., and rather conspicuous pods.—Of little value horticulturally.

N. TAYLOR.

AMPHÍCOME (*amphi*, both, and *kome*, hair; the seeds having a tuft of hair at both ends). *Bignoniaceæ*. Greenhouse herbaceous rockery plants from the Himalayas, with large, rosy, funnel-shaped, 5-lobed fls. which are axillary or terminal; lvs. alternate, unequally pinnate.—Species 2.

*arguta*, Royle. Height 3 ft.: lvs. radical, the lfts. in 3-4 pairs, sessile, lanceolate, acuminate, deeply serrate; fls. in terminal racemes, fewer than in the next; corolla-tube rose-colored, trumpet-shaped; calyx-lobes long, awl-shaped. P.M. 6:79.—Intro. by Montarioso Nurseries.

*A. Emōdii*, Royle. Height 1  $\frac{1}{4}$ -3 ft.: lfts. in 5-7 pairs, cordate-ovate, obtuse, shortly petiolulate, margin crenate-lobate; fls. at first corymbose; corolla-tube and throat orange; calyx-lobes short, thick, fleshy. B.M. 4890. Gn. 8, p. 25; 38, p. 458. F.S. 11; 1109.

AMPHIRAPHIS: *Microglossa*.

N. TAYLOR.†



**AMSONIA**, (named for Charles Amson, colonial physician in eighteenth century). Called also *Ansonia*. *Apocynaceæ*. Plants sold for border planting, mostly among shrubby, but little known in cultivation.

Tough-barked perennial herbs with alternate narrow lvs. and terminal panicles of blue or bluish narrow-limbed small fls. in May and June, the inside of the corolla-tube bearing reflexed hairs and also the 5 stamens: fr. two long and slender many-seeded follicles.—About a dozen species in E. U. S. and E. Asia. Prop. mostly by dividing the clumps; also by seeds, and by cuttings in summer.

**Tabernæmontana**, Walt. (*A. salicifolia*, Pursh. *A. Amsonia*, Brit. *Tabernæmontana Amsonia*, Linn.). Glabrous or nearly so, 2–3 ft.: lvs. willow-like, ovate to lanceolate, acuminate, alternate, short-petioled: fls. many, with lanceolate spreading lobes, succeeded by slender, milkweed-like follicles or pods 2–3 in. long. Holds its foliage late. Pa. to Fla. and Texas. B.M. 1373. L.B.C. 6:592. B.R. 151 (as *A. latifolia*).

**angustifolia**, Michx. Villous when young, the st. 1–3 ft.: lvs. linear to lance-linear, an inch or two long, much crowded, margins becoming revolute: corolla-lobes ovate-oblong to linear-oblong. Dryland, N. C., to Texas. L. H. B.

**AMYGDALÓPSIS**: *Prunus*.

**AMÝGDALUS** (Greek-made name, referring to the furrowed pit). *Rosaceæ*. A name given to the peaches, apricots and their kin, but here treated as a section of the genus *Prunus*, which see.

**ÁMYRIS** (etymologically allied to *myrrh*, in allusion to the odor). *Rutaceæ*. TORCH-WOOD. Some 10 species of shrubs and trees ranging from the S. U. S. to Cent. Amer. and W. Indies, a few of which have been mentioned as evergreen cult. plants in hothouses. Lvs. alternate, compound but lfts. sometimes reduced to 1 as in some other rutaceous plants: fls. white, in axillary or terminal spikes; sepals and petals 4; stamens 8: fr. an ovoid or globose drupe, with a single stone.—Apparently none of the species is in cult. in this country, although *A. balsamifera*, Linn., of S. Fla. and the W. Indies, *A. Plumieri*, DC., of the W. Indies, and *A. braziliensis* (properly *Protium braziliense*, of the Burseraceæ) may occur.

**ANACÁMPSEROS** (Greek-made name, of no significance here). *Portulacaceæ*. LOVE-PLANT. Succulent herbs, of a dozen species, from the Cape of Good Hope, but not grown in this country except in botanic gardens. They are greenhouse plants, with ovate fleshy lvs.: fls. racemose, expanding in the sun; petals 5, fugacious; sepals 5, oblong. Prop. by seeds or by cuttings of sts. or lvs. The commonest species is *A. arachnoides*, Sims, a peculiar, cobwebbed, green-lvd. succulent, with simple racemes of white fls. B.M. 1368.

*A. Börderi*, Hort., "is a Pyrenean alpine plant of easy culture in border or rocky; purple fls.; late-blooming." The name is apparently unknown in botanical literature.

N. TAYLOR.†



192. *Anacardium occidentale*. (× 1/5)

**ANACÁRDÍUM** (name refers to the heart-shaped character of the nut). *Anacardiaceæ*. Eight species native to the American tropics, of which one (yielding the cashew nut) is widely cultivated in tropical countries.

Trees and shrubs with leathery alternate lvs.: fls. small and numerous in panicles, polygamous; calyx 5-cleft; petals 5, very narrow; stamens 7–10: fr. kidney-shaped, borne on a greatly enlarged hard receptacle.

**occidentale**, Linn. **CASHEW**.

Fig. 192. A large, spreading tree with milky juice, very impatient of frost, and therefore adaptable only to extreme S. Fla. in the U. S.: lvs. oval or obovate, rounded, or even emarginate at the top: fls. rosy-tinted, fragrant, in clusters terminating the young branches: nut kidney-shaped or heart-shaped, the size of a large bean, the kernel edible. This nut (about 1 in. long) is borne on a fleshy receptacle (the cashew apple, Fig. 33) which is about 3 in. high when mature, white to yellow and red, and is sweetish-sour and edible. Gn. 11, p. 211.—

193. *Anagallis arvensis*. (× 1/4)

A vinous liquor is made from the apple. The kernel of the nut yields oil, and is edible when roasted; the shell of the nut is exceedingly acrid, even the fumes from the roasting being highly irritant. The tree yields a gum which is the basis of a varnish, being used to protect books and woodwork from the ravages of white ants and other insects. The tree grows 20–40 ft. high. Sometimes grown under glass in collections of economic plants; prop. then by cuttings of mature wood with lvs. retained. L. H. B.

**ANAGÁLLIS** (Greek, *delighting*). *Primulaceæ*. PIMPERNEL. Low annual, biennial or perennial herbs cultivated in the open fo. their numerous bright-colored blossoms.

Stems mostly angular, bearing opposite alternate or 3-whorled entire lvs.: fls. axillary, mostly solitary, usually not longer than the lvs., in shades of red, blue or white, the corolla rotate or rotate-bell-shaped and with lobes obovate or linear which are either entire or toothed; stamens 5, attached in the base of the corolla, the filaments usually bearded: fr. a globose caps., circumscissile.—Two dozen species of interesting little plants mostly with trailing or procumbent sts., in many parts of the world. Pax and Knuth, Engler's Pflanzenreich, hft. 22:321–334.

The pimpernels are of simple culture. They thrive in a warm soil, the seeds of the annual species being planted where the plants are to grow. The perennial kinds are increased by division, or by cuttings of young growths started under glass. All of them are free-flowering and attractive minor plants. The many forms in gardens are probably all referable to two species.

*A. lvs. ovate*.

**arvensis**, Linn. (*A. pulchella*, Salisb. *A. orientalis*, Hort. *A. Monellii*, Bieb., not Linn.). COMMON PIMPERNEL, or POOR MAN'S WEATHERGLASS (fls. close at approach of bad weather). Fig. 193. Annual: sts. procumbent or ascending, the branches becoming long, slightly winged: lvs. opposite or in 3's, sessile: fls. scarlet varying to white, the lobes broadly obovate and

obtuse and the edges finely toothed. Eu., Asia, and sparingly run wild in N. Amer. Var. *phœnicea*, Gren. & Godr. Fls. red; corolla-lobes mostly glandular-ciliate at top. Var. *cærulea*, Gren. & Godr. (*A. cærulea*, Schreb. *A. verticillata*, All.). Fls. blue; lobes not glandular and slightly ciliate. Var. *latifolia*, Lange (*A. latifolia*, Linn.). Fls. blue: lvs. very broad: plant stout. B.M. 2389.

AA. Lvs. linear or linear-lanceolate (except perhaps in var. *Monellii*).

*linifolia*, Linn. (*A. angustifolia*, Salisb. *A. fruticosa*, Vent. *A. grandiflora*, Andr. *A. Philippii*, Hort.). Perennial or biennial: sts. woody at base, 1-1½ ft.: lvs. opposite or verticillate, sessile, acute, margin often revolute: fls. blue, reddish underneath, the lobes ovate, obtuse and entire. W. Medit. region. B. M. 831. Var. *Monellii*, Knuth (*A. Monellii*, Linn., not Bieb. *A. Willmoreana*, Don). Lvs. often in 3's, somewhat broader (even to ovate or oblong): corolla longer. Var. *collina*, Ball (*A. collina*, Schousb.). Large, sts. thick: fls. rose-colored or purplish (not blue). Var. *microphylla*, Ball. Many-std., branches ascending: lvs. small, lanceolate: fls. blue, reddish beneath.

L. H. B.

**ANĀNAS** (modified from aboriginal S. Amer. name). Written also *Ananassa*. *Bromeliaceæ*. Stove herbs, allied to the billbergias, and demanding the same general treatment. As ornamental subjects, grown mostly for the rosette of rigid lvs. and the strange, often colored head of fleshy fls., which are 6-cleft, with 6 stamens and 1 style. The ripe head is composed of the thickened rachis, in which the fleshy berry is imbedded, and the fleshy persistent bracts; in the pineapple, the fls. are abortive. Prop. by the leafy crown or topknot, by



194. *Ananas sativus* (pineapple).

strong suckers, or by small offsets from the base: these are treated as cuttings, being rooted in sand with bottom heat, or in the S. set directly in the field. Monogr. by Mez, DC., Monogr. Phaner. 9.

*sativus*, Schult. f. **PINEAPPLE**, which see for field culture Fig. 194. Plant producing a single shaft 2-4 ft. high, and when 12-20 mos. old bearing a head, or pineapple, on the top of which is a rosette of stiff lvs.: lvs.

long and sword-shaped, stiff, more or less rough-edged. The same stalk does not bear a second time, but a new shoot may arise from the same root and bear fruit. Better results are usually secured by severing the sucker or crown, and growing a new plant. American



195. *Ananas sativus* var. *variegatus*. ( $\times \frac{1}{2}$ )

tropics. B.M. 1554 (as *Bromelia Ananas*). B.R. 1081 (as *A. bracteata*).—There is a common cult. form (var. *variegatus* or *stratifolius*), Fig. 195, with striped lvs. Gn. 51, p. 57. *A. Porteanus*, Koch, is a form of *A. sativus*, with olive-green, sharp-spined lvs. with a yellow central band. G.W. 5, p. 51. *A. cochinchinensis*, Hort., is another form (intro. by Pitcher & Manda, 1891).

*A. bracteatus*, Schult. f., is a showy species with red heads, all the bracts being elongated, spiny and prominent. Brazil. B.M. 5025. Regarded by Mez as a form of *A. sativus*.—*A. macrodontes*, Morr., like a bromelia, has large toothed bracts. Brazil. —*A. Mordillonus*, Hort., a form of *A. sativus* probably, has variegated spineless lvs.

L. H. B.

**ANĀPHALIS** (Greek name of a similar plant). *Compositæ*. **EVERLASTING**. Hardy border plant; useful for immortelles. A genus of 30 species, much like *Antennaria*, but differs in the pappus-bristles of the staminate fls. not being thickened (these are thickened upwards in that genus) and the st. leafy.

*margaritacea*, Benth. & Hook. A foot or two high, with many corymbose heads, white: lvs. sessile, linear-lanceolate, long-pointed: involucre pearly white, hence the value of the plant as an everlasting. N. Amer. and Asia.—The plant from Asia, with yellow fls., is perhaps better referred to *A. cinnamomea*, Clarke, but is hardly separable from the type. It is offered as a yellow everlasting.

N. TAYLOR.†

**ANARRHINUM** (snoutless). *Scrophulariaceæ*. A dozen biennials and perennials of S. Eu. and N. Afr. Allied to *Antirrhinum*, but not cult. in this country, except in botanic gardens. Fls. small, in interrupted spike-like racemes, white or blue. Easily grown in ordinary garden soil, but not certainly hardy north of New York. Known also as *Simbulata*.

**ANASTÁTICA**: Resurrection Plant.

**ANCHUSA** (*anchousa*, a paint for the skin). *Boraginaceæ*. **ALKANET**. Hardy annual, biennial or perennial plants, with blue or purple fls. in paniced scorpioid racemes or sometimes in headlike clusters; the corolla trumpet-shaped and the throat closed by scales: lvs. alternate, usually hairy.—Of easy cult. in sunny position except *A. italica* var. "Dropmore," which is best suited in partial shade. Prop. by seed generally, but old perennials may be root-divided in spring.

A. Fls. small, like forget-me-nots.

*Barreliæri*, Vilm. Perennial: height 2 ft.: lvs. ovate-lanceolate, smaller and shorter than in *A. italica*: fls.



blue, with a white tube and pink or yellow throat. May. Eu. and Asia Minor. B.M. 2349.—Valued for its earliness and for cut-fls. The least common of the 3 species.

*officinalis*, Linn. Biennial or perennial, 1–2 ft.: lvs. lanceolate, hairy, radical ones clustered: fls. opening in pairs, bright blue or purple, in loose, one-sided spikes. June–Oct. Eu.—Effective in masses and of easy cult. The common alkanet.

*capensis*, Thunb. Biennial: height 1½ ft.: lvs. narrowly lanceolate and less hispid than in *A. italica*: fls. red-margined, with a white throat; buds red; calyx inflated after the fl. has withered; divisions short-obtuse. June–Sept. Cape of Good Hope. B.M. 1822.—Fine for cut-fls. Often winterkilled, but seeds itself freely; north of Boston best treated as a coolhouse plant. Var. *alba*, Hort., has white fls.

AA. *Fls. large.*

*italica*, Retz. Perennial: height 3–5 ft.: lvs. largest of the 3 species here contrasted, ovate-lanceolate, rough, shining; radical ones sometimes 2 ft. long: fls. bright blue. Medit. B.M. 2197. L.B.C. 14:1383.—If not allowed to go to seed, will bloom continuously from June to Sept. Commonest and perhaps best species. Var. *Dröpmore*. Fig. 196. Three ft.: fls. purple, in loose heads. Best suited to partial shade. Var. *superba*, Hort., has very dark blue fls.

*A. Agárdhi*, Lehm. Lvs. linear. Siberia. Rare.—*A. myosotidiflora*, Lehm. Lvs. large; radical ones long-petiolate, cordate-reniform; cauline ones sessile, oval. Siberia, Caucasus.—*A. ochroleuca*, Bieb. Perennial: 2 ft.: fls. yellowish white: lvs. minutely strigose, lanceolate, ciliate. July, Aug.—*A. sempervirens*, Linn. Lvs. broadly ovate; lower ones petiolate: racemes short, generally bracted at the base. Eu. Esteemed in France.

N. TAYLOR.†

ANDA: *Joannesia*.

ÁNDIRA (Brazilian name). *Leguminosæ*. ANGELEEN TREE. Hothouse trees.

Trees, with conspicuous fls. in racemes: calyx 5-toothed or entire; keel petals distinct; ovary stalked: fr. a roundish 1-seeded pod.—Nearly 30 species of Tropical American and African.

Two or three species are sometimes cultivated in hothouses in the Old World and in American botanic gardens. They must be grown in rich loam and peat in the warmhouse. Propagation is by cuttings of ripened wood in sand under bell-jar, with bottom heat.

*inermis*, HBK. CABBAGE TREE. A tree 20–35 ft.: lvs. impari-pinnate, with 13–15 ovate-lanceolate and acute lfts.: fls. in terminal panicles, purple, on short pedicels. W. Indies and Brazil.

N. TAYLOR.

ANDRÁCHNE (ancient Greek name). *Euphorbiacæ*. Low shrubs with bright green foliage, of little ornamental value; sometimes grown in botanical collections.

Shrubs or perennials: lvs. alternate, usually entire: fls. small, monœcious or incompletely diœcious, axillary, 5–6-merous; staminate in clusters, with petals smaller than the sepals, stamens with free filaments, not exceeding the sepals; pistillate usually solitary, with very small petals, sometimes wanting, ovary 3-celled with 3 distinct, 2-cleft or 2-parted styles: fr. a subglobose or depressed caps., separating into 3 2-valved carpels, 6-seeded.—Ten or 12 species in N. Amer., Peru, Asia, N. and S. Afr., Malay Archipelago.

These are low deciduous shrubs similar to *Securinega*, but smaller, with small bright green leaves, slender-stalked whitish inconspicuous flowers in axillary clusters or solitary, appearing during the summer followed by small greenish brown capsular fruits. There are three species in cultivation, of which two, *A. phyllanthoides* and *A. colchica*, have proved hardy at the Arnold Arboretum; they may be used in borders of shrubberies. They seem to grow in any soil, if it is well-drained, and prefer sunny positions.

Propagation is by seeds, which are usually freely produced, and also by greenwood cuttings under glass. None of the species is in the trade.

*A. colchica*, Fisch. & Mey. Shrub, to 2 ft., usually lower, glaucous, glabrous: lvs. ovate-obtuse, ½–½ in. long: petals 5, filiform, as long as the glands of the disk, much shorter than the calyx: caps. depressed-globose, ½ in. thick. Asia Minor.—*A. cordifolia*, Muell. Arg. Shrub, to 3 ft.: lvs. ovate to oblong, rarely cordate at base, obtuse, 1–2 in. long, soft pubescent beneath: petals spatulate, disk-glands membranous: caps. depressed-globose, ¼ in. thick. E. India.—*A. fruticosa*, Linn. A greenhouse shrub from S. China with ovate or broadly ovate, short-stalked lvs., 1–1½ in. long, and small greenish white, short-stalked fls., staminate as well as pistillate in axillary clusters of 3–6, is now referred to *Breynia* as *B. fruticosa*, Benth. It is probably no longer in cult. B.M. 1862 and L.B.C. 8: 731 (as *Phyllanthus turbinata*).—*A. phyllanthoides*, Muell. Arg. (*A. Roemeriana*, Muell. Arg.). Shrub, to 3 ft. with slender glabrous branches: lvs. oval to obovate, obtuse, ¼–1 in. long, glabrous or slightly pubescent beneath: petals little shorter than the sepals, obovate, dentate near the apex; disk-glands thick: caps. depressed-globose, about ¼ in. thick. Mo. to Ark. and Texas.

ALFRED REHDER.

ANDROCÝMBIUM (name referring to arrangement of stamens around a cavity). *Liliacæ*. A dozen or more species of bulbous plants growing from the



196. *Anchusa italica*, Dropmore variety. (× ¼)

Medit region to S. Afr., one or two of which may be expected in choice greenhouse collections. Bulbs tunicated: sts. subterranean, from which arise a few narrow lvs.: fls. few, in short spikes and subtended by showy bracts in spring or summer. *A. melanthoides*, Willd., of S. and Cent. Afr., recently intro., has bulb like minute tulip: lvs. 2–4, from 3–9 in. long: fls. small, borne in clusters in axils of large bracts which reach 3 in. long and some of which are white, green-veined. G.C. III. 45:315, desc. *A. leucanthum*, Willd. (*A. punctatum*, Baker, in part), of S. Afr., has few whitish fls. in dense umbel and 4 spreading lvs.

ANDRÓMEDA (Greek mythological name). *Ericacæ*. Ornamental low plants grown for their evergreen foliage and for their flowers.

Evergreen shrubs: lvs. short-petioled, narrow, entire: fls. in terminal umbels, pedicelled; calyx small, 5-toothed; corolla urceolate with 5 short recurved lobes; stamens 10 with aristate anthers opening with pores: caps. dehiscent into 5 valves; seeds numerous, small.—Two species through the northern hemisphere.

The andromedas are low evergreen shrubs with small and narrow foliage and small pinkish flowers in terminal umbels. They are perfectly hardy North and suited for borders of evergreen shrubberies and for rockeries and grow best in peaty or sandy and moist soil and in half-shady positions.

Propagation is by seeds, sown thinly soon after maturity, in pots or pans of sandy peat soil, placed in a cool frame. They germinate easily if sown in cut sphagnum, but must be pricked into boxes as soon as they can be handled. Cuttings from mature wood, placed in sand under glass in fall, and kept in a cool greenhouse during the winter, will root easily; also increased by layers. See, also, *Leucothoe*, *Chamaedaphne*, *Pieris* and *Zenobia*.

**polifolia**, Linn. (*A. rosmarinifolia*, Pursh). Fig. 197. One-half to 2 ft.: branchlets usually not glaucous: lvs. narrow-oblong to linear,  $\frac{3}{4}$ –1½ in. long, whitish-glaucous beneath, but not tomentose, later sometimes green, revolute at the margin: fls. nodding on slender pedicels, 2–4 times as long as the globose-urceolate corolla: caps. brownish, ob-ovoid or subglobose, as high as broad. June. N. Eu., N. Asia, rare in the colder regions of N. Amer. L. B. C. 18: 1714. G.W. 12, p. 50 (habit).—Varies with narrower and broader lvs. On account of its slender-stalked fls., more graceful than the following species.



197. *Andromeda polifolia*. ( $\times \frac{3}{4}$ )

branchlets glaucous: lvs. white beneath, with a fine tomentum: fls. on curved thick pedicels, rarely twice as long as the urceolate corolla: caps. depressed, glaucous. June. N. E. Amer., south to Minn. and Pa. L. B. C. 6:546; 16:1591; 18:1725.—Varies like the preceding species with broader and narrower lvs.

*A. acuminata*, Ait.=*Leucothoe populifolia*.—*A. arborea*, Linn.=*Oxydendrum arboreum*.—*A. axillaris*, Michx.=*Leucothoe Catesbaei*.—*A. axillaris*, Lam.=*L. axillaris*.—*A. calyculata*, Linn.=*Chamaedaphne calyculata*.—*A. campanulata*, Miq.=*Enkianthus campanulatus*.—*A. cándida*, Hort.=*Zenobia pulverulenta*.—*A. cassinifolia*, Vent.=*Z. pulverulenta*.—*A. Catesbaei*, Walt.=*Leucothoe Catesbaei*.—*A. cernua*, Miq.=*Enkianthus cernuus*.—*A. dealbata*, Lindl.=*Zenobia pulverulenta*.—*A. fastigiata*, Wall.=*Cassiope fastigiata*.—*A. ferruginea*, Walt.=*Lyonia ferruginea*.—*A. floribunda*, Pursh=*Pieris floribunda*.—*A. formosa*, Walt.=*Pieris formosa*.—*A. glauca*, Hort.=*Zenobia pulverulenta*.—*A. japonica*, Thunb.=*Pieris japonica*.—*A. ligustrina*, Muhl.=*Lyonia ligustrina*.—*A. mariana*, Linn.=*Pieris mariana*.—*A. nitida*, Bartr.=*Pieris nitida*.—*A. ovalifolia*, Wall.=*Pieris ovalifolia*.—*A. paniculata*, Ait.=*Lyonia ligustrina*.—*A. parabolica*, Duham.=*L. ligustrina*.—*A. populifolia*, Lam.=*Leucothoe populifolia*.—*A. pulverulenta*, Bartr.=*Zenobia pulverulenta*.—*A. racemosa*, Linn.=*Leucothoe racemosa*.—*A. speciosa*, Michx.=*Zenobia pulverulenta*.—*A. tetragona*, Linn.=*Cassiope tetragona*.—*A. tomentosa*, Hort., not Dum.-Cours.=*Lyonia ligustrina pubescens*.

ALFRED REHDER.

**ANDROPÖGON** (Greek, *aner*, man, and *pogon*, beard, referring to the silky hairs on the spikelets of some species). *Gramineæ*. BEARD-GRASS. Annual or mostly perennial grasses of various habit but usually with coarse foliage, scarcely horticultural.

Spikelets in pairs at each joint of an articulate rachis, one sessile, perfect, 1-fl.; the other pedicelled, staminate, neutral or reduced to a pedicel; glumes of fertile

spikelet equal, indurated, the first dorsally compressed, the second keeled; sterile and fertile lemmas hyaline, the latter usually awned; palea minute or wanting: rachis usually hairy, often conspicuously so.—A large genus of probably 200 species, widely distributed in both hemispheres except in the colder regions. Includes several important native forage grasses such as blue-stem or blue-joint (*A. furcatus*, Muhl.) with about 3 digitate spikes at the summit of the tall culm; and little blue-stem (*A. scoparius*, Michx.), with single spikes scattered along the branches, both species of the prairie region. Broom sedge (*A. virginicus*, Linn.), a common grass of the Atlantic states, is considered troublesome, though it has some forage value before it flowers. Some of the species, such as silver beard-grass (*A. argenteus*, DC.), are ornamental on account of the silvery panicles. This is a stout grass, 2–4 ft., with bearded nodes and long-stalked oval panicles consisting of numerous woolly ascending or appressed spikes.

Several species of oil-producing grasses formerly included in *Andropogon* are now referred to other genera. *A. Nardus*, Linn.=*Cymbopogon Nardus*, Rendle. *A. citratus*, DC.=*Cymbopogon citratus*, DC. *A. Schoenanthus*, Linn.=*Cymbopogon Schoenanthus*, Spreng. *A. squarrosus*, Linn.=*Vetiveria zizanioides*, Nash.

For a discussion of the sorghums and Johnson-grass referred by some authors to *Andropogon*, see *Holcus*; also Vol. II, Cyclo. Amer. Agric. A. S. HITCHCOCK.

**ANDRÓSACE** (old Greek name of no significance here). *Primulaceæ*. ROCK JASMINE. Small tufted plants grown in the alpine garden.

Root-lvs. clustered: scapes mostly not exceeding 8 in. high, often very short: fls. mostly pink, red and purplish, sometimes white, primula-like but constricted at the throat, umbellate or solitary, in early spring.—Over 80 species in Eu., Asia, N. Amer. and Pacific Isls. Pax and Knuth, Engler's Pflanzenreich, hft. 22:172–220.

Many species of rock jasmine are known in European gardens, and they are much prized by fanciers in alpine-gardening. The tufted leaves sit close to the rocks. Some of them are woolly-leaved. Only currently catalogued species are included in the present account. A well-drained soil, partial shade, free circulation of air, frequent waterings in dry summer months, and protection from heavy fall and spring rains, will lead to success with these charming alpine. A heavy shading of evergreen boughs in winter will be found of great benefit. Close covering is not to be recommended, because it smothers the plants. Very many species have been tried in this country, with variable and not very encouraging results, but in a few instances, with extra care, plants have done well. The northern aspect of a steep rockery seems to be the most favorable position for them. Propagation is by division, seeds or cuttings. Plants should be kept in pots until thoroughly established. The species are biennial or perennial except in group AAA below. Many of them are densely caespitose.

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A. Lvs. long-petioled, large, orbicular-reniform or cordate, lobed or crenate.

1. **Hénryi**, Oliver. Scape 3–9 in., woolly, 12–25-fl.: lvs. to 2½ in. across, orbicular-reniform, lobed and toothed: fls. white. China.



AA. *Lvs. sessile or nearly so, spatulate or linear, nearly or completely entire.*

B. *Fls. in umbels or umbellate heads.*

C. *Plant stout: scape 4 in. or more high.*

D. *Foliage woolly or villous.*

2. *lanuginosa*, Wall. Whole plant densely white-villous: sts. leafy: lvs. small,  $\frac{3}{4}$  in. or less long, lance-ovate, acute: scapes axillary, about 4 in.; fls. rose-colored, in a dense umbel. Himalaya. B.M. 4005.

3. *sarmentosa*, Wall. Creeping by brownish stolons: lvs. clustered, all basal, more or less woolly, lanceolate or ovate-lanceolate, acute,  $1\frac{1}{2}$  in. or less long: scapes often 4 in. long; fls. many, rose-colored. Himalaya. Var. *Chúmbyi*, Hort. (*A. chumyiense*, Hort.). Rosettes dense, and the plant very cespitose: lvs. densely woolly.

DD. *Foliage bristly.*

E. *The lvs. not in rosettes, crowded at base of st., narrowed into petiole.*

4. *foliösa*, Duby (*A. sarmentosa* var. *foliösa*, Hook. f.). Stolons thick, brownish, naked: lvs. all basal, obovate or ovate, sessile but base attenuated, mucronate or acute, ciliate,  $1\frac{1}{2}$  in. or less long: scape pilose, much exceeding lvs.; fls. flesh-colored becoming whitish. Himalaya. B.M. 6661.

EE. *The lvs. in rosettes, long-petioled, usually cordate.*

5. *spinulifera*, Knuth. Not stoloniferous, densely hairy: lvs. linear-obovate, 3 in. or less long with petiole, spinulose at apex: scape 10 in. or less; fls. numerous, densely capitate, purple. China.

6. *Aizöon*, Franch. Lvs. 1 in. or less, rosulate and imbricated, leathery and glaucous, spatulate, not spinulose: scape 1 ft. or less, many times exceeding the lvs., the bracts glandular; fls. 6–10, flesh-colored or red. Himalaya. Var. *coccinea*, Franch. (*A. Bulleyana*, Hort.). Not glandular: fls. red or intense scarlet.

CC. *Plant slender: scape seldom 4 in. high: lvs. all rosulate (in rosettes).*

D. *The lvs. with hairy margins.*

7. *villösa*, Linn. (*A. odoratissima*, Schreb.). Entire plant densely white-hairy, loosely cespitose: lvs. linear-lanceolate or lance-ovate, sessile, entire: scape 2 in. or less; fls. white or rose with yellow-red throat, corolla equaling the calyx-lobes, the corolla-lobes obovate, entire or slightly emarginate. Eurasia. Very variable. Var. *arachnoidea*, Knuth (*A. arachnoidea*, Schott). More cespitose: lvs. oblong-ovate, densely webby-white: scape very short. Var. *robüsta*, Knuth. Plant robust: lvs. lance-ovate, often densely congested, white-silky. Var. *Jacquemöntii*, Knuth (*A. Jacquemöntii*, Duby). Lvs. crowded, imbricated, ovate, obtuse, the hairs white to brown: scape long; fls. flesh-colored, the corolla-lobes obtuse and entire.

DD. *The lvs. glabrous, or only obscurely ciliate.*

8. *hedræantha*, Griseb. Cespitose: lvs.  $\frac{1}{2}$  in. or less long, lance-oblong, obtuse, leathery, not crowded at base of st: scape very short (about 1 in.); fls. 5–10 in each umbel or head, violet-red or pale purple, the corolla-lobes obovate. Balkans.

9. *cárnea*, Linn. (*A. Reverchönnii*, Jord. *A. ròsea*, Jord. & Fourr.). More or less densely cespitose: lvs. linear or subulate,  $\frac{3}{4}$  in. or less long: scape 3 in. or less; fls. 3–7, rose-colored or whitish, the throat yellow. Eurasia. L.B.C. 1:40. Var. *Hälleri*, Linn. Lvs. twice longer than in type, recurved at apex, shining green, sparsely hairy. Var. *Lággeri*, Knuth (*A. Lággeri*, Huet.). Lvs. acuminate, spreading, deep green: scape very short: densely cespitose. Gn. 63, p. 333. Var. *brigantiaca*, Knuth (*A. brigantiaca*, Jord. & Fourr.). Lvs. narrowly linear, short, slightly denticulate at apex: scape to 5 in.: little cespitose.

10. *lacteä*, Linn. (*A. pauciflora*, Vill.). Cespitose, glabrous or nearly so: lvs. rosulate, membranous, linear or linear-lanceolate, obtusish, sparsely ciliate, 1 in. or less long: scape 5 in. or less; fls. snow-white. Eurasia. B.M. 868, 981. Var. *exímia*, Hook. Lvs. less rigid, strongly recurved: fls. larger ( $\frac{1}{4}$  in. across). Switz. B.M. 5906 (as *A. carnea* var. *exímia*).

BB. *Fls. solitary.*

11. *imbricatä*, Lam. Cespitose, stellate-pubescent: lvs.  $\frac{1}{4}$  in. long, linear-spatulate and obtuse, in densely superimposed imbricated rosettes. Alps.

AAA. *Lvs. scarcely petioled, oblong or linear, entire or dentate: fls. umbellate: annual.*

12. *lactiflora*, Pall. (*A. angustifolia*, Andr. *A. coronopifolia*, Andr.). Glabrous, 1 ft. or less high: lvs. 2 in. or less long, rosulate, linear-lanceolate or linear-spatulate, acute, toothed: fls. milk-white, large. Asia.—A handsome little annual, often self-seeding.

*A. Vitaliana*, Lapeyr., listed as the only yellow-fl. Androsace, is *Douglasia Vitaliana*. It is often catalogued as *Aretia Vitaliana*.

L. H. B.

ANDRÖSÆMUM: *Hypericum*.

ANDRÖSTÈPHIUM (Greek-made name, referring to the corona). *Liliacæ*. BABIES' BREATH. Outdoor bulbous plants, allied to the brodiaeas.

Small genus of S. W. and Cent. U. S., with funnel-shaped, spreading-limbed, 6-lobed perianth, 6 stamens, and 3-angled ovary, and a corona or crown at the mouth: lvs. linear, radical: scape simple, leafless.—Plant in a sunny place in sandy soil, placing the bulbs 4–6 in. deep; protect in winter. Prop. by division of the bulbs and by seeds. The name "babies' breath" or "baby's breath" is commonly applied to *Gypsophila*.

*violaceum*, Torr. (*A. cæruleum*, Greene). Slender, 6–10 in.: umbel 2–7-fl., the fls. blue, 1 in. long, supported on a stout ( $\frac{3}{4}$  in.) pedicel; crown exceeding the anthers.—Blooms in spring; pretty. N. TAYLOR.†

ANEILÈMA (Greek, *no involucre*). Syn., *Aphylax*. *Commelinacæ*. Sixty tropical perennials, allied to *Commelina*, from which it may be distinguished by its sub-paniculate infl. *A. biflorum*, R. Br. and *A. stnicum*, Lindl., are sometimes cult. in Old World hothouses and in American botanic gardens. These species are blue-fl., diffuse or trailing plants with their fls. having no involucre bracts. Culture as in *Dichorisandra*.

N. TAYLOR.†

ANÈMIA (Greek, *naked*; without indusia). *Schizæacæ*. Tropical ferns, with 1–3 pinnate lvs. with the lower pair of pinnae erect, elongate and bearing the sporangia in panicles at their extremities.—Of the 40 species, 2 are found in the southern states, and a few are occasionally in cult.

Anemias are dwarf, compact ferns, suited for shelves, or for growing near the glass in warm pits or low houses. They prefer being grown in small pots to being planted out in the fernery. Their growth is too slow to make them popular decorative ferns for general purposes. Propagation is by spores, which germinate freely; tufted kinds by division between March 15 and April 30.—Schneider, Book of Choice Ferns.

A. *Lf. 2–3-pinnate, with narrow divisions.*

*adiantifolia*, Swartz. Lf.-blade 6–9 in. long on a stalk often twice as long, the ultimate divisions oblong or linear-cuneate, with the outer margin toothed. S. Fla. and tropics.

AA. *Lf. only once pinnate with broad pinnae.*

B. *Veins free.*

*mexicana*, Klotzsch. Lf.-blade 6–9 in. long, with 4–6 pinnae on either side, which are distinctly stalked, ovate lanceolate and rounded on both sides at the base fertile pinnae 3–4 in. long, dense. Texas and Mex.

*collina*, Raddi. Lvs. 1 ft. high, stalks hairy, blades with about 10 lfts. on each side, which are rounded at the outer ends and truncate at the upper side at the base; fertile pinnæ about  $1\frac{1}{2}$  in. long, dense. Brazil. S. 1:384.



198. *Anemone patens* var. *Nuttalliana*. ( $\times \frac{1}{2}$ )

Stems usually erect, with great variation in height: basal lvs. lobed, divided or dissected, those of the st. forming an involucre near to, or remote from, the fl.: sepals few or many, petal-like; no true petals; stamens many, shorter than sepals: carpels numerous: fr. a 1-seeded achene.—A genus of about 85 species, with many handsome garden forms; all hardy perennials; cult. for their beautiful show of fls. and in a few cases for their striking foliage. Chiefly native of the north temperate and mountainous regions. As a technical generic name, pronounced *anemone*; as a vernacular, *anémone*. Pritzel, Revision of *Anemone*, in *Linnæa* 15:498 (1841). Britton, N. Amer. *Anemone*, in *Ann. N. Y. Acad. Sci.* 6:217 (1891–92).

The plants thrive best in a fresh, rather rich, sandy loam, well drained; but most of the species will do well in any good garden soil. The tuberous-rooted species are suitable for hardy borders, while most of the others prefer a place in a rockery, and some are partial to shady places. *A. hortensis*, *A. coronaria*, *A. fulgens* and others will well repay the little indoor or greenhouse care they require for producing winter blossoms. They require essentially the same handling as tulips and hyacinths, and are usually classed with bulbous plants. Tubers placed in pots in September or October bring forth a beautiful show of bloom by January or March. For this purpose they should be well drained, and not kept very wet or too warm before the growth is well started; they prefer more moisture at flowering time. There are many garden varieties of *anemone*, among which are *Whirlwind* and *Geante Blanche* (white); *Queen Charlotte*, *Lorely*, and *Kriemhilde* (pink); *Rosa Zwey* (lavender-pink); *Brilliant Diademe*, *Purpurine* and *Prinz Heinrich* (carmine and magenta).

Nearly all the species can be readily propagated by both root-division and seed. The seeds are sown very shallow in a clean bed, in either warm fall or early spring. The division of roots is best made in early spring before growth starts. The season for both outdoor and indoor planting will directly influence the flowering season. Good months for outdoor planting are September, October, November, December, February and March. As a rule, the tuberous anemones will blossom at any time desired, being influenced by the time they are kept out of the ground. The bulbs

may be ripened after flowering time by being taken from the ground to dry, or by covering the bed to keep out rains. *A. japonica* is one of the finest of all fall-blooming herbs.

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A. Achenes with long styles, which may become feather-like on ripening; fls. solitary.—*Pulsatilla* section.

B. Involucre bell-shaped, dissected into numerous linear equal lobes.

1. *vernalis*, Linn. (*Pulsatilla vernalis*, Mill. *A. sulphurea*, All.). Very shaggy, 6 in. high or less: lvs. pinnately parted, segms. trifid: fls. purple without, whitish within, and smoothish; erect, on very short peduncles; sepals 6, rarely spreading. Apr. Cool, moist places. Eu. J.H. III. 32:223. Gn. 25:320. Gn. W. 20:891; 26:134. F.E. 18:320. G. 20:158.

2. *Halleri*, All. Villous, 6 in. or less in height; simple: lvs. pinnately divided with segms. 3–4-parted; the lesser divisions lanceolate-linear; involucre of long narrow segms., sessile: fls. large, erect, whitish purple; sepals 6; anthers yellow. Apr. Sunny places. Switzerland. L.B.C. 10:940.

3. *pätens*, Linn. Much like the first variety below, which is more common in Amer., but differs in its broader and shorter lf.-segms. and smaller fls. Eu. Gn. 60, p. 364; 65, p. 167.

Var. *Nuttalliana*, Gray (*Pulsatilla hirsutissima*, Brit.). WILD PATENS. AMERICAN PASQUE FLOWER. Fig. 198. Villous, with long, silky hairs, 4–9 in. high: radical lvs. petioled, others sessile, all much divided into narrow, linear, acute lobes: fls. appearing before



199. Tubers of *Anemone coronaria*.

the root-lvs., bluish purple or whitish, erect, seldom nodding: achenes silky: styles plumose, becoming 2 in. long; peduncle elongates several in. after flowering. Apr. Low ground. North central states and Siberia. C.L.A. 3:177. Gn. M. 13:15.

Var. *ochroleuca*, Sims. Fls. creamy white, appearing at same time as basal lvs. March, Apr. J.H. III 30:343. B.M. 1991.



4. *Pulsatilla*, Linn. (*Pulsatilla vulgaris*, Mill. *A. acutipétala*, Schleich). PASQUE FLOWER of Europe. Villous, hairy, rising  $\frac{3}{4}$ –1 ft.: basal lvs. finely thrice-pinnately divided, on slender petioles; involucre sessile, deeply cut into long narrow lobes: fls. blue to reddish purple,  $1\frac{1}{2}$ –2½ in. across. Apr. Well-drained soil or stony places. Eu. Gn. 32:466; 71, p. 215, 530. L.B.C. 18:1704. G.C. III. 39:307. Gn. M. 13:17. G.M. 52:636. Gn.W. 20:225. Var. *rùbra*, Hort. (*A. rùbra*, Lam.). Dwarfier: fls. always erect. Var. *variegata*, Hort. Fls. pale, appearing in May.

BB. *Involucre lvs. 3, on short petioles, sheathing the st.*

5. *occidentàlis*, Wats. (*A. alpina*, Hook., not Linn.). Silky-hairy,  $\frac{1}{2}$ –1½ ft. high, simple: lvs. 2-parted, the divisions deeply pinnatifid into usually incised linear, acute lobes; involucre short-petioled; basal lvs. long-petioled: fls. solitary, white or purple, varying, 1–2 in. across; receptacle conic, sometimes much elongated: achenes pubescent: plumose styles reflexed; peduncle becoming much elongated after sepals fall. May. Calif. to Brit. Col. Intro. 1892.



200. *Anemone coronaria*, single-flowered form. ( $\times \frac{1}{4}$ )

6. *alpina*, Linn. (*A. acutipétala*, Hort.). Closely allied to the above. St.  $\frac{3}{4}$ –1½ ft. high, from thick, strong roots: lvs. large, finely divided, cut and serrated, smooth or hairy; lvs. of involucre similar: fls. few, in an umbel or solitary, 2–3 in. diam., creamy white inside, purple outside, but varying much; anthers yellow. Mountain-sides. Eu. May, June. L.B.C. 17:1617. B.M. 2007 (var. *major*). Var. *sulphùrea*, Hort. Fls. a delicate sulfur-yellow, larger, downy beneath: lvs. larger. Moist, rich soil. Gn. 35:10; 66, p. 195. G.M. 49:797.

AA. *Achenes woolly or smoothish, with short styles. (Anemone proper.)*

B. *Peduncle 1 (rarely 2): involucre mostly 3-lobed.*

C. *Head of fr. cylindric: achenes woolly.*

D. *Roots tuberous: involucre usually sessile.*

7. *coronària*, Linn. POPPY-FLOWERED ANEMONE. Figs. 199, 200, 201, 202. One-half to 1 ft. high, from tuberous roots: lvs. cut into many fine lobes and lobules; involucral lvs. sessile, 3–4-parted, deeply cut: fls.  $1\frac{1}{2}$ –2½ in. across, poppy-like, of many colors and mixtures of red, blue, white, etc.; stamens blue. Early in spring to June. Meadows, Medit. region. V. 11:257. B.M. 841. Gn. 50:6; 61, p. 275; 16, p. 111. A.F. 25:93. C.L.A. 4:344. G. 24:5. G.L. 20:355. Gn.M. 13:296 J.H. III. 48:383. R.H. 1893:232.—Caen, Scarlet, The Bride, St. Brigid, Victoria Giant, etc., are some of the trade names given to the single forms. Var. *flòre-plèno*, Hort. Fls. double, as shown in Fig. 202; many colors, scarlet being the most common at present. F.S. 16:1678. Gn. 63, p. 353. Var. *chrysanthemiflora*, Hort. A seedling variety produced in 1848, and intro. many years later. Fls. more completely doubled than the above variety by the stamens all becoming petal-like.—A dozen forms, beautiful, self-colored, as deep red, sky-blue and even pure white, have been fixed and named. Useful as cut-fl. Gn. 30:316. R.H. 1887:36; 1897, pp. 418–9. R.B. 21:260–1.



201. *Anemone coronaria*, semi-double-flowered form. ( $\times \frac{1}{4}$ )

8. *fùlgens*, Gay (*A. Pavo-niàna* var. *fùlgens*, DC. *A. hortensis*, Thore). Fig. 203. One ft. high, simple: basal lvs. 3–5-lobed, with rounded outline, followed later by deeply cut lvs.; involucre sessile, several in. below the solitary fl.: fls. vivid scarlet, 2 in. across; stamens black. May, June. France.—Sometimes called a variety of *A. hortensis*, Linn., from which it may have descended. Several garden forms, as *A. annuata-grandiflora*, *A. multipétala*, and Southern Star. Gn. 11:214. Gt. 37:66. R.B. 21:262–3. R.H. 1877:270. G. 4:91.

9. *hortensis*, Linn. (*A. stellata*, Lam.). BROAD-LEAVED GAR-

DEN ANEMONE. Fig. 204. St. simple, erect, 10 in. high: basal lvs. lobed and cut irregularly; involucre small, 3–5-lobed, usually 3 or more in. below the fl.: fls. red, rosy purple, or whitish, single,  $1\frac{1}{2}$  in. across; stamens brownish violet. Rich, light soil. S. Eu. May.—This differs from *A. coronaria* in its coarse, broad lvs. and its elongated, rather narrow-pointed sepals. Garden names are given to the forms with different coloration. B.M. 123. Gn. 61, p. 352. F.W. 1877:257.

10. *palmàta*, Linn. St. 6–9 in. high from tuberous root: basal lvs. leathery, 3–5-lobed, cordate, toothed; involucral lvs. 3-parted: fls. golden yellow, solitary or in 2's; sepals 10 or more. May, June. Deep, light soil. Medit. region. B.R. 200.—Three good varieties in the trade. Var. *flòre-plèno*, Hort., with double yellow or white fls. Var. *àlbida*, Sims (var. *alba*, Hort.). Fls. white: basal lvs. lobed. B.M. 2079. L.B.C. 2:175. Gn. 22:466. Var. *lùtea*, Lodd. Like the last, but with yellow fls. L.B.C. 17:1660.

11. *caroliniana*, Walt. (*A. decapétala*, Amer. authors, not Ard.). St. simple, slender,  $\frac{1}{2}$ –1 ft. high, arising from a large tuber: lvs. of involucre sessile, with 3 wedge-shaped clefts; basal lvs. thrice divided, and much lobed and parted, slender-petioled: solitary fl. erect, 1–1½ in. broad, creamy white or purple; sepals often numerous: achenes densely woolly. April, May. Open places, U. S. G. 6:521.

DD. *Rootstock creeping: lvs. of involucre petioled.*

12. *syvéstris*, Linn. St. 1–1½ ft., simple, or branched once at involucre, from a creeping rootstock: lvs. 3–4-parted, deeply cut at top, hairy beneath; involucre petioled: fls. solitary or in 2's, pure white,  $1\frac{1}{2}$  in. across, nodding, sweet-scented; sepals 6. May–July. Wooded places, Eu. and Liberia. B.M. 54. Gn. 18, p. 561; 30, p. 173; 65, p. 73; 75, p. 189. G. 2:223; 33:31.



202. *Anemone coronaria* var. *flòre-plèno*. (full double) ( $\times \frac{1}{4}$ )

Gn.M. 13:295. J.H. III. 57:80. L.B.C. 18:1739. Var. *flöre-plèno*, Hort. DOUBLE SNOWDROP ANEMONE. Has large, white, double fls. G.C. III. 19:739. *A. baicalénsis*, Turcz., is much like this species.



203. *Anemone fulgens*.  
( $\times \frac{1}{4}$ )

204. *Anemone hortensis*.  
Reduced from an old cut, to show  
a little improved form.

cc. Head of fr. hemispherical: achenes silky-pubescent.  
d. Roots tuberous.

13. *apennina*, Linn. St. simple, slender, 7-9 in.: lvs. twice-divided and lobed, much toothed: fls. sky-blue,  $1\frac{1}{2}$  in. across; sepals 10-12, elongated, obtuse; anthers white. March, Apr. Woods, Italy. Gn. 72, p. 482.—This and a form with whitish fls. are both well suited for shady nooks in clumps of shrubbery, etc. Var. *Allenii*, Hort. Fls. large, pale blue. Var. *plèna*, Hort. Fls. double. Var. *purpurea*, Hort. Fls. bright mauve. Gn. 72, p. 254.

14. *blànda*, Schott & Kotschy. St. 4-6 in. high, from a cylindrical rootstock: lvs. like *A. apennina*, but harder and smoother, and principal divisions sessile: fls. intense sky-blue, differing from above species in being larger, more finely rayed, styles black-pointed, and sepals smooth on the outside; opens in earliest spring or mild winter weather. From Taurus Mts. and Greece; rocky places. Intro. 1898. Gn. 14:200; 75 p. 152. G.L. 19:71. Gn. W. 22: Supp. Apr. 15 (var. *atrocaerulea*). G.C. III. 41:297. (var. *Scythissica*).

dd. Rootstock slender, creeping, cylindrical.

15. *memoròsa*, Linn. (*A. intermedia*, Winkl.). WOOD ANEMONE. Fig. 205. St. simple, 3-8 in., nearly smooth: rootstock horizontal, 3-4 times the st. in diam.: lvs. of involucre petioled, 3-5-parted; basal lvs. appearing after the fl.-st., 5-parted, divisions wedge-shaped, toothed: fls. white or purplish, solitary, 1 in. across: achenes pubescent; styles hooked. Apr., May. Eu. and Siberia. Gn. 63, p. 244 (as *A. intermedia*).—Three or more horticultural varieties. Var. *álba*, Hort. (var. *flöre-plèno*, Hort.). Fls. larger, pure white, and abundant. Intro. 1883. Gn. 32:344; 69, p. 233 (var. *grandiflora*): 75, p. 128 (var. *purpurea*). G. 24:255 (var. *major*). Var. *Allenii*, Hort. Fls. large, lavender-mauve. Var. *major*, Hort. A robust variety with large white fls. Var. *Robinsoniàna*, Hort. (var. *caerulea*, Hort.). A robust form, 6-12 in., with broader and thicker lvs., and large fls., becoming blue. Sometimes given as a separate species. March, Apr. Gn. 46, p. 153; 32, p. 345; 73, p. 266. G. 2:515. R.H. 1901:188. Var. *ròsea*, Hort. (var. *rùbra flöre-plèno*, Hort.). Fls. a reddish purple: now much used; suited to partially shaded places of the perennial border.

16. *quinquefòlia*, Linn. (*A. nemoròsa* var. *quinquefòlia*, Gray). This American species differs from *A. nemorosa* in having smaller fls., involucre lvs. less lobed, foliage paler, and much more slender st. and petioles.—The common windflower or spring anemone, formerly called *A. nemorosa*. Gn.M. 13:15.

17. *deltoidea*, Douglas. St. simple, slender, 6-12 in. high, from a slender rootstock: lvs. trifoliate, basal ones petioled, others nearly sessile, coarsely crenated, often incised: fls. solitary, white, rather large: achenes several, densely pubescent; style very short. Spring. Pacific slope.

ddd. Rootstock horizontal, fleshy or somewhat tuberous.

18. *ranunculoides*, Linn. YELLOW WOOD ANEMONE. St. 3-8 in., from elongated, somewhat tuberous rootstock: lvs. 3-5-parted, divisions deeply cut and serrated: fls. golden yellow, usually solitary, single or semidouble. March and Apr. Rich, light soil in open places and woods. Eu. and Siberia. Gn. 35:408. L.B.C. 6:556.

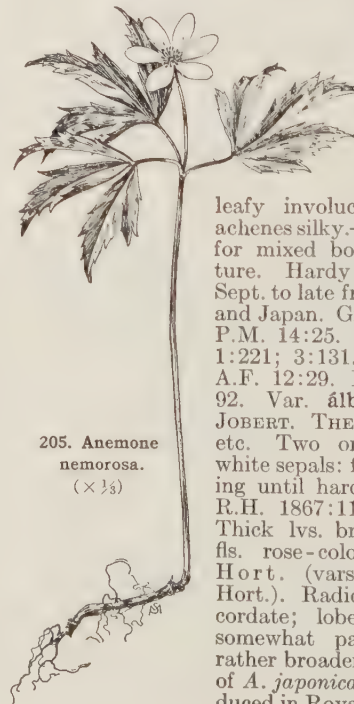
19. *Grayi*, Behr. (*A. oregana*, Gray). St. slender, 3-12 in. high, from a fleshy, brittle rootstock: basal lvs. slender-petioled, 3-parted, coarsely serrate; involucre lvs. petioled, trifoliate, the parts 2-3-lobed, much toothed; sepals blue or purplish: achenes pubescent, in a globose head. Moist, shady slopes. Ore. and Wash. In gardens west of the Rockies. Intro. 1892.

bb. Peduncles 2-5 (mostly 3).

c. Frs. (achenes) woolly or very silky: secondary involucre present.

20. *virginiana*, Linn. Plant hairy, 2-3 ft. high, stout, branching at the involucre: the petioled involucral lvs. 3-parted, the lvs. cleft and lobed; basal lvs. similar, broader than long, on long petioles: fl. peduncles naked (or the lateral ones 2-lvd.); fls. greenish or white,  $1-1\frac{1}{2}$  in. across: achenes woolly, in an oblong head; styles short, awl-shaped. June-Aug. Woods and meadows, U. S. and Canada. G.M. 33:763.

21. *japónica*, Sieb. & Zucc. Fig. 206. Stately, branching st., 2-3 ft. high: plant soft and downy, with short hairs: lvs. ternate, much lobed and toothed: fls. rosy purple or carmine; 1-3 whorls of sepals, 2-3 in. diam., on long peduncles from



205. *Anemone nemorosa*.  
( $\times \frac{1}{2}$ )

leafy involucre; stamens yellow: achenes silky.—A very useful species for mixed borders or for pot culture. Hardy in northern states. Sept. to late frosts. Rich soil, China and Japan. Gn. 30:172. B.M. 4341. P.M. 14:25. A.G. 19:305. Gng. 1:221; 3:131. G.C. III. 16:661. A.F. 12:29. F.S. 2:74. Gt. 61, p. 92. Var. *álba*, Hort. HONORINE JOBERT. THE BRIDE. WHIRLWIND, etc. Two or 3 whorls of large, white sepals: fls. 2-3 in. across, lasting until hard frosts. Gng. 5:117. R.H. 1867:11. Var. *crispa*, Hort. Thick lvs. bronzed on the edges: fls. rose-colored. Var. *hýbrida*, Hort. (vars. *ròsea* and *élegans*, Hort.). Radical lvs. 5-lobed, often cordate; lobes twice serrate: fls. somewhat paler, earlier; sepals rather broader. Said to be a hybrid of *A. japonica* and *A. vitifolia*; produced in Royal Gardens, 1848. Var.



**rûbra**, Hort. **LADY ARDILAUN**. Probably the same as the type, but having lvs. and fls. with a waxy gloss: plant 4-5 ft. high.

**22. multifida**, Poir. Plant silky-hairy, somewhat branched,  $\frac{1}{2}$ -1 $\frac{1}{2}$  ft. high, from a branched, upright rootstock: main involucre 2-3-lvd., others 2-lvd. or naked, short petioles, similar to the root-lvs., 2-3 times 3-parted and cleft, divisions linear: fls.  $\frac{1}{2}$ -1 in. across, red, varying to white or yellow: achenes very woolly. Early summer. Rocks and uplands. Middle states to Hudson Bay.

cc. *Frs. (achenes) glabrous at first: fls. white, somewhat umbellate.*

**23. canadensis**, Linn. (*A. pennsylvanica*, Linn. *A. dichotoma*, Michx., not Linn.). Hairy, stout, 1-2 ft. high, branching at or above the involucre: the 3 lvs. of main involucre sessile, 3-cleft; upper involucres each 2-lvd.; basal lvs. broader than long, much divided, cleft and toothed; petioles long: fls. white, 1-2 in. across: achenes wing-margined, naked, becoming pubescent, grouped into a spherical head. Summer. In shaded woods and open meadows. N. Amer. Gng. 2: 21. Gn. M. 13:355.

**24. narcissiflora**, Linn. (*A. umbellata*, Lam.). St. erect, rather stout,  $\frac{1}{2}$ -1 $\frac{1}{2}$  ft. high: lvs. of involucre sessile; basal lvs. petioled, 3-5-parted, divisions deeply cut: fls. white,  $\frac{1}{2}$ -1 in. across, several in an umbel; anthers yellow: achenes smooth, with short style. May-July. Mountainous regions. Northern hemisphere. Gn. 30, p. 173. B.M. 1120. G. 6:309.

*A. acutiloba*=*Hepatica acutiloba*.—*A. alba*, Juss. Allied to *A. sylvestris*, if not the same. L.B.C. 4:322. B.M. 2167.—*A. Bungeana*, Pritz. Similar in habit to *A. Pulsatilla*. Fls. golden yellow. Siberia.—*A. cernua*, Thunb. Lvs. deeply cut, divided; fls. nodding, color of dragon's-blood. Japan.—*A. cylindrica*, Gray. A tall native species, used for beauty of foliage and fr.—*A. decapetala*, Ard. (*A. trilobata*, Juss. *A. heterophylla*, Nutt.). Native and reported as having been cultivated in southern states. 1891.—*A. elongata*, D. Don. Similar in habit and foliage to *A. sylvestris* but not so beautiful: fls. dull greenish white. Himalaya.—*A. Faminii*, Haw. Fls. pure white, 2-3 in. across: 5 feet high: lvs. 1 ft. across. B.M. 6958. Gn. 34:202.—*A. hupehensis*, Hort. Allied to *A. japonica*. Fls. produced very early. Cent. China.—*A. magellanica*, Hort. Fls. yellow: pretty but not showy. Straits of Magellan.—*A. parviflora*, Michx. Pretty white fls. Native of northern states and Canada.—*A. polyanthus*, Don. Allied to *A. narcissiflora*. B.M. 6840. J.H. III. 32:259.—*A. pratensis*, Linn. Allied to *A. Pulsatilla*. L.B.C. 9:900.—*A. pratensis* var. *obsoleta*, Sims. Fls. pale: lfts. terminated with a sort of bristle. B.M. 1863.—*A. rivularis*, Bush-Ham. Is a distinct species similar to *A. narcissiflora*. G. 18:138.—*A. sphenophylla*, Poepp. Fls. blue. S.W. U.S.—*A. thalictroides*. See *Syndesmon*.—*A. trifolia*, Linn. Lvs. beautifully regular: fls. white, 1 in. across. Two blue varieties. B.M. 6846.—*A. triloba*=*Hepatica triloba*.—*A. vitifolia*, Ham. Allied to *A. japonica*. Has cordate 5-7-parted lvs. B.M. 3376.

K. C. DAVIS.

**ANEMONÉLLA**: *Syndesmon*.

**ANEMONÓPSIS** (*Anemone*-like). *Ranunculacææ*. A beautiful hardy plant for border purposes because of its effective foliage and showy flowers.

This is a perennial herb, with erect sts.: radical and st.-lvs. rather large, ternately compound and much incised, similar to *Actæa*: sepals many (often only 9), regular, petal-like, deciduous; petals many (often 12), short, sessile, with nectariferous impression at the base; carpels few (3-4), forming many-seeded follicles. In general appearance similar to the Japanese anemones, but smaller in all its parts, and with numerous drooping fls., about 1 $\frac{1}{2}$  in. across, of pale purple color. A monotypic genus from Japan, now planted in American gardens.

*Anemonopsis* thrives well in rich, deep loam, in well-drained situations in partial shade. Propagation is by division of the roots in late fall or early spring. Fresh seed may be sown in the fall or early the next spring and the plants will show some flowers the first season. Sow the seed in clean beds of black sandy loam, and cover very slightly.

**macrophylla**, Sieb. & Zucc. The petals, instead of spreading, form a half-closed bud-like cone within the sepals. Gn. 25, p. 383.

K. C. DAVIS.

**ANEMOPÉGMA**: *Bignonia*.

**ANEMÓPSIS** (Greek, from the resemblance of its fl.-cluster to the flower of an anemone). *Saururacææ*. **YERBA MANSÁ**. Aquatic herb, yielding medicinal products.

A monotypic genus closely allied to *Houttuynia* of E. Asia. Stoliferous aquatic plant with pungent aromatic rootstocks: lvs. mostly radical, minutely punctate: infl. a conical spike or spadix subtended by an involucre of petal-like bracts, resembling the fl. of an anemone; fls. small without calyx or corolla, each subtended by a bractlet; stamens 6-8, with short filaments adnate to the ovary at the base; ovary sunk in the rachis of the spike, 1-celled, composed of 3 or 4 carpels, with as many spreading stigmas and parietal 4-10-ovuled placentæ; caps. dehiscent at the top; seeds rounded, punctulate. Calif. and Mex.

**californica**, Hook. (*Anémia californica*, Nutt. *Houttuynia californica*, Benth. & Hook. *Anemiopsis californica*, Endl.)

**YERBA MANSÁ**.

**APACHE BEADS**.

**VAVISA**. An erect

aquatic herb: radical

lvs. long-petioled,

oblong-obovate,

cordate at the

base; cauline lf.

broad, clasping,

from the axil of

which grows a

branchlet reduced

to 1 or 2 lvs.: fls.

minute, crowded,

forming a conical

spadix with a whorl

of whitish petaloid

bracts below it,

giving it the appearance

of an anemone.

Calif. and Mex.

Hook. & Arn. Bot.

Beech. Voy. pl. 92.

—The pungent aromatic

astrigent

rootstocks are

strung into neck-

laces in the form

of cylindrical beads

by the Indians of

the S. W. U. S., and are used

medicinally in the form

of an infusion for malaria,

dysentery, and syphilis.

They are also pulverized and

applied locally to ulcers

and malignant sores. The

plant grows in swampy

places and on the margins of

springs and ponds more

or less alkaline. The roots

are gathered in the dry

season in Mex. and sold in

the local drug markets.

W. E. SAFFORD.

**ANETHUM**: *Dill* and *Peucedanum*; also *Fennel*.

**ANGADÉNIA**: *Ontadenia*.

**ANGÉLICA** (supposed to have angelic healing virtues). *Umbelliferæ*. **ANGELICA**. Herbs, sometimes planted for ornament.

Stout: fls. small, white or greenish, in many-lvd. involuclers: fr. fattened dorsally, with very prominent ribs.—A genus of 60 species in north temperate regions, and from New Zeal. Several of them are native to N. Amer. They are perennial herbs with compound lvs. and large umbels of white fls. not unlike the cow-parsnip (*Heracleum*). The word "angelica" is loosely applied to various plants. In the American tropics, it is used for some of the araliads. The angelica of vegetable gardens is *Archangelica officinalis*.



206. *Anemone japonica*.

**Cúrtisii**, Buckl. Stout perennial, 2-5 ft., glabrous: lvs. 2-ternate, with quinate divisions, the lfts. thin, ovate-lanceolate, irregularly sharp-toothed. Pa. to N. C.—Grown for the subtropical effect of its finely cut, ample foliage. Intro. 1891 by H. P. Kelsey.

**hirsuta**, Muhl. (*A. villosa*, B. S. P. *Archangelica hirsuta*, Torr. & Gray). Pubescent above: lvs. twice pinnately or ternately divided, the lfts. thickish and serrate, the upper lvs. mostly reduced to sheathing petioles. Eastern states. Intro. 1892 by H. P. Kelsey.

N. TAYLOR.†

**ANGELONIA** (South American name, *angelon*, of one of the species). *Scrophulariaceæ*. Perennial herbs or sub-shrubs, grown in hothouses and conservatories, and in the open far South.

Plants with the look of alonsoas: lvs. simple, opposite (or alternate above): fls. showy, blue, irregularly 2-lipped, the upper lip 2-lobed and the lower larger and 3-lobed; calyx 5-parted or 5-toothed; stamens 4, in pairs; ovary 2-celled. The axillary fls. are in a long, leafy terminal raceme: branches 4-sided.—About two dozen species from Mex. to Brazil. Grown as pot-plants in warm glasshouses and prop. by seeds or soft-wood cuttings.

**salicariæfólia**, Humb. & Bonpl. Perennial, 3 ft. or less: lvs. lanceolate to ovate-lanceolate, sessile, toothed, closely pubescent: fls. deep blue. S. Amer. B.M. 2478. P.M. 5:75. B.R. 415.

**Gárdneri**, Hook. Woody, 3 ft.: lvs. linear-lanceolate, more strongly toothed throughout their length: fls. purple, white-centered, handsome, in a long terminal leafy raceme or spike: plant pubescent-glandular and aromatic. Brazil. B.M. 3754.

**grandiflóra**, Hort. (C. Morr.?). Perennial; graceful, 2 ft.: lvs. entire, or slightly toothed, lance-pointed: fls. lilac, fragrant, solitary, not exceeding the lvs., the lobes prominent and spreading. S. Amer.—An excellent plant for winter bloom, particularly the white-fl. var. *álba*, Hort., and grown in the open satisfactorily in Fla. It is a good pot-plant for conservatory or for table decoration. Blooming plants are secured the same year the seeds are sown. Intro. 1897 in Eu. Gt. 46, p. 612; G.C. III. 22:307; Gn. 52, p. 461; R.B. 23:272; all the same picture of a pot-plant of var. *álba*.

**angustifólia**, Benth. Lower: lvs. smooth, narrow-lanceolate: fls. deep violet in erect terminal racemes. Mex.

**cornígera**, Hook. Annual, 1 ft. or more; slightly hirsute: lvs. lanceolate, practically sessile, broad at the base, slightly ciliate: fls. solitary in the axils, shorter than the lvs., rich purple and deeper colored in the throat, the upper segms. velvety-dotted, the middle segm. of the lower lip bearing a horn-like process (whence the name *cornígera*, "horned"). Brazil. B.M. 3848.

**intégerrima**, Spreng. Perennial, with fleshy root, branching above: lvs. lanceolate, entire, narrowed at base: fls. stalked in the axils of short bracts and forming a terminal spike or raceme 6 in. long, light blue and purple-spotted, the throat wide open and lobes very short and rounded except the lower which is broad-ovate and toothed. S. Brazil, Paraguay. Gt. 54:1538.

L. H. B.

**ANGIÓPTERIS** (Greek, *vessel-fern*). *Marattiaceæ*. An Old World genus of coarse greenhouse ferns, with twice- or thrice-pinnate lvs., and the large fleshy sporangia arranged in boat-shaped marginal sori. In cult., requires plenty of room and abundant drainage.

Angiopteris grows wild in swampy places, and is of robust habit. If grown in pots, the pots may stand in 2 or 3 inches of water. Although spores are freely produced, no seedlings are on record. Easily propagated by the fleshy scales at the base of each frond. Each

scale contains at least two dormant buds, and should not be divided. They may be laid in sand, covered with sphagnum, and kept in a close case for three to five months. They start more quickly in early spring. (Schneider, Book of Choice Ferns.)

**evécta**, Hoffm. Growing from a stout, fleshy, erect caudix, 2-6 ft. high: lvs. 6-15 ft. long, mostly bipinnate, with swollen rachises; lfts. 4-12 in. long,  $\frac{1}{2}$ -1 $\frac{1}{2}$  in. wide, the margin entire or slightly toothed. India and Japan to Madagascar and Queensland. S. 1:399.—Known under various names in cult., as *A. longifolia*, etc. The trade names, which appear to indicate species, may be regarded as varieties. R. C. BENEDICT.†

**ANGÓPHORA** (*vessel-bearing*; Greek, in allusion to shape of fruit). *Myrtacæ*. GUM MYRTLE. A genus of 4 species of Australian trees or shrubs, sometimes cult. in glasshouses in the Old World, but not known to the trade in this country, where their cult. seems to be confined to botanic gardens. They have large opposite lvs., corymbose fls., with a 5-6-cleft calyx. The commonest species in cult. are *A. cordifólia*, Cav., with yellowish fls. and sessile lvs., and *A. lanceolata*, Cav., with white fls. and petiolate lvs. See page 3565.

**ANGRÆCUM** (Latinized from *Angrek*, the Malay name for all orchids of this habit). *Orchidacæ*. Epiphytic hothouse orchids with the habit of *Vanda*.

Leaves flat or terete: fls. few to many in a raceme, or rarely solitary; sepals and petals nearly alike, spreading; lip adnate to the base of the column; lateral lobes small or obsolete; middle lobe entire; spur long and slender; pollinia 2, upon a single undivided stipe.—About 20 species, natives of Trop. Afr., Madagascar, and the Mascarene Isls.

These are valued for their winter-flowering habit and lasting qualities. All have peculiar or grotesque forms and some are fragrant. All need a warmhouse in winter, preferably the warmest corner, where it is moist. As the plants have no pseudobulbs they must never become dry. No soil is necessary at the roots, but a surfacing of live sphagnum may be placed over the crocks; this should be renewed as often as it becomes decayed. The angræcums may be classed with the aërides, vandas and saccolabiums as being true air-plants and the roots are impatient of confinement in pots or other receptacles. Care must be taken to secure the plants firm and upright when repotting, by means of stakes or wire. Frequent spraying overhead in bright weather is of great assistance, especially in the growing time. They must never be removed from the greenhouse for decoration elsewhere, for if the plants become chilled, there is total loss. (Orpet.)

A. Lvs. *semi-terete*, narrow.

**Scottianum**, Reichb. f. Sts. up to 2 ft. long, with brown sheaths below: lvs. terete, grooved on the upper side, 3-4 in. long, spreading or recurved; peduncles with 1-3 fls. which are inverted and 1 $\frac{1}{2}$ -2 in. across, the sepals and petals pale yellow, changing to white, linear, similar, acute, the sepals a little broader than the petals, the lip white, concave, transversely oblong, nuchronate; spur 4-5 in. long, reddish brown. Comoro Isls. G.C. II. 14, p. 137. F.M. 1880:421. B.M. 6723.

AA. Lvs. *flat*.

B. Plant dwarf: fls. few, 3-5, the clusters shorter than the lvs.

**falcátum**, Lindl. St. 1-2 in. tall: lvs. few, linear, falcate, 2-3 in. long, channeled above, keeled beneath: peduncles with 3-5 fls., fragrant, white, about  $\frac{3}{4}$  in. across, the sepals and petals acute, similar, linear-oblong; lip 3-lobed, the lateral lobes minute, the middle lobe narrow-oblong, retuse; spur curved, filiform. Japan. B.R. 4:283. B.M. 2097 (both as *Limodorum falcatum*).



BB. Plant larger than above; fls. numerous, in racemes usually longer than the lvs.

c. Fls. white or tinged with yellow.

d. Lip acute.

E. Spur less than 5 in. long, white.

F. Sepals lanceolate: fls. about 1 in. across; spur 2-3 in. long.

**modestum**, Hook. f. (*A. Sanderianum*, Reichb. f.). Lvs. oblong to obovate-oblong, acutish to emarginate, 3-6 in. long; racemes of numerous pure white fls. on orange pedicels; sepals lanceolate; petals ovate-lanceolate; lip broadly ovate. Madagascar and Comoro Isls. B.M. 6693. Lind. 2:92. R.H. 1888, p. 516. R.B. 15:217. A.F. 22:951; 35:381. O.R. 8:152; 12:337. O. 4: f. 24.

FF. Sepals elliptic: fls. about 1½ in. across; spur 3-4 in. long.

**articulatum**, Reichb. (*A. descendens*, Reichb.). Lvs. oval to obovate-oblong, 3-5 in. long, emarginate or 2-lobed: racemes pendulous, of numerous pure white fls. on pale orange pedicels; sepals and petals elliptic-oblong, acute, the lateral sepals narrower; lip broadly oblong-oval, acute; spur 3-4 in. long. Madagascar.

EE. Spur 6-7 in. long, tinged with orange-red.

**Éllisii**, Reichb. Sts. up to 1 ft. high: lvs. narrow, oblong, 5-8 in. long, emarginate or bilobed at apex: racemes pendulous, of 12 or more pure white fls.; sepals and petals elliptic-oblong, acute, the dorsal sepal inflexed at the summit, the lateral reflexed; lip oblong-elliptic, acute; spur slender, tinged with orange-red. Madagascar. G.C. II. 3:277. F.M. 1875:191. O.R. 7:81.

DD. Lip emarginate or 2-lobed at apex.

**citratum**, Thouars. Sts. 3-4 in. high: lvs. oblong-ovate, 3-5 in. long, acute or lobed at the apex: racemes pendulous, of 12 or more white or pale straw-color fls.; sepals obovate, obtuse; petals oblong-elliptic; lip flat, nearly orbicular, emarginate; spur slender. Madagascar. B.M. 5624. I.H. 33:592. Lind. 5:238.

cc. Fls. with green sepals and petals; lip white.

**superbum**, Thouars (*A. eburneum*, Lindl.). Fig. 207. Sts. up to 4 ft. or more long: lvs. up to 2 ft. long, 2 in. wide, coriaceous: racemes ascending, with 8 or more fls.; sepals and petals spreading, green, lanceolate; lip white, orbicular, fleshy, abruptly acuminate; spur green. Madagascar. B.M. 4761. B.R. 1522. Var. **virens**, Veitch (*A. virens*, Lindl.). Differs from the type in its smaller fls. with the labellum tinged green. B.M. 5170.

*A. augustatum*, Rolfe (*A. Augustii*) Allied to *A. Kotschyi*. Lvs. thick and fleshy, glaucous green: fls. in arched raceme, pure white, spur pale green. G.C. III. 45:Feb. 6, Suppl. O.R. 1908:246. Rhodeia. — *A. bilobum*, Lindl. Racemes of 6-10 fls. about 1 in. across, the sepals, petals and lips nearly alike, lanceolate-acuminate, the spur pale orange-red. W. Afr. J.H. III. 43:483. — *A. Buyssonii*, God. Resembles *A. articulatum*: fls. pure white; brown spurs.

Madagascar. — *A. caudatum*, Lindl. = *Listrostachys caudata*. — *A. Chailluanum*, Hook. = *Listrostachys Chailluanum*. — *A. distichum*, Lindl. = *Mystacidium distichum*. — *A. Eihlerianum*, Kränzl. (*A. Arnoldianum*, DeWild). St. elongated: lvs. distant: fls. large, solitary; sepals and petals oval-lanceolate, acuminate; lip large, extinguisher-shaped, emarginate and apiculate at the summit; spur about as long as lateral sepals. Afr. B.M. 7813. A.F. 25:79. Gng. 13:377. — *A. expansum*, Thouars. Fls. white, of peculiar form; spur longer than perianth segments. Mascarene Isls. — *A. fastuosum*, Reichb. St. 1-2 in. high: racemes of 2-4 fls. about 1½ in. diam., pure white, the slender spur about 3 in. long. Madagascar. J.H. III. 42:297. — *A. fuscatum*, Reichb. Sts. short: racemes of numerous fls., 1-1½ in. across, cream-white, the lip oblong, acuminate abruptly, the slender spur about 3 in. long. Madagascar. Gn. 37: p. 61. — *A. Humboldtii*, Reichb. = *Macroplectrum Leonis*. — *A. ichneumon*, Lindl. = *Listrostachys ichneumon*. — *A. infundibulare*, Lindl. Sts. long; fls. large, solitary; sepals and petals pale yellow; lip funnel-shaped, 2½-3 in. long, white with a green throat, the curved spur 3-5 in. long. W. Afr. B.M. 8153. G.C. III. 36:130. G.M. 47:629. Gn. 86, p. 109. J.H. III. 49:219; 59:387. — *A. Kotschyi*, Reichb. Lvs. obovate-oblong, 3-7 in. long; raceme of 6-10 white fls., 1½ in. across, the ovate-oblong dorsal sepals and petals reflexed, the spreading lateral sepals lanceolate; lip nearly rhomboid, with a broad claw; spur pale brown, up to 9 in. long. E. Afr. G.C. II. 14:693; III. 39:379; III. 46:221. Gn. 31, p. 323; 37, p. 101; 75, p. 553. — *A. Leonis*, Veitch = *Macroplectrum Leonis*. — *A. pellucidum*, Lindl. = *Listrostachys pellucidum*. — *A. pertusum*, Lindl. = *Listrostachys pertusa*. — *A. Rothschildianum*, J. O'Brien. Sts. 3-6 in.: lvs. ovate, 4-8 in. long; racemes of 10-12 fragrant white fls., with a pale green band along the sepals and petals, the lip white with an emerald center and black-purple throat, the spur green with a brown tip. Cent. Afr. G.C. III. 34:131. — *A. Schöffleri*, Hort. Scarcely 8 in. high: fls. long, reddish brown. German E. Afr. Var. **virens** differs from the type in having all the vegetative parts green. — *A. sesquipedale* = *Macroplectrum sesquipedale*.

GEORGE V. NASH.

**ANGULOËA** (dedicated to Don Francisco de Angulo). *Orchidaceæ*. Stout coolhouse orchids, with large pseudobulbs, the scales at the base passing into lvs.

Leaves large, plicately nerved: scapes from the base of the pseudobulbs, clothed with large lax sheaths; fls. subglobose; sepals and petals connivent, fleshy; lip shorter than sepals and petals, 3-lobed, the middle lobe much smaller than the lateral lobes, linear and recurved, or broader and 2-lipped. — Species 3, all in cult., natives of S. American Andes, at elevations of 5,000-7,000 ft.

This interesting genus comprises but few species, but these are singular, since all are well worthy of culture. Coming from the Andes of Colombia, a moderate temperature of 50° in winter will be ample for their needs, and a cool, shaded structure in summer, as the foliage is easily scorched by direct sunlight in hot weather. The peculiar structure of the flowers has given the popular name of "boat orchid," which suggests the general shape. This, together with the fragrance, and the hinged lip, which oscillates with the least movement, makes the plants very interesting when in bloom. The anguloas are rather terrestrial than epiphytal. The culture is very simple if, as a potting compost, a mixture is used containing some soil with the fiber and some sphagnum moss as a surfacing, the potting being very firm. Propagation is simple by division of the bulbs. The old back ones may be severed at the creeping rhizome after the new growth



207. *Angræcum superbum*. (× 1/6)

has been completed, and these will start new shoots usually in spring. Division must be made after the shoots are visible from the back bulbs. The black-spot disease of the bulbs is often fatal to anguloas. It appears suddenly and is generally due to too much moisture in the atmosphere or at the roots. Directly it is seen, the affected parts must be cut out clean, and dry sulfur applied; this, if done in time, will stop the progress of the disease. If brown scale attacks the plants, sponge with soap and water, taking care not to injure the tender leaves. (Orpet.)

A. Middle lobe of lip linear, recurved.

**uniflora**, Ruiz & Pav. (*A. virginalis*, Hort.). Pseudobulbs angled, ovate-oblong, 3-6 in. long; lvs. up to 2 ft. long, broadly lanceolate; fls. creamy white, often flushed or spotted internally with pink; sepals ovate, acute; petals oblong-elliptic, acute; lateral lobes of lip semi-orbicular, rounded at apex, the middle lobe linear, recurved. Peru and Colombia. G.C. III. 19:423. B.R. 30:60. B.M. 4807. Gt. 32:1137. A.F. 6:607.

AA. Middle lobe of lip ovate-triangular, 2-lipped.

B. Lateral lobes triangular, acute.

**Clowesii**, Lindl. Fig. 208. Pseudobulbs cylindric-oblong, 4-6 in. long; lvs. up to 2 ft. long, obovate-lanceolate; fls. lemon-yellow; sepals and petals acute, oblong-elliptic; lip with the lateral lobes triangular, acute, the middle lobe broadly ovate-triangular, fleshy, pubescent. Colombia. B.R. 30:63. B.M. 4313. Lind. 4:191. Veitch, Man. pl. p. 100. Var. **eburnea**, Veitch (*A. eburnea*, Williams). Differs in its ivory-white fls. Colombia.

BB. Lateral lobes semi-orbicular, rounded at apex.

**Rückeri**, Lindl. Similar to *A. Clowesii*, but smaller. Fls. green or yellowish green, flushed with brown on the outside, inside yellow densely spotted with red; sepals and petals oblong-elliptic; lip much as in *A. Clowesii*, but the lateral lobes rounded at apex. Colombia. B.R. 32:41. Gt. 3:106. A.F. 6:607. Lind. 2:53. Var. **albiflora**, Veitch. Fls. white, of waxy texture. Var. **sanguinea**, Lindl. Fls. uniformly deep red on inside. B.H. 3:31. I.H. 28:427.

*A. Cliftonii*, Hort. O. 4, pl. 3.—*A. intermedia*, Rolfe, a hybrid between *A. Rückeri* and *A. Clowesii*, was produced by Seden. This had fls. of nearly the size and shape of *A. Rückeri*.

GEORGE V. NASH.

**ANHALONIUM**. *Cactaceæ*. A name used in the first edition of this Cyclopædia, but now given place to the slightly older name *Ariocarpus*, which see. *A. Williamsii* and *A. Lewinii*, sometimes referred to *Echinocactus* or to *Mamillaria*, are here treated under *Lophophora*, which see.

**ANIGOZANTHOS** (Greek, *expanded flower*). *Amaryllidaceæ*. AUSTRALIAN SWORD LILY. About 8 Australian greenhouse or half-hardy perennials with sword-like lvs. and woolly-yellow, -green, or -red fls. in short 1-sided racemes or spikes and a much elongated perianth-tube. The two species likely to be met with are *A. flavida*, Red. (*A. coccinea*, Paxt.), with mostly red-woolly fls.  $1\frac{1}{4}$  in. long and appendaged anthers; and *A. Manglesii*, Don, with fls. about 3 in. long, red-

woolly at base and green beyond, the anthers not appendaged. These plants are little known in N. Amer.

**ANISACANTHUS** (Greek, *unequal acanthus*). *Acanthaceæ*. A genus of 6 species of Mexican and American shrubs, with mostly lanceolate, entire, petioled opposite or clustered lvs., and loosely spicate or scattered red fls. 1 in or more long; corolla-lobes 4, the tube 2-lipped, the upper lip 3-parted, the lower entire; stamens 2, equaling or exceeding the corolla-lobes.

**Wrightii**, Gray. Height, 2-4 ft.: lvs. 1-2 in. long, oblong- or ovate-lanceolate, acute or acuminate; fls. racemose, or paniculate-racemose, the corolla vermilion or purplish red,  $1\frac{1}{2}$ -2 in. long, the lip shorter than the tube; calyx deeply 5-cleft. S. and W. Texas. Offered by Franceschi of Santa Barbara, Calif.

**Gonzalézii**, Greenm. (*A. Conzatti*, Hort.). Sub-shrub, the st. much branched: lvs. 1-2 in. long,  $\frac{1}{2}$ - $\frac{3}{4}$  in. wide, acuminate, and obtuse at the apex: fls. cymose-racemose, brick-red, or scarlet and larger than in the preceding. Oaxaca, Mex.—Suitable for dry places. Intro. by Franceschi in 1911. N. TAYLOR.†

**ANISE**. *Umbelliferae*. An aromatic condimental and medicinal herb.

Anise (*Pimpinella Anisum*, Linn.) is an annual, easily grown from seeds in any warm and mellow soil. The seeds are commonly sown where the plants are to stand, and the plant matures rapidly. The seeds are used in medicine and in cookery, and for flavoring liquors; they yield a highly perfumed essential oil; they are mostly grown in Mediterranean countries. The lvs. are also used as seasoning and garnishing. The plant reaches a height of 2 ft. or less, bears twice-pinnate lvs. and small yellowish white fls. in large, loose umbels. The seeds are oblong and curved, ribbed on the convex side, grayish, the size of caraway seed. In common with all umbelliferous seed, anise seed does not retain its vitality long, the normal longevity being 1-3 years. Native from Greece to Egypt.

L. H. B.

208. *Anguloa Clowesii*.

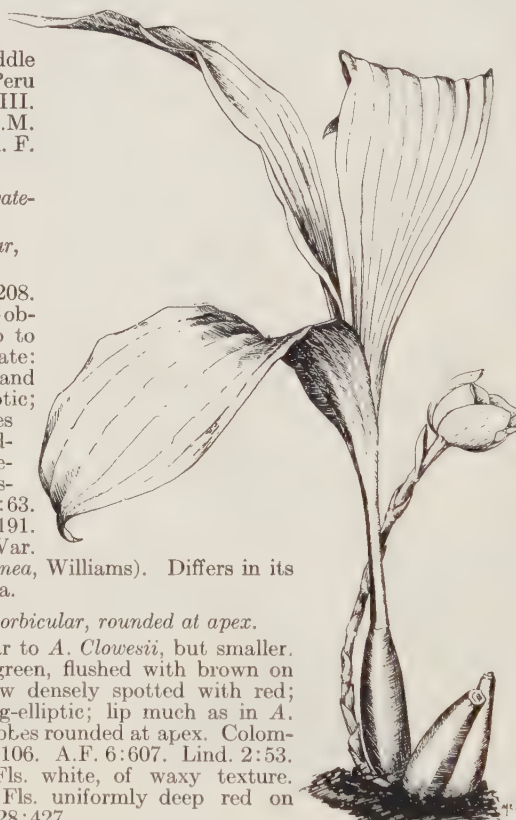
( $\times \frac{1}{4}$ )

**ANISÔTES** (Greek, *unlikeness*).

*Acanthaceæ*. Broad-leaved shrubs of about 4 Arabian and African species, one of which has been intro. to cult. recently. Fls. in short axillary clusters; sepals 5, nearly free; corolla 2-lipped, in shades of red; stamens 2, the filaments long and glabrous; fr. a caps. *A. diversifolius*, Balf., from the Isl. of Socotra, is an erect nearly glabrous shrub less than 2 ft. high: lvs. elliptic-ovate or obovate, 2 in. or less long, flame-colored or yellow, tubular and 2-lipped, the lips curved. B.M. 8219.—Warm greenhouse, blooming spring and summer. Requires the treatment given to *Justicia* and *Jacobinia*. Prop. easily by cuttings.

L. H. B.

**ANISUM**. An old generic name now referred to *Pimpinella*. *A. officinale*, D.C. (*P. Anisum*) is *Anise*, which see.





**ANNONA** (Latin, *year's harvest*, suggested by the Haitian name *anon* applied to one of the species. Commonly spelled *Anona*, but Linnæus used the double *n*). *Annonaceæ* (Richard, 1808). CUSTARD-APPLE. ARATICÚ. Tropical and subtropical woody plants cultivated for their fleshy fruits and for ornament.

Leaves 2-ranked, alternate, devoid of stipules: fls. perfect, solitary or in clusters, extra-axillary, often opposite the lvs. and sometimes subterminal; calyx usually gamosepalous, 3-parted; petals typically 6, in 2 series, but the inner series in some species reduced to small scales or even wanting; stamens numerous, crowded on the receptacle, the fleshy filament bearing a pair of linear parallel pollen-sacs on its back, these opening extrorsely by a longitudinal slit and capped by the expanded hood-like connective; pistils many, the ovaries usually clothed on the outside with minute hairs and containing a single erect ovule at the base: fr. a syncarpium, formed by the growing together of the carpels and receptacle into a fleshy mass; seeds containing a large wrinkled endosperm with small basal embryo.—Trees and shrubs, over 50 in number, chiefly from Trop. Amer., but a few from Afr., and several now widely cult. in the warmer regions of both hemispheres.

Several species have been successfully introduced into southern California and Florida. Some of those cited in catalogues and horticultural publications are merely forms of old species and others are generically distinct. Amongst these names are *A. mexicana*, which was a catalogue name used by Loddiges; *A. excelsa* of Humboldt & Bonpland, a species never fully described, the flowers and fruit of which are entirely unknown; and *A. africana*, an obscure species based by Linnæus upon an American specimen with lanceolate, pubescent leaves. *A. trilobata* and *A. obovata* are *Asimina triloba* and *Asimina obovata*; *A. asiatica* of Linnæus is not an annona at all but a rubiaceous plant, *Morinda citrifolia*; while *A. asiatica* of Loureiro is *A. reticulata*, and *A. asiatica* of Vahl is *A. squamosa*. *A. Forskahlîi* of De Candolle (*A. glabra*, Forsk., not Linn.) was based upon a specimen of *A. squamosa* growing in cultivation in Egypt; to *A. squamosa* must also be referred *A. biflora* of Mocino & Sessé, while *A. longifolia* of these authors is undoubtedly *A. reticulata*, and their *A. fruticosa* is *A. globiflora* of Schlechtendahl. *A. aurantiaca* and *A. macrocarpa* are Brazilian species, the names of which were erroneously applied to certain cultivated forms in southern California; while *A. suavissima* is only a horticultural variety of *A. Cherimola*, and *A. cinerea* of the Antilles a form of *A. squamosa*. *A. palustris* of Linnæus is identical with his previously described *A. glabra*, and the latter name must take precedence in accordance with accepted rules of priority. A number of species described as annonas belong to other genera. Among them are *A. amplexicaulis* and *A. grandiflora* of the islands of Mauritius and Madagascar, which belong to the genus *Pseudannonna*. *A. Mannii* of Oliver, an African species which has a branching inflorescence very different from that of the genus *Annona*, has been assigned to a new genus *Anonidium* by Engler & Diels; and *A. Perottetia* of A. De Candolle has been placed in the genus *Unonopsis* by R. E. Fries. *Annona obtusiflora* of Tussac, together with *A. mucosa* of Jacquin, must be placed in the genus *Rollinia* under the name *R. mucosa*, and to this genus should also be assigned the Brazilian biriba, which is probably *Rollinia orthopetala*, a species with large, fleshy fruit of delicious flavor, successfully introduced into Florida from Para. The climbing *Annona uncinata* of Lamarck belongs to the genus *Artabotrys*. *A. pyriformis*, also a climbing shrub, of Mauritius, the fruit of which is unknown, belongs undoubtedly to some other genus. For *Annona longifolia* see *Duguetia*. See also *Rollinia*, *Artabotrys* and *Cananga*.

W. E. SAFFORD.

#### Cultural notes.

While the annonas succeed best on a heavy loam, most species can be grown on light soils and under adverse conditions. The custard-apple (*A. reticulata*) thrives on the Florida keys in a semi-naturalized state; the cherimoya (*A. Cherimola*) grows and bears abundantly on steep calcareous cliffs in Central America; the sugar-apple (*A. squamosa*) is successful on dry and sandy soils with practically no attention whatever. The situation best adapted to them is a sloping piece of ground, for, with the exception of *A. glabra*, they are intolerant of stagnant water about the roots.

The cherimoya, probably the hardiest of the genus, withstands temperatures as low as 26° F. without injury, and reaches perfection only in a comparatively cool climate. The soursop (*A. muricata*) is one of the tenderest species; the sugar-apple and the custard-apple are somewhat hardier; all three are successfully grown in southern Florida, but not in California.

Propagation is usually effected by means of seeds; the most highly valued species, however, such as the cherimoya, are budded or grafted.

Seeds will retain their vitality for several years, and if planted in warm weather or under glass will germinate in a few weeks. If in a greenhouse, they may be planted at any season of the year; otherwise, it is best to plant only during spring or early summer. Sow thickly in flats or pans of light, porous soil containing an abundance of humus, covering to the depth of ½ or ¾ inch. When the plants are 3 or 4 inches high, they should be potted into 3-inch pots; care should be taken to see that the soil is perfectly drained, and waterings should not be too frequent or copious. When the plants have attained a height of 8 or 10 inches, they may either be shifted into larger pots or set out in the open ground; in the latter case, they must have careful attention until they have become established and made considerable growth.

Both budding and grafting have proved to be readily applicable to the annonas, either in the open ground or in pots, under glass. Several different species have been used for stocks, *A. Cherimola* proving the most satisfactory thus far in California, as it is best adapted to that climate; *A. glabra* has been found to be the most vigorous and satisfactory in Florida.

Shield budding, essentially the same as practised with the citrous fruits, is the method most commonly used. The work is best done in spring, shortly after the sap has begun to flow, the time varying, of course, according to locality and season. Stocks should be from ¾ to ½ inch in diameter; seedlings of this size will be eighteen months to two years old. Budwood from which the leaves have dropped, and of about a year's growth, is the most desirable. It is important that the buds be cut large,—about 1½ inches in length,—as they are likely to have difficulty in starting and be choked out, on account of the thick bark and rapid callousing of the annonas, if they are too small. The incision may be made either in the form of a T or an inverted T, raising the bark with care so that the delicate tissues lying under it will not be injured, and inserting the bud with as little pressure as possible. Waxed tape should be used for tying. Three or four weeks after insertion, the buds should be unwrapped, and, if they have united with the stock, re-wrapped loosely, lopping the stock at a point 5 or 6 inches above the bud. The wrap should not be removed until the bud has made a growth of several inches.

For grafting, two-year-old seedlings are used, the operation being a simple cleft-graft, using a scion of well-matured wood from which the leaves have dropped.

Cuttings of well-ripened wood can be rooted under glass, with bottom heat. This method of propagation is not widely practised, however.

The annonas, when grown from seed, vary greatly

in regard to productiveness as well as size, color, form, texture and quality of fruit. In southern California, many large seedling cherimoyas have been grubbed out because they were unproductive, while others produce fruit of such poor quality as to be of no value. Careful attention to culture will assist in improving the quality and size of the fruit, but the only sure way

to perpetuate choice forms and eliminate all possibility of the tree turning out to be inferior is to propagate by some asexual means.

Most species come into bearing when three or four years old. Few named varieties have been established, and these are probably confined to the cherimoya.

In some countries, the annonas are subject to certain fungous diseases and insect pests, notably the

mealy-bug. As a class, however, they seem to suffer less from these pests than most other fruit trees. They require very little pruning.

Fruits must be picked when mature,—to avoid their falling to the ground and becoming bruised,—and laid away for a few days before they are ready for eating. If they are to be shipped any distance, they must be packed in some material, such as excelsior or straw, that will allow good ventilation, each fruit being wrapped in a piece of strong paper. The selection of the toughest-skinned varieties adds greatly to the facility with which they can be shipped. F. W. POPENOE.

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A. Petals broadly cordate-ovate or suborbicular, the inner ones somewhat smaller than the outer.

B. Exterior petals valvate or edge-to-edge, usually acute, inner ones imbricate or overlapping, obtuse or rounded.

C. Fr. glabrous, bearing fleshy spines: lvs. glossy leathery, with minute pockets in the axils of the lateral nerves.

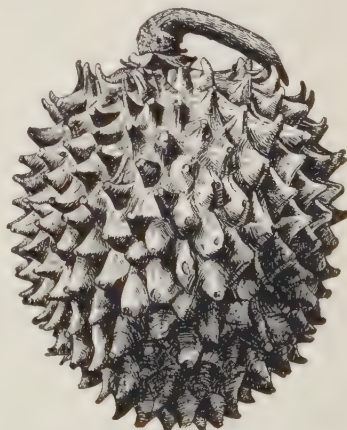
1. *muricata*, Linn. SOURSOP. GUANÁBANA. COROSSOL. CORAÇÃO DE RAINHA. GRAVIOLA. SUISAAS. ZUURSAAK. Fig. 209. Small evergreen tree, the size of a peach tree, in general cult. throughout the tropics of both hemispheres: lvs. leathery, ill-smelling, obovate-oblong or oblanceolate, to ovate or elliptic, acute or abruptly acuminate, glossy above and rusty beneath but at length glabrous, with the minute pockets in the axils of the lateral veins scarcely perceptible without a lens: fls. large, the exterior petals thick and fleshy, ovate-acute, valvate or edge-to-edge, the interior petals somewhat smaller and thinner, concave, rounded, imbricate or overlapping: fr. very large, fleshy, often as large as a child's head and weighing as much as 5 lbs., ovoid or heart-shaped, dark green, the glabrous ill-smelling skin bearing numerous recurved fleshy spines; pulp white and juicy, pleasantly subacid, with a slight mango-like flavor. Of Trop. Amer. origin,

but now common in the tropics of the Old World.—As in all cult. frs., there is more or less variation in its flavor. It is easily prop. from the seed or from buds, and is undoubtedly capable of improvement by selection. It begins to bear at a very early age and is consequently one of the most valuable fr. trees of the tropics. It is grown with especial excellence in Porto Rico, and is common in the markets of Key West, whither it is shipped from the islands to the southward. A favorite drink is made from the juice, and the pulp yields excellent jelly, tarts and preserves. Care must be taken, however, to remove the skin in preparing the fr. for the table.

2. *montana*, Macfadyan (*A. muricata*, Velloso, not Linn.). MOUNTAIN SOURSOP. GUANÁBANA CIMARRONA. COROSSOLIER BÂTARD. ARATICÚ PONHÊ. A forest tree, sometimes reaching the height of 45 ft., but usually of smaller dimensions: lvs. resembling those of the soursop, varnished above and dull beneath, with the pits in the axils of the lateral nerves often conspicuous: fls. similar to those of the soursop, solitary or in pairs. fr. spheroid or broadly ovoid, varying from the size of an orange to 6 in. diam., green at first, at length turning yellowish; skin glabrous, bearing numerous short erect fleshy spines; pulp not edible. This species, which is larger and more robust than the closely allied *A. muricata*, has been intro. into Fla. for use as stock upon which to bud other species of the genus. W. India. and N. S. Amer.; thus far unknown from Mex. and Cent. Amer.—The peculiar pits, or pockets in the axils of the lateral nerves of the lvs. set apart this species, together with *A. muricata*, from all other species of the genus.

cc. Fr. covered with felt-like tomentum, bearing rigid stout pyramidal spines often hooked at the tip: lvs. very large, subcoriaceous or membranaceous, undulate without axillary pockets.

3. *purpurea*, Mocino & Sessé. NEGRO-HEAD. CABEZA DE NEGRO. SONCOYA. SENCUYA. TORETA. Fig. 210. A small or medium-sized tree, sometimes reaching the height of 25 ft., the younger branches clothed with reddish tomentum but becoming glabrate at length: lvs. large, membranaceous or subcoriaceous, undulate, oblong-elliptical to oblong-obovate, acuminate at the apex, rounded or obtusely cuneate at the base, 8–12 in. long and 4–5½ in. broad; petioles short and thick: fls. resembling those of *A. muricata* but sessile or nearly so, solitary, extra-axillary, sometimes opposite a lf., inclosed when very young in an involucre of 2 bracts, the apex of which becomes more or less shriveled at length, and the base persists somewhat like an outer or second calyx; calyx 3-lobed, ferruginous-velvety on the outside; 3 outer petals very thick, valvate, usually acute or acuminate, sometimes obtuse at the apex, ferruginous-velvety on the outside, stained with purple within; inner petals overlapping, thinner and rounded, forming a dome-like covering over the essential parts, whitish on the outside, purple within; terminal connectives of the stamens velvety carpels distinct at first, the hirtellous ovaries crown. by 2



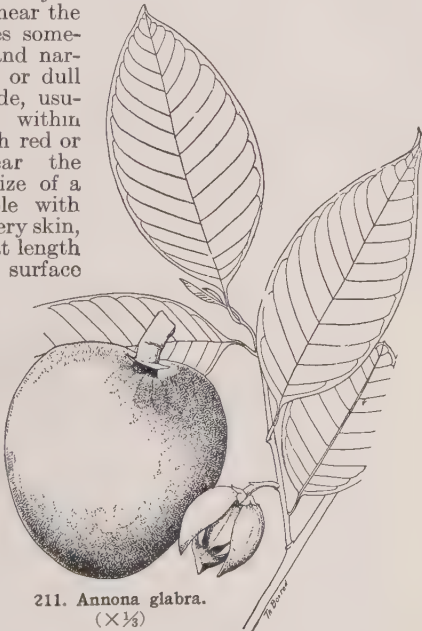
210. *Annona purpurea*. ( $\times \frac{1}{4}$ )



prismatic style about  $\frac{1}{8}$  in. long; fr. large, spheroid or broadly ovoid, sometimes 6–8 in. diam., covered with a brownish felt-like indumentum and bearing numerous pyramidal protuberances, grooved longitudinally on the ventral side and usually terminating in a hook directed toward the peduncle; seeds large, obovate, more or less flattened and marginate, sometimes exceeding an inch in length by  $\frac{1}{2}$ – $\frac{3}{4}$  in. broad; pulp fleshy, fibrous, very fragrant, edible, with a flavor somewhat like that of a mango. Mex. to Panama and perhaps N. S. Amer. It is abundant on the Isthmus of Tehuantepec and is sold in the markets of Veracruz.—The frs. differ considerably in flavor. Some of those on the Isthmus of Panama are reputed to be excellent, though here, as elsewhere, they are supposed to induce chills and fever. Intro. into S. Calif., but imperfectly known in cult. Like its congeners, it is undoubtedly capable of improvement by careful selection.

BB. *Exterior and interior petals both valvate or edge-to-edge and usually acute.*

4. *glabra*, Linn. (*A. palustris*, Linn. *A. laurifolia*, Dunal). POND-APPLE. ALLIGATOR-APPLE. MONKEY-APPLE. MANGROVE-ANNONA. MAMIN. MAMAIN. CACHIMAN-COCHON. CAYUL. CAYURES. CORK-WOOD. PALO BOBO. BOIS-FLOT. CORCHO. CORTISSO. ARATICÚ DO BREJO. Fig. 211. Small to medium-sized tree, sometimes reaching a height of 45 ft., growing in swampy places and along the banks of streams; young growth smooth: lvs. smooth and laurel-like, glossy green above, paler beneath, evergreen, ovate to oblong or elliptic, usually acute or acuminate but sometimes bluntish at the apex and rounded or tapering at the base: fls. fragrant, varying considerably in size, those of trees growing in favorable situations larger than those growing in crowded mangrove swamps; outer petals cream-colored or pale greenish yellow when fresh, usually marked within by a deep red spot near the base; inner ones somewhat shorter and narrower, whitish or dull greenish outside, usually blood-red within or spotted with red or wine-color near the base: fr. the size of a bellflower apple with a smooth leathery skin, green at first, at length yellowish, its surface covered with indistinctly outlined areoles, but these never elevated or squamose; pulp cream-colored when ripe, not edible except by iguanas and other animals. Everglades of Fla. and banks of the Indian and Caloosahatchee Rivers; also the tropical shores of Amer., W. Indies, west coast of Afr., and the Galapagos Is. — Statements that the fr. is sold in the markets of Mex. and that the tree is cult. for its fr. are based upon the confusion of other species of annona having smooth frs. with this. This species is essentially tropical and swamp-loving. Its light spongy roots are used as a substitute for cork and for floats of fishing-nets; hence its name cork-wood.



211. *Annona glabra*.  
( $\times \frac{1}{2}$ )

AA. *Petals (exterior) linear or oblong, the inner ones minute and scale-like.*

B. *Peduncles with broad persistent lf.-like bracts at the base.*

5. *diversifolia*, Safford. ILAMA. ILAMATZAPOTL. Fig. 212. Small tree with brownish-gray, aromatic, longitudinally furrowed bark; young growth glabrous,



212. *Annona diversifolia*. ( $\times \frac{1}{4}$ )

with prominent lf.-scars bordered with a margin of pale rufous hairs: lvs. thin, membranaceous, glabrous, variable in form, those near the base of the branchlets broadly elliptical and rounded at the base, those higher up oblanceolate, rounded at the apex and acute or cuneate at the base, the largest 4–5½ inches long and 1½–2 inches broad with petioles exceeding  $\frac{1}{2}$  inch in length: peduncles long and slender, recurved, glabrous, issuing from 2 suborbicular, lf.-like, amplexicaul bracts at the base of the branchlets; fl.-buds obpyriform, calyx-divisions broadly ovate or triangular, terminating at the points in a tuft of ferrugineous hairs; outer petals linear-oblong, swollen at the base and concave within, sparsely rusty-pubescent on the outside; inner petals minute, pubescent on the back and bearing 2 rudimentary pollen-sacs; carpels distinct, glabrous near the base, rufous hirtellous above, at length growing together into a compound fr. or syncarpium: fr. large, conoid or broadly ovoid with an axis of about 6 in. and a diam. of 5 in., clothed with dense grayish felt-like tomentum and when mature usually bearing stout thick protuberances directed toward the apex, but these sometimes suppressed; pulp edible, cream-colored or rose-tinted; seeds hard, smooth and nutlike, golden brown or tan-colored. Mts. and foot-hills west coast of Mex. to Salvador.—The fr. is offered for sale in the markets of Colima and Acapulco. It is described by American Consul Marion Letcher, stationed at Acapulco, as shaped like a pineapple cheese, with delicious pink-tinted pulp; and Samuel E. Magill, American Consul at Guadaluajara, states that the frs. grown on the side of the volcanos of Colima and Cerro Grande are of unusually fine quality. This species has been intro. into S. Fla.

BB. *Peduncles devoid of lf.-like bracts at the base.*

c. *Lvs. velvety beneath.*

6. *Cherimòla*, Mill. (*A. tripétala*, Ait.). CHERIMOYA. CHERIMOYA. CHERIMOYER. CHERIMOLLA. Tree, 15–25 ft. high, with young growth fulvous tomentose: lvs. persistently velvety-tomentose beneath, sparsely pubescent above, ovate to ovate-lanceolate or obovate, sometimes elliptical, obtuse at the apex or obtusely acuminate, usually rounded at the base: fls. fragrant, extra-axillary, often opposite a lf. at the base of a branchlet, usually solitary but sometimes 2 or 3 on short nodding tomentose peduncles, the exterior petals oblong-linear, not exceeding 1¼ in. length, keeled on the inside and excavated at the base, greenish yellow or rufous on the outside and clothed with velvety tomentum, pale yellow or whitish within and marked with a purple spot at the base; inner petals very small, squa-

mose, ovate or triangular, usually flesh-colored or purple and keeled on the outside; fr. variable in shape and appearance, sometimes conoid or heart-shaped, with surface bearing protuberances; sometimes spheroid or ovoid with the surface covered with concave or squamose U-shaped areoles, each bearing a small wart or tubercle; and sometimes quite smooth or with the surface having the appearance of putty marked by finger-prints; pulp white, edible, pleasantly acidulous, easily separable from the seeds; seeds usually obovate, obliquely truncate, somewhat compressed, with a thin



213. *Annona reticulata*. ( $\times \frac{1}{4}$ )

membranous brown testa which is usually more or less wrinkled or pitted, owing to the wrinkled surface of the inclosed endosperm. Andes of Peru and adjacent regions, but naturalized at a very early date in Mex. and Cent. Amer. Successfully intro. into S. Calif., Canary Isls., Madeira, the mts. of India, and Hawaii. Essentially a subtropical plant which does not yield good results in low tropical countries.—Frs. of exquisite flavor are produced on the island of Madeira, where the trees are trained on trellises and are taking the place of grapes in the economy of the island. Excellent results have also been secured in S. Calif. See *Cherimoya*.

7. *longiflora*, Wats. WILD CHERIMOYA OF JALISCO. A shrub or small tree, 3–10 ft. high; young growth softly pubescent; branches with prominent lf.-scars, which are clothed with a marginal collar of plush-like hairs; lvs. resembling those of *A. Cherimola* but distinguished when mature by being glabrate or glabrescent between the lateral nerves, which together with the midrib are persistently velvety pubescent, the blades 2–5½ in. long and 1½–3¼ in. broad, elliptical to obovate-elliptical, usually rounded but sometimes acute at the base and rounded at the apex, which is often minutely apiculate; fls. short-peduncled, pubescent, the calyx-divisions deltoid-ovate, clothed on the outside with fine soft hairs, the outer petals leathery, often 2 in. long, linear-oblong or oblong-lanceolate in shape, cream-colored or whitish, and marked within with a dark purple or blackish spot at the excavated base; inner petals minute (sometimes wanting), ovate, obtuse, finely pubescent; carpels distinct, the ovaries clothed with rufous hairs, and the styles minutely puberulent; fr. conoid or globose-ovate, its surface covered with protuberances or with reticulated areoles; pulp white, resembling that of *A. Cherimola* in flavor. State of Jalisco, Mex., especially in vicinity of Guadaluajara and Tequila. Intro. into S. Calif., but as yet little known.

cc. Lvs. not velvety.

d. Fr. smooth or nearly so, its surface divided into angular areoles by impressed lines; pulp tallow-like.

8. *reticulata*, Linn. (*A. longifolia*, Mocino & Sessé). COMMON CUSTARD-APPLE. BULLOCK'S-HEART. CORAZON. COROSSOL CŒUR-DE-BŒUF. CORAÇÃO DE BOI. MAMON. ANONAS. ANONA COLORADA. QUAUHTZAPOTL. Fig. 213. A deciduous tree, 15–25 ft. high with young growth fulvous-pubescent, at length glabrate; lvs. approximate, oblong-lanceolate or lanceolate, acute at the apex, conduplicate, glabrate, or with the midrib and lateral nerves sparsely pubescent; fls. in extra-

axillary clusters of several issuing from the new branchlets, peduncles nodding; outer petals fleshy, oblong-linear, keeled on the inside and excavated at the base, olive-green or yellowish, usually stained within with purple and with a dark purple blotch at the base; inner petals very small, scale-like, ovate, acute; carpels distinct, the ovaries covered with pale brown silky hairs, at length uniting to form a solid fr.: fr. 3–5 in. diam., smooth, with the surface divided into rhomboid or hexagonal areoles by impressed lines, usually reddish or reddish brown when ripe, or red-cheeked on the sunny side, pulp sweetish but insipid, tallow-like and usually granular, adhering closely to the seeds. Trop. Amer.; now widely spread throughout the tropics of both hemispheres.—A robust tree which has spread spontaneously in the forests of the Philippines, the island of Guam and the E. Indies, while its congeners, *A. muricata* and *A. squamosa*, occur usually only where planted. It is essentially tropical while the cherimoya, with the smooth-fruited forms of which it has often been confused, is subtropical. Its fr. is inferior in flavor to both the cherimoya and the sugar-apple (*A. squamosa*), from the first of which it may be distinguished by its long, narrow, glabrate lvs., and from the second by its solid, compact fr., as well as its larger lvs. From *A. glabra*, with which it is also confused, it may be distinguished by its elongate narrow outer petals and its small, dark brown seeds. It is common in the W. Indies and thrives in S. Fla.

dd. Fr. composed of rounded carpels loosely cohering when ripe, covered with a glaucous bloom; pulp creamy or custard-like.

9. *squamosa*, Linn. (*A. cinerea*, Dunal. *A. Forskählii*, DC. *A. biflora*, Mocino & Sessé). SUGAR-APPLE. SWEET-SOP. ANON. ATTA. ATIS. POMME-CANNELLE. KESCHTA. FRUTA DA CONDESSA. AHATE DE PANUCO. STEENAPPEL. TEXALTZAPOTL. PINHA. Fig. 214. A small deciduous tree, 15–20 ft. high, with irregularly spreading branches and zigzag branchlets bearing approximate 2-ranked lvs.; young growth pubescent, at length glabrate or clothed with scattered hairs and dotted with lenticels; lvs. conduplicate, resembling those of *A. reticulata*, but smaller, usually lanceolate or oblong-lanceolate, acute or shortly acuminate at the apex and acute or cuneate at the base, sometimes ovate or elliptical and rounded at the base with a tendency to be asymmetrical, membranaceous, minutely punctate with both surfaces pale green; sparsely hairy at first, at length glabrate or nearly so, except the petiole, which is pubescent; fls. borne on the young branchlets, closely resembling those of *A. reticulata*, extra-axillary, usually in clusters of 2, 3, or 4, but sometimes solitary; peduncles slender, sparsely and delicately pilose, at length glabrate, bearing a minute bracteole below the middle, which terminates in a tuft of floccose hairs; outer petals oblong-linear, thick, triquetrous, rounded at the apex and



214. *Annona squamosa*. ( $\times \frac{1}{4}$ )



excavated at the base, greenish yellow, usually marked within by a wine-colored or purplish red spot at the base; inner petals minute, ovate or obovate, keeled on the outside; stamens with broad terminal connectives of a cinnamon-brown or orange-red color; carpels distinct, clothed with pale brown hairs, sulcate on the ventral side and terminating in oblong or taper-pointed styles: fr. about the size of an orange, spheroid or heart-shaped, composed of loosely cohering carpels rounded at the extremities and grooved on the inner side, forming a squamose or tuberculated surface, greenish yellow and covered with a glaucous bloom at first, but soon turning black in spots when handled, and the waxy bloom easily rubbed off; pulp yellowish white, creamy or custard-like, very sweet and pleasantly flavored; seeds dark brown, smooth, closely resembling those of *A. reticulata*. Trop. Amer., now widely cult. in all tropical countries.—Less robust than *A. reticulata*, with fr. much more highly prized, and produced several times during the year instead of only once, as in that species. Like *A. reticulata*, it is essentially tropical and will not thrive in subtropical regions which are suitable for the cult. of the cherimoya. It has been intro. into S. Fla. Delicious sherbets are made from its custard-like pulp, often with the addition of a little lemon juice, but it is never cooked or made into preserves or jelly, like the soursop. The fr., when green, as well as the seeds and lvs., is used for destroying vermin; and the crushed lvs., in the form of poultices, are applied to ulcers and malignant sores in the W. Indies. The root is a drastic purgative.

W. E. SAFFORD.

**ANNUALS.** What are known to gardeners as "annuals" are plants that bloom in the open the same year the seeds are sown and that do not live over winter.

These plants are not necessarily true annuals; for annuals in the botanical sense are plants that normally complete their entire life-cycle within one vegetation-year. Perennial plants that bloom freely from seed the first year and do not usefully survive till another year may be classed as annuals by the gardener and treated as such: these are properly plur-annuals, a group standing midway between annuals and perennials. The garden *Nicotiana affinis* (properly *N. alata*) and pinks and snapdragons are such. It may be said that plur-annuals are plants of somewhat indefinite duration that are terminated by cold weather rather than by their normal maturity within the season. Many real perennials, as castor bean, are treated as annuals in northern gardens.

Some of the biennial plants—those that normally bloom and perish in the second year—may flower the first year if the seeds are sown early and the plants are hurried along. Of these, Canterbury bell, ipomopsis and some of the *cenotheras* are examples. See *Biennials*.

The annuals of gardens are grown directly from seeds, in usual practice. Some plants are reared annually from bulbs or tubers, as crocus, lilies, potato: these are really perennials that die each year to the ground and do not perish root and branch. To these plants the name pseud-annuals (i.e., false annuals) has been given.

Among the true annuals there are many grades. Some of them are winter annuals, growing in the cool part of the year and carrying over winter under the snow, as the common creeping chickweed and other crucifers. In the arid regions of the West, many annual plants spring into growth with the rains and thrive in the cool months. Many of the annuals are summer annuals and others are autumn annuals: these two classes are practically the only ones that are cultivated in the open for ornament.

Among the annuals are found some of the most

showy garden flowers. As a rule, they are easily grown, producing quick results and affording a great variety of colors, forms and foliage. Some of the annuals last only a few weeks in bloom, others continue throughout the summer. There are trailers and climbers, dwarfs and tall growers. By a judicious selection and arrangement of kinds, the handsomest effect may be produced. Many of the showy kinds are adapted to mass effects, while the dwarf-growing sorts make good flowering edgings for beds or walks. With the latter, handsome ribbon-beds are possible, but this requires care in the selection of kinds, and as the use of the trimming shears is almost precluded, it is best to limit oneself to simple designs. Annuals are well suited to the covering of bare spots of ground in the border. Like other flowers, they display best when seen against a background of foliage. The tall and leafy kinds make excellent covers for unsightly objects. For climbing and twining kinds, see *Vines*. See, also, *Everlastings* and *Grasses*.

*Classification as to hardiness.*

It is customary to divide annuals into three classes: (1) Hardy annuals are those that are sown directly in the open ground where they are to grow. They are



215. Annuals filling the formal space between a drive and a tree-group.

vitality strong, developing without artificial heat, and may be sown from February to May, according to the season and latitude. Some of them, as sweet peas, may be sown even in the fall. For this class, a well-prepared border on the south side of a fence or wall, or other sheltered place, is usually preferred for early sowings. From here the seedlings are transplanted later where they are to grow. Some sorts, however, do not bear transplanting well, consequently must be sown in the places they are to occupy. Among such are poppies, *eschscholtzia*, *bartonia*, Venus' looking-glass, lupine, malope, and the dwarf *convolvulus*. (2) Half-hardy annuals are usually sown in February or March in the window or a warm frame. The season is usually not long enough to enable them to reach full development in the open. In the early stages of growth they need protection and warmth. Such kinds are sometimes sown in the fall and wintered over in a coldframe. When once established, they are hardy with slight protection. Some of the kinds are grown to their greatest perfection only in this way. (3) Tender annuals require still more warmth, and are started from January to May in the greenhouse or other suitable place. They commonly need a temperature of 60° to 70°. The danger with early-grown seedlings, especially those started in the window, is over-crowding and want of light. As soon as crowding begins, the plants should be



thinned out or transplanted to other trays, or into pots, and reset from time to time, as they need; frequent transplanting is usually an advantage. The last transplanting is preferably into small pots, as then the seedlings may be readily set in the open ground at the proper time, with little or no check.

#### *Seed-sowing.*

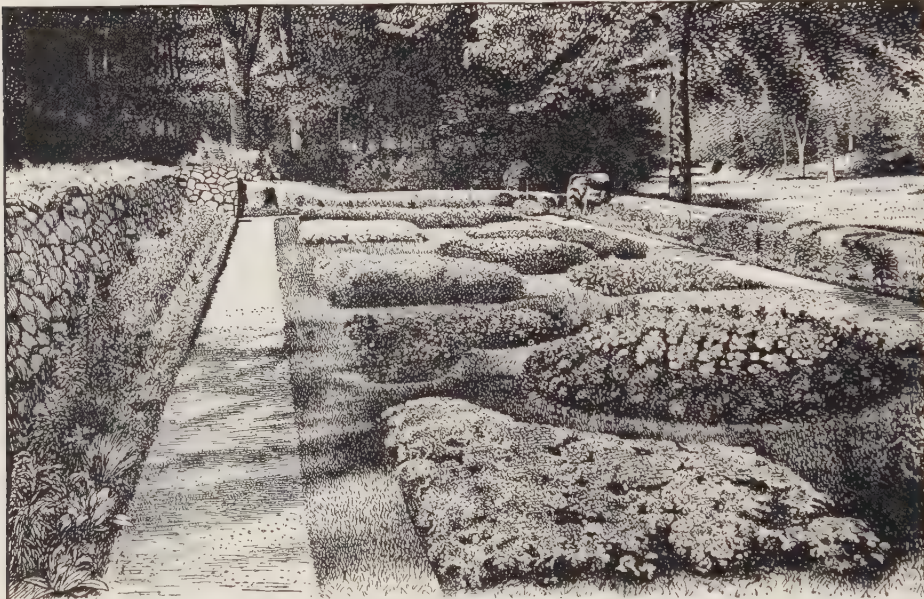
The greater number of common annuals will bloom freely if the seeds are sown in the open ground when the weather becomes thoroughly settled. But there are some kinds, as the late cosmos and moonflowers, for which the northern season is commonly too short to give good bloom unless they are started very early indoors.

In the case of others than the continuous bloomers, a succession of sowings or plantings is desirable to provide for a continuous display; then as a kind begins to fail, its place may be filled with young plants of the same

Vigorous June-sown plants are better than such weaklings. It must be remembered, however, that very early bloom usually means the shortening of the season at the other end; this may be remedied to some extent by making sowings at different times.

Only the best seeds should be purchased, and it is usually best to get the colors in separate packets. In the open ground, seeds may be covered to a depth of four or five times their own thickness, but when sown indoors in trays or pots, the rule is to cover them to about their own thickness. After covering, the soil should be pressed firmly over the seed with a board or hoe, or the feet. In soils that are inclined to bake, a sprinkling of sand or fine litter over the surface after sowing will remedy this evil. Evergreen boughs placed over the beds until the seedlings have appeared will afford useful shelter from beating rains. It is desirable to sow the seeds thickly. For the reception of seeds, the surface should

be mellow and smooth. The seeds are sown in drills or concentric circles, according to the method of planting decided upon. Taller-growing kinds are sown toward the center or back of the bed. When up, the plants may be thinned to their proper distances. Particular care should be given to this matter, and to keeping down weeds, or the plants may become weak, spindling and valueless. Much trouble will be avoided if each seed-row is plainly labeled or marked so



216. A semi-formal garden space of annual flowers.

or other species. The usual method of securing succession is to sow the seeds in flats, or beds, and transplant the seedlings first to pots. The potted plants may be set out at any time, with but little check to growth.

When flowers of any annual are wanted extra early, the seeds should be started indoors. It is not necessary to have a greenhouse for this purpose, although best results are to be expected with such a building. The seed may be sown in boxes, and these boxes then placed in a sheltered position on the warm side of a building. At night they may be covered with boards or matting. In very cold "spells" the boxes should be brought inside. In this simple way seeds may often be started one to three weeks ahead of the time when they can be sown in the open garden. Moreover, the plants are likely to receive better care in these boxes, and therefore to grow more rapidly. Of course, if still earlier results are desired, the seed should be sown in the kitchen, hotbed, coldframe, or in a greenhouse. In starting plants ahead of the season, be careful not to use too deep boxes. The gardener's "flat" may be taken as a suggestion. Three inches of earth is sufficient, and in some cases (as when the plants are started late) half this depth is enough.

One trouble with early sown seedlings is "drawing up," and weakness from crowding and want of light. This is most likely to occur with window-grown plants.

that the young plants may be distinguished from the weeds, with which they must often compete.

#### *Soils and places.*

Most annuals thrive best in an open, sunny situation, but pansies, forget-me-nots, and some others, thrive where they get the full sunshine for only half the day. Some of the kinds are at their best in full sunlight, as portulaca, sunflower, and zinnia. In all cases the best results are secured only when the soil is well enriched and thoroughly prepared previous to sowing or planting; and it is far better to make this preparation a fortnight or more in advance. A considerable proportion of humus in the soil is desirable, rendering it less subject to baking and drying out. Cow-manure, stable-manure or leaf-mold, worked in liberally, will supply this. Beds should be spaded thoroughly and at least a foot deep. If the surface is then again worked over to half this depth, better results will be obtainable. The soil should not be disturbed, however, unless it pulverizes readily.

When the flowers are to be grown about the edges of the lawn, make sure that the grass roots do not run underneath them and rob them of food and moisture. It is well to run a sharp spade deep into the ground about the edges of the bed every two or three weeks for the purpose of cutting off any grass roots that may have



run into the bed. If beds are made in the turf, see that they are 3 feet or more wide, so that the grass roots will not undermine them. Against the shrub borders, this precaution may not be necessary: it is desirable that the flowers fill all the space between the overhanging branches and the sod.

The plants should not be allowed to bear seed, else they will be exhausted and the season of bloom will be short. Sweet peas, for example, soon spend themselves and dry up if the pods are allowed to ripen. The frequent cutting of blooms prolongs the season.

#### The kinds.

Most of the staple or general-purpose types of annuals in the North are the following: petunias, phloxes, pinks or dianthus, larkspurs or delphiniums, calliopsis or coreopsis, pot marigolds or calendulas, bachelor's buttons or *Centaurea Cyanus*, clarkias, zinnias, marigolds or tagetes, collinsias, gillias, California poppies or *eschscholtzias*, verbenas, poppies, China asters, sweet peas, nemophilas, portulacas, silenes, candytufts or iberis, alyssum, stocks or matthiolas, morning-glories, nasturtiums or tropaeolums, wallflowers, gaillardias, snapdragons, coxcombs, lobelias, four-o'clocks, amaranths, balsams, sweet sultans, salpiglossis, scabiosas, nicotianas, and pansies. Other species are mostly of special or particular use, not general-use types. In the South, and occasionally at the North, some of the annuals come up voluntarily year after year from self-sown seeds, e. g., petunias, phloxes and morning-glories.

Late sowings, even as late as June in the latitude of New York City, may be made of such things as China aster, sweet alyssum, California poppy (*Eschscholtzia*), calliopsis or coreopsis, portulaca, calendula, phlox, zinnia, marigold, candytuft, mignonette, petunia. Late-blooming beds of these and other annuals may be secured by this delayed sowing. The tendency to sow everything for early bloom deprives the garden of much freshness and interest in autumn.

The numbers of varieties in some of these long-cultivated species-groups are surprising large, and they often appeal to collectors. If a collector desires annuals for autumn display, for example, he will find that zinnias have about forty current varieties, annual pinks about fifty, petunias about sixty, pansies sixty to seventy, balsams over sixty, and stocks perhaps 300, all of which may be prolonged more or less into autumn. But the most appropriate and varied of these annuals are the China asters, which have about 450 varieties. Owing to the greater variety of everything abroad, collectors naturally send to Europe for large collections, and the very low duty on flower seeds has stimulated the collecting of annuals. Perennial flowers are more difficult to import, but many persons have recently imported fifty or more varieties of the following: gaillardia about 100 varieties, hardy chrysanthemums 100 and more, florists' pentstemons more than 150 (not sufficiently hardy), delphiniums over 200, and phlox 350. Unfortunately, collections of a single flower rarely give an artistic effect, even when at their best, owing to the difficulty of isolating troublesome colors in a garden that must be sunny, failures among highly bred varieties, the fact that the early, midseason and late sections mix poorly, and so on. The obvious limitation of gardens devoted to one kind of flower is that they are unattractive out of season, and therefore it is best to isolate them. There are practically no annuals that bloom satisfactorily throughout summer and autumn.

Background plants, for bold mass-displays of color in the rear parts of the grounds or along the borders may be secured from some of the coarser species. Good plants for such use are: sunflower and castor-bean for the back rows; zinnias for bright effects in the scarlets and lilacs; African marigolds for brilliant yellows; nicotianas for whites. Unfortunately, we have no ro-

bust-growing annuals with good blues. Some of the larkspurs and the browallias are perhaps the nearest approach to them.

For lower-growing and less prominent mass-displays, the following are good: California poppies for oranges and yellows; sweet sultans for purples, whites, and pale yellows; petunias for purples, violets, and whites; larkspurs for blues and violets; bachelor's buttons (or corn-flowers) for blues; calliopsis and coreopsis and calendulas for yellows; gaillardias for red-yellows and oranges; China asters for many colors except yellows.

For still less robustness, good mass-displays can be made with the following: alyssums and candytufts for whites; phloxes for whites and various pinks and reds; lobelias and browallias for blues; pinks for whites and various shades of pink; stocks for whites and reds; wall-flowers for brown-yellows; verbenas for many colors.

Vines are abundant among the annuals, the most prominent being morning-glory, sweet pea, cobeas, climbing nasturtium, Japanese hop, cypress-vine and other ipomœas, balloon-vine, scarlet-runner, moon-flowers in the South.

Some of the "everlastings" or immortelles are useful as flower-garden subjects as well as for "dry-bouquets." These "paper flowers" are always interesting to children. The colors are bright, the blooms hold long on the plant, and most of the kinds are very easy to grow. Favorite groups are the different kinds of xeranthemums and helichrysums. The globe amaranths, with clover-like heads (sometimes known as bachelor's buttons), are good old favorites. Rhodanthes and acrocliniums are also good and reliable.

Ornamental grasses should not be overlooked. They add a note to the flower-garden and to bouquets that is distinct and can be secured by no other plants. They are easily grown. Some of the good annual grasses are *Agrostis nebulosa*, the brizas, *Bromus brizaeformis*, the species of *eragrostis*, and pennisetums and *Coix Lachryma* as a curiosity. Such good lawn grasses as arundo, pampas-grass, eulalias, and erianthus are perennials and therefore are not discussed here.

The amateur would do well to make up lists from the most detailed seed catalogues. The following short lists (under trade names) suggest a few things in several categories:

#### White-flowered annuals.

<i>Ageratum mexicanum</i> album.	Matthiola (Stocks), Cut-and-Come-Again; Dresden Perpetual; Giant Perfection; White Pearl.
Alyssum, common sweet.	Mirabilis longiflora alba.
<i>Centranthus macrosiphon</i> albus.	Nigella.
China asters.	Phlox, Dwarf Snowball; Leopoldi.
<i>Convolvulus</i> major.	Poppies, Flag of Truce; Shirley; The Mikado.
Dianthus, Double White Margaret.	Zinnia.
<i>Iberis amara</i> ; coronaria.	
<i>Ipomœa hederacea</i> .	
<i>Lavatera</i> alba.	
<i>Malope grandiflora</i> alba.	

#### Yellow- and orange-flowered annuals.

<i>Cacalia lutea</i> .	Hibiscus africanus; Golden Bowl.
<i>Calendula officinalis</i> , common; Meteor; sulphurea; suffruticosa.	<i>Ipomœa coccinea</i> lutea.
<i>Calliopsis bicolor</i> marmorata; cardaminifolia; elegans.	Loasa tricolor.
<i>Cosmidium Burridgeanum</i> .	Tagetes, various kinds.
<i>Dimorphotheca aurantiaca</i> .	Thunbergia alata Fryeri; aurantiaca.
<i>Erysimum Perofskianum</i> .	Tropaeolum, Dwarf; Lady Bird; Tall, Schulzii.
<i>Eschscholtzia californica</i> .	Zinnia.

#### Blue- and purple-flowered annuals.

<i>Ageratum mexicanum</i> ; mexicanum Dwarf.	<i>Iberis umbellata</i> ; umbellata lilacina.
Browallia Czerniakowski; elata.	Kauffussia amelloides; atrovioacea.
<i>Centaurea Cyanus</i> , Victoria Dwarf Compact; Cyanus minor.	Lobelia Erinus.
China asters of several varieties.	Nigella.
<i>Convolvulus</i> minor; minor unicaulis.	Phlox variabilis atropurpurea.
<i>Gilia achilleæfolia</i> , capitata.	Salvia farinacea.
	Specularia.
	Verbena, Black-Blue; cœrulea; Golden-leaved.
	Whitlavia gloxinoides.

*Rose- and rose-red-flowered annuals.*

Cacalia, Scarlet.	Papaver (Poppy) cardinale;
Clarkia elegans rosea.	Mephisto.
Convolvulus tricolor roseus.	Phaseolus multiflorus.
Dianthus, Half-Dwarf Early	Phlox, Large-flowering Dwarf;
Margaret; Dwarf Perpet-	Dwarf Fire-ball: Black
uai chinensis.	Warrior.
Gaillardia picta.	Salvia coccinea.
Ipomœa coccinea; volubilis.	Saponaria. [Thumb.
Matthiola annuus; Blood-Red	Tropœolum, Dwarf, Tom
Ten Weeks; grandiflora,	Verbena hybrida, Scarlet Defi-
Dwarf.	Zinnia. [ance.

*Annuals useful for edgings of beds and walks, and for ribbon-beds.*

Ageratum, blue and white	Leptosiphons.
Alyssum, sweet.	Lobelia Erinus.
Brachycome.	Nemophilas.
Calandrinia.	Nigellas.
Clarkia.	Portulacas or rose moss.
Collinsias.	Saponaria calabrica.
Dianthus or pinks.	Specularia.
Gilia.	Torenia.
Gypsophila muralis.	Whitlavia.
Iberis or candytufts.	

*Late-blooming annuals.*

Probably the best annuals to bloom in late fall, even after the first frosts, are petunia, phlox, and verbena. Other excellent kinds are ageratum, alyssum, antirrhinum or snapdragon, *Calendula officinalis*, California poppy, gaillardia, marigold, and pansy. The list may be extended by

Abronia umbellata.	Erysimum Perofskianum; ar-
Adonis œstivalis; autumnale.	kansanum.
Argemone grandiflora.	Gilia achilleæfolia; capitata;
Callirhoe.	laciniata; tricolor.
Carduus benedictus.	Iberis affinis.
Centaurea Cyanus (bachelor's	Lavatera alba.
button).	Matthiolas or stocks.
Centaureidum.	(E)nothera rosea; Lamarekiana;
Centranthus macrosiphon.	Drummondii.
Cerinthe retorta.	Podolepis affinis; chrysantha.
Cheiranthus Cheiri.	Salvia coccinea; farinacea; Hor-
Chrysanthemums.	vicia Gerardii. [minum.
Convolvulus minor; tricolor.	Virginian stocks.
Dianthus of various kinds.	Viscaria elegans; oculata; Cœli-
Elsholtzia cristata.	rosa.

If sown early or in the fall, bachelor's button, annual gypsophila and poppy will re-seed and furnish plants for late fall bloom.

L. H. B.†

**ANÆCTOCHILUS** (Greek, *open lip*). *Orchidaceæ*. A group cultivated for the beautifully reticulated leaves, which are oval or ovate, membranaceous and diversely colored; the flowers are small, not ornamental.

Terrestrial, from a creeping rhizome: lvs. basal: fls. in a spike or raceme; sepals free, the dorsal erect, forming a hood with the petals, the lateral sepals spreading; lip adnate to the foot of the column, spreading; claw fimbriate, the blade 2-lobed.—About 8 species.

Although many methods have been adopted for the successful cultivation of the best species and varieties, failure has been the rule, so that at present few American collections contain even a single specimen. Plants introduced by collectors sometimes thrive for a few years and then fail, in spite of all efforts. Frequently they can be kept only a year or two.

**Bullenii**, Low. Lvs. about 2 in. long, bronze-green, with 3 longitudinal bands of copper-red. Borneo.

**regalis**, Blume. Fig. 217. One of the most attractive species of the group: lvs. oval, large, bronze-green netted, veined with gold, the surface of the lvs. like velvet. Java. B.M. 4123. F.S. 2:79 (both as *A. setaceus*).—Several good varieties exist.

**Röxburghii**, Lindl. Lvs. ovate, median line of pale green, reticulated and veined with gold. Java and India.

Several kinds are described and figured in foreign publications, but they are all fanciers' plants. Other names which appear in the American trade are: *A. Dayana* = (?) — *A. Dawsonianus* = *Hemaria*. — *A. Frédéric-Augustii*, Reichb. f. (*A. xanthophyllus*, Planch.). Lvs. dark velvety green, the broad orange stripe down the center covered with a network of gold.

G. 10:675; 27:54. — *A. Löwis*, Hort. = *Dossinia*. — *A. Petöla*, Hort. = *Macodes*. — *A. Veitchianus*, Hort. = *Macodes*.

GEORGE V. NASH.†

**ANOGRÁMMA** (Greek, *without lines* referring probably to the absence of indusia). *Polypodiaceæ*. A small group of tropical ferns, somewhat related to *Pteris*, and characterized by linear sori uncovered by indusia. The lvs. are borne in a cluster, are small, 1-2 pinnate with pinnatifid divisions and forking veinlets.

**schizophýlla**, Diels. (*Gymnogramma schizophýlla*, Baker). Lvs. 18-24 in. long, quadri-pinnatifid, the stalks, rachises and divisions slender, the ultimate segms. finely cut. A comparatively recent intro.; very graceful in cult. Jamaica. A.G. 18:421. G.F. 2:533. A.F. 10:827. I.H. 31:522. Gn. 48, p. 417. Var. *elegantissima* (*Gymnogramma elegantissima*, Hort. W. Bull.), has reddish brown rachises.

R. C. BENEDICT.

**ANOIGÁNTHUS** (from Greek words, alluding to the expanded flower). *Amaryllidaceæ*. A small probably monotypic genus of Natal and the Cape region, the plants sometimes cult. as greenhouse winter- and spring-flowering bulbs. *A. breviflorus*, Baker (*Cyrtanthus breviflorus*, Harv.), has an ovoid bulb 1 in. diam., with a short neck: lvs. 3-4, appearing with the fls., 1 ft. or more: fl.-st. to 1 ft. high, bearing a 2-10-fl. umbel: fls. bright yellow, about 1 in. long, with a short tube and oblong-lanceolate nearly equal segms; stamens 6, in 2 series: fr. a globose membranous caps., 3-valved; seeds flat. B.M. 7072. Var. *minor*, Baker (*A. luteus*, Baker), is a dwarf mountain form with narrower perianth-segms. These plants are half-hardy in the milder parts if given good protection over winter.

**ANOMATHËCA**: *Lapeyrouisia*.

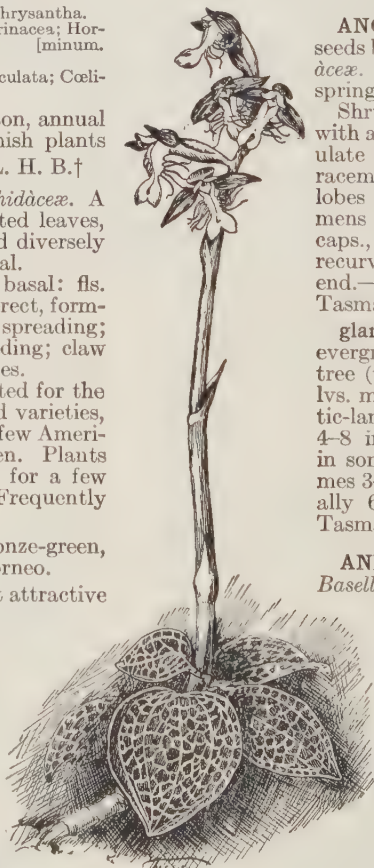
**ANÓPTERUS** (referring to the seeds being winged at top). *Saxifragaceæ*. Greenhouse shrub, blooming in spring.

Shrubs or small trees, glabrous, with alternate thick evergreen exstipulate lvs., and white fls. in terminal racemes: calyx-tube very short, the lobes 6-9, persistent; petals and stamens as many as calyx-lobes: fr. a caps., oblong-conical, opening by 2 recurved valves, seeds winged at one end.—Two species in Australia and Tasmania.

**glandulösus**, Labill. Handsome evergreen shrub, becoming a small tree (to 40 ft.) in its native regions: lvs. mostly at ends of branches, elliptic-lanceolate to somewhat obovate, 4-8 in. long, somewhat serrate: fls. in somewhat drooping bracted racemes 3-6 in. long; parts of petals usually 6, about ½ in. long. Subalpine Tasmania.

L. H. B.

**ANREDËRA** (personal name). *Basellaceæ*. A monotypic genus, allied to *Boussingaultia*. Vine, with fleshy sts. and lvs., tuberous-rooted: fls. small, white, in long slender mostly axillary spikes; sepals 2, broadly winged; petals 5, not exceeding sepals; stamens 5, the filaments fattened; stigma entire. *A. scandens*, Moq., is native Texas to S. Amer., and planted in Old World tropics, a much-branched vine sometimes cult. in greenhouses, with lvs. ovate and more or less acute, entire.

217. *Anæctochilus regalis*. (× ½)



**ANSÉLLIA** (in honor of John Ansell, African explorer). *Orchidaceæ*. Epiphytic hothouse orchids with tall, thickened leafy stems.

Flowers in panicles, showy; sepals and petals similar, spreading; lip erect, sessile at the end of the column-foot; lateral lobes broad, parallel, erect; middle lobe round-ovate, spreading; pollinia 2.—A genus of 4 closely related species, perhaps all forms of 1 species.

**africana**, Lindl. Sts. up to 2 ft. tall, leafy above: lvs. 4-8 in. long, about 5-nerved, elongated-lanceolate: panicle many-fld.; fls. 2 in. across, with brown-purple spots on a light yellow-green background; sepals narrow-oblong; petals about twice as broad as sepals; lateral lobes of lip oblong, the middle lobe ovate. Fernando Po. B.M. 4965.

**gigantæa**, Reichb. (*Cymbidium Sanderstonii*, Harv.). Differs from the above in the smaller fls. with narrower segms. which are spotted on the lower part only. Natal. B.M. 4965, f. 3.

GEORGE V. NASH. †

**ANSÔNIA**: *Amsonia*.

**ANTENNÀRIA** (pappus likened to antennæ). *Compositæ*. EVERLASTING. CAT'S-EAR. LADIES' TOBACCO. PUSSY'S TOES. Field herbs, sometimes offered by dealers in native plants.

Small, white-woolly perennial plants, with spatulate or obovate root-lvs., and mostly leafless scapes, bearing small gray or white heads which remain stiff and dry: fls. diœcious, the staminate forms rare in cult., all tubular.—None is showy. They are interesting for rock-work and the edges of borders, and for this purpose have been sparingly intro. in the last few years. They are perfectly hardy, and thrive in poor soil. The fls. are often cut before fully mature and dried (and often dyed) as everlastings. About 20 species grow wild. Prop. mostly by division of the mats; also by seeds. Allied to *Anaphalis* and *Gnaphalium*, both of which are leafy stemmed plants quite distinct from the prostrate, stemless antennarias, which send up only a bracted scape, except in *A. racemosa*. See *Everlastings*.

A. *Pappus of sterile fls. not thickened at the tip, minutely roughened.*

**dimôrpha**, Torr. & Gray. Tufted, with spatulate lvs. and a sparsely lvd. fl.-st. an inch or less high, from a stout, much-branched rootstalk. Neb. west to Calif.

AA. *Pappus of sterile fls. thickened at the top.*

B. *Not spreading by stolons.*

**Geÿeri**, Gray. Stout, thick-woolly, from a woody base: fls.-st. 3 in. or more high, very leafy to the top: pistillate heads narrow: involucre with rose-purple or ivory-white tips to the inner scales. Calif. and Ore.

BB. *Spreading by stolons.*

c. *Heads solitary or in a cymose cluster.*

**dioica**, Linn. (*A. candida*, Hort.). Basal lvs. 1½ in. or less long, 1-nerved or only indistinctly 3-nerved: st. 2-12 in.: involucre bracts all light green or light brown, with white or pinkish tips. Northern states and Eu., and Asia.—The plant in the trade as *A. tomentosum* is probably a form of this species. Also in cult. under the proper name, *A. dioica*. *A. hyperborea*, Hort., a name common in the trade, is apparently a mere form of this with pinkish fls.

**alpina**, Gaertn. Plant 1-4 in.: involucre bracts in fertile heads, dark brownish green, acute. Canada, Rocky Mts., Sierra Nevada.

**plantaginifolia**, Rich. Basal lvs. 1½ in. or more long, distinctly 3-nerved: st. 6-18 in. high.—Stoloniferous, making broad patches. Common in fields and old pastures. Perhaps not in cult.

CC. *Heads loosely nerved.*

**racemosa**, Hook. Light-woolly, the flowering sts. 6-20 in. high, sparsely leafy, the heads mostly on slender

peduncles: involucre brownish, white-tipped. Ore. and Brit. Col. to the Rockies.

*A. margaritacea*=*Anaphalis margaritacea*.

N. TAYLOR. †

**ÂNTHÉMIS** (Greek name of the chamomile). *Compositæ*. CHAMOMILE. Pyrethrum-like heavy-scented plants, annual, biennial or perennial, members of a



218. *Anthemis tinctoria*. (×¼)

large, Old World temperate-region genus, used in borders and alpine gardens.

Heads many-fld., the disk yellow, the rays white and yellow and (in the common cult. species) pistillate, the receptacle conical and chaffy, the achenes terete or ribbed, and either naked or bearing a minute crown: lvs. pinnately dissected.

Two or three of the species are weeds. Others are excellent border plants. The true chamomile is a medicinal plant. The hardy perennial species, which alone are grown in this country, are easily handled in the border, where they bloom from midsummer till frost. They thrive in almost any soil, but need full exposure to sun.

Propagation is by seeds or division of the clumps, usually the latter.

A. *Rays normally yellow.*

**tinctoria**, Linn. GOLDEN MARGUERITE. Fig. 218. Of bushy habit, 2-3 ft., with angular st. and pinnately divided, and again pinnatifid or cut-toothed lvs., and large, daisy-like golden yellow fls. (1-2 in. across). Gn. 42, p. 91; V. 18:33. *A. Kélmayi*, Hort. (or var. *Kélmayi*, Hort.), has finer-cut foliage and deeper yellow fls. There is also a pale-rayed variety and a white-fld. form is sold under the name *A. montana*. Gn. 52:484.—An excellent hardy perennial border plant, and useful at the same time for cut-fls.

AA. Rays white.

B. Perennial; cult.

*nobilis*, Linn. CHAMOMILE. Half-spreading and much-branched herb, downy, the lvs. very finely dissected: pappus wanting, chaff of the receptacle blunt. Var. *grandiflora*, Hort., is larger-fl. than the

type, and sometimes yellow-fl. —A pleasant-scented herb, sometimes escaped from cult. It yields the medicinal chamomile fls. of commerce. For medicinal purposes, the heads (the single preferred) are cut as soon as fully expanded, and dried. Cult. also as a hardy border plant; often double.

BB. Biennial or annual; weeds.

*arvensis*, Linn. Pubescent, not ill-scented: lvs. rather coarsely 1-2 pinnately parted: pappus a minute border: heads 1 in. or more across; the involucre with broad, blunt scarious marginal edges; rays pistillate, spreading, 2-toothed. —Not common and rather coarse.

*Cótula*, DC. MAY-WEED. DOG FENNEL. Fig. 219. A common

weed along roadsides, ill-scented, growing 1-2 ft. high, with finely dissected lvs., neutral rays and many asterlike fls. 1 in. across.

*A. Aizdon*, Griseb. = *Achillea ageratifolia*. Gn. 24:342. — *A. arabica*, Linn. = *Cladanthus*. — *A. coronaria*, Hort. = *Chrysanthemum coronarium*. — *A. floribunda*, Hort. Dwarf: lvs. much dissected: fl.-heads pure white. — *A. Biebersteiniana*, Koch, is found in some catalogues. It is an alpine plant with pinnate lvs., which are silvery, and yellow fls. Can be cult. only in the alpine garden.

L. H. B.  
N. TAYLOR.†

ANTHER: Flower.

**ANTHÉRICUM** (Greek, *flower hedge*). Includes *Phalangium*. *Liliaceæ*. Non-bulbous liliaceous plants grown in borders and cool greenhouses.

Herbs, with tuber-like rhizomes, and racemes of rather small, white, deep-cut fls.: perianth rotate; anthers attached between their basal lobes, and the locules many-ovuled—in these characters differing from *Paradisæa*.—Some 50 species, mostly African, but a few in the western hemisphere.

The anthericums are useful for lawn vases, for borders that are protected in winter at the North, for greenhouses and also for growing under benches. Propagation naturally by stolons; increased also by division and seeds. Of easiest culture. Give plenty of water when in bloom.

*Liliago*, Linn. ST. BERNARD'S LILY. Figs. 220, 221. St. simple, 2-3 ft. high, bearing an open raceme of open-spreading fls. 1 in. or less across, the segms. linear-oblong: lvs. long and narrow. S. Eu. and N. Afr. B.M. 914. Var. *majör*, Sims, is larger in all its parts. B.M. 1635.

*ramdsum*, Linn. St. branched: fls. somewhat smaller. Eu. B.M. 1055

*A. Bichetii*, Hort. Lvs. flexible, variegated with white; elegant habit. W. Trop. Afr. — *A. californicum*, Hort. = *Chlorogalum pomeridianum*. — *A. Höfmannii*, Engler. Free-flowering: lvs. 1 ft., 1½ in. broad, shining green: fls.-sts. scarcely exceeding the lvs.: fls. in dense panicles, star-shaped, white. E. Afr. — *A. Liliastrum*, Linn. = *Paradisæa Liliastrium*. — *A. picturatum*, *A. variegatum* and *A. vittatum* are garden names for *Chlorophytum elatum*.

L. H. B.

**ANTHOLYZA** (name from the Greek, referring to fancied shape of flower). *Iridaceæ*. Cormous plants of the gladiolus kind, grown in the open for summer bloom; red and yellow.

Perianth long-tubular, curved, dilated above, the uppermost segms. largest; stamens 3; style branched; ovary 3-loculed. — About 14 or more Cape and Trop. African plants, with linear or sword-shaped lvs. and bright fls. in 2-sided spikes. Cult. the same as gladioli, being taken up in the fall. The tubers are often started in a frame or in the house before planting in the open.

AA. Perianth red; segms. very unequal.

*Cunônia*, Linn. Corm small, globose: st. simple, 1-1½ ft.: lvs. about 4, linear, 1 ft. or less long: fls. 4-6, in a lax spike, bright red, tube an inch long, the stamens reaching to the tip of the upper segm.: seeds discoid, winged. Cape. L.B.C. 20:1971 (as *Anisanthes*).

*cáffa*, Ker. Corm large, globose, long-necked: st. 2 ft. or less: lvs. narrow-linear, 1 ft.: fls. 12-20, in a lax spike, bright red, tube 1-1½ in. long, stamens not quite reaching tip of upper segm.: seeds 3-angled, narrowly winged. Cape. — Has been hybridized with gladiolus.

AA. Perianth red and yellow; segms. less unequal.

*æthiópica*, Linn. (*A. ringens*, Andr.). Corm large, globose: st. branched, 3-4 ft.: lvs. several, sword-shaped, 1 in. broad and 1-1½ ft. long: spikes 6-9 in. long, rather dense; fls. 1½-2 in. long, red-yellow; stamens reaching to the tip of the upper segm.: seeds turgid, not winged. Cape. B.M. 561. Var. *minor*, Lindl. (*A. bicolor*, Gasp.). Dwarf: lvs. narrow: fls. red at top, pale yellow below. B.R. 1159. Var. *vittigera*, Baker, (var. *ringens*, Nichols.). Tall as the type: fls. bright yellow, striped red. B.M. 1172. Var. *immarginata*, Baker. Fls. red, with dull yellow.

*paniculata*, Klatt. Corm large, globose: st. stout, much branched, 3-4 ft.: lvs. lanceolate, oblique, 2 ft. or less long, to 3 in. broad: spikes dense, many-fl., with wavy rachis; fls. bright red-yellow, tube curved, to 1¼ in. long, upper segm. ligulate. Natal. Var. *majör*, Hort. A form with larger lvs. and fls.

*crocosmioides*, Hort. Said to be a hybrid of *A. paniculata* and *Crocsmia*: 3 ft.: spikes branching; fls. brilliant orange-red, shaded to gold.

*A. abyssinica*, Brongn. Corm globose, 1 in. diam.: st. 2 ft. or less: lvs. 3-4, linear, 1 ft. long: spike simple, few-fl.; fls. bright red, the curved tube 1 in. long. Abyssinia. — *A. quadrangularis*, Burm. (Gladiolus quadrangularis, Ker.). Corm large, globose, plant stoloniferous: st. slender, 2-3 ft.: lvs. 2-3, narrow: spike very lax, 2-4 fl.; fls. bright red and yellow, tube 2 in. long. Cape. — *A. Schweinfurthii*, Baker. St. terete, 1 ft. to spike: lvs. 5 to 6, grass-like, 6 in. long: spike simple and lax, many-fl.; fls. bright red shading to yellow, about 1½ in. long, the tube curved and dilated. Abyssinia. B.M. 7709.

L. H. B.



220. *Anthericum Liliago*.



219. *Anthemis Cotula*. (× ½)



**ANTHOXÁNTHUM** (Greek, *anthos*, flower, and *xanthos*, yellow). *Gramíneæ*. Aromatic grasses with spike-like panicles. Spikelets with 1 awnless perfect floret, and two 2-lobed, awned sterile lemmas. Species 4, Eu. A perennial species, sweet vernal grass (*A. odoratum*, Linn.), is occasionally cult. as a meadow grass to give a pleasant odor to hay. Dept. of Agric., Div. of Agrost., Bull. 20:55. Another species, an annual (*A. Puellii*, Lecq. & Lam.), is more rarely cult.

A. S. HITCHCOCK.

**ANTHRÍSCUS:** *Chervil*.

**ANTHÚRIUM** (Greek, *tail-flower*). *Aráceæ*. Choice hothouse foliage plants.

Perennial, the st. creeping, climbing, assurgent or arborescent: lvs. variable, net-veined, with a prominent midnerve and lateral nerves, and a well-defined nerve at or near the margin: fls. in a spike (spadix), subtended or inclosed in the spathe: fr. a berry. Tropical herbs and climbing plants of perhaps 608 species besides varieties, mostly from the central and warmer parts of S. Amer., though probably not one-tenth are in cult. in this country. Grown either for their showy spathes and spadices, or their handsome velvety lvs. Spathe usually spreading or even reflexed, only rarely partially inclosing the spadix. Differs from *Alocasia* and allied genera in technical characters. Monogr. by Engler in De Candolle's *Monographiæ Phanerogamarum*, Vol. 2 (1879), and *Pflanzenreich*, hft. 21 (1905).

The genus *Anthurium* appears to be a constantly increasing one as regards the number of species. Index Kewensis, when first issued in 1893, gave the number of known species as 213. The supplements have now recognized 365 more species, making in all about 578 known species, though there are probably not more than fifty in cultivation in this country and perhaps not more than ten or fifteen known to the trade. Of those that are in cultivation there are several varieties or hybrids, as the species seem to cross readily.

Anthuriums are tropical aroids of great beauty, and at least a few species should be included in every collection of choice plants. They seem to fall naturally



221. Stolon of *Anthericum Liliago*.

into two sections or groups, viz., foliage and flowering. Although anthuriums all flower, those that have the large handsome velvety leaves, such as *A. crystallinum*, *A. Warocqueanum*, *A. splendidum*, and the like, have very inconspicuous or decidedly unattractive flowers, while *A. Andræanum*, *A. Brownii*, *A. Regnellianum* and *A. Scherzerianum* and many others have remarkably showy, usually scarlet spathes and spadices but much less handsome foliage. All are striking plants.—Anthuriums such as *A. Andræanum*, *A. ornatum*, and their numerous hybrid progeny, require at all

times a high and humid atmosphere. Under these conditions and in a good rooting medium, they ought to be continually in flower. A bloom is produced from the axil of each leaf, and immediately beneath this leaf a new root is produced, thick and succulent at first, becoming tough with age, and, if not allowed to bury itself among the compost in which the plant grows, it eventually hardens and is of no help in the sustenance of the plant.

Therefore, the growing point of the specimens should not be allowed to get too high, or the flowers will be few and poor. When the plant forms stems above the pot, the compost should either be built up around the stem, to catch the roots, or the plant may be cut over, rooted afresh in sand, and given a new start in a pot. The two ornamental-leaved species, *A. Veitchii* and *A. Warocqueanum*, should be treated in the same manner. When cut down, one may look for the old stocks to send out small growths, which in course of time may be taken off and put in small pots. All of the above are such free-rooting kinds that they may, with the addition of some rotted manure, be grown in sphagnum moss. A good mixture is as follows: sphagnum, chopped not too fine, one part; fern or kalmia roots, chopped up and the fine substance removed,



222. *Anthurium Scherzerianum*. ( $\times \frac{1}{2}$ )

one part; another part to be made up equally of sand and rotted manure. With well-drained pots, this forms an admirable rooting substance.—Most of the other species and their forms, including *A. Scherzerianum* and *A. crystallinum*, will thrive better in material mainly composed of rough, fibrous loam and peat with the fine material sifted from it. This rough, fibrous material should be mixed with a small quantity each of sphagnum, charcoal and sand. Good drainage, and less water than is needed for the *Andræanum* and *Warocqueanum* groups will be necessary. *A. Scherzerianum*, although thriving well in the hottest house, will succeed in an intermediate house.—Established plants of anthurium will need repotting only once in two or three years, but should have a fresh top-dressing every year; the best time to overhaul them is about the end of January, or before active growth begins. They should be given a shaded position, free from draughts of cold air, and ordinary stove temperature. Care must be taken not to mar the leaves by hard spraying. The temperature during winter should not fall below 55°.—Propagation is by suckers or cuttings of the rhizome inserted in small pots containing a mixture of peat fiber, chopped sphagnum moss and silver-sand in equal proportions, and plunged in a propagating-box in a temperature of 75° to 80°, with bottom heat. About the end of January is the most suitable time to take the cuttings. Anthuriums may also be propagated by seeds sown in a mixture of very fine fibrous peat and chopped sphagnum moss in 4-inch pots. The seeds should be lightly covered with sphagnum, and the pots placed either in a propagating-case or under bell-glasses, where a temperature of 80° can be maintained. A constant humid atmosphere is very necessary to induce the seeds to germinate. To prevent damping, the seedlings should be pricked off round the edge of a 3-inch pot as soon as the first leaf is large enough to handle. Seeds of such kinds as *A. crystallinum* and *A. regale* will germinate well on the moss of nepenthes baskets.

Seeds are secured by pollinating the flowers, the stigmas of which become mature long before the anthers. Anthuriums of the Scherzerianum type may be increased by division of the crown. (E. J. Canning and G. W. Oliver.)

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A. Lvs. plain green: grown mostly for the showy "flowers."

B. Spadix coiled.

1. *Scherzerianum*, Schott. Fig. 222. A foot or two high, evergreen: lvs. long-lanceolate (the blade 1 ft. or more long and petiole of nearly equal length), thick, usually somewhat revolute, with a strong vein parallel with each edge and close to it, and many cross-veins: scape long and slender (1-2 ft.), red; spathe ovate-oblong, 3-4 in. long, spreading or deflexed, intense red (sometimes double, I.H. 37:107); spadix slender, curled, yellow. Cent. Amer. B.M. 5319. R.B. 22:121. Gn. 33, p. 89. G.C. II. 12:301. G. 3:55. A.F. 6:569 (in variety).—An old favorite. Runs into many forms: spathe white, vars. *album*, *album magnificum*, *lacteum*, *maximum album*, *Williamsii*, *Vervænum*; spathe parti-colored, vars. *andegavense* (scarlet on the back, white and scarlet spotted above), *mutabile* (white-bordered), *nebulosum* (double white spotted rose), *Rothschildianum* (scarlet mottled white, Gn. 30:454), *Warocqueanum*, not *A. Warocqueanum* (white spotted red); spathe very large, vars. *giganteum*, *maximum*, *Wardii*, *Woodbridgei*. Very dwarf is var. *pygmæum*; rose-salmon spathe and orange spadix is var. *pariense*; sharp pointed lvs. and spathes is var. *Bennettii*; rose-colored spathes, var. *roseum*; deep blood-red spathes, var. *sanguineum*.

BB. Spadix not coiled.

c. Spathe narrow, green.

D. The lvs. narrow, not cordate.

2. *spathiphyllum*, N. E. Br. Two ft. or less, stemless or nearly so: lf.-blade 2 ft. or less, narrow-lanceolate, attenuate in a straight line from the middle to the base, acuminate, bright green above and grayish beneath,



223. *Anthurium Andræanum*. (× 1/2)

with prominent midrib: spathe 2 in. or less long and a half or more as wide, erect, boat-shaped, pale green or whitish; spadix 1 in. long and very blunt, pale yellow. Trop. Amer.

3. *Regnellianum*, Engl. Lvs. 5-6 in. long, about 2 in. broad, obtuse or slightly emarginate at the base, gradually narrowed to an acute apex, green: spathe

about 1 1/2 in. long, 1/4-1/2 in. broad; spadix dark green, 1 1/2-2 in. long, on a short stipe. Brazil.

DD. The lvs. broad, deeply cordate.

4. *Bröwnii*, Mast. Lvs. 2-3 ft. long, a deep sinus separating the rounded basal lobes, leathery, dark shining green above, paler beneath, with 12-15 pairs of prominent lateral nerves: spathe 6-8 in. long, lanceolate, greenish, rose-tinted; spadix 10-15 in. long. Colombia. G.C. II. 6:744-5.

cc. Spathe cordate-ovate, colored.

5. *Andræanum*, Lind. Fig. 223. Low species, with lf.-blades drooping like an alocasia and cordate ovate-lanceolate: spathe cordate-ovate, thick in texture, 6-10 in. long, orange-red, widely open-spreading; spadix 3-4 in. long, yellowish, with white band marking the zone in which the stigmas are receptive. Colombia. B. M. 6616. A.F. 6:569; 10:1065. Gt. 38:1293. I.H. 24:271; 37:105. V. 9:259; 11:138. G.C. II. 13:497.—Beautiful and popular. Runs into many varieties. Spathes white, var. *album*; spathe very bright red, shining, var. *Gæmeri* (R.H. 1907:30, desc.); spathes very large, pure white, var. *Láwrenciæ*; spathes of a soft rose-color in upper part passing into light green on lateral lobes, var. *rhodochlorum* (R.H. 1901:452); spathes shining rose-pink, var. *roseum*; spathes salmon-color, var. *salmoneum*; spathes dark crimson, var. *sanguineum*.

AA. Lvs. prominently marked with white or colors, or with deep bands of green: cult. mostly for foliage.

B. The lvs. not bullate.

c. Markings green or greenish.

6. *Veitchii*, Mast. Fig. 224. Tall and robust species (st. 2-3 ft.): lf.-blades pendent, like a fine alocasia, often 3-4 ft. long, cordate or eared at base, metallic green, but marked by deep-sunk nerves, which arch off the midrib: spathe 1 ft. long, horizontal, green; spadix 6-8 in. long, straw-color. Colombia. G.C. II. 6:773. B.M. 6968. Mn. 8:187. I.H. 27:406. Gn. 29, p. 453. G.C. III. 44:181.—Striking.

cc. Markings white or essentially so.

7. *Warocqueanum*, Moore. Fig. 225. Very vigorous: lvs. oblong-lanceolate, long-tapering, hanging, 2-4 ft. long, deep velvety green, with rib and principal veins of a prominently lighter shade, making handsome contrasts. Colombia. I.H. 27:392. G.C. III. 44:180.—A handsome and striking foliage plant.

8. *magnificum*, Lind. Lf.-blade deep cordate, oval, 2 ft. long, upper surface olive-green with white nerves; petiole 4-angled: spathe small, oblong, green; spadix green, cylindrical. Colombia.

9. *crystallinum*, Lind. & André. Like *A. magnificum*; differs in petiole terete or only very imperfectly angled, sinus of blade smaller, veins wide-banded and whiter and very regular: lf.-blade ovate-cordate, short, deep velvety green, with the midrib and two consecutive bands crystal white: spathe linear-oblong, acuminate,



224. *Anthurium Veitchii*. (× 1/2)  
Young leaf, not yet showing the arched depressions.



green. Peru. I.H. 20:128. G.C. III. 24:417 (var. *illustre*). G. 21:98. G.W. 15, p. 254.

10. *regale*, Lind. Lf.-blade cordate-oblong, long-cuspidate, 3 ft. or less, at first tinged rose, but becoming dull green and marked with white veins; petiole nearly terete: spathe broad-lanceolate, greenish. Peru.

BB. *The lvs. bullate.*

11. *spléndidum*, Hort. Lvs. large, cordate-ovate, coriaceous, sea-green, glaucous above, bullate, the depressions and nerves brownish. Colombia.

Various horticultural forms and hybrids are in cult. in this country: *A. amabile*. Lvs. soft rose (crystallinum  $\times$  magnificum).—*A. Archiducis Josephii*, Lind. Spathe shining carmine, broadly cordate (Andraeanum  $\times$  Lindenianum).—*A. atropurpureum*, Pynaert. Spathe black-purple, spadix white.—*A. bicolor*, Crousse. Spathe white beneath, above whitish and rose-colored. R.H. 1904:40.—*A. carneum* is a hybrid of Andraeanum and ornatum.—*A. Chantiniæ*, Mart. Spathe rose, with paler nerves.—*A. Chantrieri*. Lvs. triangular, with wide-spreading basal lobes: spathe ivory-white, erect (nymphæfolium  $\times$  subsignatum).—*A. chelseiense*, N. E. Br. (Andraeanum  $\times$  Veitchii). G.Z. 31, p. 169.—*A. Clarkianum*. Lvs. large and broad: spathe resembling that of Andraeanum but salmon-rose.—*A. ferrierense*. Lvs. large, cordate: spathe cordate, brilliant red (ornatum  $\times$  Andraeanum).—*A. floribundum*, Lind and André= *Spathiphyllum floribundum*. I.H. 21:159.—*A. Fræbelii*. Lvs. large and cordate: spathe deep carmine (Andraeanum  $\times$  ornatum).—*A. grande* = *A. magnificum*.—*A. Hrúbyi*, Hort. Spathe flesh-colored or almost white.—*A. hybridum*. Lvs. large, lobed at base, obtuse, green.—*A. musaicum*.—*A. ornatum*. Lvs. oval or oblong, cordate: spathe linear-oblong, white, purple-tinted.—*A. Reynoldsianum*, various forms (ferrierense  $\times$  Andraeanum?).—*A. Siebrechtianum*. Lvs. much as in *A. magnificum*, rich, velvety green, with thick margins: spathe light green shading to cream; spadix large, crimson.—*A. triumphans*. Lvs. long-heart-shaped, bright green with lighter veins: spathe narrow, green; spadix greenish white.

*A. acule*, Schott. Fls. fragrant: lvs. 1-2 1/4 ft. long, very broad. W. Indies.—*A. acutum*, N. E. Br. Lvs. 8-10 in. long, triangular and long-acuminate, green: spathe reflexed, green; spadix deep green. Brazil.—*A. Allendorffii*=Andraeanum  $\times$  Grusonii.—*A. Bakeri*, Hook. Lvs. elliptic-lanceolate or linear, green: spathe small, reflexed, green; spadix 3 in. long, yellowish green, becoming longer and red and drooping in fr.—the chief merit of the plant. Costa Rica. B.M. 6261. G.C. III. 29:2.—*A. bogotense*, Schott. Lvs. with a very broad halberd-shaped base and a long-acuminate middle lobe, dark green. Gt. 46, p. 525.—*A. brevifolium*, N. E. Br. Lvs. oval-acuminate, cordate, 8-10 in., paper-like, green: spathe lanceolate, purplish: spadix purplish brown.—*A. carneum*, Hort. Chant. Spathe a beautiful rose color.—*A. Chamberlainii*, Mast. Lvs. 4 ft. long, broadly cordate-ovate and narrowly long-pointed, green: spathe erect, boat-shaped, 8-9 in. long, purplish outside, crimson inside, partially inclosing the purplish spadix. Venezuela. G.C. III. 3:465. I.H. 35:62. B.M. 7297.—*A. Clémentinae*, DeSmet. Spathe white



225. *Anthurium Warocqueanum*.

with rosy nerves.—*A. coriáceum*, Endl. Lvs. very thick, leathery, 2 ft. long. Brazil.—*A. Eduardii*, Pynaert. Spathe white (Andraeanum  $\times$  Lindenianum).—*A. Forstii*, N. E. Br. Related to *A. crystallinum*, but smaller and with petate lvs. of a deep rich green with a velvety sheen, the veins not quite so marked. Colombia.—*A. Glaziovii*, Hook. Lf.-blade obovate-oblong, not hanging; tapering to petiole, green and strongly light-veined: spathe linear-oblong, often twisted, purple (as is also the spadix). Brazil. B.M. 6833.—*A. grandiflorum* var. *perfectum*, Hort. Spathe very large, of a pronounced red color.—*A. Gustávii*, Regel. Lvs. broadly ovate-cordate, bright green: spathe cylindric, about 1 ft. long, and dark violet-purple like the spadix. Colombia. B.M. 7437.—*A. Hardyæ*, Mart. Spathe rose, spadix white.—*A. Hookeri*, Kunth. Lvs. dotted with black, spathe lanceolate. B.M. 2987 (as *Pothos crassinervia*). W. Indies.—*A. insignis*, Mast. G.C. II. 6:365.—*Philodendron tripartitum*.—*A. Kalbreyeri*, Hort. Climbing: lvs. 9-parted. Colombia. G.C. II. 16:117.—*A. Laucheanum*, Hort., Sand. Resembles *A. Andraeanum*, but lvs. reticulated: sts. climbing. Colombia. G.C. III. 43:258.—*A. Lindenianum*, Koch & August. Lvs. ovate-cordate, green, coriaceous: spathe pure white, linear-oblong, 5-6 in. long; spadix dark purple. Colombia. B.M. 5848. F.M. 1876:236 (both as *A. ornatum*).—*A. Miquelianum*, Koch. St. climbing: lvs. shining, elliptic-oblong, 1-2 ft. long: spathe lanceolate, green. Brazil. G. 7:435 (as *A. ornatum*).—*A. Nicolaiæ*, Engl. Spathe yellowish, flushed with rose.—*A. nymphæfolium*, Koch. Spathe white; spadix purple. Venezuela.—*A. purpureum*, N. E. Br. Lvs. oblong-lanceolate, thick, green: spathe and spadix purple. Brazil.—*A. rotundispatheum*, Lind. & Rod. Spathe nearly round, intensely sanguineous.—*A. Sanderi*, Hort. R.B. 34, p. 196.—*A. signatum*, Koch. Lvs. 3-lobed, deep green. Venezuela.—*A. trifidum*, Oliver (B.M. 6339)=*A. signatum*.—*A. trinerve*, Miq. Climbing: lvs. oblong-elliptic, 4-7 in. long: spadix up to 2 in. long, 3/4 in. thick in fruit: berries lilac. S. Amer. B.M. 8251.—*A. watermaliense*, Hort. Allied to *A. Andraeanum*. Spathe of a metallic black. Colombia. Intro. from Watermall, Belgium.

L. H. B.

GEORGE V. NASH.†

**ANTHÝLLIS** (Greek, meaning *downy flowers*). KIDNEY VETCH. *Leguminosæ*. Perennial herbs, or somewhat shrubby, prized for their spikes or heads of yellow, purple or white flowers and usually silky pinnate foliage; also for forage; in the Old World, prized mostly for rockwork.

Calyx-tube inflated near the base, dentate or lobed above; petals pea-like; the stamens all connected into a tube: legume usually ovoid.

The culture is the easiest, as the plants thrive even in poor soil. Propagation is by seeds or division, or, rarely, by soft cuttings. Not generally known in United States.

A. *Lfts. 4 or more pairs.*

**Vulneraria**, Linn. SAND CLOVER. WOUNDWORT. A foot high: lfts. 5 or more: fls. normally yellow, but there are red and white varieties. Eu.—A deep-rooted, clover-like, hardy plant, excellent for sandy and light lands. Useful for forage, and, for that purpose, occasionally grown in this country. Requires 20 lbs. of seed to the acre. See Cyclo. Amer. Agric., Vol. II, p. 308 and fig. 416.

**montana**, Linn. A foot or less high, silky-hoary: lfts. numerous: fls. purple in dense heads subtended by a leafy involucre. Herbaceous. Var. *rúbra*, Hort., is a reddish fld. form suitable for rock-gardens. Eu. L.B.C. 6:578.

**Bárba-Jóvis**, Linn. JUPITER'S BEARD. Glasshouse silky evergreen, 3-8, or even 12 ft. high, with several to many pairs of narrow, pointed lfts.: fls. straw-colored or whitish, in clover-like heads. S. Eu. B.M. 1927.—In frostless countries, endures sea-winds and salt spray.

AA. *Lvs. unifoliate or trifoliate.*

**Hérmannia**, Linn. Two to 4 ft.; dwarfier and more bushy than the preceding: lvs. almost sessile, simple or trifoliate, the lfts. oblong-cuneate: fls. yellow in axillary almost sessile, few-fld. heads. S. Eu. B.M. 2576.—Good for dry places. Intro. by Franceschi in 1910. N. TAYLOR.†

**ANTIARIS** (name derived from Greek word for *arrow*, the sap being used for arrow poison.) *Moracæ*. Five or 6 trees or shrubs of the E. Indies and Malaya famous because of the upas-tree, *A. toxicaria*, Lesch., fabled for years to be so poisonous that men or animals were destroyed who came within some distance of it. These

legends are apparently Javan. The tree has been grown in botanic gardens, however, with no disastrous results. The dried milky juice is very poisonous, and the natives use it with other ingredients (the ipoh poison) for poisoning arrows. The tree grows 60–70 ft. high, with alternate distichous short-std. oblong or oblong-ovate, entire lvs. and monoecious fls., the sterile fls. in dense heads and the fertile fls. solitary; fr. a 1-seeded fleshy drupe. A fiber is yielded from the inner bark. Another species, *A. innoxia*, Blume, yields fiber that is used for the making of sacks.

**ANTIDÉSMA** (Greek, *for* and *band*, the bark of *A. Bunius*, being used for cordage). *Euphorbiaceæ*. Tropical trees rarely cult. Lvs. large, alternate, simple: fls. small, in spikes; calyx imbricate; petals none; ovary 1-celled, 2-ovuled. The 1 species cult. for its currant-like berries used in preserves. The very tough fiber of the bark also used. The tree is very ornamental and suited to the subtropical parts of this country. Prop.



226. *Antigonon leptopus* var. *albus*. ( $\times \frac{1}{5}$ )  
From a plant grown under glass.

by cuttings. There are about 70 other species in the warmer parts of the Old World.

**BUNUS**, Spreng. NIGGER'S CORD. SALAMANDER TREE. CHINESE LAUREL. BIGNAY of Malays. A medium-sized evergreen tree with dark green laurel-like foliage, and small red berries in racemes. Malay region.

Two similar shrubs, *A. nitidum*, Tul., from Malaya, and *A. venosum*, Mey., from S. Afr., have been intro. by U. S. Dept. of Agric.

J. B. S. NORTON.

**ANTIGONON** (name from Greek, probably referring to the kned or angled character of stem). *Polygonaceæ*. Showy-flowered climbers, abundant in southernmost United States and southward, and sometimes grown in warmhouses.

Tropical tendril-climbers: sepals 5, colored petal-like and cordate, the 2 interior ones narrower; stamens 8; styles 3, and ovary 3-angled: lvs. alternate and entire: fls. in racemes, which end in branching tendrils. —Species 3 or 4, in Mex. and Cent. Amer.

The usual species is *A. leptopus*, one of the most conspicuous and beautiful climbers grown in Florida, and always in flower from early spring to late autumn. It grows 30 to 40 feet high in good soils. Some plants are shy bloomers, while others are often covered from top to bottom with a mass of bright deep rosy red. Too much fertilizer effects a very vigorous growth at the cost of the flowering. Verandas covered with antigonon look extremely beautiful, and cabbage palmettos decorated with masses of its pendent flower-trusses

form charming objects. The plants form large tubers and when killed down by frost, sprout readily again in spring. Seeds, looking much like buckwheat, are abundantly produced and form a ready means for propagation. Small plants from self-sown seeds come up everywhere in Florida gardens. (H. Nehrling.)

**léptopus**, Hook. & Arn. MOUNTAIN ROSE. ROSA DE MONTANA. SAN MIGUELITO. CORALLITA. LOVE'S CHAIN. Plant tuberous-rooted: st. slender and tall, glabrous, or nearly so: lvs. cordate and acuminate, or hastate-ovate, 3–5 in. long: fls. 6–15 in the raceme, handsome rose-pink. Mex. B.M. 5816. G.C. III. 17:797. Gn. 68, p. 320. G.M. 49:317. Var. *álbus*, Hort. (Fig. 226), has fls. nearly or quite white.—One of the handsomest summer-blooming greenhouse climbers, requiring abundance of light and recommended to be planted near heating-pipes and to be trained on the rafters; usually grown from seeds, but also from cuttings. Give plenty of water when in flower but keep dry when at rest. In the S. and the American tropics it is one of the commonest vines on fences, arbors and verandas.

*guatemalense*, Meisn. (*A. insigne*, Mast.). Pubescent: lvs. broader: fls. more numerous, the sepals nearly twice longer (1 in. long) than in the last. Guatemala. G.C. II. 7:789.

L. H. B.

**ANTIRRHINUM** (Greek, *snout-flower*). *Scrophulariaceæ*. SNAPDRAGON. Flower-garden and greenhouse herbs.

Erect or climbing herbs or even half-shrubs: lvs. usually opposite below and commonly entire, never compound: corolla saccate or gibbous at base, but not spurred, personate or closed at the throat; stamens 4: seeds not winged.—Closely allied to *Linaria*, from which it differs in the spurless fls. About 30 or 40 species in the northern hemisphere, particularly in N. Amer.

Snapdragons are flowered either in the open or under glass. The common varieties are forms of *A. majus*, and are perennial, although the first crop of bloom is usually the only one that is desired. Most of the varieties of this species are hardy in the North, if well covered during winter. Seeds sown very early in the spring, especially under frames, and transplanted, produce blooming plants the same season. It is usual, however, if early bloom is desired, to sow the seeds in August or September, and cover the plants with a mulch on the approach of cold weather. These fall-sown plants may be transplanted into pots (or grown in them from the first) and flowered in the house. For growing under glass in this way, snapdragons are very satisfactory. The temperature and treatment required for geraniums and carnations suit them well. Dwarf varieties are used for edgings.

A. Plant erect, herbaceous.

B. Root annual: small-fl'd.

**Oróntium**, Linn. SMALL SNAPDRAGON. Fig. 227. A low, slender annual, with linear lvs. and small fls. purple or white ( $\frac{1}{2}$  in. long) in the axils. An occasional weed in cult. grounds, 6–12 in. high; not cult.

**Orcuttianum**, Gray. Slender, 2–4 ft., glabrous: corolla  $\frac{1}{2}$  in. long, white or violet, lower lip not much larger than the upper: lower lvs. spatulate-lanceolate, the upper linear. Lower and S. Calif.—Intro. by Orcutt in 1891. Tendril-like branchlets are produced in the fl.-clusters.

BB. Root perennial: large-fl'd.

**majus**, Linn. COMMON or LARGE SNAPDRAGON. Fig. 228. Perennial, or practically a biennial under cult.: 1–3 ft., not downy except in the fl.-cluster: lvs. oblong or lanceolate, entire, sometimes variegated: fls. large,



long-tubular, with spreading, very irregular lobes, in an elongated terminal spike or raceme. In many colors and varieties (ranging from red and purple to white), in forms both tall and dwarf. *Medit. region*; sometimes running wild about gardens. A.F. 9:909; 13:949. I.H. 41:22. A.G. 17:379. F.E. 7:711.—There are double

forms. Some of the varietal names used by horticulturists are *album*, *bicolor*, *coccineum*, *procerrum*, *pumilum*, *variegatum*. Peloric forms are reported, with regular corolla and the much-reflexed limb 5-7-lobed. Gt. 53:1524.

AA. *Plant erect, perennial and shrubby; fls. about 1 in. long.*

**speciosum**, Gray. Three to 4 ft., somewhat pubescent, leafy: lvs. oval or oblong, short-petioled, thick: fls. scarlet or pink-red, the corolla-tube three times length of the lips (which are narrow). S. and Lower Calif., on the islands.

AAA. *Plant trailing or procumbent, perennial, with small fls.; used mostly in rock-gardens. June, July.*

**Asarina**, Linn.

Grayish-clammy, procumbent: lvs. 5-lobed, cordate, crenate, long-petioled: fls. axillary, solitary, white and sometimes tinged red, the palate yellow. S. W. Eu.

**sempervirens**, Lapeyr. Procumbent, woolly, small: fls. white with purple blotch. Pyrenees.

**glutinodsum**, Boiss. & Reut. Prostrate, glandular-pilose: lvs. alternate, elliptic to elliptic-ovate, short-petioled: fls. pale yellowish white, the lip striped red. Spain. B.M. 7285.

AAAA. *Plant climbing, perennial.*

**maurandioides**, Gray (*Maurandia antirrhiniflora*, Willd.). Fig. 229. Climbing 2-6 ft. by means of the coiling petioles and peduncles: lvs. 3-lobed, halberd-shape: fls. axillary, 1 in. or more long, violet or purple, handsome. Texas to Calif. B.M. 1643.—Attractive plant for the window, cool greenhouse or conservatory. Suitable for baskets. L. H. B.

**ANTRÔPHYUM** (Greek, *growing in caverns*). *Polypodiaceæ*. A genus of simple-lvd. herbaceous ferns, rarely found in cult. Native in tropics, in damp forests. All the species are epiphytes, and not of commercial value except as rarities. Require high temp.

**ANTS, Their Habits, Activities, Injuries and Control.** Various kinds of ants are troublesome to gardeners; and all the ants are most interesting animals.

The ants belong to the same great group of insects (Hymenoptera) that contains the wasps, bees, sawflies, and others; and like the honey bee and common wasps are congregate in their habits of living. The abdomen of all the common ants is attached to the thorax by a

slender waist, or peduncle; and each segment (there may be one or two) of this peduncle is expanded on the top side and forms a lens, or button-shaped knot, a character that distinguishes ants from all other insects.

Everyone is familiar with ants; they occur in all lands and all regions, from the dry deserts to the damp forests, from the timber line of mountains to the lowest valleys and among the dwellings and habitations of man. They seem to thrive in all kinds of environment and multiply enormously, so that they outnumber all other terrestrial animals.

*The nature of an ant colony.*

Ants are social; that is, they live in colonies or communities where every individual ant works for the good of the whole and not for itself alone. A colony of ants furnishes an illustration of a more perfect communistic society than any ever established by man, and perhaps a more amicable one than any he will ever be able to organize.

In a typical colony of ants, there are at least three kinds of individuals, the queen, the males, and the workers. The queen is not the ruler but the mother of the colony. Her only business seems to be to lay eggs which hatch into workers and other forms to take the places of those that disappear or die, thus maintaining the full and continuous strength of the community. When the queen comes forth from the pupal stage, she has wings which she retains until after the swarming period. After the swarming flight is over and the queen alights, her wings fall off or are torn off by herself or workers and from that time she remains wingless. In some species of ants there may be modified forms of the queen, for example, giant queens, dwarf queens, worker-like queens, and other forms.

The males, which have wings, exist only to mate with the queens, and after the swarming period is over they eventually die. The males are also often modified into giant males, dwarf males, worker-like males, and other forms.

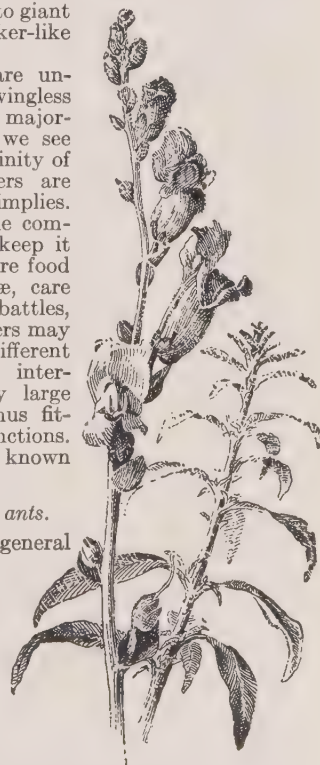
The workers, which are undeveloped females, are wingless and constitute the great majority of individuals that we see running about in the vicinity of an ant-nest. The workers are just what their title implies. They do the work of the community, build the nest, keep it clean, care for and procure food for the queen and larvae, care for the eggs, fight the battles, and so forth. The workers may exist under several different forms. One especially interesting form has a very large head and strong jaws, thus fitting it for war-like functions. Ants of this form are known as the soldiers.

*The nests and activities of ants.*

The nests of ants, in a general way, consist merely of a system of passageways or cavities communicating with each other and connected to the outside world with one or more openings. There are some species of ants that live below the surface of the earth and have no openings from their nests into



227. *Antirrhinum Orontium*. ( $\times \frac{1}{2}$ )



228. Young spike of a dwarf form of *Antirrhinum majus*. ( $\times \frac{1}{2}$ )

the air, except at the swarming period. The style of construction and the materials used by ants in making their nests vary with the different species and with the environment in which the animals live. Moreover, the nests are very irregular, especially when compared with those of wasps and bees.

The passageways of the nests are enlarged here and there into comparatively large cavities, or chambers. It is in these different chambers that the activities of



229. *Antirrhinum maurandoides*, in bud.  
( $\times \frac{1}{2}$ )

the colony are conducted. The queen lies deep within the interior of the nest in a dry, dark chamber. Here she is carefully tended and fed by the workers who bear the eggs as they are laid, to other chambers and zealously care for them. Many insects never see their young;

others may see them but do not care for them; others, like the bees and wasps, put food into the gaping mouths of their young but have no further association with them. The ants, however, stand alone among insects in their very intimate relations with their progeny from the egg to the adult. Some of the chambers in the nest are reserved for the eggs, some for the larvæ, and some for the pupæ. If, as often happens, the eggs, larvæ and pupæ are all in one chamber, then they are each grouped by themselves in separate piles, reminding one, as Lubbock says, "of a school divided into five or six classes." In the simpler and more primitive ants, this grouping and separation may not be so distinct. The ants are constantly transferring their young from one part of the nest to another in search of the right degree of moisture, temperature, and the like. In the warm part of the day, the young will be transferred to near the surface but at night will be carried down again away from the cool air. The ants are constantly cleaning the young, caring for the eggs to prevent mold from growing on them, helping the callow ants to emerge from their cocoons, bringing food, cleaning, enlarging and reconstructing the nest and doing thousands of things contributing to the comfort, growth and happiness of the community.

#### *The relation of ants to plants and to insects.*

It has been argued and many observations have been offered to show that there is a most intimate relation between ants and many kinds of plants. Certain observers think that many plants not only offer special inducements to attract ants to them by affording favorable nesting-places, but also offer the ants delectable food in the way of a sweet liquid, the floral and extrafloral nectar. In return for the domiciles and the food, the ants are supposed to protect their plant hosts from certain insect and other animal enemies. In other words, the relationship is one of mutual benefit, or a symbiotic one. It is certainly true that many species of ants make their homes in the hollow stems of plants, in the thorns of acacias which the ants easily hollow out (see *Bull-horn Acacias*), in cavities in bulbs, leaves, and so on, and in the dried seed-pods of plants. It is also true that ants assiduously collect and carry to their nests the sweet nectar excreted by many plants. It is not so clear, however, that these favorable nesting-places and the nectar are provided by the plants on purpose to attract the ants, nor is it clear that the ants afford the plants protection from their animal enemies.

In other words, more definite proof is needed to show that the relation between ants and plants is a purposely mutual one.

On the other hand, the relation of ants to plant-lice, tree-hoppers and certain scale insects is clearly, in many cases, a mutually helpful one. Especially is this true of the relations between ants and plant-lice. The aphids secrete a sweet liquid material known as honey-dew, of which the ants are very fond and which they are active in collecting and carrying to their nests. It can hardly be supposed that the aphids excrete the honey-dew solely for the ants. The liquid is an excretion from the alimentary canal and is exuded whether ants are in attendance or not. On the other hand, ants are very solicitous in their care of aphids in return for the honey-dew. The ants sometimes build "sheds" over the lice for their protection and sometimes take the lice into their own nests to care for them. In the case of the corn-root louse, the ants collect the eggs of the aphid in the fall, carry them into their own nests, and care for them all winter. In the spring, the newly-hatched aphids are carried out by the ants and placed in burrows dug beforehand among the roots of certain early food-plants. Later, the ants excavate burrows along the roots of the corn and transfer the aphids to these plants.

It is interesting to watch the ants collecting the honey-dew from the aphids. An ant approaches a louse and gently strokes the latter with its antennæ, whereupon the aphid exudes a drop of the sweet material which is quickly gathered up by the ant. This action may be repeated with three or four of the aphids until the ant has all it desires, when it hurries down the stem of the plant and away to its nest with its load of sweet provender.

#### *The life-history of ants.*

Enough observations have now been made to enable us to say that most, if not all, colonies of ants are started by a solitary queen or occasionally by two queens working together. The queen, after the swarming period, alights, breaks off her wings, and digs a burrow in the soil or in decayed wood, forms a small chamber, and then closes the opening. Here she remains until her eggs are laid and have hatched into small larvæ that finally mature into normal but diminutive workers. All this time the queen has taken no food but has lived and fed the first workers on the reserve material in her body. The small workers now begin to enlarge the nest and soon other larger workers are reared and the community begins to multiply and increase.

The eggs laid by the queen are small and white and rarely seen by the ordinary observer. These are solicitously cared for by workers and finally hatch into white, footless, soft, grub-like larvæ. The larvæ are also tenderly cared for by the workers and changed from chamber to chamber in conformity with variations in temperature and moisture. The workers feed the larvæ either on food which has been predigested and which the workers now regurgitate, or on bits of dead insects, leaves, or seeds that have been chewed fine. The larvæ finally, after attaining their growth, change to whitish pupæ which, in some species, are inclosed in cocoons, while in others they are not. These the workers treat with the same solicitude and care that they show toward the larvæ. The pupæ are often mistaken for eggs. Often, on raising up a flat stone, one will see the workers running this way and that with the larvæ and pupæ in their jaws, evidently seeking a place of safety for them. The pupæ finally transform to the adult ants of the various forms, workers, queens, and males.

#### *Economic importance of ants.*

Ants, as a whole, may probably be considered as agents in making the earth more habitable for man,



Some of the species are neutral, perhaps, in relation to the economic status of mankind. A great many species are certainly beneficial through their action in stirring and aerating the soil. They are constantly burrowing deep into the earth and bringing up the particles which they distribute over the surface. Their action in this respect is similar to that of earthworms, the value of which was revealed to us by the classic investigations of Darwin. Ants are also important agents in aiding in the decomposition of organic substances. Their work in this respect is little appreciated or realized because it is invisible. It must be remembered, however, that this work of ants is gradual, incessant, and extends through tremendously long periods of time.

Again, ants are great insect-destroyers. Their food consists, in great part, of the juices and tissues of dead insects or insects that they kill. The interesting driver ants of the Old World and the legionary ants of tropical Africa pass through a territory killing and devouring multitudes of living insects, rats, mice, and the like. Hunter and Hinds tell us that there are twelve species of ants known to attack the immature stages of the Mexican cotton boll-weevil. "In some cases more than half of the immature stages in fields have been found to be destroyed by ants alone. To find 25 per cent so destroyed is not a rare occurrence."

On the other hand, certain household species of ants are very annoying and troublesome. Moreover, the leaf-cutting ants of tropical America are very injurious to plants. They will strip a fruit tree of its foliage in a very short time. One species of these leaf-cutting forms (*Atta texana*) found in Texas, attacks cotton, corn, fruit trees, sorghum and other plants, and has become of considerable economic importance. In some places, land is not planted on account of fear of attack by these ants.

The mound-building prairie ant (*Pogonomyrmex occidentalis*), distributed over a large part of the western plains of the United States, has become a distinct pest since man has begun to occupy the prairies. Its large mound-nests in fields of alfalfa or grain become serious obstacles to harvesting the crops. Moreover, when the nests are disturbed, the ants emerge in large numbers and attack man and beast, inflicting painful wounds with their stings. In dooryards and lawns and along paths, they are liable to attack the passerby, especially dawdling children.

The agricultural ant (*Pogonomyrmex barbatus molefaciens*) of Texas may build its mound-nests in fields of alfalfa, corn, or cotton, and, since it allows no vegetation to grow over a considerable area around the nest, the injury may be serious. Moreover, they are pugnacious and sting intruders severely.

Perhaps the most injurious rôle assumed by ants is their protection and fostering of plant-lice, scale insects, and the like. Aphids and scale insects are among the most injurious insect pests, and anything that protects them or aids them in increasing may be considered an enemy to man.

As a pest, the Argentine ant (*Iridomyrmex humilis*), stands by itself. Professor Newell says, "As a household pest I venture the opinion that this ant has no equal in the United States." Unfortunately, it has also become a serious menace to horticultural interests as well. It destroys the buds, blossoms, and fruit of certain plants and protects and fosters certain scale insects that are very injurious to sugar-cane. Moreover, it has in a few instances actually shown itself to be dangerous to human life by nearly suffocating young infants.

The Argentine ant was probably first introduced into the United States through the port of New Orleans, and is now found in Louisiana, Mississippi, parts of California, and probably Texas. It is an exceedingly tenacious ant, holding on where once established, increasing with great rapidity, and driving out all the native ants.

*The termites, or white ants.*

The termites are not true ants. In fact, they stand at the opposite end of the insect-world, widely separated from the ants just discussed. They resemble the true ants, however, in many important respects. For example, they live in great colonies, and many tropical species build large mound-like nests. Moreover, in each colony there are several kinds of individuals, for example, the queen, the males, the workers which are blind or have imperfect vision, and, finally, the soldiers. The food of termites usually consists of dead or decaying wood, and the species in the United States live mostly underground or in old logs, in the timbers of buildings, or in the walls and floors of houses. Occasionally they injure young pecan and orange trees by mining into the stems and sometimes attack sugarcane. The greatest injury performed by termites, however, is by burrowing into the sills and foundation-timbers of buildings, thus undermining the whole structure. They also injure books and documents stored in damp basements and sometimes become serious pests to greenhouses.

*The control of ants in gardens, lawns and fields.*

The only method of getting rid of ants permanently is by locating the nests and treating them in such a way that the queen will finally be destroyed. The substance most used for treating the nests is carbon bisulfide. One or more holes should be made in the nest with an iron bar and an ounce or two of the liquid poured into each hole. The openings to the holes should be quickly and tightly closed with a clod of dirt. A heavy wet blanket thrown over the nest will aid in retaining the gas and tend to make the fumigation more effective. The liquid evaporates and the gas penetrates the whole nest, killing queen and workers, thus exterminating the colony.

Within the past few years, several workers have used potassium cyanide with good success in destroying ants in the field. J. D. Mitchell conducted experiments against the leaf-cutting ant in Texas. He dissolved the cyanide at the rate of one ounce in one quart of water and poured a quart into each of the openings of the nests. In every case the colony was destroyed by one or two applications. This method may be followed to advantage in destroying ants in gardens and on lawns, but the solution may be made weaker—one ounce of the cyanide to two to four quarts of water. Best results will be secured by using 98 per cent pure potassium cyanide. It must be remembered that this is a deadly poison and great care should be exercised in handling and storing it.

G. W. HERRICK.

**AÔTUS** (without ear; no calyx appendages). *Leguminosæ*. Greenhouse plant, blooming April to June in N.

Shrubs, with simple scattered or 3-whorled revolute-margined lvs., and yellow or reddish fls. in axillary clusters or short terminal racemes; calyx 2-lipped; petals long-clawed, the standard nearly orbicular and longer than lower petals, the wings oblong and keel incurved; stamens free; pod ovate, flat or turgid, 2-valved.—Ten or 11 species in Austral.

**gracillima**, Meisn. Tall shrub, with long slender branches, hoary or slightly tomentose; fls. yellow with crimson or dark-colored keel, in long leafy dense racemes, the petals twice as long as calyx. W. Austral. R.B. 26:193.

L. H. B.

**APËRA ARUNDINÆA**: *Stipa arundinacea*.

**APHANANTHE** (Greek, *aphanes*, inconspicuous, and *anthe*, flower). *Ulmææ*. Ornamental deciduous tree cultivated for its foliage and sometimes planted as a shade tree.

Trees or shrubs: lvs. alternate, petiolate, serrate; stipules free; fls. monœcious, inconspicuous; staminate

in axillary corymbs; sepals and stamens 5; pistillate solitary, axillary; ovary 1-celled with 1 ovule, styles 2: fr. a drupe.—Three to 4 species in E. Asia and Austral. The only species in cult. is a deciduous tree of the appearance of a hackberry, with slender branches forming a dense head; fls. and fr. inconspicuous. Not hardy north of Ga. Prop. by seeds sown after maturity and by cuttings of mature wood in fall; it also may be grafted on *Celtis*.

*áspera*, Planchon (*Homoicéltis áspera*, Blume. *Homoicéltis japonica*, Hort.). Tree, to 60 ft.: lvs. ovate to ovate-oblong, broadly cuneate at the base, long-acuminate, 2–3½ in. long, serrate with straight veins ending in the teeth, with appressed hairs on both sides, rough to the touch, on short stalks ½ in. long; fls. greenish, with the lvs.: drupe globular, black, ½ in. diam., short-stalked. Early spring: fr. in autumn. Japan. S.I.F. 1:37.—This tree has been confused with *Celtis sinensis*, but is easily distinguished by the straight veins ending in the teeth, while in *Celtis* they are curved and form loops along the margin.

ALFRED REHDER.

**APHELÁNDRA** (Greek-made name). *Acanthaceæ*. Tropical American evergreen shrubs or tall herbs, grown in hothouses for the fine foliage and very showy 4-sided terminal spikes of red or yellow gaudy-bracted flowers.

Leaves mostly opposite, simple, entire or toothed, usually many and large; fls. labiate, the upper lip mostly 3-lobed and the middle lobe erect or arching, the lower lip more or less 2-lobed or notched; stamens 4, rising from the base of the corolla, the anthers connivent and 1-celled; style 2-lobed: fr. a 4-angled caps.—About 60 species.

Aphelandras are of easy culture, if given plenty of diffused light in the growing season, and plants are not allowed to become tall and leggy. It is well to grow new plants frequently. Propagation is by seeds when obtainable, or by cuttings of partially ripened wood at any season or the young growths taken off with a heel. They bloom in autumn, but can readily be brought into flower at other seasons. When done blooming, the plants should be rested in an intermediate temperature, kept rather dry, but not allowed to wilt or shrivel. They require treatment of *justicias*, and thrive along with allamandas and poinsettias.

A. Fls. in yellow series.

*squarrōsa*, Nees (*A. Leopoldii*, Hort. *A. chrýsops*, Bull). Lvs. large, ovate to ovate-elliptic, acuminate, dark green above (pale below), with white rib and main veins: infl. a simple, erect, or compound spike, up to 1 ft. long; fls. pale yellow and exserted one-third their length beyond the yellow crenate-dentate bracts. Brazil. *A. squarrosa* itself is not in cult., the showy plant in the trade (and described herewith) being Var. *Leopoldii*, Van Houtte. Fig. 230. F.S. 9:889. G.C.

III, 1, p. 737. Var. *Lobisæ*, Van Houtte. Dwarfier and smaller in all its parts than var. *Leopoldii*: St. slender, dark reddish green, terete, covered in parts with soft pilose hairs, upper part of the st. below the infl. quite glabrous: lvs. 3–5 in. long, elliptic, rich dark green with brighter colored silvery markings along the midrib and principal veins: infl. 3–6 in. long, unbranched; bracts ovate, ¾ in. long, rich canary-yellow, with green markings in the middle; fls. exserted beyond the bracts over half their length, rich canary-yellow, ½ in. diam., lower 3 petals forming a lip and reflexed, upper 2 hooded, reflexing with age; tube broad, broadening out upwards with a narrow base, 1¼ in. long. Brazil. G.W. 3:157.

*Chamissoniāna*, Nees (*A. punctata*, Bull). An erect herb or sub-shrub: sts. slender, erect, terete, green, lower part more or less woody: lvs. petiolate, elliptic or elliptic-lanceolate, tapering at apex and base, and up to 6 in. long, upper part light green, marked along the principal veins and midrib with dull silvery white or yellowish white, the silvery markings sometimes spreading over nearly the entire l.; petiole short or up to an inch or more long, lower side dull light green: infl. an erect unbranched spike, as much as a foot long when strong and 2–3 in. wide; bracts ovate-lanceolate, bright yellow, tipped with green, coarsely serrate, slightly reflexed; calyx ½ in. long; sepals lanceolate; corolla bright yellow, an inch diam.; tube 1½ in. long, curved outward and tapering upward; lobes ovate, nearly equal; anthers yellow. S. Brazil. B.M. 6627. I.H. 29:457.

*Blanchetiāna*, Hook. f. (*A. amēna*, Bull). St. terete, green, tinted with dull purple, with deeper shading around the base of petiole and at the nodes, thick and stout: lvs. ovate-acuminate, with many pairs of conspicuous nerves, green, the midrib, and often the main veins, white; petiole, 1–2 in. long, terete, glabrous: fls. dark yellow, exceeding the long, entire, cusp-pointed red scales: spike sessile. Brazil. B.M. 7179.—Known in the trade as *A. amēna*, having been described under that name before it had flowered in cult.

AA. Fls. in red-orange series,—i.e., scarlet, or verging to orange.

*aurantiaca*, Lindl. Lvs. ovate-elliptic, deep green above, light green below, strongly veined, but not particularly wavy edged: fls. orange, with a tinge of scarlet, the spreading limb overhanging the greenish sharp-toothed scales.—A dwarf-growing species of easy cult. and readily raised from seed. Mex. B.M. 4224. B.R. 31:12. Var. *Rœzlii*, Nichols. (*A. Rœzlei*, Carr.). Fls. with more scarlet: lvs. twisted, with silvery hue between the veins. Mex. Gn. W. 20:576.—Showy and good. Not so tall as *A. aurantiaca*.

*Macleayi*, Bedd. Lvs. ovate-elliptic, 3 in. or less long, acute, entire, green both sides with white band along midrib above: spike cone-like, orange-scarlet, nearly 2 in. long. Country unknown.—Said to have been cult. as *A. punctata* and *A. squarrosa*.





**tetragōna**, Nees (*A. cristata*, Lindl. *Justicia cristata*, Jacq. *J. tetragōna*, Vahl). An erect or spreading, shrub: sts. terete, woody below, green, tinted with red when young; lvs. opposite and decussate, petiolate, green, glabrous or nearly so, elliptic or elliptic-ovate, acuminate or acute, 6–12 in. long, and 2–7 in. diam., entire or crenate, slightly undulate; petiole as much as 6 in. long, slender, hairy; infl. an erect-terminal cluster of spikes, the central one hairy, 6–8 in. long, with shorter ones branching from its base, often, when well grown, bearing from 10–12 lateral spikes of various lengths; fls. bright scarlet, crowded on the spike, and the bulk of them opening together; bracts erect, closely adpressed to the rachis, green, ovate, acute,  $\frac{1}{2}$  in. long, ciliate; bracteoles lanceolate, hairy; corolla scarlet,  $1\frac{1}{4}$  in. diam., tube 2 in. long, narrow at the base, broadening upwards, lip reflexed,  $1\frac{1}{4}$  in. long; upper pair of petals hooded, lateral ones reduced to short obtuse lobes. Trop. S. Amer. B.M. 8272. Gt. 40: 1354.—The finest species in cult.; a magnificent stove plant.

**nitens**, Hook. f. An erect herb or sub-shrub: st. terete, green, stout, usually dwarf and compact; lvs. shortly petiolate, ovate-acute, entire, thick, rich dark olive-green above, bright vinous purple below, highly glabrous on both sides, margins recurved; petiole very short or none, winged; infl. an erect terminal spike, 6 in. or more long; bracts green and erect,  $1-1\frac{1}{2}$  in. long, serrate; sepals  $\frac{1}{2}$  in. long, linear-lanceolate; corolla bright vermilion-scarlet,  $1-1\frac{1}{2}$  in. diam.; lip ovate, larger than the rest of the petals and slightly reflexed; upper pair of petals hooded; tube  $1-1\frac{1}{4}$  in. long, yellow. Colombia. B.M. 5741. Gn. 48:122.—A fine dwarf-growing stove plant readily prop. by cuttings and often setting seed if kept in a cooler and drier house when in flower.

**fascinator**, Lind. & André. Habit stiff and erect, with fls. opening in succession over a period of some 4–6 weeks: st. terete, green, glabrous; lvs. elliptic, lanceolate or ovate-lanceolate, acuminate, entire, shortly petiolate, 6–9 in. long, upper side dark green with narrow band of silvery white along midrib and principal veins, lower side dull wine-red with veins of a darker shade; infl. an erect unbranched terminal spike up to 6 in. long; bracts ovate or elliptic, basal ones an inch long, tapering upwards to  $\frac{1}{2}$  in. long, covered with short pilose hairs; sepals  $\frac{1}{2}$  in. long, lanceolate, glandular, green; corolla bright vermilion-scarlet,  $1\frac{1}{2}$  in. diam. with large and prominent front lobe; tube slender.  $1\frac{1}{2}$  in. long. B.M. 8398. I.H. 21:164.—A beautiful and striking species, well worth growing for its handsome foliage apart from its beautiful fls. It should be kept rather on the dry side as soon as the fls. appear, otherwise the plant is likely to lose all its roots.

*A. atrovirens*, N. E. Br. Dwarf: lvs. very dark green above and purplish beneath; fls. yellow, 1 in. long. Brazil. I.H. 31:527.—*A. liboniana*, Lind. Dwarf: lvs. ovate and long-acuminate, with a white rib, green below; fls. deep yellow, small, scarcely exerted beyond the red bracts. Brazil. B.M. 5463.—*A. macedoniensis*, Lind. & Rod. Said to be a form of *A. atrovirens*. Lvs. with white rib and main veins. Brazil. I.H. 33:583.—*A. margaritæ*, E. Morr. Lvs. elliptic-acuminate, barred with white, purple below; fls. yellow, the bracts strong-toothed. Brazil. G.C. III. 2:585.—*A. orientalis*, offered in Amer. is possibly a form of some well-known species.—*A. pumila*, Hook. f. Less than 1 ft.: lvs. large, acute; fls. orange, bracts purplish. Brazil. B.M. 6467.—*A. variegata*, Morel. A near ally of *A. Blanchetiana* with bright scarlet bracts, and bright yellow fls. Probably not now in cult. B.M. 4899. F.S. 10:981.

L. H. B.  
C. P. RAFFILL.

**APHELÉXIS**: *Helichrysum*.

**APHÝLLON** (Greek, *leafless*). *Orobanchææ*. Two species of small N. American parasitic herbs, now often united with *Orobanchæ*, and by others kept distinct under *Rafinesque's* name, *Thalesia*. These plants are not cult., but are always interesting to the collector and surprising to one who runs across them in woods or fields. *A. uniflorum*, Gray, Fig. 231, produces very

few leafless 1-fl. pale scapes, 3–8 in. high, and 5-lobed, curved, white or violet fls., and known as cancer-root. *A. fasciculatum*, Torr. & Gray, has the scaly st. rising higher out of the ground and bearing several crowded peduncles: fls. purplish yellow.—These plants occur sparingly nearly or quite across the continent.

**APICRA** (*not bitter*, from the Greek). *Liliacæ*, tribe *Aloineæ*. Aloe-like plants, grown with other succulents.

Shortly caulescent small succulents: lvs. spirally arranged or crowded along the st.: fls. greenish, often striped with white, straight, tubular or prismatic, with short, flat or spreading white limb surpassing the stamens. Cape region.—Agave house or cactus house; suitable for rockeries during the summer. Prop. like Aloe. Monogr. by Baker. G.C. II, 11:717 (1879). Journ. Linn. Soc. Bot. 18:216. Berger in *Das Pflanzenreich* 1908, hft. 33.



231. *Aphyllon uniflorum*. ( $\times \frac{1}{2}$ )

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*A. Lvs. warty on the back: fls. smooth.*

1. **áspera**, Haw. (*Alde áspera*, Haw. *Haworthia áspera*, Haw.). St. mostly simple, erect, 4–6 in. high,  $1\frac{1}{2}$  in. diam., including lvs.: lvs. half-globose, acuminate, slightly keeled,  $\frac{5}{8}$  in. long, green, smooth on the rather convex upper surface, green-warty on the back, the margin granular; infl. scarcely 1 ft. high, unbranched; fls. somewhat rosy,  $\frac{3}{8}$  in. long, twice as long as the pedicels. Cape. Salm. Aloe §2. f. 2.—A large form with white-warty lvs. twice as long, is var. **mājor**, Haw.

2. **bicarināta**, Haw. (*Alde bicarinata*, Roem.). St. erect, 6–12 in. high: lvs. faicately short-ovate, acute, acutely keeled,  $\frac{5}{8} \times \frac{3}{4}$  in., green, smooth on the somewhat concave upper surface, irregularly white-warty on the back, the margin and keel granular roughened. Cape. Berger 40.

3. **bullulāta**, Willd. (*A. pentagōna bullulata*, Baker. *Alde bullulata*, Jacq.). St. erect: lvs. lanceolate, acute, obliquely keeled,  $\frac{5}{8} \times 1\frac{1}{4}$  in., pale, the back unequally



232. *Apicra pentagona*.

white-warty, the margin and keel finely denticulate: fls. somewhat yellow. Cape.

AA. Lvs. not warty.

B. Fls. warty: lvs. smooth.

4. *spirâlis*, Baker (*A. imbricatâ*, Willd. *Alde spirâlis*, Linn. *A. imbricatâ*, Haw. *A. cylindrica*, Lam. *Hawôrthia imbricatâ*, Haw.). Sts. somewhat clustered,



233. *Apios tuberosa*. ( $\times \frac{1}{4}$ )

erect, 6–12 in. high; about  $2\frac{1}{4}$  in. diam., including lvs.: lvs. broadly triangular-acuminate, biconvex,  $\frac{1}{2} \times 1\frac{1}{4}$ – $1\frac{1}{2}$  in., glaucescent, the margin slightly granular: infl. about 1 ft. high, unbranched; fls. greenish,  $\frac{1}{2}$  in. long, more than twice as long as the pedicels. Cape. DC., Pl. Gr. 56. Jacq., Fragm. 110. B.M. 1455. Salm, Aloe §1. f. 1. Dillenius, Eltham. 13. Commelin, Præl. 32.

BB. Fls. smooth: lvs. sometimes granular in the first.

5. *pentagôna*, Willd. (*Alde pentagôna*, Haw. *Hawôrthia pentagôna*, Haw.). Fig. 232. St. mostly solitary, erect, 6–12 in. high; about 4 in. diam., including lvs.: lvs. distinctly 5-ranked, broadly triangular-lanceolate, acute, biconvex, somewhat low-keeled,  $\frac{3}{4} \times 1\frac{1}{2}$ –2 in., green, slightly (sometimes granularly) white-dotted, the margin slightly granular: infl.  $1\frac{1}{2}$  ft. high, sometimes forked; fls. greenish,  $\frac{3}{8}$  in. long, twice as long as the pedicels. Cape. Jacq., Fragm. 111. B.M. 1338. Salm, Aloe §1. f. 4. Berger 40.—Varies into forms with lvs. less obviously 5-ranked: large, in somewhat evident oblique ranks, var. *Willdenôwii*, Baker (*A.*

*spirâlis*. Willd. *Alde spirâlis*, Haw. *A. pentagôna spirâlis*, Salm-Dyck), Salm, Aloe §1. f. 5; smaller, scarcely in distinct ranks, var. *spirêlla*, Baker (*Alde spirêlla*, Salm-Dyck. *Hawôrthia spirêlla*, Haw.), Salm, Aloe §1. f. 3.

6. *congêsta*, Baker (*Alde congêsta*, Salm-Dyck.). St. solitary, erect, about 1 ft. high and 4 in. diam., including lvs.: lvs. broadly ovate, acuminate, rather flat above, more or less keeled,  $1-1\frac{1}{4} \times 1\frac{1}{2}$  in., green, glossy, the margin granular: infl.  $1\frac{1}{4}$  ft. high, simple; fls. greenish, nearly  $\frac{5}{8}$  in. long, with rather large spreading segm.-tips, thrice as long as the pedicels. Cape. Salm, Aloe §2. f.

7. *delloîdea*, Baker (*Alde delloîdea*, Hook.). Sts. somewhat clustered, 6 in. or more high, about  $2\frac{1}{4}$  in. diam., including lvs.: lvs. distinctly 5-ranked, ovate, sub-acute, somewhat concave and low-keeled,  $1 \times 1\frac{1}{4}$ – $1\frac{1}{2}$  in., green, glossy, the margin and keel serrulate: infl. 1 ft. high, simple; fls. nearly sessile, yellow-green, about  $\frac{3}{8}$  in. long, the rather large spreading white segm.-tips at first rosy. Cape. B.M. 6071.—Varies in a form with more turgid lvs. less obviously 5-ranked, var. *turgida*, Berger (*A. turgida*, Baker), and a smaller form with evidently 5-ranked sometimes bluish lvs., var. *intermêdia*, Berger.

8. *foliolôsa*, Willd. (*Alde foliolôsa*, Haw. *Hawôrthia foliolôsa*, Haw.). Sts. somewhat clustered, erect, at length a foot or more high;  $1\frac{1}{8}$  in. diam., including lvs.: lvs. broadly ovate-acuminate, flat above, acutely keeled,  $\frac{3}{8}$ – $\frac{5}{8}$  in. long and wide, green, glossy, the margin granular: infl. over 1 ft. high, simple; fls. greenish, about  $\frac{3}{8}$  in. long, twice as long as the pedicels. Cape. B.M. 1352. Salm, Aloe §2. f. 4. Berger 40.

WILLIAM TRELEASE.

ÂPIOS (pear, from the Greek, alluding to the shape of the tubers). *Legumindœ*. Hardy twining herbs, with tuber-bearing roots, infrequently planted.

Leaves pinnate, of 3–9 mostly ovate-lanceolate scarcely stipellate lfts.: fls. in dense, short racemes, papilionaceous, the standard broad and reflexed, keel incurved and coiled; stamens 9 and 1: pod linear and flat, several-seeded.—Two species in E. N. Amer., and 3 others in Asia.

*tuberôsa*, Mœnch. GROUNDNUT. WILD BEAN. Fig. 233. Four to 8 ft., climbing over bushes: root bearing strings of edible tubers, 1–2 in. long: lfts. 5–7, ovate-lanceolate: fls. fragrant, chocolate-brown, the standard very broad and turned back, the keel long, incurved and scythe-shaped. July, Aug.—Common in low grounds and swamps. The fr. often fails to mature. Prop. by the tubers, 2–4 of which should be planted together at a depth of 3–4 in.; also, by seeds. Grows well in the wild border, in any loose, rich soil. Under these conditions, the plant covers a trellis or other support in a comparatively short time. Dry tubers offered by seedsmen are likely to start slowly. The brown of the fls. is a very unusual color in hardy herbs. Likely to become a weed in rockeries and wild gardens.



234. Fruit of *Aplectrum hyemale*. Nearly natural size.



*A. Fortunei*, Maxim., is occasionally cult. in Japan for its small, ovate, edible tubers. A.G. 13:77.—*A. Piceana*, Rob., native to Kentucky, may be expected to appear in the trade: root a single large tuber, becoming 6-7 in. diam.; fls. pale rose-color; a vigorous climber, first described in 1898 (Bot. Gaz. 25:451, with illus.).

**APIUM:** *Celery*.

L. H. B.

**APLÉCTRUM** (Greek, *with no spur*). *Orchidaceæ*. A small orchid, with smallish dull-colored fls. in a raceme, on a leafless scape, which springs from a large corm-like tuber. Single species (or possibly two), in woods in the northern states.

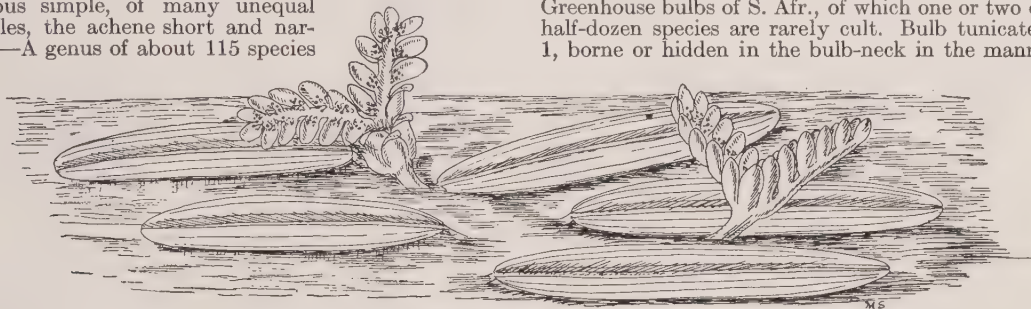
Flower spurless and sacless; petals and sepals similar, narrow; lip 3-lobed and crested, deflexed; fertile anther 1, the pollen-masses 4, smooth and waxy; column free, compressed, the anther borne below the top.

**hyemåle**, Nutt. (*A. spicatum*, B. S. P.). PUTTY ROOT. ADAM-AND-EVE. Fig. 234. Sends up a pointed green lf. 2-6 in. long, which lasts through the winter, and in spring a stalk about a foot high, bearing a raceme of rather large greenish brown fls., which are succeeded by hanging, oblong-pointed pods (Fig. 234).—Hardy. May be grown in rich, loamy borders. Interesting, but not showy.

L. H. B.

**APLOPÁPPUS** (Greek, *simple pappus*). Syn., *Haplopappus*. *Compósitæ*. Herbaceous perennials, sometimes offered for the hardy border.

Leaves mostly stiffish or rigid, alternate: heads radiate, many-fld., the rays pistillate; involucre hemispherical, with several series of closely imbricated bracts: pappus simple, of many unequal bristles, the achene short and narrow.—A genus of about 115 species



235. *Aponogeton distachyus*. ( $\times \frac{1}{2}$ )

of herbaceous perennials, rarely shrubs, mostly from Calif. and Chile. Fls. yellow, in summer and autumn. Separated only by technical characters from *Bigelovia*, into which it insensibly grades. (*Bigelovia* has discoid few-fld. heads and pappus in single row.) The only 3 species known to have been in the American trade are

**lanuginosus**, Gray. Hardy alpine herb, woolly, 4 in. high, from creeping rootstocks; lvs. soft, narrowly spatulate, or upper linear, 1-2 in. long; rays 15-20. Mts. of Wash. and Mont.—Intro. 1889, by F. H. Horsford.

**Párryi**, Gray. Alpine herb, 6-18 in. high, green and almost glabrous; lvs. oblong-obovate, 2-4 in. long; fl.-heads about  $\frac{1}{2}$  in. high, pale yellow, the involucrel bracts oblong and obtuse; rays 12-20, small and narrow.—Suitable for rockwork.

**cræceus**, Gray. St. about 1½ ft., erect and stout, and with radical lvs. a foot or less long; cauline lvs. ovate-oblong to lanceolate, partly clasping; fls. showy, saffron-yellow, the rays about an inch long, the inner involucrel bracts ragged. Rocky Mts. June-Oct.

*A. ericoides*, Hook. & Arn. Shrub, 2-5 ft. high; lvs. very numerous, filiform, those of the dense fascicles, 2 or 3 lines long; fls. very numerous. G.C.III. 20:301.

N. TAYLOR.†

**APÓCYNUM** (Greek for *dog-bane*). *Apocynaceæ*. DOG-BANE. INDIAN HEMP. Native herbs, sometimes planted in borders.

Flowers small, the calyx with acute teeth; corolla

bell-shaped, with 5 appendages inside; stamens 5, inserted deep in the corolla, the filaments very short; style 0: seeds silky.—Tough perennial herbs, with milky juice, chiefly of north temperate zone, with oblong or ovate, opposite lvs., milkweed-like fls. in small cymes, and slender follicles or pods. About 25 species, 10 native to N. Amer.

**androsæmifolium**, Linn. SPREADING DOG-BANE. Three ft. or less high, usually glabrous, the branches spreading; lobes of corolla revolute and tube of corolla longer than the calyx; lvs. oval or ovate, mucronate, short-petioled; cymes loose, axillary and terminal; fls. bell-like, white or pink. N. N. Amer.; common. B.M. 280.—Sold by dealers in native plants. Useful for the hardy border as it will stand dry open places. Root used in medicine; sometimes gathered by drug-collectors for *A. cannabinum*, but as its action is different, it should not be substituted.

**cannabinum**, Linn. Branches erect or nearly so: lobes of corolla nearly erect, the tube not longer than calyx; lvs. ovate to lance-oblong, short-petioled; cymes dense; fls. greenish white. Northern states; common.—Not known to be in the trade, but likely to be confounded with the above. Root emetic, cathartic, diaphoretic, expectorant, and diuretic. The tough fibrous bark of the stalks formerly used by the Indians for making twine.

L. H. B.

**APODOLÍRION** (Greek combination, *footless lily*, the peduncles not being evident). *Amaryllidaceæ*. Greenhouse bulbs of S. Afr., of which one or two of the half-dozen species are rarely cult. Bulb tunicated: fl. 1, borne or hidden in the bulb-neck in the manner of

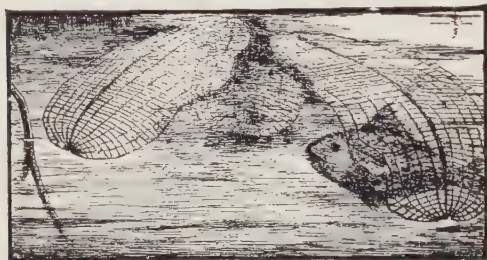
crocus, white or reddish: lvs. usually not appearing with the fls., narrow. **A. Êttæ**, Baker, and **A. lanceolatum**, Baker, are probably best known as cult. plants. The former has a white, tinged red fl. 3 in. long and crocus-like lvs.; the latter (*Gethyllis lanceolata*, Linn. f.) has a much shorter fl., white or whitish, and a solitary lanceolate lf. appearing with the fls. The apodolirions are prop. by offsets or seeds.

**APONOGÈTON** (Greek name, referring to its habitat in the water). *Aponogetonaceæ*. Aquatics, mostly with flat floating lvs. and emerging spikes of fls. Includes *Ouvirandra*.

Submerged herbs, with tuberous rhizomes and fibrous roots; lvs. long-stalked, oblong or linear, sometimes lacking the parenchyma and having a lattice-like character: fl.-characters those of the family (p. 13).—About two dozen species of warm countries, Asian, African and Australian. Krause & Engler, *Das Pflanzenreich*, hft. 24 (1906). There are two main species in cult., the aponogeton proper with solid lvs., and the ouvirandra with open-work lvs. The former is grown mostly out-of-doors; the latter in warm green-houses.

**distachyus**, Linn. f. CAPE POND-WEED. WATER HAWTHORN (from the fragrance). Fig 235. Fls. in twin spikes on the emersed ends of long scapes, wholly naked, but subtended by a double row of petal-like bracts, very fragrant, with purple anthers:

lf.-blade floating, oblong-lanceolate, round-based, parallel-veined, 3-6 in. long. Cape of Good Hope. B.M. 1293. F.R. 1:463. P.G. 4:106. G.W. 5:195. Gng. 2:25. —A charming and interesting plant. In a protected pool, especially if it can be covered in winter, the plant is hardy in the N., blooming nearly all summer. Removed to tubs in the fall, it blooms nearly all winter; or it can be grown permanently in tubs or deep pans in the house. Requires about 2 ft. of water, or out-of-doors it may have twice that depth. Prop. chiefly by seeds, but fls. should be pollinated and kept above water at least 24 hours afterward, and seeds not be allowed to become dry. Var. *Lagrängei*, Hort. (A.



236. *Aponogeton fenestralis*, the lace-leaf plant. Known to gardeners mostly as *Ouvirandra*.

*Lagrängei*, Hort.), is a rare and beautiful variety, with violet bracts and lvs. violet beneath. It props. slowly. R.H. 1895:380.

*fenestralis*, Hook. f. (*Ouvirandra fenestralis*, Poir.). LACE-LEAF. LATTICE-LEAF. Fig. 236. Lvs. oblong, 6-18 in. long and 2-4 in. broad, reduced to skeletons, floating just under the surface of the water: fls. small, consisting of 6 stamens, 3 pistils and 2 white petal-like bodies, numerous, in 2 spikes each about 2 in. long, which are united at the base, and borne on the top of a scape a foot or so long. Madagascar. A.F. 7:67. A.G. 15:169. B.M. 4894. Gt. 1863:387. G.M. 38:830. Gn. 30, pp. 344, 345. Mn. 6, p. 231. F.S. 11:1107. I.H. 8:300. G.W. 10:595 (var. *major*).—The lvs. are merely a tracery of nerves and cross-veins, but despite their lace-like delicacy they can be handled with considerable roughness. The venation of the lace-leaf plant is like that of the common aponogeton, and now and then a lf. occurs in which the spaces between the veins are partly or wholly filled with green matter. There is another species with skeletonized lvs. (*A. Bernierianus*), but the open spaces are smaller and the plant is less desirable for cult.

The lace-leaf plant can be grown in a tub in a warm greenhouse. For some unknown reason the plant seems rarely to succeed in a jar or glass aquarium. Some cultivators think that the water must be changed every day, but this is not necessary. If confervæ appear, introduce a few tadpoles and snails; these will devour the green scum, and help to keep the plant in good health by furnishing oxygen. See *Aquarium*. The plant should be potted, and plunged not more than 18 in. below the surface of the water. For potting soil use a rich compost, such as is recommended for water-lilies. The water should be kept clean and sweet, and a



237. *Aporocactus flagelliformis*. ( $\times \frac{1}{2}$ )

temperature of 65-70° provided. Avoid direct sunlight. In Madagascar the streams often dry up, and the tubers carry the plant over the dry season. In imitation of nature some cultivators take the tubers out of the soil, and leave them on a shelf in a hot-house during the month of Feb. It is doubtful whether

this is necessary. Potting should be done while the plant is in active growth, not dormant. Prop. by division. The lace-leaf is cult. in all the finest collections of aquatics, and is prized as a curiosity.

*A. angustifolius*, Ait. (A. capensis, Perry). Like *A. distachyus*, but much smaller: fls. small, white. S. Afr.—*A. Bernierianus*, Hook. f., differs from *A. fenestralis* in having smaller open spaces in the lvs., and pinkish 4-parted spikes.—*A. Dinteri*, Engl. & Kr. Tuber globose: floating lvs. oblong, rounded or somewhat emarginate at base, long-nerved, not lace-like: inflorescence 2-spiked, yellowish. German S. W. Afr. G.W. 14:659.—*A. Henckelianus*, Hort. Allied to *A. fenestralis*, but rhizome larger and not creeping: lvs. pale green, less lasting. Madagascar. G.C. III, 40:270.—*A. monostachyus*, Linn. f. (A. natans, Engl. & Kr.) Lf. linear-oblong infl. in 1 spike, pink. India, Austral. G.W. 9:62.

L. H. B.

WM. TRICKER.

### APOROCÁCTUS (Greek, *impenetrable* and *cactus*).

*Cactaceæ*. A very slender vine-like creeping, clambering, or hanging cactus, sending out aerial roots: fls. rather small, slender, somewhat irregular, bright red: fr. small, globose, reddish, setose.—Three species recognized, the one below and *A. flagriformis*, Lem., and *A. leptophis*, Britt. & Rose. Only one appears to be in cult. These plants are commonly referred to *Cereus*.

*flagelliformis*, Lem. (*Cereus flagelliformis*, Mill.). RAT-TAIL CACTUS. Fig. 237. Sts. about  $\frac{1}{2}$  in. diam., branching: ribs 10-12: fls. 2-3 in. long. Trop. Amer.—This is commonly hybridized with other species. It is a well-known window-plant. It is easily grown and is a great favorite with people who know little about cacti. It is often grafted on other cacti and worked into various fantastic designs. It is rather a free bloomer, and with proper care a most charming plant can be obtained.

J. N. ROSE.

**APOSÈRIS.** An alpine composite, now included in the genus *Hysomeris*, which see.

**APPLE.** *Rosaceæ*. The fruit and tree of *Pyrus Malus*, one of the rosaceous group. The name is also applied, with qualifications, to many other edible fruits, as may-apple, pond-apple, rose-apple.

The apple is native to southwestern Asia and adjacent Europe. It has been cultivated from time immemorial. Charred remains of the fruit are found in the prehistoric lake dwellings of Switzerland (Fig. 238). Now widely cultivated and immensely variable, the apple is grown in every temperate climate, and is probably the most important commercial pomological fruit.

The apple has come apparently from two original stems. All the common apples are modifications of *Pyrus Malus* (see *Pyrus*), a low round-headed tree, with thick and fuzzy irregularly dentate, short-stemmed leaves and fairly compact clusters of woolly-stemmed flowers. The crab-apples are derived chiefly from *Pyrus baccata*, commonly known as the Siberian crab. This species is probably of more northern or eastern origin than the other. It is of smoother and more wiry growth, with narrower and thinner essentially glabrous long-stemmed leaves, and more open clusters of glabrous-stemmed flowers. The apple is small and hard, and the calyx-lobes fall at maturity, leaving the eye or basin of the fruit smooth and plain. Hybrids between these species apparently have given the race of large-fruited crab-apples, of which the Transcendent and Hyslop are examples. The race known to pomologists as *Pyrus prunifolia* is perhaps a hybrid group. Certain apples are native to North America. Two species, *Pyrus ioensis* and *P. coronaria*, are of interest to the pomologist. The former is the prairie-states crab, and is the more promising. In characters of growth, leaves



238. Apple remains from the Swiss lake dwellings.







VII. The flowers of the apple tree.



and flowers, it bears a striking resemblance to forms of *Pyrus Malus*. The fruit is spherical or spherical-oblong, short-stemmed, very hard, and remains green-colored. The fruit of the eastern-states crab, *Pyrus coronaria*, is distinctly flattened endwise, and is long-stemmed. The leaves are deep-cut and often three-lobed. There are no improved varieties of this eastern species, and no authentic hybrids between it and the common apples. The fruit is sometimes used by settlers, but it has little comestible value. *Pyrus ioensis* has produced a number of promising hybrids with the common apple, and this mongrel race is known as *Pyrus Souldardii*. The Souldard crab is the best known of these. Its value lies only in its extreme hardiness. The pomological value of the native crabs is prospective. For a completer account of the native apples, see Bailey, "Evolution of our Native Fruits."

One of the most perfect apple regions of this country—considering productiveness, quality, long-keeping attributes, longevity of tree—is that which begins with Nova Scotia and extends to the west and southwest to Lake Michigan. Other important regions are the Piedmont country of Virginia and the highlands of of adjacent states; the Plains regions; the Ozark and

especially important, in our hot and sunny country, that the roots extend deep enough to escape the disastrous effects of drought. The ideal treatment of orchard land is to fit the ground deep before the trees are replanted, to plow deep for a year or two or three in order to force the roots down and thoroughly to ameliorate the soil, and to practise shallow tillage to conserve moisture. Since trees make most of their growth early in the season, the tillage should be begun as soon as the land is fit in spring; and it may be discontinued by midsummer or August. This cessation of



241. Showing the side bud that is to continue the spur the following year.

the tillage allows of the growing of some cover-crop or catch-crop late in the season, in order to provide humus and to improve the physical texture of the soil. If the land is well handled in the first few years, it will not be necessary to turn a furrow in the orchard frequently thereafter, but merely to loosen the surface in the spring with a spading-harrow, spring-tooth harrow, or other tool, to reestablish the surface mulch. The only reasons for turning a furrow will occur when the land is so hard that the surface tools cannot mellow the surface, or when it is desirable to turn under a green-manure crop. Even hard lands may be got in such condition, by means of tillage and green-manures, that they may be worked up with harrow tools when the orchard comes into bearing. Plowing the orchard, therefore, has two legitimate objects: to mellow and ameliorate the land to a considerable depth, so that the roots may forage deep; to turn under a cover-crop. The former purpose should not be necessary after the first few plowings. An incidental object of plowing is to facilitate the making of the annual surface mulch; and this mulch is to save the moisture.

On good lands in which there is a sufficient natural supply of moisture, the sod-mulch treatment may take



239. Spur and fruit-bud of apple.

240. Only one fruit may set in a cluster.

Arkansas region; the intermountain region from Montana to New Mexico; the Northwest, including both large and small areas in British Columbia, Washington and Oregon; and the Pacific region, comprising the foothills and parts of the coast in California. All parts of the United States north of Florida and the Gulf borders, and excluding the warm-temperate parts of the Southwest, are adapted to the apple in greater or lesser degree. North America is the leading apple-growing country of the world. A full crop for the United States and Canada, of all kinds and grades, is probably not much less than 100,000,000 barrels, although it is doubtful whether more than one-third of this vast quantity is marketed in a fresh state. The apple is a cosmopolitan fruit, and, since it thrives almost anywhere, it is commonly neglected.

The apple was early introduced into this country. In the first days it was prized chiefly for cider. It is an ancient and common notion that any apple is good enough for cider; and this is one reason for the neglect in which the apple plantation was commonly allowed to stand.

#### Brief or summary statement.

The best results in apple-growing are to be expected in general when the land is tilled. The reasons for tilling the orchard are those that apply to other crops,—to make plant-food available, to extend the area in which the roots can grow, to conserve moisture. It is



242. The flower-cluster and the leaf-cluster.

the place of tillage. This procedure keeps the land in sod, and the grass is mown and allowed to remain on the ground or is spread under the trees.

The apple thrives in a variety of soils. Lands that yield good crops of wheat and corn may be expected to be good apple lands, if other conditions are right. Rolling, inclined, or somewhat elevated lands are generally considered to be most desirable. Their value lies in the better drainage of water and air. The trees may be set in either fall or spring. Forty feet apart each way is the standard distance for apple trees; but some varieties, as the Wagener and the crabs, may be set closer. In the South and on the plains, trees may



be set closer, as they do not attain such great size as in the northeastern states. In general, it is best to devote the land to apples alone; but persons who are willing to

give the plantation the best of care may plant other trees between the apples as fillers. The more diverse the kinds of trees which are planted together, the more difficult it is to give the proper care to each. Some of the shorter-lived varieties of apples make excellent fillers in the apple orchard; and in special cases dwarf apples may be used.

Although it should be the general purpose to till the apple orchard throughout its life, whenever the trees seem to be growing too rapidly, the plantation may be seeded down for a time. That

is, tillage is the general practice; seeding down and sod-mulching are the special practices. For the first few years, annual crops may be grown in the apple

orchard; but every year a more open space should be left about the trees. As often as the land becomes crusted it should be tilled. On strong lands which are well handled, it is rarely necessary to apply concentrated fertilizers until the trees are old enough to bear. What fertilizers are then needed, and how much to apply, are to be determined by the behavior of the trees. If the trees are making insufficient growth, and the foliage lacks color, one or all of three things may be the

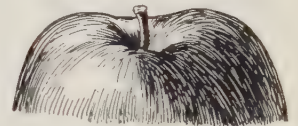
that they lack nitrogen, this material may be supplied in the form of nitrate of soda, sulfate of ammonia, or the unburned animal substances, as blood and tankage.

Two to three hundred pounds to the acre of the nitrate of soda or sulfate of ammonia are liberal applications on well-tilled lands. If the trees are making vigorous growth, the probability is that they are not in need of more nitrogen. Potash and phosphoric acid may then be applied. Three hundred pounds of muriate of potash, or other concentrated material, should be sufficient for an acre, under ordinary conditions. As a rule, all orchards in full bearing should have a liberal annual application of fertilizing materials. In the East, apple trees should be in profitable bearing at twelve years from planting, and should continue for thirty years. In recent years, lime has been applied in many cases with good results, about 1,000 pounds to the acre every four or five years.

The two staple enemies of the apple are the apple-worm (the larva of the codlin-moth), and the apple-scab. These are readily held in check by spraying,—with arsenical poisons for the worm, and with lime-sulfur or bordeaux mixture for the scab. See *Spraying*. Spraying for the worm should be performed as soon as the last petals fall; for the scab as soon as the buds are well burst. In badly infected regions and on very susceptible varieties, it may be necessary to spray first



247. Gano. ( $\times \frac{3}{8}$ )



248. Black Gilliflower. ( $\times \frac{5}{8}$ )



249. Grimes. ( $\times \frac{1}{2}$ )

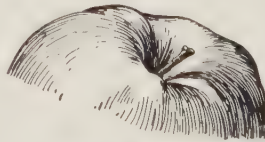


243. Baldwin. ( $\times \frac{1}{2}$ )



244. Ben Davis. ( $\times \frac{3}{8}$ )

trouble: the trees may need water; they may be suffering from insects or disease; they may lack nitrogen. If it is thought



245. Blue Pearmain. ( $\times \frac{3}{8}$ )



246. Esopus (Spitzenberg). ( $\times \frac{3}{8}$ )



for the scab before the buds swell. Since there are insects (as canker-worms, case-bearers, bud-moth) that appear before the flowers open, it is advisable to add arsenical poison to the fungicide at the early spraying. The number of times to spray depends on the thoroughness of the work, the pests to be combated, and the season; but it is a good rule to expect to spray with the combined fungicide and insecticide mixture when the buds burst, and again when the petals have fallen. In the plains country, less spraying may be necessary for the fungous diseases.

The apple commonly bears on spurs. The fruit-bud is distinguished by its greater size (usually somewhat thicker than its branch), its greater width in proportion to its length, and more conspicuous pubescence. It is also distinguished by its position. A fruit-bud is shown in Fig. 239. A fruit-scar is shown near the base of the branch. If this fruit was borne in 1912, the side branch grew in 1913 from a bud which came into existence in 1912. If we go back to the spring of 1912, the matter can be made plain. A cluster of flower appeared. One flower set a fruit

(Fig. 240). This apple is at the end of the branchlet or spur. The spur cannot increase in length in the same axis. Therefore, a bud appears on the side (Fig. 241). The fruit absorbs the energies of the spur. There is little nourishment left for the bud. The bud awaits its opportunity; the following year it grows into a branchlet and makes a fruit-bud at its end (Fig. 239); and thereby there arises an alternation in fruit-bearing, although not all alternating in fruit-bearing may be attributed to this cause. The difference between fruit-buds and leaf-buds becomes apparent when the buds burst (Fig. 242).

The apple is budded or root-grafted on common apple seedlings. These seedlings are usually grown from seeds secured from cider mills. In the East, budded trees are preferred. In the upper Mississippi Valley, root-grafted trees are preferred, largely because own-rooted trees of known hardiness can be secured. In Russia, seedlings of *Pyrus baccata* are used as stocks. They prevent root-killing, and give earlier fruit-bearing. Apple trees are usually planted when two or three years old.

Apples are dwarfed by working them on various kinds of Paradise and Doucin stocks. These stocks are merely naturally dwarf forms of the common apple, and which, in some remote time, have originated probably from seeds. Dwarf apples are much grown in Europe, where small-area cultivation and wall-training are

250. Hubbardston. ( $\times \frac{3}{8}$ )

254. Rome Beauty. ( $\times \frac{3}{8}$ )

251. Yellow Newtown. ( $\times \frac{1}{2}$ )

255. Wealthy. ( $\times \frac{3}{8}$ )

256. Stayman (Winesap) ( $\times \frac{3}{8}$ )

252. Northern Spy. ( $\times \frac{3}{8}$ )

253. Rhode Island Greening. ( $\times \frac{3}{8}$ )

257. York Imperial. ( $\times \frac{3}{8}$ )

common, but they are little known in America, and, because of economic conditions, are usually not profitable here. See *Dwarfing*.

#### Varieties.

The varieties of apple trees actually on sale in North America in any year are not far from 1,000 kinds. Each great geographical area has varieties that are particularly adapted to it. In the northern Mississippi Valley, there are few of



258. Tompkins King,—the flat or oblate American apple. ( $\times \frac{1}{2}$ )

the eastern-states apples that thrive. Varieties have been introduced from Russia with the expectation that they will be adapted to the region; but more is to be expected of their progeny than of themselves. Varieties of local origin, coming from various stem types, are now providing that region with satisfactory apples. In the selection of varieties, one should be guided by this adaptation to the region, and by the purpose for which the fruit is designed to be grown. Consult the recommended lists of the state horticultural societies; ask persons who have had experience in the given region; write to the experiment station; enquire at the markets. The leading commercial varieties in North America are Golden Russet (N. Y.), Red Astrachan, Baldwin (Fig. 243), Ben Davis (Fig. 244), Blue Pearmain (Fig. 245), Oldenburg (Duchess of), Esopus (Spitzenberg) (Fig. 246), Fameuse, Gano (Fig. 247), Black Gilliflower (Fig. 248), Gravenstein, Grimes (Fig. 249), Hubbardston (Fig. 250), Ralls, Jonathan, Tompkins King, McIntosh,



259. The oblate and spherical forms of apple.



260. The conical and ovoid forms of apple.

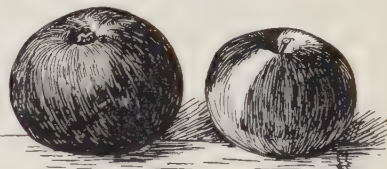


262. Monument to the Baldwin apple.



263. Tablet to the Primate apple.

Missouri (Pippin), Newtown (Albemarle) (Fig. 251), Northern Spy (Fig. 252), Peck (Pleasant), Fennock, Rhode Island Greening (Fig. 253), Rome Beauty (Fig. 254), Shockley, Twenty Ounce, Wealthy (Fig. 255), Willow (Twig), Winesap and Stayman Winesap (Fig. 256), Wolf River, Yellow Bellflower, York Imperial (Fig. 257), King (Fig. 258). Baldwin and Ben Davis, the former of secondary quality and the latter of worse, hold the supremacy in American market apples. The apples of the eastern and central country tend toward flattened or oblate shape (Figs. 258-9). The typical form of the so-called long or conical American apple may be seen in Fig. 260. Many odd and unusual varieties are grown for dessert, one of which is shown in Fig. 261.



261. Lady, a small dessert apple. ( $\times \frac{1}{2}$ )

Monuments or markers have been erected to a few of the most noted varieties of apples. Fig. 262 shows the monument erected in Wilmington, near Lowell, Mass., in 1895, to the Baldwin, with the following inscription:

THIS PILLAR ERECTED IN 1895  
BY THE

RUMFORD HISTORICAL ASSOCIATION

Incorporated April 28, 1877

Marks the estate where in 1793 Samuel Thompson, Esq., while locating the line of the Middlesex Canal, discovered the first Pecker apple tree. Later named the

BALDWIN

The first tablet in New York state in memory of any apple was erected in the town of Camillus, Onondaga County, on the original site of the Primate apple tree (Fig. 263). John T. Roberts, Syracuse, N. Y., on September 11, 1903, caused a bronze tablet to be erected there. On this tablet is the following inscription:

On this farm Calvin D. Bingham, about 1840, produced  
the marvellous

PRIMATE APPLE

Named by Charles P. Cowles

GOD'S EARTH IS FULL OF LOVE TO MAN

A second marker was erected in New York in 1912 to the Northern Spy, Early Joe and Melon apples, at Bloomfield, by the Ontario County Fruit-Growers' Society (Fig. 264), with the following tablet:



264. Northern Spy monument  
(4 ft. high.)



### THE ORIGINAL NORTHERN SPY APPLE TREE

stood about 14 rods south of this spot, in a seedling orchard planted by Heman Chapin about 1800.

THE EARLY JOE AND MELON APPLES  
ALSO ORIGINATED IN THIS ORCHARD

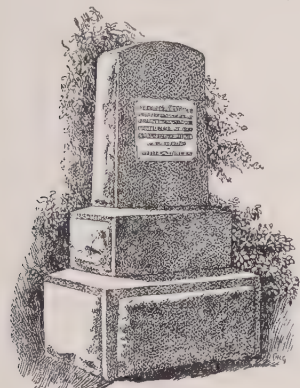
The McIntosh apple (McIntosh Red) is commemorated (Fig. 265) by a monument at Dundela, Dundas County, Ontario, as follows:

### THE ORIGINAL MCINTOSH RED APPLE TREE

stood about 20 rods north of this spot. It was one of a number of seedlings taken from the border of the clearings and transplanted by John McIntosh in the year 1796.

ERECTED BY POPULAR SUBSCRIPTION 1912.

The history is that John McIntosh came to Canada with the United Empire Loyalists. After spending some time along the frontier, he settled on his homestead in the county of Dundas in 1790 at a place later called McIntosh's Corners, although that place has now become extinct and Dundela has taken its place. In the year 1796 while clearing some forest land, he came upon a clump of young apple trees, about twenty in number. As apples were at that time a luxury, the apple trees were left unharmed, and a few days after were replanted in a clearing nearer his house. Most of the trees thrived for a few years but finally died. In 1830 only one tree out of the twenty remained. As this apple was unnamed, Mr. McIntosh combined



265. Monument to the McIntosh apple. (5 ft. high.)

color of the apple and christened it "McIntosh Red." From the time it was transplanted, it grew rapidly and in a few years bore an abundance of fruit the color and flavor of which attracted the attention of the earlier settlers. It was situated about fifteen feet from the house, and when in 1893 the house was burned, the tree also received its share of the fire and one side was badly burned. Nevertheless, the other side continued to bear until 1908. That summer the leaves began to wilt and the apples to fall off until it was entirely bare. Thus the old tree which had withstood the storm of 112 years was forced at last to submit to the injuries received from the fire of 1893 (Fig. 266). The wide circulation of the McIntosh apple is due to his son, the late Allen McIntosh, who, fully appreciating the fruit, wished others to enjoy it also and started propagating by grafting and budding from the original tree. This has been repeated year after year since 1836.

The origin of the Wealthy apple, the leading variety of the upper Mississippi Valley, is commemorated on the monument erected to the memory of Peter M. Gideon, Excelsior, Minnesota (Fig. 267). The tablet was unveiled and dedicated with appropriate ceremonies on the old farmstead, where he passed the last forty-six years of his life, at 2 o'clock on the afternoon of Saturday, June 15, 1912. The memorial consists of a block of granite, raised on a platform of solid concrete, surrounded by a chain supported by a number of black iron posts. On the sloping top of stone is a bronze tablet bearing this inscription:

This Tablet commemorates Peter M. Gideon who grew the original

### WEALTHY APPLE TREE

from seed on this<sup>a</sup> his homestead, in 1864.  
Erected by the Native Sons of Minnesota, June, 1912.

The triangular piece of ground on which this is placed containing approximately a half-acre, is surrounded by a chain and post fence. This ground, the gift of O. P. Briggs, is dedicated as "Gideon Memorial Park." It lies on the main traveled boulevard between Excelsior and Minnetonka Beach, a few hundred feet south of the Manitowish station on the electric line.



266. Original McIntosh apple tree.

### Special literature.

Several books devoted wholly to the apple have appeared in North America: Warder, Apples, 1867; Todd, Apple Culturist, 1871; Waugh, The American Apple Orchard, 1908; Burritt, Apple Growing, 1912; Woolverton, Canadian Apple Grower's Guide. For varieties, the two volumes, Beach, Apples of New York, published by the New York Agricultural Experiment Station, at Geneva, are invaluable. Consult, also, Vol. 25, Nebraska State Horticultural Society, 1894; The Apple, a report of the Kansas State Horticultural Society, 1898. Nearly all the fruit manuals devote space to the apple.

L. H. B.

### Apple-growing in the northeastern states.

Although the eastern region (New England, New York, Pennsylvania) early developed an apple industry, it had few commercial orchards until near the middle of the last century. About that time many named varieties of American origin were disseminated. At first the product was used largely for the making of cider. Gradually there arose a demand for fresh fruit,



267. Monument to Peter M. Gideon and the Wealthy apple.

and as transportation facilities improved and the business became more profitable, there was a rapid increase in the number and size of the orchards. The production of apples increased more rapidly than the facilities for distribution and soon the supply apparently exceeded the demand. The low prices received in the following years discouraged the growers from further planting. Many growers, being attracted by the

alluring settlement of the West and others by the opportunities in the rapidly growing manufacturing centers, forsook their orchards. Of those who remained, many cut down the trees to make room for more profitable crops. The orchards that remained were mostly neglected and many of them may still be found, although few of them are now profitable. There have been two or three attempts at reviving the industry and these mark well-defined epochs of orchard planting.

With the phenomenal amassing of population in the eastern cities and with the marked improvement in transportation facilities, there has developed within the past ten years a remarkable opportunity in the growing of apples. As a result, enormous areas are being planted and many of the old and neglected orchards are being revived. Many persons from the cities are being attracted to the cheap lands in the East and most of them are planting apple trees. It is difficult to ascertain, even in an approximate way, the number of trees being planted in any section. The thirteenth census shows that there are over 7,425,000 apple trees in the eight states under discussion that had not reached the bearing age in 1910, and there has been much greater activity in tree-planting in the three subsequent seasons than ever before. Many of the old orchards, however, are fast passing out of existence. From the census reports it may be seen that despite the number of young orchards coming into bearing in the ten-year period, there were 10,488,000 more trees of the bearing age reported in 1900 than in 1910.

The question of the probability of over-production immediately arises. Most of the growers are still optimistic, thinking that for various reasons many of the orchards will never reach the bearing age and that with the rapidly growing population, the increasing opportunities for exporting, the raising of varieties of better quality, and with better methods of grading and packing, the supply will not exceed the demand for any considerable time.

#### *Apple regions.*

It is remarkable that the apple industry has reached its highest development in certain restricted regions. When pomologists speak of the western New York fruit-belt or the Champlain Valley district, a fairly definite area is understood. Usually such districts are marked by exceptionally favorable soil or climatic conditions. The conspicuous apple regions of the Northeast, although frequently hundreds of miles apart, possess about the same set of conditions. This is especially true within the same parallels of latitude. The distinctive features of these regions are:

(1) A favorable climate, that insures protection from extreme temperature, affords sufficient rainfall in summer, and that furnishes long days and abundant sunshine throughout the growing season.

(2) A favorable soil, that insures good drainage, ease of cultivation, and a spacious feeding-ground for the roots.

(3) A suitable topography, that affords adequate atmospheric drainage and insures protection from frosts and freezes. Lands adjacent to large bodies of water, however, are not necessarily dependent upon variations in altitude to insure protection from frost.

While favorable soil, climate and topography often are determining factors and are considerations of great

importance, there is now known to be much greater latitude in this respect than was generally considered. In recent years, apples have been successfully and profitably grown under conditions that formerly were thought to be very undesirable. This is mentioned here to show that the proper selection of varieties and the adoption of special methods of treatment are also important factors, and that the "fruit-belt" is not the only controlling factor.

The accompanying table gives some information regarding the number of apple trees and the production of apples in the states under consideration. One column also shows the relation of the production of the various states to the total production of the United States:

VARIOUS APPLE STATISTICS FOR THE NORTHEASTERN STATES, ACCORDING TO THE CENSUS REPORTS FOR 1900 AND 1910.

State	Bushels 1899	Bushels 1909	Per cent of total pro- duction of U. S. 1909	Trees of bearing age		Trees not of bearing age 1910
				1900	1910	
Maine.....	1,422,000	3,636,000	2.48	4,185,000	3,477,000	1,045,000
N. Hampshire..	1,979,000	1,108,000	.08	2,034,000	1,241,000	207,000
Vermont.....	1,177,000	1,460,000	.10	1,675,000	1,184,000	220,000
Massachusetts..	3,023,000	2,550,000	1.73	1,852,000	1,367,000	356,000
Rhode Island...	339,000	213,000	.01	214,000	152,000	55,000
Connecticut....	3,709,000	1,541,000	1.04	1,167,000	799,000	212,000
New York.....	24,111,000	25,409,000	17.22	15,055,000	11,248,000	2,829,000
Pennsylvania...	4,641,000	11,048,000	7.49	11,774,000	8,000,000	2,501,000
Total.....	40,401,000	46,965,000	31.83	37,956,000	27,468,000	7,425,000

By comparing the production from the various counties, it is easy to determine the conspicuous apple sections. The following table shows the production from the twenty-four highest producing counties in the northeastern states:

TABLE SHOWING PRODUCTION OF APPLES FROM THE TWENTY-FOUR HIGHEST PRODUCING COUNTIES IN THE NORTHEASTERN STATES, CENSUS OF 1910.

County	State	Bushels
Wayne .....	New York	3,304,000
Monroe.....	New York	2,592,000
Niagara.....	New York	2,367,000
Orleans.....	New York	2,229,000
Ontario.....	New York	913,000
Columbia.....	New York	893,000
Dutchess.....	New York	795,000
Ulster.....	New York	668,000
Chautauqua.....	New York	646,000
Middlesex.....	Massachusetts	633,600
Greene.....	New York	630,000
Wyoming.....	New York	625,000
Erie.....	New York	623,000
Worcester.....	Massachusetts	595,000
Genesee.....	New York	581,000
Cattaraugus.....	New York	558,000
Albany.....	New York	528,000
Cayuga.....	New York	484,000
Oxford.....	Maine	443,000
Berks.....	Pennsylvania	426,000
Oswego.....	New York	406,000
Tioga.....	Pennsylvania	399,000
Kennebec.....	Maine	392,000
Franklin.....	Maine	389,000

It will be seen that of the twenty-four counties, seventeen are in New York state, three in Maine and two each in Massachusetts and Pennsylvania.

The territory under consideration lies mostly between the 68th and 81st degrees of longitude and the 40th and 46th degrees of latitude. It possesses, on the whole, a very irregular topography, resulting from glacial deposits. It is drained in almost all directions by rivers of various sizes. It includes many fertile valleys, elevated plateaus, and several mountainous areas. Along



the coast in many sections, and on the shores of the Great Lakes are fairly broad low-lying plateaus. These areas, with the broad river valleys and their bordering slopes, are of great importance from a fruit-growing standpoint.

In a rough way, the lands may be divided into two main groups. The first embraces the river valleys, including the valley slopes, and the lower plains adjacent to the Great Lakes, and certain areas near the coast. To this group belong the most conspicuous apple-growing areas, such as those along the valleys of the Connecticut, the Hudson, the St. Lawrence, the Mohawk, the Susquehanna and other smaller rivers, and the shores of Lake Erie, Lake Ontario, Lake Champlain and various inland lakes.

The second group of lands embraces the uplands, composed usually of more or less rolling land with innumerable hills, narrow valleys, and great plateaus. This territory embraces much rough mountainous land that is of little value except for forestry. In general, the upland territory is devoted mainly to diversified farming. As a rule, only the hardier varieties of apples are grown, but in the uplands there are innumerable areas of restricted dimensions that are well adapted to the growing of apples in conjunction with other interests.

In the East apples are extensively grown for home use and for local market. For this reason the apple industry is not so centralized as it is in some other regions, although there are many large commercial orchards. Many individual orchards are small, being on diversified farms. According to the thirteenth census, the average value of farm lands throughout the eight states is \$23.28 per acre. The price recorded for the states of Pennsylvania, New York, Massachusetts, Connecticut and Rhode Island was about the same, averaging \$33.92 per acre, while that for the remaining three states, Maine, New Hampshire and Vermont was much lower, averaging \$13.31 per acre.

The apple-growing area in the northeastern states is rapidly extending and comprises much of the cheaper lands of the territory. In New England, the area embraces the southern half of Maine, New Hampshire, and Vermont, projecting somewhat northward along the western border of the latter state, and extending southward to include the greater part of Massachusetts, Connecticut, and Rhode Island. Here the leading varieties in the older orchards are Baldwin, Rhode Island Greening, Northern Spy, Roxbury, Ben Davis, Fameuse, Tolman, Hubbardston, Oldenburg, Red Astrachan, Bethel, Twenty Ounce, McIntosh, Yellow Bellflower, and Wealthy. The later plantings are mostly of higher quality varieties, including Northern Spy, McIntosh, Wealthy, Fall Pippin, Sutton, Wagener, Red Canada, Esopus (Spitzenberg), Gravenstein, Yellow Transparent, Red Astrachan, Fameuse, Tompkins King, and Williams. The Baldwin, however, continues to be the most popular variety in New England.

In New York, the main apple-growing section extends along the south shore of Lake Ontario, but the industry is rapidly developing in many other parts, including the Hudson, Champlain, St. Lawrence, and lower Mohawk valleys, and the lands surrounding the central lakes. The leading varieties in the bearing orchards are Baldwin, Rhode Island, Northern Spy, Tompkins King, Roxbury, Hubbardston, Esopus (Spitzenberg), Golden Russett, Ben Davis, Tolman, Black Gilliflower, Twenty Ounce, Swaar, Westfield, Pumpkin Sweet, Fameuse, Fall Pippin, Yellow Bellflower, McIntosh, Wealthy, Oldenburg, Red Astrachan, Jonathan, Yellow Newtown, Green Newtown, Maiden Blush, Gravenstein, Blue Pearmain, Early Harvest, Alexander, and Yellow Transparent. Many of these varieties are still

being planted, but the tendency is to set fewer varieties and more of the leading commercial sorts.

The apple-growing area in Pennsylvania is limited largely to the southeastern part of the state. The industry has reached its highest development in the Cumberland Valley, especially in Cumberland, Adams and Franklin counties. Much planting is now being done along the upper Susquehanna in Luzerne, Lackawanna, and Wyoming counties. In the southwestern part of the state, Bedford and Somerset counties also have many commercial orchards. Southern Pennsylvania has a longer growing season than New York and New England and this is plainly shown by the nature of the varieties most commonly grown. The older orchards are composed mainly of York Imperial, Baldwin and Northern Spy, but the newer plantings are mostly Stayman Winesap, McIntosh, Delicious, and Northern Spy.

#### *Cultural peculiarities.*

While there is diversity of opinion regarding cultural methods, the common practice embraces a sys-



268. Apple orchard at bearing age, as seen in the northeastern states.

tem of clean culture with cover-crops. In some regions, especially on the heavier soils, it has been found that this treatment, if practised year after year, produces too much growth. In such cases, the cover-crop, instead of being turned under, is allowed to stand till about June, when it is cut and allowed to remain on the surface as a mulch. In New England, clover is most commonly used as a cover-crop. In New York and Pennsylvania, various crops are used for the purpose; among these the most common are clover, vetch, rye, buckwheat, turnips, cowpeas, and soybeans. Some growers in various parts have secured good results from growing their trees in sod, mowing the grass and leaving it as a mulch. The success of this method depends largely on the quantity of herbage that can be grown in the orchard. If the orchard does not produce enough, it must be supplemented with some form of coarse material from other sources. A system of this kind may be very satisfactorily employed in various parts of Pennsylvania, New York and New England, where there is much land that, although well adapted to apple-growing, is oftentimes too steep for cultivation.

As a rule, chemical fertilizers are used in the orchard. Since the supply of humus may be maintained in the orchard by the use of cover-crops, most growers prefer to use the available stable manure for crops like corn, hay, or vegetables, that are not so easily adapted to cover-crop treatment. Stable manure, however, is



often used in sod orchards to supply additional mulch as well as the elements of plant-food. Many growers are coming to realize that the apple tree does not require heavy applications of fertilizers. More important than fertilizers is moisture supply, and this is maintained by increasing the humus and by cultivation. Very few growers are applying much nitrogen, depending upon leguminous cover-crops to keep up the supply. As a source of phosphoric acid, raw ground bone is the most common material. In recent years, very large quantities of basic slag have been used, 600 to 800 pounds per acre usually being applied. Potash is usually applied in the muriate form, but some growers prefer to use the sulfate of potash. Recently, growers have realized the necessity for applying lime, and this is being used largely in the form of ground limestone.

There is a growing feeling that in the past young trees have been pruned too severely. Progressive growers think that the young apple tree should not be pruned very severely during the dormant season. With this is associated the idea that when much pruning is necessary, some of it, at least, should be performed in the growing season. This practice tends to bring the



269. Harvest time in the apple orchard.

trees into bearing earlier and to make better-shaped trees. Summer pruning, when employed, is usually performed about July 1 or just before growth ceases. Mature trees tend to overbear, and pruning them in the dormant season is the rule.

A striking feature in the work of renovating old orchards is the severity with which many of the trees are pruned. High-headed trees, especially those that are very weak, are cut back to mere stubs on which the growth of water-sprouts is encouraged. From these sprouts new heads are formed. Trees treated in this way often produce fair crops of fruit, when properly trained, the fourth or fifth year following the treatment. Other trees that are in better shape to start with, are dealt with less severely, only the higher branches being removed and the remaining ones shortened in.

Spraying practices are about the same throughout the various regions of the Northeast. The concentrated lime-sulfur wash, either prepared or home-made, has become the standard remedy for scale. In some sections and especially for use on old apple trees, the miscible oils are preferred. For the various fungous troubles, of which scab, black-rot, rust and sooty-blotch are the most conspicuous, a weak lime-sulfur preparation is generally employed. Applications are usually made just before the blossoms open, again after the petals fall, and one or two later applications at intervals of three or four weeks. Arsenate of lead is usually added for the control of insects. In New England, the lime-sulfur as a summer spray has not given satisfaction, and the tendency is to use regular bordeaux

mixture for the first application and a very weak bordeaux for the subsequent treatments. With most varieties, and under ordinary conditions, the one application is sufficient to control the various diseases. One or two applications of arsenate of lead, either with or without bordeaux, is usually applied after the blossoms have fallen.

The practice of thinning apples is becoming somewhat general among the commercial growers of New England and in most sections of New York and Pennsylvania. The work is usually performed about July 1, or just after the so-called "June drop." In some sections in western New York, where the evaporating trade takes the greater part of the crop, the practice is almost unknown.

#### Marketing.

The apple crop in general farming districts is mostly disposed of within the limits of the territory and usually in the local market. The more extensive growers, however, ship large quantities to the eastern cities, and varying quantities, depending upon the supply, are exported. Progress in grading and packing has been slow, chiefly because of lack of necessity. There is great demand in the manufacturing centers for a medium grade of fruit and in such places it has not paid to increase the price of apples by fancy grading and packing. Some growers, even at the present time, say that they make as much from their lower grades as from their higher grades. This applies especially to sections where peddlers come to the orchard, take the fruit away and bring the barrels back. The enormous number of varieties has also affected progress in the way of improved methods. Methods of packing and selling are very diverse. The barrel still remains the most popular package, although the box is being largely used. In the vicinity of the large cities and towns, special packages are used for the retail trade. Around Boston, a slatted bushel box is in common use. In Connecticut, the common Jersey peach basket is largely used, with a growing tendency toward the climax basket. Near Philadelphia, the familiar hamper is still in use. The box package as used in the West has been adopted by many growers in New York and in northern New England. In Connecticut, there is a movement to adopt a distinctive package, like the climax basket, for the fancy retail trade and to continue to use the barrel for the general crop.

C. D. JARVIS.

#### The apple in Canada.

Apples have been cultivated in Canada for about 300 years. In the early part of the seventeenth century, the French settlers brought with them seeds and trees to the banks of the St. Lawrence River, along which the first settlements were made. In that part of Canada which in the French régime was known as Acadia, now the province of Nova Scotia, apple trees were planted early in the seventeenth century also. Trees were top-grafted in Nova Scotia as early as 1764, and some of these old trees are still alive. On account of poor transportation facilities in Canada until comparatively recent years, the development of apple-growing was slow for a long time and it has been only during the past fifty or sixty years that a rapid growth in the industry has taken place. Now, however, the production of apples is large and is increasing very fast. In 1911 the number of bushels of apples grown in Canada was estimated at 10,384,985.

#### Regions.

The area in Canada over which apples can be grown is very large. In the provinces of Ontario and Quebec, there is a belt of about 700 miles in length, where apple trees can be successfully grown, while in the province of Ontario alone the best winter apples can be



grown over an area of about 350 miles long by 30 to 150 miles in width. Over this great winter-apple area, which may be roughly divided into, first: that part bordering on Lake Ontario and extending for 30 and more miles inland; second, that bordering Lake Huron and for several miles back; and third, the southwestern part of Ontario,—the Northern Spy, Baldwin, Tompkins King and Rhode Island Greening are the predominant winter varieties of the better class.

Nova Scotia has long been noted for its winter apples, which ship and keep well. The most favored parts are the Annapolis and Cornwallis valleys, which have a total length of about 100 miles and vary in width from 6 to 11 miles. Here apples of British or European origin, such as Blenheim, Ribston, Gravenstein, Cox Orange Pippin, and Yellow Bellflower do particularly well. But it is being found that winter apples can be grown successfully along the southeastern part of Nova Scotia, and a large area will no doubt be eventually planted to apple trees there. In the northern part of Nova Scotia, the harder apples, including some winter varieties, do well. Prince Edward Island, the smallest province in Canada, produces excellent apples, and here may be found, perhaps, the longest-keeping fruit in Canada of the varieties grown, due no doubt to the cool autumn. The season is somewhat short for some of the latest-maturing varieties. The province of New Brunswick has for a long time shown its adaptability for apple-culture, and in this province some of the highest-colored and best-flavored apples are grown. The climate over a large part of New Brunswick is much the same as the southern part of the province of Quebec and eastern and central Ontario, and over this great area such apples as Wealthy, Fameuse, McIntosh, Alexander, Wolf River and others are grown to great perfection.

In the far West, British Columbia has many districts and valleys well suited for summer, autumn and winter varieties of apples, but some varieties do better in one district than in another. At present the three most important parts are, first, that comprising the damp climate of the lower mainland near the coast, and Vancouver Island; second, the dry interior country where irrigation is, as a rule, necessary, including the Okanagan and other valleys; and third, the Kootenays, East and West, the Salmon Arm, and other districts where irrigation is in most places unnecessary. Many valleys farther north than the present commercial orchards extend are being found suitable for apple-culture.

In the prairie provinces of Manitoba, Saskatchewan and Alberta, few apples have as yet been grown, but it is thought that before long some parts of these provinces will be producing large quantities of apples. In southern Manitoba the Russian varieties of apples are succeeding well in places where cared for, and considerable quantities of fruit have been obtained there. The chief causes of failure in the prairie provinces appear to be, first, too late growth, preventing proper ripening of the wood, and due, we believe, to the rich soil with its large percentage of available nitrogen; second, to the drying out of the trees in winter on account of their being exposed to dry and very cold winds for a long period; and third, on account of early growth in spring followed by hard frosts. All of these causes of failure may in a large degree be overcome by planting the hardiest varieties in well-drained, light soil, protecting them from winds in winter by means of windbreaks, and choosing exposures where growth will not start early. In the wooded country in northern Saskatchewan and Alberta, where the springs are cooler and where there is natural protection, it is thought that ultimately large quantities of apples will be grown. At present crab-apples are being grown in a number of places and also the small hybrid apples originated by William Saunders.

The farthest north that apples have been grown in

Canada east of the Rocky Mountains, of which we have a record, is at Fort Vermilion, Peace River, in latitude 56°, where, in 1910, fruit was grown of the hybrid apples referred to.

#### *Varieties of apples recommended for different parts of Canada.*

ONTARIO (districts bordering Lake Ontario and Lake Huron, and southwestern Ontario): *Summer*—Red Astrachan, Oldenburg, Fall—Gravenstein, Wealthy, Alexander, McIntosh, Fameuse, Blenheim. *Winter*—Tompkins King, Rhode Island Greening, Baldwin, Northern Spy, Cranberry, Stark.

NOVA SCOTIA (Annapolis, Cornwallis, and adjacent valleys): *Summer*—Red Astrachan, Oldenburg. *Fall*—Gravenstein, Wealthy, Blenheim, Ribston. *Winter*—Tompkins King, Yellow Bellflower, Wagener, Cox Orange Pippin, Rhode Island Greening, Stark, Northern Spy, American Golden Russet, Fallawater, Roxbury Russet (Nonpareil), and Ben Davis.

NOVA SCOTIA (northern and colder parts) NEW BRUNSWICK, QUEBEC (except coldest parts), EASTERN AND CENTRAL ONTARIO: *Summer*—Transparent, Lowland Raspberry, Oldenburg. *Fall*—St. Lawrence, Wealthy, Dudley, Alexander, McMahon. *Winter*—McIntosh, Fameuse, Wolf River, Bethel, Milwaukee.

PRINCE EDWARD ISLAND: *Summer*—Transparent, Oldenburg, Fall—Wealthy, Dudley, Gravenstein (which keeps well into winter here). *Winter*—Alexander, Wolf River, McIntosh, Stark. Such varieties as Blenheim, Ribston, Tompkins King, Northern Spy, and many others can be grown on Prince Edward Island, but are not so reliable for commercial purposes.

BRITISH COLUMBIA (lower mainland, Vancouver Island): Yellow Transparent, Oldenburg, Gravenstein, Wealthy, Tompkins King, Grimes. For irrigated districts of Southern British Columbia: Transparent, Red Astrachan, Oldenburg, Wealthy, McIntosh, Jonathan, Wagener, Rome Beauty, and in addition for the most favored parts, Esopus, Yellow Newtown, and Winesap. Other temperate parts where irrigation, if practised, is not general, including the Kootenays, Salmon Arm, and Armstrong district: Yellow Transparent, Oldenburg, Gravenstein, Wealthy, McIntosh, Jonathan, Wagener, Grimes and Northern Spy.

Hardest varieties for coldest parts of Canada: *Summer to Autumn*—Blushed Calville, Lowland Raspberry, Oldenburg, Chalamoff. *Autumn to Winter*—Antonovka, Wealthy, Hibernial, McMahon, Longfield, and Patten. *Crab-apples*—Whitney, Virginia Martha, Transcendent, Hyslop and the small hybrid apples originated by Wm. Saunders.

Up to comparatively recent years, Canada had depended mainly on the other parts of the world for varieties to plant, but some excellent apples of Canadian origin are now in commerce, such as Fameuse, McIntosh, St. Lawrence, and Baxter. Within the past twenty years under the direction of the Dominion Government, many new varieties have been originated with a view to furnishing suitable kinds for the prairie provinces, and secondly to obtain apples of the best color and quality which would succeed over a wider range than those on the market at present. The results so far have been very promising.

#### *General outlook.*

Canadians are fully alive to the importance of practising the best methods of apple-culture, and in those parts of the Dominion where the industry is an important one, the methods employed and culture given are equal to those in other countries.

The coöperative movement is strong in Canada, and there are many coöperative associations for the buying of horticultural supplies and for the marketing of fruit. There has been an Act in force in Canada since 1899 by which Dominion inspectors may examine fruit packed in closed packages before shipment in any part of Canada. The Act empowers the inspectors to mark the package "Falsely Marked" if the fruit within the package is not of the grade or quality indicated by the marks outside, and the person who packs the fruit and marks the package is liable to a fine.

There is a minimum standard or legal barrel of 96 Imperial quarts for apples throughout Canada, and a uniform box of 10 x 11 x 20 inches, inside measurements. The barrel is still the popular package in eastern Canada, although the use of the box is steadily increasing. In British Columbia, however, the box is used practically altogether.

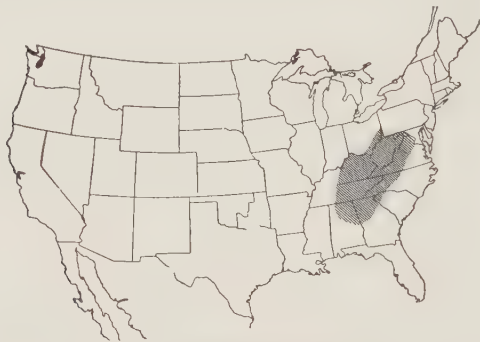
The outlook for apple-growing in Canada is bright. The market for Canadian apples appears to be

unlimited, if the fruit is well packed and properly distributed, and the quantity of apples that Canada is able to produce is enormous. For further information, see *British North America, Horticulture in.*

W. T. MACOUN.

**The apple in the southern Alleghany Mountain region. Fig. 270.**

With respect to climatic conditions, the Alleghany region presents the widest range of extremes within short distances in eastern North America. Extending through nearly seven degrees of north latitude, its great



270. The Alleghany apple region.

valleys, plateaus, detached hills and long ridges vary in elevation from 500 to more than 4,000 feet above sea-level, presenting in their varied slopes almost every angle of exposure to the sun. Correspondingly varied soils occur also, often in close proximity, so that within short distances, combinations of soil and climatic conditions adapted to more widely differing types of plants are found than elsewhere in the humid regions of the United States. The extreme contrasts occur in western North Carolina, where in the sheltered valleys and thermal belts of the eastern slopes of the Blue Ridge, the fig and the European grape are grown with a fair degree of success within a few miles of higher lands well adapted to a wide range of winter apples.

While fewer chronological records have been preserved of the earlier history of apple-culture in this region than is true of some of the more northern apple districts, it is evident from scattered references that in some localities in Virginia and North Carolina, rather systematic culture of this fruit was undertaken in a small way at a very early date.

It is known that as early as 1686 there was one apple orchard of 2,500 trees in Virginia, mostly grafted, and that by the close of the seventeenth century, few plantations in that state were without orchards. In these, the apple was the leading fruit along with the peach, the pear, the plum, the quince and some others. As early as 1773 Thomas Jefferson recorded in his "Garden Book" the grafting of "Newtown Pippin" in Albemarle County, Virginia, and in 1778 the planting of these grafted trees on his Monticello estate. This variety had apparently reached that section from the vicinity of Philadelphia as early as 1755 in the form of cions brought in the saddle-bags of Dr. Thomas Walker, the commissary officer of the Virginia troops in Braddock's army, when he returned after the disastrous defeat of that year. (See Bulletin 5, Division of Pomology, U. S. Department of Agriculture, p. 360.-1898.)

But if written records were entirely lacking, the large size and evident age of the surviving trees about farm dwellings and the abundant distribution of seedling apple trees of great age and large size at the present time would sufficiently establish the fact of early introduction and the general adaptability of the conditions to the requirements of the apple. The late T. K. Bruner, of North Carolina, cites an example of an

orchard in Haywood County in that state in which, though never cultivated, a hundred trees had attained a size of full 3 feet in diameter of trunk, the largest having a girth of 11 feet and 9 inches. While these exceptionally large trees are usually found in the lower slopes or in mountain coves where the wash from the mountainsides above brings to them the moisture and fertility of considerable areas of land, many unoccupied benches and gradual slopes exist where such soil conditions could be approximately duplicated by the orchardist.

*Varieties of the Alleghany region.*

While less attention has probably been given in this region to the systematic study of the seedling fruits that have originated there than in most of the earlier settled parts of the country, upwards of fifty varieties of the 319 included in the last catalogue of fruits of the American Pomological Society are traceable to this region. These include such commercially important varieties as Ben Davis, Grimes' Golden, Kinnard, Paragon and Willow, together with such highly esteemed home-use sorts as Bonum, Buckingham, Gilpin, Pilot, Red June, Shockley, Summer King, Terry and Virginia Beauty. R. L. Watts, working in Tennessee, and C. C. Newman, in South Carolina and Georgia, have made a beginning in the canvass of the region for valuable seedlings in connection with their experimentation work, but this region undoubtedly remains at the present time the most promising field in America for the searcher after promising new varieties of apples.

As in most of the earlier settled parts of the country, commercial development of orchards in this region is comparatively recent. The first plantings were solely for home-supply. Later, small orchards were planted for the production of sun-dried apples, cider, apple-brandy and similar products in a commercial way, rather than for the sale of the fresh fruit on any extensive scale. So long as these uses determined the selection of trees for planting, little attention was paid to varieties, or, in fact, to the perpetuation of varieties at all; hence the numerous small seedling orchards persisting throughout the less accessible portions of the region at the present time. Gradually, in certain localities, the quality of fruit produced gave the more durable winter varieties a money value for marketing by wagon, river-boat or railroad to more distant markets. The longer-keeping Winesap and other winter apples of Tennessee found profitable wagon-market demand in the lower valleys of Alabama and Georgia where this



271. A mountain orchard, Virginia.

fruit did not succeed. The Willow, Gilpin and Bentley of the northern Panhandle of West Virginia found eager buyers when transported by boat down the Ohio and Mississippi Rivers as far as New Orleans. The Yellow Newtown, rechristened Albemarle Pippin in the county of that name (under the impression that it was a dis-



tinct sort) found its way from Virginia by railroad to the eastern seaboard cities and at an early date moved across the Atlantic in considerable quantities, where its durability and fine dessert quality created an active demand at prices that yielded a good profit to the grower.

#### *Extent of the planting.*

Gradually commercial orcharding has been differentiated from ordinary farm fruit-growing and a considerable number of farms have become distinctively orchard farms on which the apple is the main crop, with merely such cereals and forage crops as can be grown without interfering with the essential orchard operations, such as orchard cultivation, spraying, harvesting, and the like.

Most of the systematically planted and cared for orchards are under thirty years of age and a large proportion of the acreage in these has been planted since 1900. Accurate statistical information regarding the acreage or number of trees of orchard fruits in the United States is lacking, and this is peculiarly true of those regions in which, because of varying topography and the resulting eccentricities of climate and variations in soil, the orchard areas vary greatly in size and form, as is true of much of this region. Outside of the Great Valley of Virginia, and Tennessee, and those portions of the Piedmont region of Virginia that are adapted to orcharding, most of the best orchard sites occur as coves, benches or broken slopes, possessing at the same time suitable depth and character of soil, and adequate atmospheric drainage. (Figs. 271, 272.) Some of the best orchards are strung out along the lower slopes, varying in width in accordance with particular soil types. This is especially true of the "pippin orchards" in the Blue Ridge district of Virginia and North Carolina where certain particular combinations of soil and slope are considered important for the Yellow Newtown.

The following summary of the number of trees, both bearing and non-bearing, and of yield and value of crop in the eight states comprised in the region, is compiled from the advance sheets of the census of 1910:

APPLE IN SOUTHEASTERN UNITED STATES, CENSUS OF 1910.

	Trees, April 15, 1910		Product, 1909.	
	Of bearing age	Not of bearing age	Bushels	Value
United States ..	151,323,000	65,792,000	147,522,000	\$83,231,000
Virginia .....	7,005,000	3,436,000	6,104,000	3,130,000
W. Virginia .....	4,571,000	2,772,000	4,225,000	2,461,000
N. Carolina .....	4,910,000	1,835,000	4,776,000	2,015,000
S. Carolina .....	582,000	269,000	363,000	276,000
Georgia .....	1,878,000	822,000	896,000	556,000
Alabama .....	1,468,000	738,000	888,000	621,000
Tennessee .....	4,839,000	2,117,000	4,640,000	2,172,000
Kentucky .....	5,538,000	2,106,000	7,368,000	3,067,000
	30,791,000	14,095,000	29,260,000	\$14,298,000
	20 per cent	20 per cent	19 per cent	17 per cent

It will be observed on comparison of these tables with those of the United States as a whole that this region is credited with approximately 20 per cent of both bearing and non-bearing trees, and that the product of the region in the crop year of 1909 was of somewhat smaller proportion (19 per cent) and value (17 per cent).

#### *Outlook for the Alleghany region.*

In contrast with the more northern apple districts, most of this region was until recently somewhat at a disadvantage so far as commercial production is concerned. Higher humidity favored the development of certain injurious diseases in foliage and fruit; the warmer weather commonly prevalent in autumn accelerated

ripening and therefore shortened the storage durability of the fruit; relatively long hauls from orchards to railroad station over rough roads resulted in much bruising and, by prolonging the exposure of the fruit to the weather, still further impaired its keeping quality. The development of efficient remedies and spraying equipment, and the improvement in methods of handling the fruit, coupled with the marked improvement in roads that has been accomplished in many sections is rapidly changing this. The railroads also, in recognition of the need have accelerated and improved their ser-



272. Apple orchard in Piedmont region of the Alleghenies.

vice so that certain parts of the region are handling their apples as well as the best eastern or barrel-fruit districts, and better than in much of the older commercial apple territory.

The conspicuous essent als of success in orcharding in this region, as in others, are:

(1) *Suitability of site*, as regards character of soil and adequacy of atmospheric drainage.

(2) *Adaptability of varieties to the soil and climate of the location.*—

The standard northern varieties, though growing and frequently bearing well, are unreliable in most localities, especially below elevations under 200 feet, although in certain localities succeeding well under careful management. The thoroughly proved and distinctively important commercial sorts of the region are York Imperial, Winesap, Stayman Winesap, Kinnard, Ben Davis, Yellow Newtown, Grimes, Willow and Rome Beauty. In some sections less well-known sorts, such as Paragon, Arkansas (syn. Mammoth Black Twig), Bonum, Virginia Beauty, Lowry, Shockley, and Terry, are considerably planted in commercial orchards.

Gano, Delicious, Jonathan and some other sorts of Mississippi Valley or northern origin are promising in certain localities, but these have not yet been sufficiently tested to justify extensive planting.

Summer varieties, though succeeding well throughout most of the region and universally found in sufficient quantity for home use, have not become so important commercially as in the lower lands of the tidewater districts and of the Mississippi Valley. This is in a large measure due to the earlier ripening of the fruit at lower elevations, which frequently gives it a distinct advantage in northern markets. Recently, considerable plantings of Yellow Transparent, Williams, Oldenburg, Gravenstein and some other sorts have been made in the more northern districts of the region, especially in West Virginia and western Maryland.

(3) *Abundance of water for spraying.*—The necessity of thorough and systematic spraying of orchards to protect against insects and fungi makes the orchard water supply an important factor. In many places, flowing springs are available at considerable elevations from which the supply can be piped by gravity to convenient mixing stations, thus permitting prompt distribution without long wagon haul of liquid. The use of compressed-air spraying-outfits, charged at conveniently located air-compressing and spray-mixing stations, has developed more largely in the lower Shenandoah Valley part of this region than elsewhere, but the gasoline engine is the prevailing type of equipment.

(4) *Adaptability of land to cultivation.*—While occasional orchards in this as in other humid regions do well without systematic tillage, especially if heavily mulched with stable manure, straw or other humus-producing material, annual or at least alternate-year plowing and cultivation, supplemented by leguminous crops, is rapidly becoming the generally accepted best practice of the region. Some sites otherwise admirably adapted to apple-growing are too rocky or too steep to plow, and therefore of doubtful value to the orchardist. Much can be done on such sites by contour-terracing, however, both to dispose of loose rocks and to reduce washing of the slopes, thereby conserving the soil moisture against droughty periods.

(5) *Adequacy of transportation facilities.*—This includes both railroads and highways. Some of the earlier-planted commercial orchards were located as much as 15 to 25 or even 30 miles from the shipping station. The expense incident to this long haul and the ill effect of the jolting and exposure of the fruit to the weather are evident. Every additional mile beyond a distance of 3 miles from the station over a good road is a handicap which the orchard

planter should avoid unless it is overbalanced by other important advantages. As roads are improved, the practical distance will increase.

Several of the State Experiment Stations, as well as the United States Department of Agriculture and the North Carolina Department of Agriculture, have published bulletins bearing on different phases of apple-orcharding, especially Maryland, Virginia, West Virginia, Tennessee, and South Carolina.

WM. A. TAYLOR.

### The apple in mid-continental or plains districts.

In that vast region of the interior of the United States which lies between the Great Lakes, Ohio, Kentucky, and Tennessee on the east and the Rocky Mountain states on the west, the Canadian boundary on the

in the valley of the Red River of the North and a rather narrow strip along the northeast boundary lies in the basin of the Great Lakes.

The larger part of this mid-continental district, as outlined, has an elevation of 500 feet to 2,000 feet above sea-level. The southwest point of Indiana, southern Illinois, southeastern Missouri, and eastern Arkansas have an elevation of less than 500 feet. The remainder of Indiana and Illinois, much of Missouri, and a portion of southern and eastern Iowa lie between 500 feet and 1,000 feet elevation. The range of elevation of 1,000 to 2,000 feet takes in the remaining parts of Iowa, most of Minnesota, and the eastern part of the Dakotas, Nebraska, Kansas, Oklahoma, and the Ozarks. The remainder lies to the west in the Great Plains Plateau at an elevation above 2,000 feet.

In the more northern and western districts of this region, there is little or no commercial orcharding.

Only in their more favored localities are apples produced at all, and the lists are restricted to the hardier varieties. This is because the recurring extremes of temperature and of drought make the environment unfavorable to the apple, at least during critical periods. But throughout the states of the corn-belt, the apple is very generally grown for home use and certain sections show a notable development of commercial orcharding (Figs. 274, 275). In fact, the most extensive individual apple orchards known are found in parts of Arkansas, Missouri, Kansas, and Illinois, some of them being several hundred acres in extent.

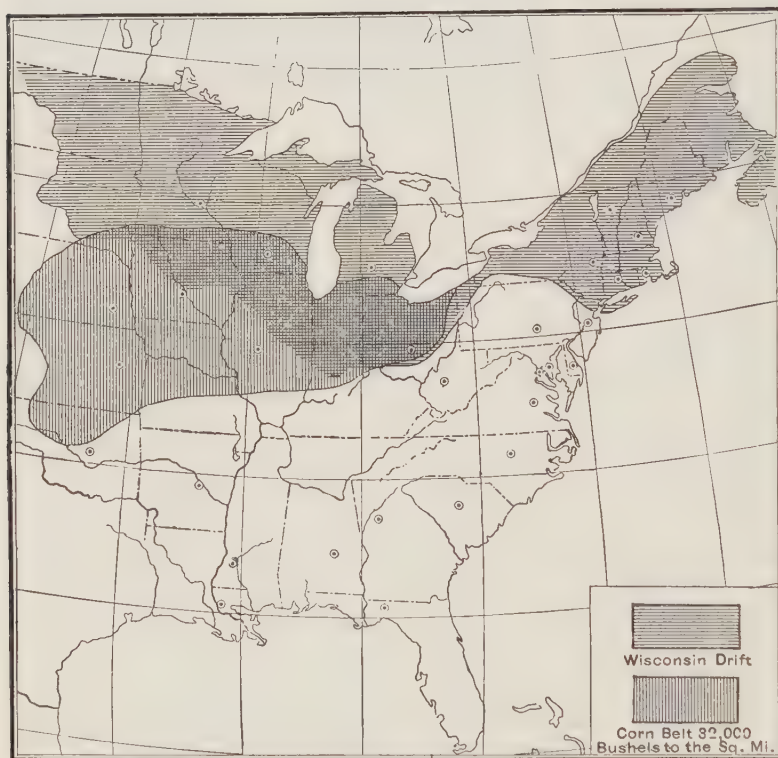
Orchards well located and rightly managed are proving to be profitable in different sections of the corn-belt states. With the rapid growth of the United States in population and wealth, must come a corresponding increase in the home-market demand for good apples at remunerative prices. This, with the improvement and extension of storage and transportation facilities and the contemporaneous expansion of our foreign trade, tends to make the outlook encouraging for the apple-growing industry in this region. The more general adoption

of up-to-date methods of marketing and of orchard management will help to put the industry on a more stable basis, and gradually to enlarge it and extend it.

### Rank in apple-production.

According to the United States census reports of 1910, approximately 40 per cent of the bearing apple trees of the United States is found in the territory above outlined, together with 33 per cent of the young trees not yet of bearing age. In the census year of 1909, it produced approximately one-fourth of the apple crop of the entire United States.

Following is a list based on United States census reports, which indicates something of the relative standing. For comparison they are also ranked as to their averages in apple-crop production for 1905, 1907, and 1909, combined on the basis of the crop reports published in the American Agriculturist Yearbook:



273. The mid-continental corn-belt, in which the apple is the leading fruit; and the Wisconsin drift, on which the Ben Davis family is not at its best.

north and the Gulf states on the south, the leading fruit is the apple. This mid-continental territory includes the greater part of that exceptionally rich agricultural region which has come to be known as the corn-belt of America. (Fig. 273.) It extends also into the northern wheat-belt of the Upper Mississippi Valley plains and into the wheat and livestock country of the Great Plains Plateau of Oklahoma, Kansas, Nebraska, and the Dakotas.

### Geography.

The topography may be indicated in a very general way by the statement that this region takes in the Upper Mississippi Valley plains, a large part of the Great Plains Plateau, and all of that more limited area known as the Ozark Plateau. Its great river valleys are those of the Ohio, Mississippi, Missouri, Arkansas, and Red. A limited area in Minnesota and the Dakotas lies



RANK OF MID-CONTINENTAL STATES IN YIELD OF APPLES. Fig. 274.

Name of State	1909		1899		1905-7-9 Rank based on combined averages
	Rank in United States	Yield in bushels	Rank in United States	Yield in bushels	
Missouri....	4	9,969,000	9	6,496,000	16
Iowa.....	6	6,747,000	18	3,129,000	19
Nebraska...	15	3,321,000	23	1,343,000	26
Illinois....	16	3,093,000	5	9,178,000	11
Indiana....	17	2,759,000	7	8,620,000	13
Arkansas...	20	2,296,000	20	2,811,000	21
Wisconsin...	21	2,232,000	33	303,000	27
Kansas....	27	1,356,000	16	3,214,000	25
Minnesota...	29	1,044,000	40	120,000	
Oklahoma...	32	742,000	41	111,000	
S. Dakota...	40	192,000		*	
N. Dakota...	47	4,000		*	

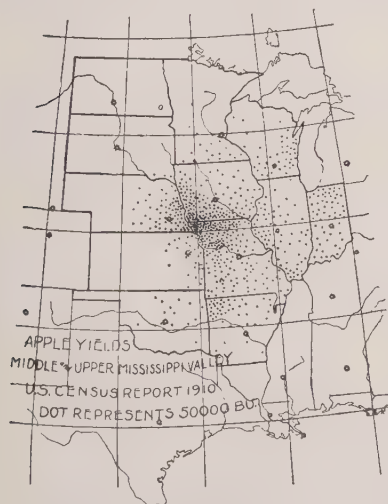
\*Record included with other states.

RANK OF MID-CONTINENTAL STATES IN NUMBER OF ORCHARD TREES IN CENSUS YEAR 1909. Fig. 275.

	Bearing Trees		Non-bearing Trees	
	Rank in United States	Number	Rank in United States	Number
Missouri.....	1	14,360,000	3	3,625,000
Illinois.....	3	9,901,000	7	2,548,000
Arkansas.....	6	7,650,000	2	3,940,000
Kansas.....	9	6,930,000	24	1,116,000
Iowa.....	10	5,847,000	17	1,914,000
Indiana.....	11	5,705,000	16	1,962,000
Oklahoma.....	18	2,956,000	14	2,060,000
Nebraska.....	19	2,937,000	27	967,000
Wisconsin.....	21	2,430,000	21	1,409,000
Minnesota.....	26	1,380,000	19	1,572,000
South Dakota...	41	275,000	34	461,000
North Dakota...	47	16,000	44	70,000

### Apple belts.

In comparing the great apple-growing regions of the continent it is convenient to designate each by its leading variety. In the eastern part of the continent, there is the Fameuse or Wealthy belt on the north, the Ben Davis belt on the south, and the Baldwin belt lying intermediate between these two. It is seen that varieties differ greatly as to their adaptability to different regions. The degree of soil aeration and of soil moisture and the range of atmospheric and soil temperatures are among the most important determining factors of the geographical range of commercial apple-growing with any variety.



274. Apple areas in the Mississippi Valley—Yields, 1909 crop.

Passing westward into the mid-continental region, it is found that the Baldwin belt does not extend west of Lake Michigan. The climatic extremes are here too severe for that variety and many of its eastern associates of a similar degree of hardness. In

all that vast territory which extends westward from the Great Lakes, these varieties disappear and do not again appear till the states of the Pacific Coast are reached. Instead, the Wealthy belt extends southward till it reaches the region where Wealthy yields leadership to Ben Davis. In this connection it is worthy of note that from the Atlantic Coast westward to the Missouri River the north margin of the Ben Davis belt approximately coincides with the southern boundary of the geological area covered by the Wisconsin drift. (Fig. 273.)

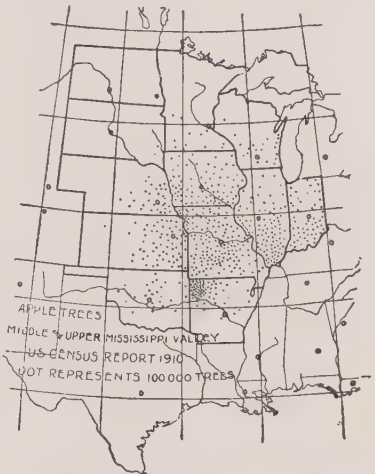
*Wealthy belt.*—The mid-continental territory in which Wealthy is, generally speaking, the leading variety, includes northern Illinois, the north half of Iowa, and practically all of the apple-growing districts of Wisconsin, Minnesota, South Dakota, and northern Nebraska. Among the more important varieties associated with it are, for the more northern parts, Oldenburg, Okabena, Patten (Patten Greening), and Malinda. Among the very hardiest of the large-size apples for the North are those of the Hiberna group, but their fruit is so austere that it is esteemed of little value except for culinary uses. In the southern part of the Wealthy belt are grown hardy varieties of more or less local value such as Salome, Windsor, Black Annette, and Colorado Orange, varieties which as yet have not established themselves in the great world markets but which are valued where better varieties cannot be satisfactorily grown.

*Ben Davis belt.*—Generally speaking, Ben Davis is the leading variety in central and southern Illinois, the south half of Iowa, and the apple-growing districts of Arkansas, Oklahoma, Missouri, Kansas, and the south half of Nebraska. With its close kin, the Gano and the Black Ben Davis, which evidently are highly-colored bud-sports of Ben Davis, it probably produces at least one-half of the commercial apple-crop in this region. Winesap and Jonathan appear to be next in order of importance, with Winesap perhaps in the lead. Other important varieties are Grimes, Rome Beauty, Willow (Twig), Missouri (Pippin), Minkler, and Ralls. York Imperial is gaining ground. Stayman Winesap is one of the newer kinds which will be more largely planted. Delicious, also, is attracting attention, particularly because of its agreeable dessert quality and good appearance. The Stayman and Delicious are being planted to some extent in the southern part of the Wealthy belt, as Jonathan and Grimes have been.

### Varieties.

The following varieties of apples are those most commonly grown in the prairies and plains regions:

Arkansas (Mammoth Black Twig).	Jonathan.	Salome.
Ben Davis.	Minkler.	Stayman.
Black Ben Davis.	Missouri.	Wealthy.
Gano.	Oldenburg.	Willow (Willow Twig).
Grimes Golden.	Ralls (Ralls Genet.	Winesap.
Ingram.	Geniton).	Yellow Transparent.
	Rome Beauty.	York (York Imperial).



275. Apple areas in the Mississippi Valley—Trees.

*Status of the apple industry in the mid-continental states.*

**Wisconsin.**—Apples are grown mostly in small plantings about homesteads. The crop is important chiefly in supplying the home and the local markets with summer and fall fruit. The varieties are those of the Wealthy belt.

**Minnesota.**—Apple-growing is chiefly confined to the southeastern quarter of the state, although crab-apples and the very hardiest apples are being planted in other sections. From Minneapolis southward to the Iowa line, many farm orchards are found and some commercial plantings. Heretofore, these have seldom produced enough fruit to supply the local demand at any time and then for a brief period only. However, apple-production is gradually increasing in the state and apple-planting is being slowly extended. It will doubtless assume greater proportions as late-keeping varieties are developed which are hardy and desirable.

**North Dakota.**—This state raises but very few apples or crab-apples and those only of the kinds most resistant to cold and drought. It ranks next to the bottom of the list in apple-production among the states of the Union.

**South Dakota.**—Apples are produced in very limited quantities and chiefly near the Missouri River in the southeast corner of the state and in the Black Hills district. The varieties are those of the northern section of the Wealthy belt. The recommended list of the State Horticultural Society includes: Northern District—first degree of hardiness—Hibernal, Oldenburg (Duchess); second degree of hardiness—Patten (Greening), Anisim, Wealthy. Southern District—in addition to the above—Northwestern Greening, Malinda, and, in favorable locations, Ben Davis. Planting increases slowly.

**Nebraska.**—Apples are grown in the eastern third of the state and under irrigation in some places farther west. It has some important commercial orchards, the majority of them being in the southeastern part of the state and within three counties of the Missouri River. The northern third of the state grows the varieties common to the Wealthy belt. In the southern two-thirds are grown the Ben Davis and its kin and also Winesap, Grimes, Arkansas or Mammoth Black Twig, Jonathan, Missouri (Pippin), Willow (Twig) and others of the Ben Davis associates. Planting is not active, but growers are beginning to take a more lively interest in modern methods of orchard management.

**Iowa.**—In the amount of crop produced, Iowa was ranked sixth in the Union by the 1910 census, but often it drops as low as the eighteenth or nineteenth place. The greater proportion of the crop is grown in home orchards and goes to supply home and local market demands, but in the aggregate there is a considerable number of commercial orchards. These are found in all parts of the state. They are sparsely scattered in the north and gradually increase in number to the southward, being most abundant in the south tier of counties. The most important commercial apple district includes the counties bordering the Missouri River in southwestern Iowa. Here Grimes and Jonathan of superior quality are grown. Northern Iowa grows the varieties of the Wealthy belt. The southern Iowa list is almost identical with that given for southeastern Nebraska. Planting is not active. Modern methods of management are being adopted by a few of the more progressive growers but most orchards suffer from neglect.

**Illinois.**—At present, Illinois takes second rank in apple-production among the mid-continental states, being surpassed by Missouri only. Northern Illinois, like Wisconsin, grows apples chiefly for home use and the varieties are those of the southern area of the Wealthy belt. Central and southern Illinois contain altogether many large commercial apple orchards. In

good-crop years, they produce in the aggregate large quantities of winter apples, including Ben Davis, Black Ben Davis, Gano, Arkansas or Mammoth Black Twig, Winesap, Jonathan, Grimes, Missouri, Willow, Ralls, and several other varieties commonly found in the Ben Davis belt. Winter injury and late spring freezes have often seriously diminished the general crop. Injurious insects together with blight, cankers, bitter-rot, blotch, scab and other diseases, have also caused great losses. Clean tillage and other up-to-date orchard methods would doubtless be more generally practised if crops were more reliable. Planting is not very active, although the number of trees of bearing age is gradually increasing.

**Missouri.**—The 1900 census gave Missouri ninth rank and the 1910 census gave it fourth rank in apple-production, but it often falls as low as the sixteenth place among the states of the Union. On the whole, it may be regarded as the leading apple state of the mid-continental region. Apples are very generally grown for home use and local market throughout Missouri, but the more important commercial apple districts are in the Ozark country of southwest Missouri and the loess soil region along the Missouri River in the northwest quarter of the state. The apple industry in Missouri has been retarded by troubles similar to those described for Illinois, but undoubted progress is being made in knowledge of the methods for holding them under control.

**Arkansas.**—The apple districts of Arkansas are mostly located in the northwest third of the state, particularly in the two northwest counties of Benton and Washington, which have from four to five million trees planted. There is also an undeveloped west-central region. The older plantings include about 90 per cent Ben Davis, Arkansas or Mammoth Black Twig, and Winesap. The later plantings are made up principally of Gano, Black Ben Davis, Jonathan, Grimes, Winesap, Stayman Winesap, with some Ingram, Collins, King David, and Delicious. Arkansas has enough apple trees of bearing age to produce a very large crop, but as in Missouri and Illinois, within recent years unfavorable climatic conditions with diseases and injurious insects have proved a rather serious handicap to the progress of the apple industry. Generally speaking, planting is not now being rapidly extended. The planting of thousands or even hundreds of acres under one management is fortunately no longer generally regarded with favor, and the trend is distinctly towards reducing the individual holdings to a size that is compatible with careful and thorough orchard management. The future will see a large development of commercial apple-growing in this region.

**Kansas.**—Northeastern Kansas from Topeka northward to the Nebraska line and northeastward to the Missouri River forms a part of an important apple-growing region which takes in southeastern Nebraska, southwestern Iowa, and northwestern Missouri. Here Jonathan and Grimes are grown to a high degree of perfection, together with Ben Davis, Gano, Winesap, and other varieties of the Ben Davis belt. There is another important apple district which is located in the Arkansas Valley from Hutchinson to the Oklahoma line. In recent years, this has taken the lead in crop-production in this state. The older Kansas orchards were largely of Ben Davis, Gano, and Missouri. The newer plantings have more of York Imperial, Jonathan and Grimes. Other varieties common to the Ben Davis belt are also found.

**Oklahoma and northwest Texas.**—In Oklahoma, the apple has not yet developed very large commercial importance. Planting is gradually increasing in the Red River section and also in west Texas where the altitude reaches 2,000 feet. Here Ben Davis, Missouri and Arkansas Black are among the most important commercial varieties.



*Establishing and managing the orchard on the prairies and plains. Fig. 276.*

**Preparation of land.**—The fundamental principles of proper preparation of soil for orchard planting in the mid-continental country are much the same as those that are set forth for other regions, although they may differ somewhat in relative importance. One of the first things to be considered is the matter of putting the soil in such condition that the entire root-system of the apple tree may withstand, without injury, any period when the soil is filled with water. Unfortunately, the importance of this is not generally nor fully realized, even among experienced orchardists. The principle that apple roots must have a constant supply of air in order to do their work should never be lost sight of. Stagnant water cuts off the supply of air to the roots and very quickly impairs the health of the root-system. Excepting on such soils as deep porous loess, or when the subsoil is of such a sandy or gravelly nature as to

It is well to grow grain or some cultivated crop on the land the season previous to planting the orchard. The land may then be fall-plowed to a good depth and disked in the spring, or it may be plowed in the spring and disked just before planting. North of the latitude of southern Iowa, spring planting is always to be preferred, while to the southward, orchards may be planted either in fall or spring. In the case of fall planting, two or three furrows should be turned towards the tree on each side of the row as a matter of protection from alternate thawing and freezing about the roots and to turn away surface water from the trunk.

In planting the tree it is essential that the first earth that is put in the hole should at once be tramped about the roots, and this process repeated as the hole is filled. Great care must be taken in this region to keep the trees from drying out in handling them while they are being transferred from nursery to orchard. Trees should be kept perfectly dormant till planted. Nursery stock should be neither accepted nor planted after its buds have started growth. Sometimes when such stock is transferred promptly from nursery to orchard on a rainy day, it may grow well, but as a rule it dies or makes but feeble growth.

Budded apple trees should not be planted in any part of the upper Mississippi Valley for the reason that when such trees are set in the orchard the point of union between the top and the seedling root comes at or near the surface of the ground, thus exposing the root to greater liability of suffering winter injury than when it is buried more deeply. By using a long cion grafted on a short piece-root, it is possible to produce a nursery tree that will permit of planting the seedling root deeply. During the history of apple-growing in the more northern parts of the mid-continental apple districts, it has repeatedly happened that when the harder cultivated varieties have been budded on some tender seedling roots, the roots have been winterkilled, while the top remained uninjured until it died from the lack of live roots to support it. In many cases when root-grafted trees of the very hardy varieties had sent out roots from the lower part of the cion, they were able to withstand the severest winters uninjured, while trees of the same kinds which were not thus established on their own roots died from winterkilling of the roots. Such experiences have led fruit-growers to demand root-grafted apple trees.

The methods of spraying now being followed by the more intelligent and progressive apple-growers of mid-continental America do not differ materially from those of the best growers east and west.

**Pruning.**—Pruning is, generally speaking, sadly neglected by the ordinary apple-grower. In recent years, the tendency of orchard practice in the Mississippi Valley has been towards the methods of heading and pruning apple trees which are most commonly practised in the intermountain and Pacific coast districts. Very high-headed trees are comparatively scarce except in old closely planted orchards in which the lower limbs have been lost by over-crowding. The trees are headed rather low, commonly at about 18 to 24 inches from the ground to the first limb. The leader is taken out at a height of 28 to 36 inches, leaving for the framework of the tree from three to five ascending main limbs which should be at least 6 inches apart. In regions where the trees are comparatively short-lived or with varieties that are not expected to live more than from twenty to thirty years, this is doubtless the best practice, but with longer-lived trees it is open to the very serious objection that when loaded with fruit or weighted with ice and snow these large limbs sometimes break at the trunk, leaving an injury which can never be healed, and as a result the whole tree goes down within a few years. On the other hand, trees that are trained with a central leader may lose very large branches and yet heal over such wounds and live



276. A ten-year-old Nebraska apple orchard.  
The trunks are protected from the sun by board jackets.

let the surplus water pass off readily, it may be laid down as a general principle that thorough tiling is fundamental to the highest degree of regular and abundant crop-production and longevity of the apple tree. On land where the general slope is sufficient to carry off the surface water and even on hillsides, tiling may be, and often is, essential to the best success. The lines of tile should be not less than 4 rods apart and in many cases 2 rods apart gives enough better results to more than repay the extra expense. Even in arid regions, progressive orchardists are learning that, under irrigation, in many places it becomes necessary to under-drain the land so as to prevent the seepage and waste-water from water-logging the soil and damaging the root-system of the trees.

**Humus.**—It is highly important that the orchard soils have an abundance of humus to begin with, and that the supply be continually kept up by the use of either green manures or barnyard manure or both. The humus not only puts the soil in a more fertile condition but increases its moisture-holding capacity and gives it greater ability to withstand drought. The necessity of promptly getting rid of surplus water in the soil has already been emphasized. It is equally important to conserve soil moisture so as to carry the tree unharmed through any periods of drought that may occur either in summer or winter. Generally speaking, this can best be done in the mid-continental regions by thorough tillage during the growing season, followed by the growing of cover-crops. In places where soils wash so badly that this practice cannot be followed, perhaps the next best way to develop the capacity of the soil to hold moisture is by the use of barnyard manure and the growing of clovers or other crops that can be mowed twice or more during the season and allowed to rot on the ground.

to old age in good condition. In training trees in this way, it is best to cut off the leader at the proper height when the tree is planted. This tends to force the growth of the branches which are needed to form the main framework of the tree. One of these branches may be allowed to grow in the center of the top so as to form a new leader.

Aside from shaping the tree so as to give it right mechanical framework for supporting heavy loads of fruit, it needs to be kept sufficiently open to permit light and air to reach the foliage throughout the top. This will favor the best development of abundant and strong fruit-buds and perfect fruit. It also leaves the top open so that all of its foliage and fruit may be readily sprayed. Thick, dense tops are to be avoided and trees should not be allowed to grow so close together as to crowd each other.

*Tillage.*—As before stated, the best system for general practice in conserving soil moisture and fertility is tillage throughout the growing season, till late July or early August, followed by a good cover-crop. The greatest care must be used not to bruise the trees when cultivating. In this interior climate, it often happens that such wounds do not readily heal and they may result in the loss of the tree within a very few years. If a wound happens to be made, the loose bark should be at once cut away and the exposed surface coated with a thick paint of pure white lead and raw linseed oil and kept thus protected till completely healed over.

*Mice and rabbits.*—For the last few years in the writer's experience, lime-sulfur sprayed on the trunks and low branches of the trees as soon as the leaves drop has prevented attacks of mice and rabbits. Use at same strength as indicated for the dormant season.

*Handling the crop.*—At the present writing, the apple crop of the mid-continental regions is marketed locally, either in bulk, open packages, or in barrels, or it is shipped in barrels or in bulk. Box-packing is practically unknown here. It is just beginning to be practised by a few scattering enterprising fruit-growers. It would extend more rapidly but for the fact that very few persons in this region know how to pack apples in boxes. The Iowa Experiment Station has taken the lead in introducing box-packing among the apple-growers of the interior by arranging for schools of instruction in apple box-packing in that state and assisting in introducing them into other states. The effect of this work is already shown in the rapidly growing local interest in improved methods of grading and packing apples for market.

The methods followed in barrel-packing and in handling apples in bulk do not differ materially from those which are prevalent in the eastern states. So also the handling of apples in cold storage follows the general lines of this business as practised by eastern growers and dealers, but the storage facilities are not yet developed as extensively as in eastern apple-growing sections, although many strictly up-to-date storage establishments are found.

*Fruit-growers' organizations.*—There are as yet comparatively few apple-growers' organizations in this mid-continental region. Generally speaking, these are organized along lines similar to those which characterize the fruit-growers' organizations of the Rocky Mountain and Pacific coast states, except that in no case are they yet combined in a fruit-growers' exchange. With the increase of intensive orcharding, it may reasonably be expected that apple-growers' organizations in this region will become more abundant and more thoroughly systematized.

*Orchard-heating.*—The recent advent of the practice of fighting late spring frosts by orchard-heating undoubtedly marks a new era in fruit-growing in the mid-continental regions. It reduces the hazards by bringing an heretofore uncertain factor under some degree of

control and thus puts the industry upon a more stable basis.

The amount of losses in this region during only the past decade from injury to orchard blossoms and fruits by late spring frosts and freezes aggregates an enormous sum, a considerable part of which doubtless might have been saved by proper orchard-heating. In the Iowa Horticultural Society Report for 1910, Laurence Greene estimates the amount of loss from frost injury to the apple crop of Iowa alone from 1905 to 1910 at \$5,000,000 to \$10,000,000. In some of the other states, the losses have been even greater.

The practice of orchard-heating for this region is in many respects still in the experimental stages, and much will need to be learned before all the details shall have been definitely worked out into the most efficient and economical practice. Nevertheless, it may now rightly be regarded as a good method of insurance against frost injury.

For detailed treatment, see *Orchard Protection*.

S. A. BEACH.

### Apple-growing in the western mountain states.

Accepting the common geographical grouping of the states, the mountain division embraces the states of Colorado, Idaho, Montana, New Mexico, Utah, Wyoming, Arizona and Nevada. According to the census report, these states produced in 1909 a little less than 4 per cent of the total apple crop of the United States, or 5,600,000 bushels. While New York alone produced four times this amount, and the New England states more than 19,000,000 bushels, these mountain states are competitors worth considering in commercial apple-growing. In 1910, these states reported only 40 per cent of their total acreage of apple orchards in bearing, while the New England states, as well as New York, reported about 80 per cent of their apple trees of bearing age.

#### *The mountain states.*

In the two years that have passed since these figures were gathered, at least five of the mountain states have greatly extended the plantings of apple orchards, and it is safe to say that in no group of states is the apple industry growing more rapidly. Of this group, Colorado stands first in production, Idaho second, Utah third, Montana fourth and New Mexico fifth. In total acreage planted to apple trees, Colorado ranks first, Idaho second and Montana third. Colorado has a substantial lead and promises to hold its place for some years to come. Comparing Utah and New Mexico, it would be unsafe to say which leads in total acreage of apple orchards. The same is true of Arizona, Nevada and Wyoming. The fruit-growing industry of the region has grown up in comparatively recent years and, with the exception of Arizona and Nevada, all states reported the larger per cent of the apple trees too young to bear in 1910. The status of the apple-growing industry in these states individually may be briefly summarized as follows:

*Colorado.*—In 1910, Colorado reported 1,688,000 apple trees of bearing age and 1,973,000 trees not bearing. In 1909 the state produced, according to census figures, 3,559,000 bushels of apples. The state's principal apple-growing sections are the Grand Valley (Mesa County); the North Fork Valley (Delta County); the Uncompahgre Valley (Montrose County); the Cañon City district (Fremont County); and a new and promising district embracing a large part of Montezuma County. The varieties most largely grown are Gano, Jonathan, Rome Beauty and Winesap. In the older orchards, there has been a considerable planting of Ben Davis, but many of these are now grafted to the better varieties. Little is done in the way of apple-growing without irrigation. Most of the orchard land



is found in comparatively narrow mountain valleys or upon the bench or mesa lands of these valleys.

*Idaho.*—In 1910, Idaho had 1,006,000 apple trees of bearing age and 1,540,000 trees not bearing. The state is credited with the production of 660,000 bushels of apples in 1909. The Snake River Valley is the principal apple-growing section. In the north of the state, the Clearwater Valley and the valleys of the Kootenai and Clarke's Fork of the Columbia afford additional possibilities for commercial apple-growing. The industry is growing rapidly, and it is probably safe to say that in 1913 the output of the state was double that of 1909. The principal varieties grown are Gano, Jonathan, Winesap and Rome Beauty, with Esopus and Yellow Newtown in the newer plantings. In the northern half of the state, the moisture supplied by natural rainfall is generally sufficient to mature the apple crop, while in the southern half of the state additional moisture must be supplied by irrigation.

*Montana.*—In 1910, Montana had 697,000 apple trees of bearing age and 1,308,000 trees not bearing. The estimates of the State Board of Horticulture placed the total acreage of apple orchards in Montana, in 1912, as 30,000 acres. The principal apple-growing sections are the Bitter Root Valley, the Flathead district, which embraces a portion of the valley above Flathead Lake and the land along the lake shore, the Clarke's Fork Valley (Carbon County) and the Yellowstone Valley (Yellowstone County); with newer plantings in the valley west of the junction of the Missoula and Flathead Rivers (Missoula and Saunders Counties) and in the Tobacco Plains and Kootenai Valleys in Lincoln County. With the exception of the greater portion of the Flathead districts, all are irrigated. The principal varieties grown are McIntosh, Wagener, Rome Beauty, Northern Spy and Wealthy. A few Gano, Jonathan and Delicious are being planted. The Transcendent Crab, largely planted in the older orchards and those just coming into bearing, is being little planted now, on account of its susceptibility to pear blight.

*New Mexico.*—The apple industry of this state is comparatively young. In 1910 there were 543,000 trees of bearing age and 914,000 trees not bearing. In 1909, the state produced 417,000 bushels of apples. The orchards are all under irrigation and are located in the Rio Grande Valley from north of Albuquerque to the Texas line, in the Roswell district in the Pecos Valley, and in the Farmington district (San Juan County), which may be said to be a continuation of the Montezuma district of Colorado. The varieties grown are Ben Davis, Gano, Arkansas Black, Winesap, Jonathan, White Pearmain and Rome Beauty. The apple industry is growing rapidly, especially in the Roswell and Farmington districts. The state bids fair to take third place in the mountain region.

*Utah.*—In 1910, Utah reported 517,000 trees of bearing age and 789,000 not bearing. In 1909 the total apple-production was 350,000 bushels. In the past ten years the state has not shown the growth in apple-production as has Colorado, Idaho, Montana and New Mexico; yet many new orchards are being planted in the Cache Valley (Cache County), Bear Valley (Iron County), Utah Valley (Utah County), and in the Ogden district. These are the leading apple-growing sections of the state. Gano and Jonathan are most widely planted, although Winesap, Rome Beauty and other standard winter varieties are grown in smaller quantities. The orchards are all irrigated.

*Arizona.*—Approximately 1,000 acres were in apple orchards in Arizona in 1910, about one-half being of bearing age. The climate over most of the state is too warm for the apple, and in the mountainous sections of the state where apples may be successfully grown, the areas which can be irrigated are very limited in extent. There is apparently little chance for development in commercial apple growing.

*Nevada.*—With a climate similar to that of Arizona, the apple industry has not flourished in Nevada. Latest census figures credit the state with little more than 1,000 acres of apple orchards. Limited areas located near the Sierra Nevada Mountains in the northwest part of the state are fairly well adapted to apple-culture. The rainfall is light and all orchards are irrigated. A number of the standard winter varieties are grown.

*Wyoming.*—The interest in apple-growing in Wyoming is confined principally to the development of the home orchard. The acreage planted is about equal to that of Arizona or Nevada, with a little more interest now manifest in the development of the industry. The varieties planted are Wealthy, McIntosh and Jonathan.

#### *General practices.*

Generally speaking, this whole region is arid, little being attempted in the way of apple-growing except with irrigation. The atmosphere is dry, and during the summer months there is an exceptionally large amount of sunshine. Especially in the mountain valleys, the days are warm and the nights cool. The entire region is more or less subject to untimely spring frosts. For this reason many of the best fruit sections of the region are found in narrow mountain valleys, protected more or less by cañon breezes, or upon the bench lands of broader valleys, where the air drainage is good. Within this region, however, we find many sections afforded this natural protection where the apple crop seldom fails.

*Soils.*—Within this group of states, apples are grown on a large variety of soils. The great majority of orchards have been planted upon virgin land, and as time goes on, we shall probably learn to consider soil-adaptation a more important factor in apple-growing. From the standpoint of ease of cultivation, ease of irrigation and the maintenance of soil fertility, the medium sandy loams are proving the most satisfactory apple soils.

*Tillage.*—The orchardists of the mountain states have from the beginning been exponents of clean culture. In many sections, however, they are now beginning to feel that this has been overdone, and in the present system of tillage, clean cultivation and cover-crops alternate. In some cases the orchard is well tilled during the early part of the season and seeded to field peas, vetch or other crop in midsummer. Another practice is to seed the orchard to clover, which is turned under after two seasons' growth. The orchard is then cultivated for one or two seasons and again planted to clover. Alfalfa has been used instead of the clover. Providing it is kept away from the trees and within reach of the turning plow, alfalfa is not objectionable in orchard lands free from stones. On rocky land it is difficult to kill the alfalfa out. In this arid region, some such system of tillage must be practised as a means of maintaining soil-fertility.

*Irrigation.*—The irrigation practice of the orchardists of these states is not unlike that of the other western states. Practically all water is applied by the furrow method, running shallow ditches close together in sandy soils and deep ditches farther apart in the heavy soils. The distances between ditches will vary from 2 to 6 or 8 feet. The old orchards receive from two to four applications during the growing season. The plan is to get the fruit up to size early in the season and then promote coloring by maintaining only a moderate moisture supply during the latter part of the summer. In sections where the winters are dry, both the old and young orchards receive one late fall irrigation. This is applied after the first frosts when there is no longer danger of starting new growth. The young orchards are well watered during the early part of the growing season. After midsummer, little water

is applied. Every effort is made to check the growth of the trees early, for when well matured they withstand severe freezing best.

*Pruning.*—The apple-growers of the mountain states are quite unanimous in their choice of the vase-form as the standard to be worked for in training apple trees. While the eastern grower many justly condemn such a system of training on account of limited fruiting area, the objection is without merit in this region where the tendency is for most varieties to overbear. In the first three or four years in the orchard, the young trees are severely headed-in each spring, the object being to get a stocky trunk with the first scaffold limb within 12 or 18 inches of the ground and three or four more spaced along the trunk at intervals of 6 inches. After these first three or four prunings, little heading-in is done until the trees begin to overbear. The trees are then cut back and thinned out sufficiently to induce annual bearing and the production of fruits of desirable sizes with the minimum amount of hand thinning. In the commercial fruit-growing sections, the fruit is systematically thinned. There is little occasion for summer pruning.

*Marketing.*—The bulk of the apple crop of these states is sold in standard apple-boxes, and much of the fruit is wrapped and packed in sizes in tier packs. As a rule, the fruit is marketed through coöperative fruit-growers' associations, some of the oldest and most successful associations in the United States being found in this region. The fruit is generally distributed in all eastern, southern and western markets where extra fancy boxed apples are in demand.

*Diseases and insects.*—The apple-growers of the mountain states are little troubled with fungous diseases. During the summer season the atmosphere is generally dry and the fungi apparently do not thrive. In some of the more humid sections of this region, especially in rainy summers, apple scab becomes a serious menace. It is easily controlled, however, with the lime-sulfur sprays. Over the entire region, pear blight has attacked some of the more susceptible varieties of apples. The planting of Alexander and Transcendent Crab has been discontinued on this account, and in some sections other varieties must be watched carefully and will probably be discarded eventually.

Of the apple orchard insects, the codlin-moth is easily the most important, and over almost the entire region up-to-date methods of control must be employed. Both the green and woolly aphids are ever-present enemies of the apple orchards, the first troubling young orchards especially. The San José scale has not as yet become a troublesome pest in the apple orchards of the greater part of the mountain region. The oyster-shell scale, the bud-moth and the green fruit-worm are of only local importance.

The majority or orchardists of this region are well equipped with modern power spraying machinery, and as a rule are well posted on spraying methods.

O. B. WHIPPLE.

### The apple in Oregon and Washington.

The states of Oregon and Washington are noted for their diversity of fruit conditions. Their soils range from the lightest loam to the heaviest adobe; their rainfall varies from 8 or 9 inches to over 100; their elevations extend from sea-level to the snow line. From the horticulture of each of these states, which is thoroughly described in this Cyclopaedia, the readers can get complete details concerning these special characteristics.

In Oregon apple-culture is largely confined to such valleys as the Rogue River, Umpqua, Willamette, Hood River, Freewater-Milton, and Grande Ronde, with certain developments along the coast, especially in such regions as Coos Bay.

In Washington the development is largely east of the Cascade Range in such inland districts as Wenatchee, Yakima, Walla Walla and Lewiston-Clarkston.

### General considerations.

Apple-culture on the Pacific Coast is characterized by the following:

*Communal development.*—In such valleys, for example, as the Hood River (Fig. 277) or Wenatchee, one finds that apple-growing is almost the sole industry, and large contiguous areas are devoted to apple-production alone. One sees the entire absence of diversity of agriculture in some districts. These orchards may occasionally be very large, although in the more highly developed regions the tendency is for small orchards very intensively developed.

*Intensive tillage.*—There is practically not a fruit-grower to be found on the Pacific Coast who is not a firm believer in tillage. In a few sections, the introduction of shade-crops is supplementing the former intensive tillage, but the almost universal practice is to till very intensively.

*Systematic spraying.*—Each orchard is given frequent sprayings, according to a specified program. There are very few orchards on the Pacific Coast that are not equipped with power sprayers, capable of maintaining 200 pounds of pressure. Pacific Coast apple-growers are thoroughly alive to the value of spraying for pests.



277. Apple orchard in Hood River valley.

*Methodical thinning.*—It would be very hard indeed to find any fruit districts in which the orchardists do not thin regularly. They would no sooner give up thinning than eating. It is thought by a great many growers that thinning pays a larger dividend on the investment than any other orchard practice.

*Skillful packing.*—The Pacific Coast has long been famous for the high-grade packing of its fruit products. Lively effort is made to educate the growers to be skillful fruit-packers, and rigid systems of inspection are maintained in order that the high grade of the pack may not be sacrificed.

*Spirit of coöperation.*—Almost every community is thoroughly organized. The spirit of coöperation has taken a firm hold with the people and its benefits are thoroughly realized. Not only have certain sections organized, but there is every indication at the present time that within the next few years apple interests of the entire Pacific Coast will be consolidated into a central selling agency.

*The personnel of the Pacific Coast fruit-growers* can be characterized by the large number of young men, especially college graduates, who are engaging in apple-culture. In Hood River alone there are in the neighborhood of one hundred and thirty college graduates from all parts of the country engaged in apple-growing and making it a life-work and study. There are also large numbers of retired business and professional men from various parts of the country. Such men, because of their enthusiasm, are anxious to adopt up-to-date methods in order to make very successful fruit-growers. They intend to specialize in making apple-growing a very serious business. It is not an uncom-







VIII. The York Imperial apple.



mon thing to find a man devoting his entire energy to the growing of two varieties of apples.

#### *Orchard management.*

Most of the orchardists practice annual spring plowing. In some of the lighter soils, disking takes the place of plowing, but the present tendency is to plow and harrow down the soil very thoroughly. With the heavy loams the plowing is generally followed by light harrowing, supplemented by the use of the clod-masher, corrugated roller or brillion. After the ground is placed in good condition, frequent cultivations are made. One of the best tools to use in such cases is the Kimball weeder; this stirs the soil and prevents drying or baking of the surface soil. Often as many as eighteen harrowings are given during the summer-time. By the middle of August or at such time as the young trees have made sufficient growth, cultivation ceases, but with the heavier-bearing orchards cultivation is generally continued up to the harvesting. With the lighter soils, such as many of the volcanic ash, after the ground has been plowed in the spring, the tendency is to compact the ground more by the use of subsoil packers or by dragging the ground with floats. Such soils tend to blow out constantly and it is only by these methods that the moisture can be retained in the surface soil.

*Irrigation.*—Irrigation becomes more and more a factor to the Pacific Coast apple-grower east of the Cascade Mountains where the rainfall is less than 15 inches. Irrigation is made to supplement tillage. The water is applied by the furrow or rill system, and as soon as possible after irrigation the ground is thoroughly harrowed and, after becoming smooth, is kept in good shape with smoothing harrows. Irrigation is practised more with trees fifteen years of age and up than with young trees.

The growers are finding out that an abundant supply of moisture either through intensive tillage or irrigation tends to make the trees produce larger crops, makes them annual bearers, increases the individual size of the specimens and tends to make the fruit more elongated and of a livelier, brighter color. In some cases too much moisture is used, resulting in soft, poorly colored fruit of poor shipping qualities.

*Fertilizers.*—At the present time no commercial fertilizers are being used. The growers, however, are taking hold of cover-crops very enthusiastically. Vetch becomes a principal crop,—the forage or Oregon vetch in the region where the climate is mild, and the hairy vetch where the climate is severe. The vetch is generally combined with rye, oats, or wheat, and is drilled in by the latter part of August, about forty pounds of vetch and ten pounds of rye being the common amount to use to the acre. Under normal conditions, from 2 to 3 feet of growth can be realized by early spring.

*Shade-crops.*—In the irrigated sections where the tendency to use shade-crops is becoming common, alfalfa and the clovers are the principal crops grown. There is a great difference in opinion among the growers whether alfalfa is a suitable crop to use as a shade-crop, clovers being more commonly used. Some growers practise growing clover for two years, cutting it and allowing it to mat on the ground; while other growers disk the clover under each year and allow it to reseed itself. The practice of growing shade-crops is yet so new that it will be a number of years before the growers unite on some practice, but a larger percentage of growers are resorting to shade-crops each year.

*Thinning.*—Nearly all varieties of apples are thinned very carefully. The thinning generally begins as soon as the drop is over, in some places before the drop takes place. The apples are thinned at various distances, according to varieties. The red apples are generally thinned one to a spur. With yellow apples, there is a

tendency to leave two specimens on certain spurs but to remove all the fruit from the remaining spurs. The growers think that when this method is followed there is a tendency to maintain the trees as annual bearers. The distances apart vary extremely. Winesaps are thinned from 8 to 10 inches apart, whereas the larger varieties of apples are thinned rather sparingly, as they often have a tendency to overgrow if thinned too vigorously.

*Pruning.*—Most growers practise annual pruning. The trees are started very low, the head being 9 to 18 inches from the ground. Most of the growers resort to what is known as the open, goblet or vase tree. In this tree, most of the branches issue from one point and the trees are kept open constantly by rigorous pruning. The growers think that more light is allowed to play around the fruit by such a system and that a better color is developed. During the first three years, the trees are cut back very rigorously each spring, but as they become older less heading-back is resorted to and more thinning-out is practised. Many of the growers are now leaning more to the modification of the center tree, growing what is known as the modified center tree, the leaders being allowed to grow for a few years and then being suppressed. This system gives a better distribution of the branches and makes a stronger tie, and it also gives a larger fruiting area. Some growers contend that varieties like the Yellow Newtown do better if trained as leaders.

There is much sentiment among the fruit-growers on the Pacific Coast in favor of summer pruning. In their enthusiasm, many of them are overdoing summer pruning. On the stronger loams certain varieties like Yellow Newtown are slow in coming into bearing, but on the lighter loams and higher altitudes come into bearing in three to five years. In such cases summer pruning is not resorted to.

*Pollination.*—Pollination has become a subject to which the Pacific Coast growers are paying a great deal of attention and the orchards are now being planted in oblong blocks of two to six rows of a variety. It is felt that where this is practised, a larger set of fruit is secured, that there is a greater uniformity in the crop and a tendency for increase in size of specimens. Formerly trees were planted in large blocks, but the heavy shedding of fruit has caused the growers to abandon this system and plant so that interpollination can take place.

*Frost-fighting.*—Frost-fighting is resorted to in many of the mountain valleys that are early and subject to damage from frosts. The most common method for controlling is smudging with oil in pots. The last few years many growers have been very successful in saving the crops under adverse conditions. See *Orchard Protection*.

*Spraying.*—Practically every grower has a spray calendar which he follows very carefully. Power outfits are used extensively and high pressure is maintained. In all the older orchards, high platforms are built on the spray outfits so the trees can be thoroughly covered with spray. The principal diseases are the mildew, found more in California and southern Oregon; apple scab; apple tree anthracnose, or black spot. These are about the only diseases that receive much attention. Of the insect pests, the codlin-moth and aphids are the most serious. The codlin-moth is distributed over the entire district with the exception of the coast regions, which are free from this insect pest. The green aphid attacks the young trees injuriously, and for the past two years the brown aphid has been of serious menace to the fruit. In some regions the brown aphid is now doing more damage than the codlin-moth. The scale insects, for the present time, receive very little attention, as they are so easily controlled. Occasionally the red-spider and borers give considerable trouble.

*Packing.*—The apples are all packed in boxes known as the Northwest Standard, 10½ x 11½ x 18 inches.

All the better grades of apples are wrapped in paper, and lithographs are placed on the boxes. The fruit is graded very carefully before packing. The present tendency is to use one size of box and pack the apples by what is known as the diagonal pack.

*Packing-houses.*—Very large and expensive packing-houses are being erected all over the Pacific Coast and enormous storage plants are being built at all the immediate shipping points. In most cases, the packing is very rigorously inspected. Most of the states have laws that require the grower to put on the box his name, the grade of fruit and the number of specimens in the package. Most associations require the packer to stamp his number on the box, so that in the case of any imperfections it can be easily traced.

*Marketing.*—The marketing of the fruit is done largely through associations. By coöperating, the growers have been able to improve constantly their pack and have also tended to distribute the fruit more widely. At the present time, the Pacific Coast is sending fruit to nearly all the leading ports of the world, and the effort is made to get a wider and wider distribution rather than to send it to a few distributing points like Chicago and New York, which was the system formerly followed.

The willingness of the people to organize, and the coöperative system, which is broadcast in the region, is a very important factor in successful apple-culture on the Pacific Coast.

C. I. LEWIS.

### The apple in California.

Although the apple was introduced into southern California by the Mission padres nearly a century before the American occupation, and although the Russians established an apple orchard in northern California more than a quarter of a century before the gold discovery, it was not fully demonstrated until about 1880 that the state can produce an apple of character and quality to entitle the region to standing among



278. A California apple orchard.

the commercial apple regions of the United States. California pioneers were accustomed to concede apple adaptations to Oregon and to claim none for themselves. This was chiefly due to the fact that early plantings were made in the mining districts of the lower foothills and on valley lands adjacent to routes of travel thereto from the port of San Francisco. Climatic conditions in such situations forced too early maturity of winter varieties, which impaired quality and keeping and, as main commercial desirability was vested in long-keeping, California was conceded to lack adaptations for the production of a good apple, and local supplies of the fruit were drawn for three decades from the orchards in western Oregon. Popular judgment was, however, reversed by the notable long-keeping of California apples shown at the New Orleans Fair in 1885, which is explained by the fact that the exhibits were

gathered from family orchards in the coast districts and in the high plateaus and mountain valleys where growing conditions are quite unlike those of the lower foothills and adjacent valleys. The conclusion from this demonstration was that when the right variety is planted in the right place, in California, superior fruit, both for local use and long shipment, may be secured. Since that time, California apples have been successfully sold in considerable quantities in England and on the continent of Europe, on the Atlantic Coast of America, in Australia and in Eastern Asia—as well as throughout the interior states of the Pacific Slope, in Canada and in Alaska. The uprise of a great apple industry in other states of the Pacific Slope has, however, recently excluded the California winter apple from large American areas in which it formerly sold freely, but California still retains in the same areas its market for summer and fall apples because mature fruit can be shipped before the same varieties ripen farther north or at greater elevations. Fig. 278 shows a representative California apple orchard.

### Summer apples.

It is now clear that there are two distinct branches of the apple industry of California, in which, first, effort is concentrated on the production of summer apples in what are known as early districts and, second, fall and winter apples in other districts where slower development is favored by prevalence of lower spring and summer temperatures. In the interior valleys and lower foothills, the forcing heat brings early varieties, like the Astrachans, quickly to notable size, crispness and flavor, and there is an ample demand for such fruit for shipment, providing it is sound and free from pests, some of which, however, are more aggressive than they are in cooler sections. Fall apples are successfully grown in the same districts but they also are profitable in the coast district, as is shown by the behavior of the Gravenstein in the Sebastopol section of Sonoma County where "Gravenstein shows" are annually held in August. Another instance of specialization is found in the commercial importance of the Yellow Bellflower in the Watsonville district, where it enters largely into the "Apple Annual"—a greater exhibition held the first week in October. In these typical fall-apple districts, the winter apples are also important, the Esopus (Spitzenberg) leading these varieties at Sebastopol and the Yellow Newtown at Watsonville. These facts emphasize the importance of certain varieties; for specialization is built upon varieties even more than upon the classes to which they belong.

### Winter apples.

The chief importance does, however, rest with the winter apple in California, in the same way, but perhaps not to such a degree, as in other apple-growing states and countries, and the chief investment and expectation are made upon that basis. Aside from the conditions cited, which make nearly exclusively for the summer and early fall varieties, the state has great capacity for the production of winter apples of the type for which the coast has become so famous during the last few years. Every county in the state has apple trees, but the requirements of a winter apple are fully met by two main divisions of the state, viz.: the smaller valleys close to the coast, in fact, in some cases, the coast flats, where the exposure is directly toward the cooling breezes of the ocean which produce a cool summer—a long, slow-growing season, which develops great beauty and high quality in a winter apple. Similar results are also produced by the climate found at an elevation of about 2,500 to 5,000 feet on the interior plateaus and in the mountain valleys. The coast district has developed a greater commercial apple industry than the mountains, because transportation facilities for shipment are vastly better; but as the state advances, the mountain



districts will be employed in this production much more largely than at present. The greatest apple district of the state now is the Pajaro Valley, including parts of Monterey and Santa Cruz Counties, centering at Watsonville, which shipped about 6,000 carloads of apples in 1912. The county next prominent in apple-growing is Sonoma; Santa Cruz and Sonoma Counties have about one-half of all the trees in the state, while many other counties have good apple orchards in less total acreage; in fact, from San Diego on the south to Siskiyou on the north, localities exist which afford the elevation or the coast exposures that favor the production of good winter apples, and planting is progressing in all these districts.

#### Extent.

The number of apple trees in California in 1913 is about 2,500,000, occupying, as nearly as can be calculated, 30,000 acres of land. The varieties of chief commercial importance, in order of ripening, are: White and Red Astrachan, Gravenstein, Yellow Bellflower, Yellow Newtown, Esopus, White Pearmain, Winesap and Rome Beauty. Many other winter varieties have been planted recently in different districts, but their relative importance cannot be predicted.

E. J. WICKSON.

**APRICOT.** *Rosaceæ*. A tree and fruit somewhat intermediate between the peach and the plum, grown largely in California and in special localities in the East.

The apricot tree is a round-headed grower, with dark, somewhat peach-like bark, and very broad or almost circular leaves. The fruit, which usually ripens in advance of both the peach and plum, is peach-like in shape and color, with a smoother skin, rich yellow flesh and large flat smooth stone. The flesh is commonly less juicy than that of the peach, and, as a rule, perhaps, of higher quality. The apricots are of three species, all probably native of China or Japan. (1) The common apricot of Europe and America is *Prunus Armeniaca*: fr. variable, but smooth at maturity, red or yellow, the sweet and firm flesh free, or very nearly so, from the large, smooth, flat stone: tree with a round, spreading top, and a reddish, cherry-like or peach-like bark: lvs. (Fig. 279, right) ovate or round-ovate, with a short point and sometimes a heart-shaped base, thin and bright green, smooth or very nearly so below, as are the gland-bearing stalks, the margins rather obtusely and mostly finely serrate: fls. pink-white and borne singly, sessile or very nearly so, preceding the lvs. (Fig. 280). The Russian apricot is a hardy but smaller-fruited race of this species. (2) The Japanese apricot, in Japan grown for flowers rather than for fruit, is *Prunus Mume*: fr. small, yellowish or greenish, the flesh rather hard and dry, and adhering tightly to the pitted stone: tree like the common apricot, but with a grayer or greener bark and duller foliage: lvs. grayish green, generally narrower (Fig. 279, left) and long-pointed, more or less hairy along



279. Apricot leaves.  
P. *Mume* on left;  
P. *Armeniaca* on right.

the veins below and on the shorter mostly glandless stalk, thick in texture and prominently netted beneath: fls. fragrant, borne singly or in 2's, and sessile (without stalks); more lately intro. into this country, chiefly under the name of Bungoume plum. (3) The third species is the purple or black apricot, *Prunus dasycarpa*, which is little cult.: fr. globular and somewhat plum-like, with a distinct st., pubescent or fuzzy even at maturity, dull dark purple, the sourish soft flesh clinging to the plum-like fuzzy stone: tree round-headed, with much the habit of the common apricot, with lvs. ovate and more or less tapering at both ends, thin, dull

green, on slender and pubescent, mostly glandless, stalks, finely appressed-serrate and hairy on the veins below: fls. large and plum-like, bluish, solitary or in 2's, on pubescent stalks  $\frac{1}{2}$  in. or more long, and appearing in advance of the leaves. See *Prunus* for related species. The apricot-plum, *Prunus Simoni*, is discussed under *Plum*. The plumcot is a hybrid of plum and apricot, accounted for under *Prunus*.

L. H. B.

**East of the Mississippi** the apricot is not grown commercially to great extent, although it is a popular fruit for the home orchard and garden. As a commercial crop, it does not seem to be increasing in favor. There are two important reasons for this: the loss of the fruit by spring frosts because of the very early season of bloom, and the great liability to curculio attack. Possibly the apricot has not yet been given a thorough test. Its value may be more appreciated and the difficulties of its culture lessened when the fruit has received greater study and attention.



280. Flowers of the apricot.

The apricot is as hardy as the peach and thrives in similar localities and under the same general cultivation and treatment, but demands very strong soil. The ideal land for this fruit seems to be one that is deep and dry, and loamy or gravelly in character. The rolling loamy lands that are well adapted to apples seem to be well suited to the apricot, if the exposure and location are correct. The apricot is particularly impatient of wet feet, and many of the failures are due to retentive subsoils. The kind of soil has an important bearing also on the stock to be used.

Particular attention should be given to the location and exposure of the apricot orchard. In the East the best results are secured if the plantation stands on elevated land near a large body of water, for there the spring frosts are not so serious as elsewhere. Generally a somewhat backward exposure, if it can be had, is desirable, to retard blooming. Apricots will be sure to fail in frosty localities.

The apricot should always be given clean culture. For the first two or three years, some hoed crop may be grown between the rows, but after that the trees should be allowed the entire land, particularly if set less than 20 feet apart. Tillage should be stopped late in summer or early in fall to allow the wood to mature thoroughly. It is best to raise a cover-crop in the latter part of July or in August to hasten this maturity and also to protect the roots and to improve the physical properties of the soil.

The trees are pruned in essentially the same way as plums. The fruit-buds are borne both on spurs (two are shown in Fig. 281) and also on the wood of the last season's growth on either side of the leaf-bud, as shown in the twin and triplet buds above *a* in Fig. 281. Each bud contains a single naked flower (Fig. 280). As the fruit begins to swell, the calyx-ring is forced off over the top (Fig. 282) and the injury from curculio may then be expected. The fruit is often borne so close together as to appear to be in clusters (Fig. 283).

When grown under the best conditions, the apricot may be considered to be nearly or quite as productive as the peach. Like other fruit trees, it bears in alternate years, unless the crops are very heavily thinned. It can never be recommended for general or indiscriminate planting. Only the best fruit-growers can succeed with it. Apricots are to be considered as a dessert or

fancy fruit, and therefore, should be neatly packed in small and tasty packages.

The varieties mostly in demand in the eastern states in order of preference are: Moorpark, Harris, Alexis, Montgamet, Budd, Early Golden, St. Ambroise, Alexander and Peach. The Royal and Superb are grown to some extent. Of the above-mentioned varieties, the

Harris, St. Ambroise, Montgamet, and Early Golden are early as regards season of ripening; the Peach and Moorpark are medium; the Alexander, Alexis and Budd are late. The Alexander, Alexis, Budd and some others belong to the Russian race. Fig. 284 shows a good-shaped apricot.

The apricot is propagated by budding or grafting the desired varieties on the peach or plum stock. On its own root the apricot seems to be less successful, probably because of the peculiar soil-requirements that it demands. The peach seems to give a better union and consequently a better stand, whereas the plum stock gives a tree that is harder, longer lived, and less subject to attacks of borers. Both Myrobalan and Domestica stocks are used, the preference being for the latter.

The most serious enemy of the apricot is the curculio, the same insect that attacks the fruits of plum and peach. This insect seems to have a particular fondness for the apricot, and as the fruit sets very early, the crop may be expected to be destroyed unless the most vigilant means are employed. The foliage of the apricot, as in the case of the peach, is especially sensitive to the arsenical sprays and therefore entomologists have hesitated to recommend paris green and arsenate of lead for the control of the curculio. The work of W. M. Scott and A. L. Quaintance, of the United States Department of Agriculture, has shown, however, that arsenate of lead in combination with self-boiled lime-sulfur is successful in controlling this pest on the peach. It is probable that the mixture will be equally successful in controlling the curculio on the apricot. They recommend the use of two pounds of arsenate of lead combined with fifty gallons of self-

boiled lime-sulfur applied as follows:

First application.—About the time the calyces, or shucks, are shedding from the young fruit.

Second application.—Two or three weeks later, or about one month after the falling of the petals.

Another method of control of this insect is by jarring the trees, in the same way as with plums and peaches, but the work must be even more thoroughly done than with those fruits. The jarring should begin as soon as the blossoms fall, and continue as long as the insects are numerous enough to do serious damage. It will usually be necessary to catch the insects for three to six weeks, two or three times a week, or perhaps even every day. The work must be performed early in the morning, while the curculio is indisposed to fly. The operation consists in knocking the insects from the tree by a quick jar or shake, catching them on a white sheet or in a canvas hopper. The catcher formerly used in western New York was a strong cloth hopper mounted on a wheelbarrow-like frame, and run on two wheels. The hopper converged into a tin box, into which the curculios rolled as they fell on the sheet. One man wheeled the device, by barrow-like handles, under the tree, then dropped the handles and jarred the tree; or

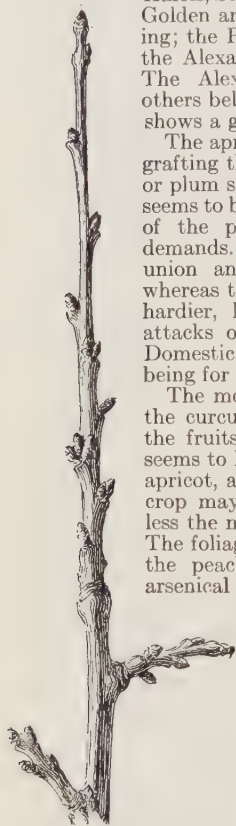
sometimes two men went with a machine one wheeling it and the other jarring the trees. If the work of spraying, as above recommended, is done thoroughly, it will probably not be necessary to use this jarring device in addition; and the device is now going out of use.

The apricot is often trained on walls, where the fruit reaches the highest perfection. Care should be taken that the wall does not face the east or the south, or the early-forced flowers may be caught by frost. An overhanging-cornice will aid greatly in protecting from frost.

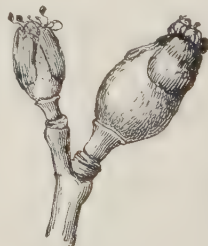
C. S. WILSON.†

The apricot in California is one of the leading commercial fruits. It was apparently introduced by the Mission Fathers, for Vancouver found it at the Santa Clara Mission in 1792. However, there is no relation between this early introduction and the expansion that quickly followed the American occupation, because the Mission Fathers had only seedling fruits, while the early American planters, shortly before the gold discovery, introduced the best French and English varieties, and were delighted to find that these sorts, usually given some protection in the Old World, grew with surprising thrift of tree and size of fruit in valley situations in California in the open air. Upon these facts the apricot rose to wide popularity. The acreage has steadily increased during the last fifty years, and with particularly swift rate during the last twenty years, until the number of trees reported in 1899 was about three millions, occupying upwards of forty thousand acres of land. Since then, however, the acreage has not increased, because the crop is irregular on account of frost injuries in some districts. The fruit is sold fresh, canned, dried and in crystallized forms, in all the regions of the United States, in England and on the Continent, where, by reason of its superior size and acceptable manner of curing, it has achieved notable popularity. The year 1905 was the greatest thus far in amount of dried product realized, viz., 36,000,000 pounds. The year 1911 was greatest in amount of canned product, which reached upwards of 758,325 cases, each containing two dozen 2½-pound cans. The shipment of fresh apricots out of California during the summer of 1910 was 290 carloads.

The chief part of the apricot crop of California is grown in the interior valleys. In the low places in these valleys, however, the fruit is liable to be injured and sometimes almost wholly destroyed by spring frosts, although the trees make excellent growth. In foothill situations adjacent to these valleys, there is also serious danger of frost above an elevation of about 1,500 feet above sea-level, and the tree is rarely planted for commercial purposes. In southern California the apricot succeeds both in the coast and interior valleys. But along the coast northward, excepting the very important producing regions of the Alameda and Santa Clara valleys, eastward, and southward from the Bay of San Francisco, the apricot is but little grown, owing to frost troubles. In respect to these, the apricot is somewhat less subject to harm than the almond, but it is less hardy than the peach, and has, therefore, a much narrower range of adaptation. The average date of the blooming of apricot varieties is about two weeks later than that of the almonds. The apricot is adapted to a wide range of soils, because to the rather heavy, moist loams which its own root tolerates, it adds the lighter tastes of the peach root, upon which it is very largely propagated. However, attempts to carry the apricot upon heavier, moister soils by working it upon the plum root have not been very successful, owing to the dwarf-



281. Fruit-buds of the apricot. Borne beside the leaf-bud, as on the peach, and also on spurs.



282. Young apricots shedding the ring.



ing of the tree; and the movement toward the light, dry loams, by working upon the almond root, has failed because the attachment is insecure, and the trees are very liable to be snapped off at the joining, even though they may attain bearing age before the mishap occurs. The apricot root itself is a favorite morsel with rodents, and is for that reason not largely used. The mainstay for the apricot, then, is the peach root, and the soils which this root enjoys in localities sufficiently frost-free are, therefore, to a great extent the measure of the apricot area.

Apricot trees are produced by budding on peach or apricot seedlings during their first summer's growth in the nursery row, from pits planted when the ground is moist and warm, at any time in the preceding winter. When there is a great demand for trees, planting in orchard is sometimes done with dormant buds, but ordinarily the trees are allowed to make one summer's growth in the nursery. The trees branch during the first year's growth from the bud, and usually come to the planter with a good choice of low-starting branches, from which to shape the low-headed tree which is universally preferred. The method of securing such a tree is identical with that already described for the almond, but the treatment of the tree after reaching bearing age, in its third year, is very different from the after-treatment of the almond. The apricot is a rampant grower and most profuse bearer. Unless kept continually in check it will quickly rush out of reach, and will destroy its low shoots and spurs by the dense shade of its thick, beautiful foliage. There is continually necessary, then, a certain degree of thinning of the surplus shoots and shortening of the new growth, to continue the system of low branching, to relieve the tree from an excess of bearing wood, and to avoid small fruit and exhaustion of the tree, resulting in alternate years of bearing. In the coast regions, where the tree makes moderate wood-growth, it can be kept in good form and bearing by regular winter pruning. In warmer regions, where the tendency is to exuberant wood-growth, the main pruning is done in the summer, immediately after the fruit is gathered. This has a tendency to check wood-growth and promote fruit-bearing, and where the main cutting is done in the summer, winter pruning is reduced to thinning out shoots, to prevent the tree from becoming too dense and to lessen the work of hand-thinning of the fruit later on. In addition, however, to the most intelligent pruning, much fruit must be removed by hand when there is a heavy set of it, in order to bring the fruit to a size satisfactory to shippers or canners, and to reach the highest grades, if drying is practised. California apricot orchards are all grown with clean tillage, for the main purpose of moisture conservation. In regions of good rainfall and sufficiently retentive loams no irrigation is required; good tillage will suffice for the production of large fruit and perfection of fruit-buds for the following year. As the trees are becoming older and bearing larger crops the demand for moisture increases, and the use of irrigation water is growing. In most places, however, one irrigation is sufficient, and that is given after fruit-gathering, to carry the tree through the last half of its season's work. In the regularly irrigated regions of the state, water is periodically applied through the growing season, in such amount and at such intervals as the local climate and soils require.

Although probably all the good varieties of the apricot in the world have been introduced into California in the last half-century, and scores of selected seedlings of local origin have been widely tested, the varieties that have survived the tests and are now widely grown

are comparatively few in number. Most of the rejected varieties met this fate because of shy bearing, and those which now constitute the bulk of the crop are very regular and full bearers, under rational treatment. A local seedling, the Pringle, was for many years chiefly grown for the earliest ripening, but this has recently been largely superseded by another local seedling, the New-castle, which is of superior size and about as early. The European varieties, Large Early and Early Golden, are fine in a few localities where they bear well, and do better in southern California than elsewhere. The universal favorite is the Royal; probably three-fourths of all the trees in the state are of this variety, though recently the area of the Blenheim has been increasing largely. The Hemskirk stands next to the Blenheim in popu-



283. A characteristic branch of apricot.  
( $\times \frac{1}{2}$ )

larity. The Peach is largely grown in the Sacramento Valley. The best apricot grown in California is the Moorpark; in size and lusciousness, when well ripened, it heads the list. It is, however, rather shy in bearing, and is forsaken for this fault in most regions. It shows the best behavior in the Santa Clara Valley, and is there retained, in spite of frequent lapses, because of the high prices which it commands at the canneries. About a dozen other varieties are carried in small number by the nurserymen to meet limited local demands.

Apricots for canning and drying are graded according to size: Extra, not less than  $2\frac{1}{4}$  inches in diameter; No. 1, 2 inches; No. 2,  $1\frac{1}{2}$  inches; No. 3, 1 inch. The first three grades must be sound, clean and free from blemish, and No. 3 must be of good merchantable quality. The shippers and canners require well-colored but only firm-ripe fruit, because both the long rail transportation and the canning process require it; soft-ripe fruit will neither can nor carry. For drying, riper fruit is used, and yet over-ripeness has to be guarded against to avoid too dark color. For canning, the fruit must be carefully hand-picked; for drying, much is shaken from the trees. The drying process consists in cutting

the fruit in halves longitudinally, dropping out the pits and placing the halves, cavity uppermost, upon light wooden trays. Breaking or tearing the fruit open will not do; it must show clean-cut edges. When the trays are covered they are placed in a tight compartment, usually called a "sulfur box," though it may be of considerable size, and the fruit is exposed to the fumes of slowly burning sulfur, to ensure its drying to the light golden color which is most acceptable to the trade. The production of the right color is the end in view, and different dryers regulate the amount of sulfur and the length of exposure according to the condition of their fruit and their judgment of what it needs. The exposure varies from half an hour to two or three hours, according to circumstances. After sulfuring, the trays are taken to open ground, and the fruit is cured in the sun. Only a very small fraction of the California product of evaporated apricots is cured in an evaporator. It requires about six pounds of fresh apricots to make one pound of cured fruit.



284. Good apricot fruits, one-half natural size.

A moderate estimate of the yield of apricots might be placed at seven and one-half tons to the acre; extreme yields are far away from this both ways.

The apricot is, as a rule, a very healthy tree in California. It is, however, subject to injury by scale insects of the lecanium group in some parts of the state. During recent years there has been increasing injury by a shot-hole fungus, which perforates the leaves and makes ugly pustules upon the fruit. Such fruit is unfit for canning except the fruit be peeled, which is little done as yet. It also makes low-grade dried product. This fungus can be repressed by fungicides of the copper class.

EDWARD J. WICKSON.

**AQUARIUM.** The aquarium as here understood is a glass tank for live fish, plants, and the like, for the dwelling-house or other suitable place.

The aquarium should be in a place where it may receive light, but direct sunlight is not necessary; and to keep an aquarium in a healthy condition, living plants in the water are absolutely necessary and plants will not thrive in dark rooms; neither will fish retain their bright coloring. The square or rectangular aquarium with open top affords a large breathing-space or air for the fish—which is another requisite, and the fish will be healthier and live longer than in a glass globe with small neck and orifice. Another and very important factor in the aquarium is sand and small pebbles. These should be washed clean of all soil before placing in the aquarium. About 2 inches over the bottom is sufficient. The plants should be planted before filling the aquarium with water. Figs. 285–287 show useful window aquaria.

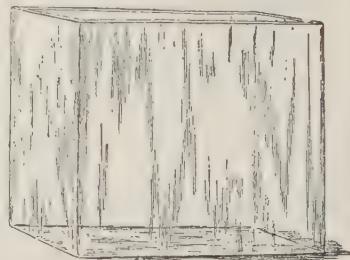
An aquarium, to be in a healthy condition, should contain living plants—oxygenators—which are as necessary as food, as fish must have good air. The aquarium must be kept clean. The sediment should be removed from the bottom with a dip tube twice a week, and the inner side of the glass cleaned with a wiper once a week. Encourage the growth of the plants at all seasons; admit plenty of light, but no direct sunshine. There should also be a few tadpoles and snails in the aquarium. These are very essential, as they are scavengers, and devour the confervoid growth that frequently accumulates on the plants. In fall, give a thorough cleaning and rearrangement of the aquarium, so that all are in the best condition possible before winter sets in. In March it should be carefully looked over, and undesirable plants removed or transplanted. Additions may be made or any change if necessary.

Following are some of the best plants to place in the aquarium, all of which can be easily and cheaply procured from dealers who make a specialty of aquatics: *Cabomba caroliniana* (commonly called Washington-grass or fish-grass) is one of the very best oxygenators and a most desirable plant for the aquarium and can usually be had in quantity at any season, except late in winter. It is usually sold in bunches, but after winter sets in, bunches of cabomba will not remain long in a healthy condition in the aquarium without care and attention. Plants to be of benefit in the aquarium must be living, and before these bunches of grass can emit roots and be self-sustaining, the fish too often nibble and disturb them to such a degree that, instead of being serviceable to the aquarium, they are a positive injury. *Elodea*, or *Anacharis* (water pest): there are two forms of this useful plant. *E. canadensis* is a very rapid grower and may be found in ponds in dense masses. When once established, it is a pest and hard to eradicate; but being of stem growth, it is not so readily grown in the aquarium. The giant form is a very desirable and valuable plant and can be used to good advantage, making a very interesting as well as a valuable plant in the aquarium. *Myriophyllum spicatum* somewhat resembles the cabomba, but is of a darker color and stronger in growth and texture. It is a hardy plant and will withstand the winters in the neighborhood of Philadelphia. When cabomba is unattainable, this may be had in good condition. It is also an excellent plant to use for fish spawn during the breeding season. This must not be confused with the *Myriophyllum proserpinacoides*, commonly called parrot's feather, as the latter is useless as an aquarium plant.

*Sagittaria natans* is a very pretty strap-leaf variety of sagittaria and useful for a small aquarium. But *S. sinensis*, the giant form, is the best of all sagittarias for the aquarium, and is indispensable. When planted in the aquarium and allowed to get well rooted before the fish are introduced, it can be relied upon to maintain the aquarium



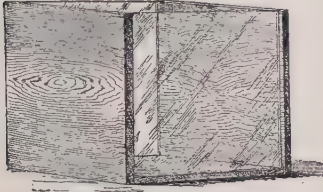
285. A museum-jar aquarium.



286. A rectangular glass aquarium.



in a healthy condition for several months. *Vallisneria spiralis* (eel-grass, tape-grass, wild celery) is a native plant inhabiting streams and rivers, and often used in the aquarium. Its long, narrow, strap-like blades or leaves are more flexible than the sagittaria and the tips float on the surface of the water. They are light green in color and of softer texture. It is a difficult plant to carry over winter, its natural propensity being to die down in winter, just the season when it is wanted in evidence in the aquarium. *Ludwigia Muletti* is one of



287. Permanent aquarium made of wood and glass.

the most conspicuous, ornamental and useful plants for the aquarium and is always in great demand. It is much larger and a stronger grower than *L. palustris* of the middle and northern states. It is a native of the southern states, whence come our supplies in winter in small quantities and for high prices, the plants very unsatisfactory at best. The difficulty is that plants, or rather sprays, plucked from growing plants and shipped North, receive a violent check in the change of temperature and the closely confined condition of the packing-case. The result often is that the plants or sprays lose a great part of their foliage, and when afterward subjected to cold running water are completely ruined. The only safe way is to secure stock during the summer or early fall, getting plants established in pots before preparing the aquarium for winter. In this condition, the plants will hold their own and winter over; but to attempt to grow southern stock in winter in our northern states is futile. There are a few other submerged plants that might be used, but the above-mentioned are the best and the best oxygenators for large or small aquariums. Floating plants should be used sparingly in the aquarium, an open, clean surface being most desirable and even necessary for air. Moreover, the majority of the floating plants are suitable only for summer culture. Another reason why surface or floating plants do not succeed in a house aquarium is that the water is deficient of plant-food suitable for such plants. Plants that die in an aquarium would, if transferred to a tub containing a quantity of soil, as well as water, make rapid and healthy growth. *Limncharis Humboldtii* (water poppy) is a plant often used in the aquarium. It is necessary to plant this in the sand in the same manner as other aquatic plants, although the leaves are floating, similar to the leaves of a pond-lily. *Eichhornia crassipes major* (water hyacinth) is a very desirable plant for catching the fish spawn, but under ordinary conditions lasts but a few days in the aquarium. Miniature plants of these are very pretty, and fish are very fond of nibbling at the roots to the detriment of the plants. These, with many other plants, are best adapted for the summer aquaria where they can enjoy the benefit of sunlight and open air.

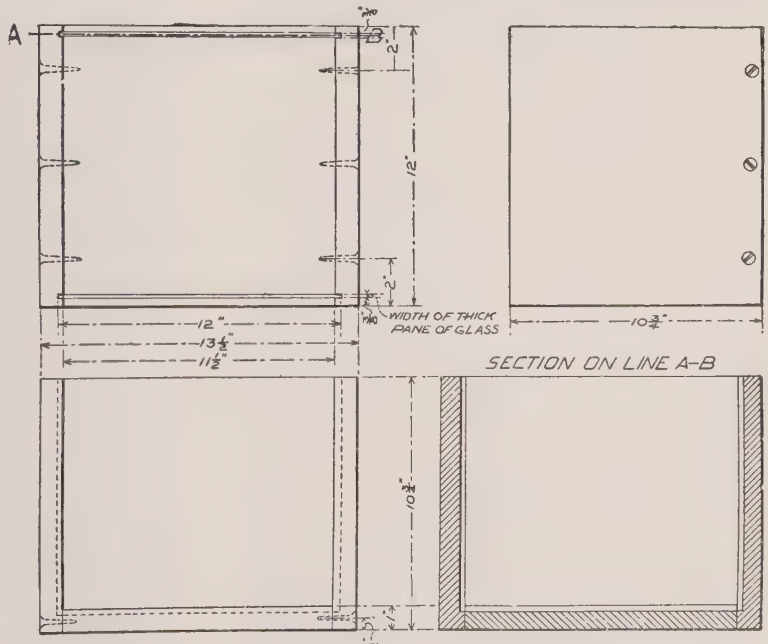
Numerous free-floating plants are adapted to the aquarium, but too many must not be in evidence, or the fish may become suffocated. The azollas are very pretty, and the fish

will occasionally eat the plants. The salvinia is another small plant often seen in the aquarium, but under favorable conditions it grows very rapidly, and forms a complete mat, which must be avoided. The European and American frog's-bits (*Lemnium Spongia*, *Hydrocharis Morsus-ranae*) are very attractive plants, their long, silky roots reaching down in the water.

In summer the plants and fish should be placed out-of-doors in a fountain basin, pool, or a tub sunken in the ground in a partially shaded place; and a fresh aquarium should be stocked in the fall.

Aquariums are rapidly increasing in popularity for home use, and are of great service in nature-study. A permanent aquarium need not be an expensive affair. The rectangular ones are best if large fishes are to be kept, but they are not essential. A simple home-made aquarium of glass and wood (Fig. 287) is described in Jackman's "Nature Study," as follows (the dimensions being slightly altered): "Use an inch board  $11\frac{1}{2}$  inches wide and 12 inches long for the bottom, and two boards of the same thickness and length,  $10\frac{3}{4}$  inches high, for the ends. Three-eighths of an inch from the edge on either side, with a saw, make a groove  $\frac{1}{4}$  inch deep and wide enough to receive loosely double-strength glass. Groove the end boards and fasten them to the bottom with screws, so that the grooves will exactly match. Partially fill the grooves with soft putty, or, better, aquarium cement, and press into each side a pane of glass. By making the bottom board  $11\frac{1}{2}$  inches long, an ordinary 10 x 12 window pane will be the proper size. When the glass is pressed to the bottom of the groove, draw the two ends in at the top until the glass is held firmly and then fasten them in place by narrow strips of wood, one on each side of the tank, placed on top of the glass and screwed to the end pieces. These strips also protect the hands from injury while working with the specimens in the aquarium. Before filling with water, the inner surface of the bottom and ends should be well rubbed with oil or paraffin and the grooves inside the glass well packed with putty." After the box is made it would be well to let it stand in water for a day or two. The wooden sides will swell and tighten the joints, and leakage will be less probable.

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288. Working drawings for making box shown in Fig. 287.

**AQUATICS.** A term applied to plants suited to cultivation only in water, particularly to those grown in ponds and tanks.

North America is the most highly favored country in the world for the cultivation of aquatic plants. Collections can easily be made to furnish a display of flowers from April to October in the open without artificial heat. There are numerous aquatic plants other than nymphaeas, nelumbiums and victorias. Some very desirable plants are *Acorus japonica variegata* (variegated sweet flag), *Aponogeton distachyus* (Cape pond-



289. Lawn pond of aquatics, with mason-work margin.

weed, or water hawthorn), *Caltha palustris* and *C. palustris* fr. pl. (marsh marigolds), *Cyperus Papyrus* (Egyptian paper plant), *limnanthemum* in variety. Some of the bog or marsh plants may be used in margins, as many varieties of sagittaria, not omitting the common cat-tail, *Typha latifolia*, the hibiscus of mammoth proportion, and the beautiful new hybrids with gorgeous flowers of all shades from pink to scarlet and crimson. See *Bog-gardening*. Figs. 289 and 290 show formal and informal lawn ponds.

**Soil.**—All aquatics require a rich soil, and this without limit, a depth of water from 1 to 3 feet, and ample space to spread their succulent leaves. In a natural pond, in which there is an accumulation of humus overlying a clayey subsoil, nothing more is wanted, but on a sandy or gravelly bottom it is necessary to place a layer of rich earth 12 to 18 inches deep. In artificial ponds, built of masonry (Fig. 289), a layer of rich soil is necessary if the things are to be planted out, as is best for nelumbiums. The soil best suited for aquatics is a turfy loam, inclining to heavy, and thoroughly rotted cow-manure, two parts of the former to one of the latter, and, when possible, it should be composted some time before using, and turned over two or three times to thoroughly incorporate the manure. When cow-manure can not be obtained, other thoroughly rotted manure may be used. The next best fertilizer is pulverized sheep-manure, but this, being less bulky and stronger in proportion, should not be used so freely as other manures; one part sheep-manure to nine of soil is sufficient. Chemical manures, ground bone, horn shavings, and the like should not be used unless in extreme cases, and then very cautiously. Tankage may be used to good advantage. It contains dried blood, and ground bone. It is very desirable for permanent beds or soils that may continue two or more seasons without renewing. The bone is not readily dissolved and has a lasting quality. Blood, being soluble, has immediate effect and is a valuable fertilizer, if used sparingly.

**Depth of water.**—In natural ponds, water-lilies are found growing in water from a few inches to 4 and 6 feet deep, but in artificial ponds a depth of 12 to 18 inches will be found sufficient for most nymphaeas, and 18 to 24 inches is a good depth for victorias. In constructing an artificial pond, a depth of 2 to 2½ feet is ample. Water to the depth of 12 inches above the crowns of the plants is sufficient, and a box containing the soil may be 12 inches deep. Thus a pond 2 feet in depth is deep enough, and will allow a man, with hip

boots on, to walk between the plants with ease. For a small pond, less than 12 feet over, a plank laid across will suffice for all operations.

**Protection.**—Where severe frosts are prevalent in winter, and ice 12 to 18 inches in thickness is found, there will be danger of the roots freezing. In such cases, an additional depth of 6 inches will be a great advantage, and a protection of bracken, salt hay, green manure, leaves, or any other non-conducting materials should be used to protect the masonry, in severe weather, against expansion and breakage. To protect tubs, small pools or ponds, cover with boards and pile on dry leaves to the depth of 8 or 12 inches, then salt hay or fresh stable-manure to keep the leaves from blowing away. This is one of the best means of protection against freezing. The general use of concrete work instead of brick and stone is to be commended. Reinforcement makes the walls frost-proof and water-proof.

**Planting.**—All hardy nymphaeas may be planted any time between the 1st of April and the 1st of September. Those planted early, other things being equal, will give good results the same season, while those planted late will get well established before winter, and will be in excellent condition to start at nature's summons early the following spring. The hardy nymphaeas differ considerably as to rootstocks. Those of the native species are long and of a spongy, soft texture, and rambling in growth, while the European species have a much larger and very firm rootstock, and grow more compact. In planting, all that is necessary is to press the rootstock firmly into the soil, and if there is any danger of the root rising to the surface, place a brick or any weight upon it, to keep it in position until anchored by its own roots. Tender nymphaeas should not be planted until the latter end of May or beginning of June, according to location. They should not be planted out before coleus, alternanthera, and other tender bedding plants. They require to be started indoors, and will be grown in pots, which are much handier to plant than roots of the hardy varieties, and can be planted under the water with ease and facility. Nelumbiums should not be planted until about the 1st of May. Southward the season is earlier. The existing conditions should be such that tubers shall start at once into active growth.



290. A lawn pond.



They should be already "started" before setting out. The tubers should be laid horizontally in a slightly excavated trench and covered with 2 or 3 inches of soil, using a weight, if necessary, to keep the tubers in position. Plants established in pots or pans are very convenient for planting, and may be purchased when tubers can no longer be procured, and can be planted a month later in the season with good results.

The *Victoria regia* has always been an aristocrat among water-lilies, and few cultivators could indulge in such a horticultural luxury. To grow it satisfactorily, a large surface space with a greater depth of water is necessary than for other aquatics, and a higher temperature is needed at the early stages. It can be cultivated in the open air, but artificial heat must usually be applied and protection afforded, so as to maintain a temperature of 85° F. In 1898 the introducer of *V. Trickeri* brought the Victoria within easy reach and culture of all lovers of aquatic plants. *V. Trickeri* is entirely distinct from other known varieties and can be grown in the open alongside of *Nymphaea zanzibariensis* and *N. devoniensis*, and under precisely the same conditions. When planted out about the middle of June, the plants grow rapidly, and will develop their gigantic leafage and magnificent flowers in August, and continue to do so until destroyed by frost. *V. Trickeri* is none other than *V. Cruziana*, which was never introduced into cultivation until 1898. All that existed outside of its native haunts, on the Parana River, South America, was an herbarium specimen of part of a leaf. It is now generally and extensively grown throughout the United States and in Europe where aquatics are cultivated.

**Enemies.**—Aquatics, like other plants, have their enemies in the way of insect pests, although in a less degree than most plants. Aphides are sometimes troublesome, or at least very unsightly. These, however, have their enemies, especially the coccinella (lady-bird), insectivorous birds, and so on. When these do not keep them down, a weak application of kerosene emulsion will make a clearance. Another method of getting rid of these pests, especially in a small artificial pond, where an overflow is (or should be) provided, is to take the hose with a spray, using a little force, and drive the insects off the plants, and, as they readily float on the water, the action with the hose will drive them out at the overflow pipe. Recently an insect pest that has its home in Florida has migrated northward, causing some annoyance. The larva of the moth *Hydrocampa proprialis* eats the leaf, and also cuts out pieces of the same, which it uses for protection, thereby greatly disfiguring the plant, and at the same time making it difficult to get at the enemy. The best remedy for this and the nelumbium moth, which is very much like it, is a lamp trap. Any ordinary lamp placed near the plants at night, and standing in a shallow vessel containing kerosene, will attract the insects, which, on striking the lamp, fall into the kerosene and are no further trouble. For other insects, such as leaf-miners and those which eat the leaves of plants, the best remedy is arsenate of lead. Muskrats are more or less troublesome, especially where nelumbiums are grown. They will eat the tubers in winter and early spring, and will make sad havoc with banks. They will also eat the roots of some nymphaeas. The best remedy for these is the steel trap. A sporadic disease has also made its appearance. The leaves are affected with spots, which, under a damp, warm atmosphere, spread rapidly. Such climatic conditions, followed by bright sunshine, cause the affected leaves to shrivel up. This greatly weakens and checks the plants. This disease yields readily to a weak solution of bordeaux mixture. The same remedy is also very valuable in ridding the pond of all confervoid growth.

*Tub culture* should be resorted to only from lack of space, or when no other method can be adopted (Fig. 291). For this system of culture, nymphaeas should be

chosen that are moderate growers, yet free-flowering, and other miscellaneous aquatic plants. The tubs should hold from 4 to 12 cubic feet of soil for nymphaeas, according to the variety, some being moderate growers, others vigorous and robust. The tubs may remain above ground or sunken. If sunken during the warm weather, the roots are kept cooler, and this is desirable, especially if hardy kinds are grown. A great improvement over tubs is a concrete pool 4 or 5 feet in diameter made in the shape of a tub, and 2 feet deep. A circular form 4 or more feet in diameter should be made and the ground then excavated 8 inches larger than the form. This will allow a wall of concrete 4 inches thick. Wire netting should be used for reinforcing, arranged so as to be in the middle of the wall. Use a mixture of sand,



291. Tub of water-lilies.

gravel or cinders in the following proportion: two bags of Portland cement, three wheelbarrows of sand, five wheelbarrows of gravel or finely broken stone or cinders and lime equal to one-fourth of cement. This must be thoroughly mixed before using. After the second day, remove the form and lay the bottom with the same material 4 to 6 inches thick. This will make a strong, durable, water-tight pool and at a very moderate cost.

WILLIAM TRICKER.

[The standard book on the American culture of aquatics is "The Water Garden," by Wm. Tricker, N. Y., 1897, pp. 120, to which the reader is referred for extensive cultural directions and for lists of aquatic plants. For botanical descriptions of the various kinds of aquatics, with brief, special cultural directions, the reader may consult the articles in this Cyclopaedia, under the various genera, as *Nelumbium*, *Nymphaea*, and *Victoria*.—L. H. B.]

**AQUILEGIA** (from *aquilegus*, water-drawer, not from *aquila*, eagle). *Ranunculaceae*. COLUMBINE. Hardy perennial herbs of the northern hemisphere; grown for their profusion of showy flowers in early summer, and the delicate foliage later on in the year. See page 3565.

Mostly with paniculate branches, terminated by showy fls., and 1-3 ternately-compound lvs., commonly glaucous: the lfts. roundish and obtusely lobed: fls. large, showy, usually in spring or early summer; sepals 5, regular, petaloid; petals concave, produced backward between the sepals, forming a hollow spur; stamens numerous: fr. of about 5 many-seeded follicles.—About 30 distinct species. J. G. Baker, A Synopsis of the Aquilegia, in G.C. II. 10:19, 76, 111, 203 (1878).

The columbines are among the most beautiful and popular of all hardy plants. The tall and strong-growing

species can be used to advantage in half-shady positions. The attractive forms and rich variations in hue of aquilegias come out well when associated with hemerocallis, Siberian irises, thalictrums, polygonatum, *Spiraea Filipendula* and wild ferns. In the North, a similar effect is produced by grouping columbines together with white and blue *Lupinus polyphyllus*, *Campanula persicifolia*, *Iris germanica* and *I. pallida* var. *dalmatica*, Iceland poppies and trollius. For rockeries, the low-growing early alpine species, such as *A. alpina*, *A. Stuartii* and *A. flabellata* are well adapted. Throughout the middle and northern states, columbines need winter protection, dry leaves being preferable for covering.

Seeds sown in pans, in coldframes in March, or open air in April, occasionally bloom the first season, but generally the second. The different species should be some distance apart, if possible, if pure seed is desired, as the most diverse species hybridize directly. They may be propagated by division of the roots in late fall, winter or early spring, but the better way is by seeds. Absolutely pure seed is hard to obtain except from the plants in the wild state; and some of the mixed forms are quite inferior to the true species from which they have come. *A. cærulea*, *A. glandulosa*, and *A. vulgaris* are likely to flower only two or three years, and should be treated as biennials; but *A. vulgaris* may be kept active for a longer period by transplanting.

A light sandy soil, moist, with good drainage, sheltered, but exposed to sun, is what aquilegias prefer. Some of the stronger species, when of nearly full flowering size, may be transplanted into heavier garden soil, even heavy clay, and made to succeed; but for the rearing of young seedlings, a light, sandy loam is essential. The seed of most columbines is rather slow in germinating, and it is necessary to keep the soil moist on top of the ground until the young plants are up. A coldframe, with medium heavy cotton covering, is a good place to grow the plants. The cotton retains sufficient moisture to keep the soil moist on top, and still admits sufficient circulation of air to prevent damping-off of the young seedlings. When large enough, the seedlings may be pricked out into another frame for a time, or, by shading for a few days until they get a start, they may be set into the permanent border, or wherever they are to be placed. (F. H. Horsford.)

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A. *Sepals not more than 1/2 or 3/4 in. long: expanded fls. 1 or 1 1/2 in. diam.*

B. *Limb of petal shorter than the sepal.*

1. *Jonesii*, Parry. True st. very short or almost wanting, soft-pubescent: tufted root-lvs. 1-2 in. high from the stout, ascending branches of the rootstock, biternately divided; partial-petioles very short or none; lfts. very crowded: fls. blue; sepals oblong-obtuse, equaling the spurs, and twice the length of the petal-limbs and head of stamens: foliicles glabrous, large, nearly 1 in. long; styles half as long; peduncles lengthening to about 3 in. in fr. July. Wyoming and Montana. G.F. 9:365.

2. *oxysépala*, Traut. & Mey. Plant 2 1/2 ft., slightly pubescent above: radical lvs. long-petioled, secondary divisions sessile: sepals blue, ovate-lanceolate, much exceeding in length the petal-limbs, which are 6 lines long, white, rounded-truncate; stamens not protruding beyond the petal-limb; spur knobbed, bent inward, shorter than petal-limb: foliicles pubescent, with styles their own length. June. Siberia.—Said to be one of the first to bloom, and one of the most attractive in the list. It is one of the most dwarfed; fls. large blue, yellow and white; it comes so much before the others that its pistils, as a rule, all fertilize before any of the other species come into flower." Only recently intro. to cult.

3. *lactiflora*, Kar. & Kir. St. 1 1/2 ft. high, glabrous



292 *Aquilegia canadensis*.

root-lvs. 1-2 in. long; lfts. sessile or the end one shortly stalked, lobes rather narrow and deep; lower st.-lvs. petioled, biternate: sepals oblong, obtuse, ascending, greenish, equaling the broad, greenish petal-limb, but not reaching the head of stamens; spur straight, slender, 1/2 in. long, not knobbed: pubescent foliicles as short as their styles. Summer. E. Siberia.—Not so much used as the following variety:

Var. *atropurpurea*, Vilm. (*A. atropurpurea*, Willd.). Limbs of the petals deep blue or lilac-purple, and the sepals and spur somewhat tinged with the same hue. B.R. 922.

5. *canadensis*, Linn. COMMON COLUMBINE of Amer Figs. 292, 293. Height 1-2 ft.: primary divisions of petioles of root-lvs. 1-2 in., having 3 divisions; 2 or 3 of the st.-lvs. petioled, biternate: fls. several to a st.; sepals yellowish or tinted on the back with red, about 1/2 in. long, not reflexing; limb of petals a little shorter, yellowish, truncate; spur 3/4 in. long, nearly straight, knobbed at the end, bright red throughout; stamens much protruding: foliicles 3/4 in. long, with styles half as long. May-July. Stony banks, east of Rocky Mountains. Introduced 1890. B.M. 246. L.B.C. 8: 888. Mn. 5:21. R.H. 1896, p. 109. F.W. 1878:33.—There are some beautiful hybrids of this and the blue

in the lower part: partial-petioles of root-lvs. 1 1/2-2 in. long; lfts. sessile or short-stalked, 1 in. long, many lobes reaching half way down; st.-lvs. petioled and compound: fls. about 3 to a st.; sepals nearly white or tinged with blue, over 1/2 in. long, narrow; petal-limb half as long as sepal; spur 1/2 in., slender, nearly straight, not knobbed at tip; stamens equal in length to the limb. June. Altai Mts., Siberia.—A desirable species, but not much planted.

BB. *Limb of petal about equal to sepal.*

4. *viridiflora*, Pallas. St. 1-1 1/2 ft. high, finely pubescent throughout, several-fld.: the partial-petioles of



species. Var. *nana*, Hort. Plant 1 ft. high or less: fls. like the type.

Var. *flavescens*, Hook. A pale-ld. yellow-fl. variety. Very pretty. Intro. 1889. This has often been called *A. flavescens*, Wats.; *A. cærulea* var. *flavescens*, Lawson; *A. flaviflora*, Tenney; *A. canadensis* var. *flaviflora*, Brit. B.M. 6552 B.



293. Radical leaves of *Aquilegia canadensis*.

$\frac{3}{4}$  in. long, style half as long. Early. Japan.—Brought from St. Petersburg, 1892.

AA. Sepals about 1 in. long: expanded fl. about 2 in. diam.

B. Spurs shorter than the petal-limb, and incurved.

7. *flabellata*, Sieb. & Zucc. St. 1–1½ ft., few-fl.: partial-petioles of root-lvs. 1 in. or more, lfts. nearly sessile; st.-lvs. large and petioled: fls. bright lilac, or pale purple or white; sepals 1 in. long, obtuse; limb of petal half as long, often white in the lilac-fl. form; spur shorter than the limb, slender toward the end, much incurved; stamens not protruding beyond the petal-limbs: follicles glabrous. Summer. Japan. R.H. 1896, p. 109. Var. *nana-álba*, Hort. (var. *flöre-plëno*, Hort.). Fls. pure white: plant dwarfish. R.B. 15:157. B.M. 8354 (var. *nivea*).

BB. Spurs at least as long as petal-limb.

c. Stamens short, not much protruding.

8. *leptoceras*, Fisch. & Mey. St. several-fl., about 1 ft. high: partial-petioles of root-lvs. over 1 in., lfts. sessile; st.-lvs. petioled biternate: fls. violet, with the tips of the sepals greenish, and tips of the short petal-limb yellow; spur slender, slightly curved,  $\frac{1}{2}$  in. long, not knobbed; stamens protruding a little beyond the limbs of petals: follicles slender, glabrous, nearly 1 in. long. Summer. E. Siberia. B.R. 33:64. F.S. 3:296.—Little used in Amer.

9. *vulgaris*, Linn. (*A. stellata*, Hort. *A. atrata*, Koch). COMMON COLUMBINE of Eu. Sts. 1½–2 ft. high, many-fl., finely pubescent throughout: root-lvs. with 3 partial-petioles 1½–2 in. long, secondary branches certain, ultimate lf.-lobes shallow and roundish, texture firm; lower st.-lvs. petioled and biternate: fls. violet, furnished with a claw, acute, 1 in. long, half as wide; petal-limb  $\frac{3}{4}$  in. long, equaling the head of stamens; spur about same length, stout, much incurved, knobbed: follicles densely pubescent, 1 in. long, style half as long. Summer. Eu., Siberia, and naturalized in Amer. Gn. 12, p. 288; 70, p. 16 (as *A. sellata*). G.W. 3, p. 229. Var. *flöre-plëno*, Hort. Fls. much doubled, ranging from pure white to deep blue. Here belong

many horticultural varieties with personal names. Var. *Vervæneana*, Hort. (var. *foliis-aureis*, Hort. Var. *atroviolacea*, Hort.). Lvs. with yellow variegated lines.

Var. *nivea*, Baumg. (var. *álba*, Hort.). MUNSTEAD'S WHITE COLUMBINE. Often 2–3 ft. high: a great profusion of large, pure white fls. for several weeks in early spring. Var. *nivea grandiflora*, Hort., is much like this.

Var. *olympica*, Baker (*A. olympica*, Boiss. *A. Wittmanniana*, Hort. *A. blanda*, Lem.). A fine variety, with several large fls.; sepals light lilac or bright purple, 1 in. or more in length; petal-limb white. I.H. 4:146. R.H. 1896, p. 108.

Var. *hybrida*, Sims. Much like the last variety, but with stout, lilac-purple spurs as long as the sepals, only slightly incurved.—Probably a hybrid of *A. vulgaris* and *A. canadensis*. B.M. 1221.

10. *sibirica*, Lam. (*A. bicolor*, Ehrh. *A. Garnieriana*, Sweet. *A. speciosa*, DC.). St. 1½–2 ft. high, many-fl.; often nearly glabrous throughout: partial-petioles of root-lvs. 1–2 in., sometimes showing 3 distinct branches; terminal lfts. 1 in. or more broad, lobes rather shallow and rounded; lower st.-lvs. petioled and biternate: fls. pale or bright lilac-blue; oblong sepals fully 1 in. long, spreading or reflexed a little; petal-limb half as long, equaling the head of stamens, and often white; spur rather stout,  $\frac{1}{2}$  in. or more, very much incurved, or even coiled: follicles glabrous, 1 in. long, style  $\frac{1}{2}$  in. Summer. E. Siberia. S.B.F.G. II. 1:90. Var. *flöre-plëno*, Hort. (*A. bicolor* var. *flöre-plëno*, Hort.). Fls. much doubled by the multiplication of both the limbs and the spurs.

Var. *spectabilis*, Baker (*A. spectabilis*, Lem.). A large, bright lilac-fl. var.; petal-limbs tipped yellow. Amurland. I.H. 11:403.

cc. Stamens long, protruding far beyond the petal-limb.

11. *formosa*, Tesch. (*A. canadensis* var. *formosa*, Wats.). Habit as in *A. canadensis*: root-lvs. and st.-lvs. like that species, but fls. brick-red and yellow, or wholly yellow, and sepals larger, quite twice as long as petal-limb; spurs more spreading, somewhat more slender, and often shorter. May–Aug. Sitka to Calif., and east to the Rockies. Intro. 1881. B.M. 6552. F.S. 8:795. Gt. 32:372. R.H. 1896, p. 108. G.C. 1854:836.

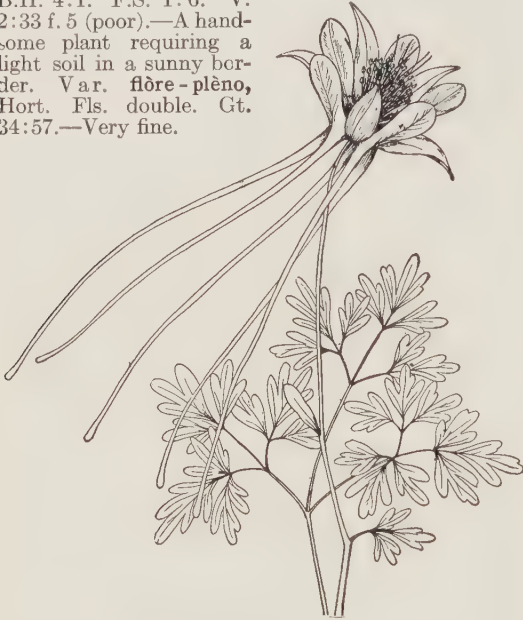
Var. *hybrida*, Hort. (*A. californica* var. *hybrida*, Hort. *A. superba*, Hort.). Fls. large, with scarlet sepals and yellow petals; spurs spreading, long and slender.—A supposed hybrid with *A. chrysantha*. F.M. 1877:278. V. 2:33 f. 2. Var. *rùbraplëno*, Hort. (var. *flöre-plëno*, Hort.). Fls. as in var. *hybrida*, but several whorls of petal-limbs. Var. *nana-álba*, Hort. Fls. pale, often nearly white: plant not exceeding 1 ft.

Var. *truncata*, Baker (*A. truncata*, Fisch. *A. californica*, Lindl.). Fls. with short, thick spurs and very small sepals and a small petal-limb. Intro. 1881. F.S. 12:1188 (as *A. eximia*, Hort.).



294. *Aquilegia chrysantha*. ( $\times \frac{1}{4}$ )

12. *Skinneri*, Hook. St. 1–2 ft. high, many-fld., glabrous: root-lvs. long-petioled, with both primary and secondary divisions long; lfts. cordate, 3-parted; several st.-lvs. petioled and biternate: sepals green, keeled, lanceolate, acute, never much spreading,  $\frac{3}{4}$ –1 in. long; petal-limb greenish orange, half as long as sepal; spur bright red, tapering rapidly, over 1 in. long; stamens protruding far beyond the limb; styles 3: fr., at least when young, bearing broad, membranous, curled wings. After flowering, the peduncles become erect. July–Sept. Mts. of New Mex. B.M. 3919. P.M. 10:199. B.H. 4:1. F.S. 1:6. V. 2:33 f. 5 (poor).—A handsome plant requiring a light soil in a sunny border. Var. *flöre-plèno*, Hort. Fls. double. Gt. 34:57.—Very fine.



295. *Aquilegia longissima*. ( $\times \frac{1}{2}$ )

BBB. Spurs very long, several times the length of petal-limb.

13. *chrysántha*, Gray (*A. leptocèras* var. *chrysántha*, Hook.). Fig. 294. Height 3–4 ft.: root-lvs. with twice 3-branched petioles, lfts. biternate; st.-lvs. several, petioled: fls. many on the plant, 2–3 in. across; sepals pale yellow, tinted claret, spreading horizontally; petal-limb deep yellow, shorter than the sepals, and nearly as long as the head of stamens; spur rather straight, very slender, divergent, about 2 in. long, descending when fl. is mature: follicles glabrous, 1 in. long; style half as long. May–Aug. New Mex. and Ariz. Gn. 16: 264; 51, p. 385. B.M. 6073. R.H. 1896, p. 108. F.R. 2:169. Gt. 33:84. G.C. 1873:1501. F.M. 1873:88. V. 2:33 f. 3. F.S. 20:2108. H.F. 4:120. H.U. 3, p. 324. Var. *flavescens*, Hort. (*A. aurea*, Junk. *A. canadensis* var. *aurea*, Roetzl.). Fls. yellow, tinged with red; spurs incurved, and shorter than in the type. Gt. 21:734. Var. *álba-plèna*, Hort. (var. *grandiflora álba*, Hort.). Fls. very pale yellow or nearly white, with two or more whorls of petal-limbs. Intro. 1889. V. 12:311. G.W. 8, p. 375. Var. *nàna*, Hort. (*A. leptocèras* var. *lutea*, Hort.). Like the type, but plant always small, not exceeding  $1\frac{1}{2}$  ft. Var. *Jäschkani*, Hort. About the same height as last: fls. large, yellow, with red spurs.—Thought to be a hybrid of *A. chrysántha*  $\times$  *Skinneri*, hence sometimes called *A. Skinneri* var. *hybrida*, Hort.

14. *longíssima*, Gray. Fig. 295. Tall, somewhat pubescent with silky hairs, or smoothish: root-lvs. biternate, even in the petioles; lfts. deeply lobed and cut, green above, glaucous beneath; st.-lvs. similar, petioled: fls. pale yellow, sepals lanceolate, broadly

spreading, 1 in. or more, the spatulate petals a little shorter, about equaling the head of stamens; spur with a narrow orifice, 4 in. long or more, always hanging. Distinguished from *A. chrysántha* by its longer spur with contracted orifice, by the narrow petals, and by the late season of flowering. Late July to Oct. 1. Ravines S. W. Texas into Mex. G.F. 1:31 (adapted in Fig. 295).—The seed must be obtained from wild plants, as those cult. usually fail to produce seed; hence not much used.

AAA. Sepals  $1\frac{1}{4}$ – $1\frac{1}{2}$  or even 2 in. long; expanded fls.  $2\frac{1}{2}$ –3 in. diam.; stamens not protruding.

B. Spurs long and not incurved.

15. *cærùlea*, James (*A. leptocèras*, Nutt. *A. macrantha*, Hook & Arn.). St.  $1\frac{1}{2}$  ft., finely pubescent above, bearing several fls.: lower st.-lvs. large and biternate; basal-lvs. with long 3-branched petioles; lfts. 3-lobed on secondary stalks: fls. 2 in. across, whitish, but variously tinted with light blue and yellow; sepals often blue, oblong, obtuse, twice as long as the petal-limb; spurs long, slender, knobbed at the end, rather straight, but curving outward; head of stamens equaling the petals: follicles pubescent, 1 in. long; style  $\frac{1}{2}$  in. Apr.–July. Lower mt. regions, Mont. to New Mex. B.M. 4407; 5477. Gn. 16:264. Mn. 6:61. V. 2:33 f. 4. F.S. 5:531. F.R. 10:165. Gn. 59, p. 147. G. 28:241. Var. *álba*, Hort. Fls. of same size but entirely white. Intro. 1883. Var. *hybrida*, Hort. Sepals some shade of blue or pink, or mixed, and petals nearly white or yellow, also called var. *lutea*, Hort. The true form of this is probably *A. cærulea*  $\times$  *A. chrysántha*. Gn. 51, p. 385. R.H. 1896:108. A.G. 15:315. I.H. 43:61. Var. *Helenæ*, Hort., is very probably a form of this hybrid; very robust, fls. numerous, blue and pure white. G.W. 6:212. Var. *flöre-plèno*, Hort. Fls. longer and very showy, more or less doubled toward the center.

BB. Spurs incurved and hardly longer than petal-limbs.

16. *alpina*, Linn. (incl. var. *superba*, Hort.). Fig. 296. St. nearly 1 ft. high, finely pubescent upwards, 2–5-fld., bearing petioled, biternate lvs.: partial-petioles of basal-lvs. 1–2 in. long, with 3 nearly sessile divisions, deeply lobed: expanded fl.  $1\frac{1}{2}$ –2 in. across, blue, rarely pale or white; sepals  $1\frac{1}{4}$  in. long, half as broad, acute; petal-limb half as long as sepals, often white; spur stout, incurved, same length as the limb; head of stamens not protruding: follicles pubescent, 1 in. long; style much shorter. May, June, Switzerland. L.B.C. 7:657. Gn. 9:384. F.W. 1879:353. B.M. 8303. Var. *álba*, Hort. Fls. pure white.

17. *glandulösa*, Fisch. Fig. 297. St.  $1\frac{1}{2}$  ft. high, glandular pubescent in the upper half, 1–3-fld.: partial-petioles of root-lvs. 1–2 in. long, each with 3 distinct divisions; lft.-segms. narrow and deep; st.-lvs. few, bract-like: fls. large, nodding; sepals bright lilac-blue, ovate, acute, about  $1\frac{1}{2}$  in. long and half as broad; petal-limb same color, but tipped and bordered with creamy white, less than half the length of the sepals, very broad; spur very short,  $\frac{1}{4}$ – $\frac{1}{2}$  in., stout, much incurved; stamens



296. *Aquilegia alpina*. ( $\times \frac{1}{4}$ )



not protruding: follicles 1 in. long, 6-10 in number, densely hairy, with short, falcate style. Allied to *A. alpina*, but a taller plant, with shorter spurs, larger fls., and a greater number of follicles. May, June. Altai Mts. of Siberia. B. 5:219. F.W. 1871:353. Gn. 15:278; 45, p. 193; 64, p. 26. Gt. 289 f. 1.—One of the handsomest.



297. *Aquilegia glandulosa*. ( $\times \frac{1}{4}$ )

Var. *jucunda*, Fisch. & Lall. Fls. rather smaller than in the type; petal-limb white, more truncate at the tip; stamens as long as limb. B.R. 33:19. F.S. 5:535.—A fine variety, with some tendency to double.

18. *Stuartii*, Hort. A recorded hybrid of *A. glandulosa*  $\times$  *A. vulgaris* var. *olympica*. Fls. very large and beautiful. It very much resembles the latter in form of sepals and petals, and the former in shape of spurs and coloration. May, June. Intro. 1891. Gn. 34:344; 61, p. 409. G.M. 54:416.

19. *caryophylloides* is a garden name given to some very mixed forms, with a great variety of colors. Special characters seem not to be well fixed.

*A. baikalensis*, Hort. Fls. large, violet-blue, spurs long.—*A. haydnensis*, Hort., and its var. *delicatissima*, Hort., are much like *A. chrysantha*, and resemble it in habit and color of fls. but the spurs are not so long.

K. C. DAVIS.

**ARABIS** (*Arabia*). *Cruciferae*. ROCK-CRESS. Small perennial or annual herbs, with white or purple flowers, grown mostly on borders and in rockwork.

Flowers mostly in terminal spikes or racemes, small, but often many or appearing for a considerable period of time: lvs. mostly undivided: siliques long, linear, flat: stigma 2-lobed.—In temperate regions, about 100 species, several native to this country; some of them are alpine. Usually prop. by division; also by seeds and cuttings. Hardy, requiring plenty of sun, and thriving even in poor soil. The following four species are perennials:

A. Fls. purple or rose.

*muralis*, Bertol. (*A. rosea*, DC.). A foot high, with a rather dense raceme of pretty fls.: lvs. oblong, sessile (the radical ones with a long narrow base), prominently and distantly blunt-toothed, sparsely pubescent. Spring and summer. Italy. B.M. 3246.

AA. Fls. white.

*serpyllifolia*, Vill. (*A. nivalis*, Guss.). Tufted, 2-6 in.: radical lvs. entire or few-toothed, the st.-lvs. small and sessile, not clasping: fls. in a short cluster, the calyx as long as the peduncle, the limb of the petals linear-oblong and erect. Eu.

*albida*, Stev. (*A. caucásica*, Willd.). Fig. 298. A few inches high, pubescent: lower lvs. narrow at the base, the upper auriculate-clasping, all angle-toothed near the top: fls. in a loose raceme, the calyx shorter than the pedicel, the petal-limb oval and obtuse. Eu. B.M. 2046. Gn. 62, p. 280; 72, p. 67; 74, p. 620. F.E. 16:611.—Blooms early, is fragrant, and is well adapted for rock-gardens and edgings, and covering steep banks.

Var. *flöre-plèno*, Hort. Double. Gn. 65, p. 306. Var. *variegata*, Hort., has yellow-white stripes on lvs. Gt. 45, p. 108. Var. *Billardièri*, Boiss. (*A. Billardièri*, DC.). Hoary-pubescent, slender: lvs. small, very obtuse, entire or with 1 or 2 teeth at base: pod long, slender and spreading: fls. often tinged. Eastern. Gn. 63, p. 422.

*alpina*, Linn. Fls. smaller than in the last, plant only slightly pubescent and hairy: lvs. somewhat clasping but not auriculate; small-toothed nearly or quite the entire length, the cauline ones pointed. Eu. B.M. 226. G.C. III. 30:239.—Blooms very early, and is one of the best rock-plants. Var. *variegata*, Hort. Var. *nana compàcta*, Hort., a dwarf form. Gt. 44, p. 203. Var. *flöre-plèno*, Hort. Fls. full-double; handsome. Gt. 51, p. 211. G. 26:199.

*A. arenosa*, Scop. Fls. rose varying to white: lvs. pinnatifid, those on the st. deep-toothed. Eu.—*A. aubrietoides* Boiss. Much like *A. albida*, but pale pink. Cilicia.—*A. blepharophylla*, Hook. & Arn. Fls. large, rose-purple: lvs. sharp-toothed, sessile or clasping, the margins hairy. Calif. B.M. 6087.—*A. Ferdinándi-Coburgii*, Kell. & Suenderm. Lvs. gray in rosettes, becoming green in winter: fls. small, yellowish. Macedonia.—*A. lucida*, Linn. f. Fls. white: lvs. shining, obovate, clasping. There is a variegated form. Eu.—*A. mollis*, Stev. Fls. white: lvs. pubescent, large-toothed, the lower ones rounded and long-stalked. Eu.—*A. petræa*, Lam. Fls. white: lvs. toothed, the radical ones often parted, the st.-lvs. oblong-linear. Eu.—*A. præcox*, Walldst. & Kit. = *A. procurrens*.—*A. procurrens*, Walldst. & Kit. Fls. white: lvs. ciliate, those on the st. entire and sessile, the others stalked: stoloniferous. A variegated form. Eu.—*A. Stuartii*, Hort. A compact but vigorous garden form with large clear white fls.—*A. verna*, R. Br. Annual, hairy: fls. large, purple: lvs. oblong-ovate to round-oblong, the upper ones clasping, rather coarse-toothed. Eu. B.M. 3331. L. H. B.

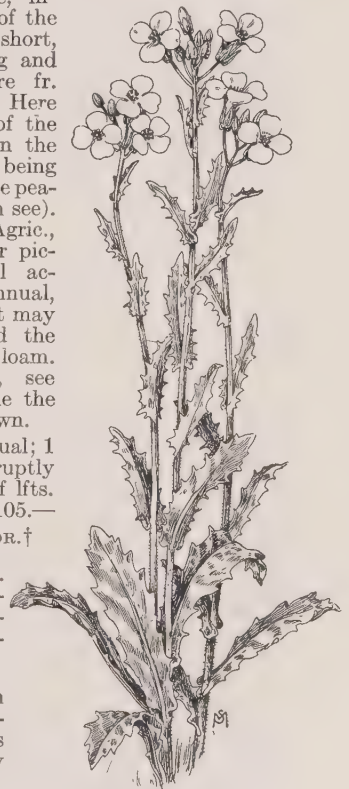
**ARACHIS** (Greek, *without a rachis*). *Leguminosæ* PEANUT. GOOBER. The peanut is sometimes grown in the economic house of botanical gardens, and also as a curiosity in outdoor gardens. The genus has nine species, of which eight are Brazilian. Lvs. abruptly pinnate: fls. 1-3, yellow, in a dense, axillary, sessile spike; ovary stipitate, inclosed within the tube of the calyx, the stipe at first short, subsequently elongating and carrying the immature fr. beneath the ground. Here develops what is one of the most anomalous frs. in the whole Leguminosæ, it being wholly indehiscent,—the peanut of commerce (which see). See also Cyclo. Amer. Agric., Vol. II, pp. 514-519 for pictures and agricultural account. As a hothouse annual, the seeds of the peanut may be sown in heat, and the plants potted in sandy loam. For outdoor culture, see *Peanut*, by which name the plant is commonly known.

*hypogæa*, Linn. Annual; 1 ft. or less high: lvs. abruptly pinnate, with 2 pairs of lfts. and no tendrils. Mn. 7:105.—Procumbent. N. TAYLOR.†

**ARACHNANTHE**. (Greek for *spider-flower*). *Orchidææ*. Included under *Renanthera*.

**ARALIA** (derivation obscure). *Araliææ*. Ornamental herbs, shrubs or trees grown chiefly for their bold foliage.

Stems often spiny: lvs.



298. *Arabis albida*. ( $\times \frac{1}{2}$ )

alternate, deciduous, pinnate to 3-pinnate; fls. small, whitish, in umbels usually forming panicles; pedicels articulate; calyx-lobes minute; petals imbricate in bud; stamens 5; ovary 5-, rarely 2-celled, with the styles free or connate only at the base: fr. a berry-like drupe with 2-5 compressed stones.—About 20 species in N. Amer., Asia, Malay Archipelago and Austral.

The aralias are large herbs, shrubs or small trees, often spiny, with large decompound foliage, small whitish flowers in umbels forming large terminal panicles and followed by small usually black berry-like fruits.

The species are hardy or nearly hardy North. They prefer rich or heavy soil. They are often planted as single specimens on the lawn for the bold subtropical effect of their foliage. Propagation is by seeds sown in spring, which do best with slight bottom-heat, or by root-cuttings, also with bottom-heat.

There are also a number of tender shrubby

plants cultivated as ornamental greenhouse or stove plants, which have been provisionally referred to the genus *Aralia*, as their flowers and fruits are not yet known; therefore it has not been possible to determine their true botanical affinity. In the present work they are referred to other genera. They should be looked for under *Polyscias*, *Pseudopanax*, *Schefflera*, *Oreopanax*, *Panax*, *Sciadophyllum*, *Dizygotheca*. Other related genera, perhaps not including any horticulturally important forms, are *Heptapleurum* and *Monopanax*.

A. Prickly shrubs or rarely low trees: lvs. bipinnate, 2-3 ft. long: umbels numerous, in a large, broad, compound panicle: styles distinct.

*spinosa*, Linn. ANGELICA TREE. HERCULES' CLUB. DEVIL'S WALKING-STICK. Sts. very prickly, 40 ft. high: lvs.  $1\frac{1}{2}$ - $2\frac{1}{2}$  ft. long, usually prickly above; lfts. ovate, serrate, 2- $3\frac{1}{2}$  in. long, glaucous and nearly glabrous beneath, mostly distinctly petioled; veins curving upward before the margin. Aug. Southern states north to Tenn. S.S. 5:211. Gn. 50, p. 126.—The stout, armed sts., the large lvs., and the enormous clusters of fls. give this species a very distinct subtropical appearance. Not quite hardy N. Bark possesses medicinal properties.

*chinensis*, Linn. (*A. japonica*, Hort. *A. mandshurica*, Hort. *Dimorphanthus elatus*, Miq. *A. spinosa* var. *canescens*, Franch. & Savat.) CHINESE ANGELICA TREE. Fig. 299. Sts. less prickly, 40 ft.: lvs. 2-4 ft. long, usually without prickles; lfts. ovate or broad ovate, coarsely serrate or dentate, usually pubescent beneath, nearly sessile,  $3\frac{1}{2}$ -6 in. long; veins dividing before reaching the margin and ending in the points of the teeth. Aug., Sept. China, Japan. M.D.G. 1897:461. Gn. 1, p. 561. G.W. 5:509.—In general appearance very much like the former species, but considerably hardier. Grows well also in somewhat dry, rocky or

clayey soil. Var. *glabrescens*, Schneid. (*A. spinosa* var. *glabrescens*, Franch. & Savat. *A. spinosa* var. *canescens*, Sarg. *A. canescens*, Sieb. & Zucc.). Lvs. often prickly above; lfts. glabrous beneath, except on the veins, dark green above. More tender. Var. *mandshurica*, Rehd. (*Dimorphanthus mandshuricus*, Maxim.). St. prickly: lfts. pubescent only on the veins beneath, more sharply and densely serrate than the foregoing variety and hardier. G.C. II. 10:592; 23:313. Var. *variegata*, Rehd. (*A. japonica variegata*, G.C.). Lfts. bordered with white. I.H. 33:609. G.C. III. 31:231. Gn. 63, p. 379. Var. *aureo-variegata*, Rehd. (*Dimorphanthus mandshuricus elegantissimus* fol. var., Hort.). Lfts. variegated with yellow.

AA. Unarmed herbs: styles united at the base.

B. Umbels numerous, in elongated puberulous panicles: 3-10 ft. high.

*racemosa*, Linn. SPIKENARD. Height 3-6 ft.: glabrous, or slightly pubescent: lvs. quinately or ternately decompound; lfts. cordate, roundish ovate, doubly and sharply serrate, acuminate, usually glabrous beneath, 2-6 in. long: fls. greenish white. July, Aug. E. N. Amer. west to Minn. and Mo. B.B. 2:506.—Root-stock employed medicinally; properties similar to those of *sarsaparilla*.

*californica*, Wats. Height 8-10 ft.: resembles the preceding: lfts. cordate, ovate or oblong-ovate, shortly acuminate, simply or doubly serrate: panicle loose; umbels fewer, larger, and with more numerous rays. Calif. M.D.G. 24:343.

*cordata*, Thunb. (*A. edulis*, Sieb. & Zucc.). Height 4-8 ft.: lvs. ternately or quinately decompound, pinnæ sometimes with 7 lfts.; lfts. cordate or rounded at the base, ovate or oblong-ovate, abruptly acuminate, unequally serrate, pubescent on the veins beneath, 4-8 in. long. Japan. Gt. 13:432 (as *A. racemosa* var. *sachalinensis*). R.H. 1896, p. 55. A.G. 13, pp. 6, 7. Young stalks edible: see *Udo*.

*cachemirica*, Deene. (*A. cashmeriana*, Hort. *A. macrophylla*, Lindl.). Height 5-8 ft.: lvs. quinately compound, pinnæ often with 5-9 lfts.; lfts. usually rounded at the base, oblong-ovate, doubly serrate, glabrous or bristly on the veins beneath, 4-8 in. long. Himalayas.

BB. Umbels several or few on slender peduncles; pedicels glabrous: 1-3 ft. high.

*hispida*, Vent. BRISTLY SARSAPARILLA. WILD ELDER. Height 1-3 ft., usually with short, woody st., bristly: lvs. bipinnate; lfts. ovate or oval, rounded or narrowed at the base, acute, sharply and irregularly serrate, 1-3 in. long: umbels 3 or more in a loose corymb; fls. white. June, July. From Newfoundland to N. C. west to Minn. and Ind. B.M. 1085. L.B.C. 14:1306.—Bark diuretic, alterative.

*nudicaulis*, Linn. WILD SARSAPARILLA. SMALL SPIKENARD. Stemless or nearly so: usually 1 lf., 1 ft.



299. *Aralia chinensis*.



high, with 3 quinate pinnate divisions; lfts. oval or ovate, rounded or narrowed at the base, acuminate, finely serrate, 2-5 in. long; umbels 2 or 3; fls. greenish. May, June. Newfoundland to N. C., west to Mo. B.B. 2:506.—Rootstock employed medicinally; properties similar to those of sarsaparilla.

*A. japonica*, Thunb.=*Fatsia japonica*.—*A. papyrifera*, Hook.=*Tetrapanax papyriferum*.—*A. pentaphylla*, Thunb.=*Acanthopanax pentaphyllum*.—*A. quinquefolia*, Decne. & Planch.=*Panax quinquefolium*.—*A. Sieboldii*, Hort.=*Fatsia japonica*.—*A. trifolia*, Decne. & Planch.=*Panax trifolium*. (See also *Ginseng*.)

ALFRED REHDER.

ARATICÚ: *Annona* and *Rollinia*.

**ARAUCÁRIA** (Chilean name). Including *Columbea* and *Eutacta*. *Pinææ*. Large South American and Pacific Australian evergreen trees (about a dozen species), grown in their juvenile state in greenhouses and windows and often used in summer for lawn decoration; they are very decorative pot-plants.

Tall strict or widely branching conical trees: lvs. small, scale-like and stiff, clothing all the branches uniformly and usually closely imbricated; fls. mostly dioecious, the staminate terminal and solitary or disposed in fascicles; anthers 6-8-celled; pistillate fls. in ovoid or globose heads that become large woody cones with only 1 seed underneath each scale.—The South American species (*Columbea*) have scarcely winged scales, the cotyledons 2, and the germination hypogeal (cotyledons remaining below ground); the Australian and Pacific species (*Eutassa*) have winged scales, cotyledons 4, and germination epigeal.

Araucarias are probably the most prized pot evergreens in cultivation. They are much used in house decoration, particularly at Christmas time, as they are not only attractive but will stand much hard usage. *A. excelsa* (Fig. 300) is the one commonly seen in residences. Propagation is by seeds and cuttings, as given under *A. excelsa* below. Symmetrical plants are secured from the leading shoots. Side shoots are likely to make misshapen specimens, as seen in Fig. 301. The arau-



300. A good specimen of *Araucaria excelsa*.

carias need cool treatment. The temperature should not be above 60° at night. If kept too crowded or not given sufficient light, they become ragged and straggling, as in Fig. 302. In summer the plants should be protected from direct burning sun.

The species thrive in the open in southern Florida and in parts of California. *A. imbricata* is the hardiest. It is rarely seen in greenhouses. *A. Bidwillii* is

apparently the second hardiest, and also one of the best species for all purposes. *A. excelsa* and its allies are about as hardy in southern Florida as crotons and acahyphas.

The commonest species in greenhouses is *A. excelsa*. It is grown on an enormous scale in many nurseries for



301. Unsymmetrical *Araucaria excelsa*, grown from a side shoot.

decoration as window or table plants. When raised from seed the plants grow rapidly and the branches are invariably disposed in tiers with wide internodes, often as much as 2 feet separating each tier of branches. Such plants are of little use for ordinary decorative work and recourse is made to plants raised from cuttings. This practice has grown up as it is found that plants raised from cuttings assume a dwarf compact habit, with the tiers of branches placed close together, and that they do not grow into large specimens until many years old. The plants for stock purposes are usually raised from seed, and when they have formed some three to six tiers of branches the tops are taken out and put in as cuttings in light sandy compost in a close house or case at a temperature of about 60° F. They are kept shaded from hot sun and damped over frequently until rooted. The stock plants are kept growing and soon break out into new growth in the axils of each of the upper branches. These are all "leader" growths, and when long enough they each furnish a suitable cutting which is treated in the same way as the primary growth or leader. After each of these has been removed for stock, the stem of the stock plant is cut off to the next tier of branches, which in turn will furnish another set of cuttings and so on until the plant is reduced to the bottom layer of branches, when it is discarded and another stock obtained again from seed. It should be pointed out that the branches themselves may be rooted as cuttings, but they always retain their flat asymmetrical shape and are useless for stock purposes. (See Fig. 301.)

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*A. Lvs. (or most of them) awl-like, at least at apex.*

1. *excelsa*, R. Br. NORFOLK ISLAND PINE. Figs. 300-303. Plant light green: branches frondose, lvs. curved and sharp-pointed, rather soft,  $\frac{1}{4}$ - $\frac{1}{2}$  in. long, and densely placed on the horizontal or drooping branchlets. Norfolk Isl. F.R. 2:411.—The commonest species in this country, being much grown as small pot specimens. A blue-green form is cult. as var. *glauca*, (or *A. glauca*). It is a form in which the tips of the growths are white when young; has recently been intro. under the name of "Silver Star." It is a most beautiful plant and sure to have a great future as a market plant. There is also a strong-growing, large variety, with very deep green foliage, var. *robusta*, Hort. Var. *virgata*, Hort., primary branches with no secondary branches, or very short ones. In its native wilds *A. excelsa* reaches a height of over 200 ft. and a diam. of even 9 or 10 ft. The solid, globular cones are 4 or 5 in. diam.

F.S. 22: 2304-2305.—An excellent house plant, and keeps well in a cool room near a window. In summer it may be used on the veranda, but must be shaded.

The timber is used for ship-building.



302. *Araucaria excelsa*, a poor specimen because too crowded or not sufficient light.

and resin. Locally known as hoop pine, Moreton Bay pine, colonial pine, coorong, cumburtu, coonam.

3. *Coëkii*, R. Br. (*A. columnaris*, Hook.). A slender columnar tree, much narrower in shape than *A. excelsa* which it closely resembles when young: branches disposed as in *A. excelsa*, but tree tending to shed the lower ones; branchlets crowded on the branches and turning upwards in a boat-like form: young lvs. alternate and rather closely arranged on the branchlet and  $\frac{1}{4}$  in. long, broad and slightly decurrent at base, slightly curved, mucronate; adult lvs. densely imbricated, short and ovate, obtuse; cones 3-4 in. diam. and somewhat longer. New Caledonia, where it reaches a height of 200 ft., making very straight and imposing shafts. B.M. 4635. A.F. 12:559.—Named for Captain Cook. Var. *aurea*, Hort., has golden-yellow foliage. There is also a var. *glauca*, Hort., with silvery lvs.



303. *Araucaria excelsa*. ( $\times \frac{1}{2}$ )

4. *Balánsæ*, Brongn. & Gris. (*A. elegans*, Hort. Bull.). A dwarf-growing species of slow growth (when grown as a pot-plant) and with few loosely arranged tiers of branches, usually 5 in a tier; branchlets distichous, narrow and deflexed with age: lvs. imbricated, short, stiff;  $\frac{1}{2}$  in. long, falcate, more or less obtuse, dark olive-green in color: male cones cylindrical-conical, 2-3 in. long; female cones globose or elliptic, 4 in. long. New Caledonia.—Rarely grown. The narrowest and most slender-branched species in cult.

AA. Lvs. broader, usually plane and imbricated.

5. *Rùlei*, Muell. Fig. 304. Leafy branchlets very long: lvs. oval-elliptic, imbricated, concave, arched towards the branch, nearly or quite obtuse, with a prominent dorsal nerve, silvery gray on the upper and rich glossy green on the



304. *Araucaria Rulei*. ( $\times \frac{1}{2}$ )

lower side. Variable at different ages. When young, the branches are often drooping and the lvs. compressed and obscurely 4-angled and nearly or quite subulate, var. *polymorpha*, R.H. 1866, p. 350. There is also a var. *compacta*. New Caledonia. Reaching 50 ft. in height. R.H. 1866:390, and plate. I.H.

22:204. A strikingly beautiful plant and somewhat rare in cult. The figure in G.C. 1861:868, is *A. Muelleri*, Brongn. & Gris., a broader-lvd. species. Var. *Goldieana*, Hort. (*A. Goldieana*, T. Moore). A variety with narrower lvs. and with branches rather more erect than the type. F. 1877:39. A var. *elegans*, Hort., is described, with smaller lvs., and close-whorled more slender branches: dwarf.

6. *Bidwillii*, Hook.

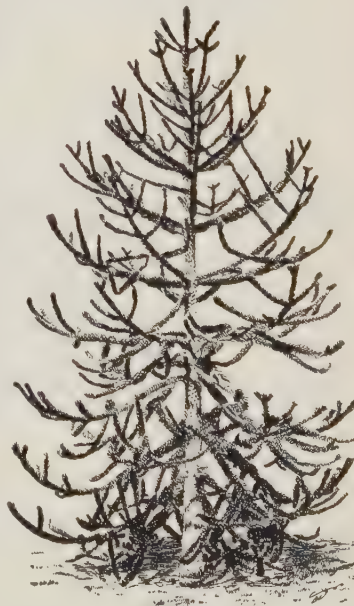
Fig. 305. Rather narrow in growth, especially with age, the branches simple: lvs. in two rows, lance-ovate and very sharp-pointed, thick, firm and shining. Austral., where it attains a height of 150 ft., and is known as bunya-bunya. R.H. 1897, p. 500, desc. G.C. III. 15:465, showing the pineapple-like cone.—One of the best and handsomest species for pots.



305. *Araucaria Bidwillii*. ( $\times \frac{1}{2}$ )

7. *braziliæna*, A. Rich. (*A. gracilis*, Hort.). Branches verticillate, somewhat inclined, raised at the ends, tending to disappear below as the plant grows: lvs. alternate, oblong-lanceolate, 1-2 in. long, somewhat decurrent, much attenuated and very sharp-pointed, deep glaucous green, loosely imbricated: cone large and nearly globular. S. Brazil, reaching a height of 100 ft. F.S. 21:2202. Var. *éiegans* (*A. elegans*, Hort.), is a form with very numerous branches and more crowded and often glaucous lvs. Var. *Ridolfiana*, Gord., is a more robust form, with larger and longer lvs.

8. *imbricata*, Pav. MONKEY PUZZLE. Figs. 306, 307. A striking tree of pyramidal habit: branches generally in 5's, at first horizontal, with upward-curving (sometimes downward-curving) tips, but finally becoming much deflexed; branchlets in opposite pairs, curved upward when young, and continuing to grow until several feet long when adult: lvs. imbricated and persisting, even on the trunk, ovate-lanceolate, very stiff, leathery, and sharp-pointed, 2 in. long on the primary st. and branches, 1 in. long on the branchlets, slightly concave at the base, bright green on both sides: cone 6-8 in. diam. Western slope of the Andes in Chile, reaching a height of 100 ft. F.S. 15: 1577-1580. R.H. 1893, p. 153; 1897, pp. 271, 319, desc. Gt. 44:115. G.C. III. 21:288; 24:154.—Hardy in the S. This is the species which is grown in the open in England and Ireland. The hardiest species in cult. Thrives well in a heavy loamy soil in a moist valley or position sheltered from rough winds in mild climates. The branches are heavy and rather brittle and the beauty and symmetry is soon destroyed if planted in an exposed position. The timber is

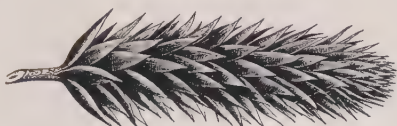


306. *Araucaria imbricata*. California.



valuable. The seeds constitute the chief food of the aborigines in some sections of S. Amer. Var. *platifolia*, Hort., is a form with very broad lvs.

*A. albospica*, Hort.=*A. excelsa*.—*A. Dombeyi*, A. Rich.=*A. imbricata*.—*A. intermedia*, R. Br. Tall and erect, sparingly



307. *Araucaria imbricata*. ( $\times \frac{1}{2}$ )

branched, nearly denuded of foliage; lvs. sessile, imbricated, cordiform, obtuse, green and shining. New Caledonia.—*A. Lindleyana*, Van Houtte = *A. braziliana*.—*A. montana*, Brongn. & Gris. Tall; lvs. scale-like, curved, ovate, ob-

tusish, more or less concave, with white spots in many series. New Caledonia.—*A. Muelleri*, Brongn. & Gris. Lvs. almost flat, with whitish spots in series. New Caledonia.—*A. Niepráskui*, Bau-

mann. Branches wide-spreading with long drooping side branches; perhaps a form of *A. Rulei*. R. B. 31: p. 132.—*A. subulata*, Vieill. Like *A. intermedia*, but trunk less naked, and lvs. linear-subulate. New Caledonia.

L. H. B.

C. P. RAFFILL.

**ARBORETUM.**—A living collection of trees and other woody plants.

Collections of trees have found a place in the botanic gardens of all countries since the physic garden at Tokyo was founded eight hundred years ago; and for more than three centuries individuals have made such collections for the decoration of estates or for purposes of study. In Europe the largest collection of the woody plants of temperate regions is found in the Royal Gardens at Kew; and in the Dutch Colonial Garden at Buitenzorg on the island of Java is the most important collection of the trees of the tropics. Small experimental arboreta composed chiefly of timber trees of supposed value have been planted in connection with most of the forest schools or forest institutes of Europe.

#### Historical sketch.

As early as the middle of the sixteenth century, a collection of trees was made at Touvoye in France by René du Bellay, Bishop of Mans, who received the seeds of a number of exotic trees from Pierre Belon, physician and traveler, who first brought to Europe some of the trees of western Asia. In its day, the garden at Touvoye was pronounced by the botanist Gesner the richest and most beautiful in France, Germany and Italy. Like most of the early collections of trees made by individuals, all traces of the trees planted by René du Bellay have disappeared.

Nearly two centuries later, the head of the French Marine, Duhamel du Monceau, a man of scientific attainments, wealth and social influence, gathered from Europe and North America large collections of trees on his two estates of de Veigny and du Monceau and formed what must be considered the first arboretum made with scientific purpose. Du Monceau undertook a critical study of his collections and published in 1755 his "Traité des arbres et arbustes qui se cultivent en France." His arboretum is said to have contained a thousand species of woody plants belonging to one hundred and ninety-one genera. Duhamel's publications and example had much influence and led to the introduction of many exotic trees into French parks and plantations. Noble specimens of the cedar of Lebanon, the deciduous cypress of the southern United States and other trees planted by him, are still living.

The arboretum established in 1825 in France at Les Barres near the village of Nogent-sur-Vernisson (Loiret) by Pierre Philippe André de Vilmorin is still one of the most important dendrological stations in Europe. Vilmorin was especially interested in the different geographical forms or varieties of the principal timber trees of Europe and made large plantations of these and of a number of exotic trees. In 1866, after the death of the founder, the arboretum at Les Barres was purchased by the French Government and now, greatly improved

and enlarged by new plantations, is known as the Arboretum National des Barres and is used as a school of sylviculture. In 1906 a critical catalogue of this collection, prepared by Monsieur L. Pardé, Inspector des Forêts, and accompanied by an atlas of plans of the arboretum and pictures of many of its principal trees, was published in Paris. The value of the arboretum at Les Barres has been increased by the formation in its immediate neighborhood of the Fruticetum Vilmorinianum. This collection of shrubs, which is the most complete in Europe, was established in 1894 by the grandson of the founder of the arboretum at Les Barres, Monsieur Maurice L. de Vilmorin, who has been successful in introducing many interesting plants into gardens through his relations with French missionaries in China. A catalogue of the Fruticetum Vilmorinianum was published in 1894.

In 1857 Monsieur Alfonse Lavallée began to plant an arboretum at Segrez in the Department of Siene-et-Oise. This was a scientific enterprise and the value of the living collections was increased by the establishment at Segrez of a botanical library and herbarium. Aided by the professors of the Museum d' Histoire Naturelle in Paris, it had become in 1875, when the "Enumération des Arbres et Arbrisseaux Cultivés à Segrez" was published, one of the largest collections of woody plants that had been made up to that time. This catalogue was followed in 1880 by the "Arboretum Segrezianum" in which appear critical descriptions and figures of some of the rare plants cultivated at Segrez. Six parts with thirty-six plates of this work appeared. M. Lavallée died suddenly in 1884 and his publications and a few trees in the park at Segrez are the only monuments left of his zeal and industry in the study of trees. In 1858 Monsieur G. Allard began the arboretum at la Maulévie, near Angers in France, which he still maintains, and which contains one of the largest and most interesting collections of the oaks of Europe and southwestern Asia in the world, and is particularly rich in conifers.

At Muskau in the valley of the Neisse in Silesia, on the estate made famous by the beauty of arrangement given to it by Heinrich Hermann von Puckler, an important arboretum was established by Prince Frederick of the Netherlands, who purchased the Muskau estate in 1845. The critical catalogue of the plants in the Muskau Arboretum by Petzold & Kirchner, published in 1864, and entitled "Arboretum Muscaviensis," is a standard work on cultivated trees and shrubs. Many of the trees planted by von Puckler are still living, but the arboretum is now conducted as a commercial nursery.

In Great Britain, no important scientifically managed collection of trees and shrubs, with the exception of those connected with general botanic gardens, has been attempted. The arboreta, however, connected with the



308. Old Deciduous Cypress in Bartram's Garden. This tree still stands, although dead.

national gardens at Kew, Edinburgh and Dublin have greatly increased the knowledge of trees and stimulated the taste for planting not only in Great Britain but in all civilized countries. At Kew is to be found probably the largest number of species of trees and shrubs which has yet been gathered together, for in England more plants can be made to grow together than flourish in any one country on the continent of Europe or in any one place in the United States. Kew, as a garden in connection with royal residences has existed since the middle of the sixteenth century; in 1841 it was created a national garden and its growth and improvement have continued uninterruptedly ever since. In the older parts of the garden many noble trees testify to the age of the establishment, but it was not until 1848 that the systematic planting of an arboretum was begun by Sir William Hooker, the first director of the national garden. The reputation of the succeeding directors of Kew, its scientific standing and the interest of the nation in its garden have made it possible to gather there plants from all parts of the world; and although much of the soil occupied by the arboretum is not well suited for the growth of trees, and the smoke of the city makes the cultivation of conifers and many other evergreen plants difficult and sometimes impossible, every serious student of trees must avail himself of the great opportunities for study which this arboretum affords. A collection of trees was once planted by the Horticultural Society of London at its gardens in Chelsea; this was given up by the Society many years ago. On many of the large private estates in England, Scotland and Ireland there are important arboreta; and the desire of the owners of British estates to cultivate new trees, especially conifers, stimulated the botanical explorations in all the temperate parts of the world in the first half of the nineteenth century undertaken by the Horticultural Society of London and by some of the large firms of European nurserymen. Some of these private collections have been of great value to students.

In connection with the Quinta Normale and the Museum of Natural History in San Diego in Chile is a small but remarkable arboretum in which are found the oaks, hickories, magnolias and other trees of eastern North America flourishing as they flourish nowhere else outside the United States, and with these the poplars and birches of northern Europe are growing with the cypresses and pines of California, and the eucalypti of Australia.

Few interesting collections of trees have been made in North America. In 1728 John Bartram, a Pennsylvania farmer and later distinguished as a traveler and botanist, purchased a piece of land on the banks of the Schuylkill River about three miles from Philadelphia and established a botanic garden, in which he planted a number of American trees collected in his various journeys, which extended from the shores of Lake Ontario to Florida, or received from his correspondents in Europe; among these were some of the famous botanists of the day. Bartram was appointed botanist to the King of England and, through his labors, many American trees were introduced into England and many Old World plants first reached America. Bartram died in 1777. Later his garden was used as a nursery and, after having passed through the hands of various owners, was bought in 1891 by the city of Philadelphia and is now a public park. A few only of the trees planted by John Bartram are now standing. Fig. 308.

Bartram by his own labors and through his European correspondents attained much influence, and is one of the most interesting figures among those who have increased the knowledge of American trees. Not the least important of his good works was the inspiration which his cousin, Humphrey Marshall, another Pennsylvania farmer, derived from his example and advice. Marshall in 1773 made a garden and planted a number

of trees near the Bradford Meeting-house now in the village of Marshalltown, a few miles from West Chester, traveled widely to study and collect plants, and in 1785 published the "Arbustum Americanum," a description of the trees and shrubs indigenous to the United States. This was the first book on plants written by a native-born American. Many of the trees planted by Marshall have grown to a great size and are still in a flourishing condition. His arboretum is now the most interesting of the old collections of American trees.

The garden and arboretum planted about 1830 by John Evans, another Pennsylvanian, in Delaware County about twelve miles west of Philadelphia, contained for many years one of the largest collections of plants in the United States. Evans kept up an active correspondence with Sir William Hooker, the Director of the Royal Gardens at Kew, from whom he received the seeds of many Himalayan and other rare and little-known plants. A few only of the trees planted by Evans, who died in 1862, are now alive; among them is probably the largest specimen of the European hop hornbeam in the United States.

In 1841 Henry Winthrop Sargent, of Boston, bought Wodenethe, an estate of twenty-two acres above Fishkill Landing, New York, overlooking the Hudson River. A friend and pupil of his neighbor, A. J. Downing, Sargent through Downing's influence became interested in the cultivation of trees and especially of conifers. At Wodenethe every coniferous plant that could be obtained was tested, and for forty years it remained the most important place in the United States for obtaining information on the value of these plants for cultivation in this country. If the results of Sargent's experiments were largely negative, that is if they were more successful in showing what trees were not suitable for the eastern states than in adding numerous species to the number of conifers which can be permanently grown here, they were of great interest and value to the country. For many years the influence of H. W. Sargent among lovers of country life in the United States was considerable and has done much in the last sixty years toward increasing the knowledge of trees and directing sound horticultural taste. To this influence is largely due the horticultural careers of his relatives, Horatio Hollis Hunnewell and Charles Sprague Sargent.

In 1852 Mr. Hunnewell began the development of an estate in the valley of the Charles River at Natick (now Wellesley), about twelve miles west of Boston. Here, with the aid of his relative at Wodenethe, he planted coniferous trees for which the well-drained gravelly soil proved to be suited. Past middle life when he began to plant his trees, he was able to see many of them attain a large size and his pinetum, in number of species and beauty of individuals, the most important in the United States. In the hands of a younger Hunnewell, it is constantly enlarged and improved, and Wellesley is still one of the most interesting places in America for the lover of cultivated trees.

About 1870 Josiah Hoopes, author of "The Book of Evergreens," the only American book on the subject, planted in connection with his nursery in West Chester, Pennsylvania, a large number of coniferous trees. This at the time was one of the best collections of these plants that had been made in the United States. Twenty-five years later, and after Mr. Hoopes' death, although a large number of the species had disappeared, many survived to show their beauty and value as ornamental trees. The Hoopes pinetum should be visited by everyone interested in the cultivation of conifers.

In 1874 Charles A. Dana, the distinguished journalist, bought Dosoris, an island about fifty acres in extent off the north shore of Long Island, near Glen Cove, and began planting trees. Great intelligence and industry was shown in this undertaking, and in the Dosoris collection are still found many rare trees and



shrubs of exceptional size and beauty; but with the change of owners this, like most private collections of trees in the United States, is probably destined to suffer from neglect or to entirely disappear."

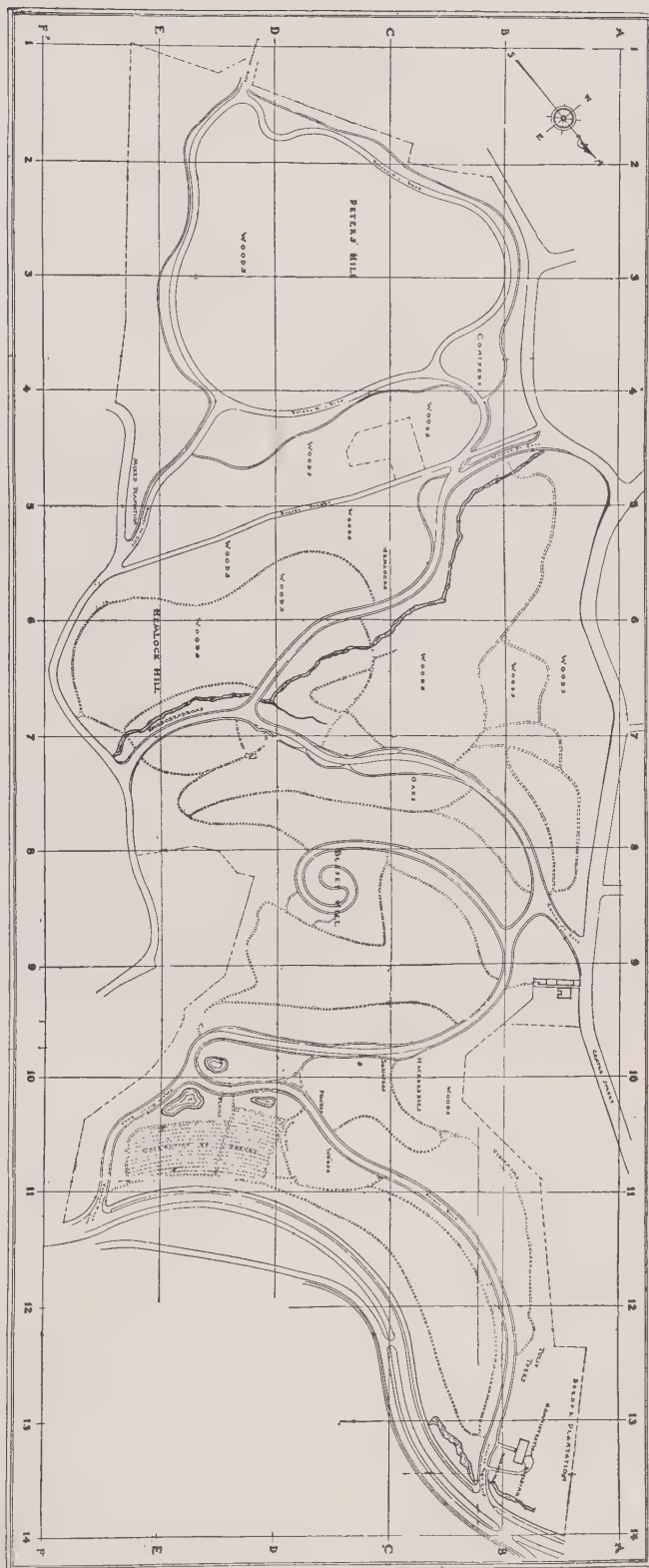
In Highland Park, Rochester, New York, on grounds admirably situated for the purpose, the park department of that city has established an arboretum which contains one of the largest collections of trees and shrubs in the United States and which, situated as it is in a great center of commercial horticulture, cannot fail to become a powerful factor in horticultural education. Equally important in educational possibilities is the excellent arboretum which has been established by the Government of the Dominion of Canada on its Central Experimental Farm at Ottawa. Placed in a region of great winter cold, the lessons which the Ottawa Arboretum can teach of the hardiness of plants will be of special value to Canada and to the northern borders of the United States.

The influence of American nurserymen by their introduction and multiplication of trees and shrubs must not be overlooked, and American lovers and students of trees will always gratefully remember such names as Kenrick and Hovey of Massachusetts, Price and Parsons of Long Island, Ellwanger and Barry of Rochester, New York, Thomas Meehan of Pennsylvania, Berckmans of Georgia, and Robert Douglas of Illinois. The arboreta which they planted in connection with their nurseries offered in their time valuable object lessons, and the influences of their publications are often of lasting value.

*The Arnold Arboretum. Figs. 309-311.*

It has been left to Harvard University to establish an arboretum on a large scale and in a manner which seems destined to make it permanent. This arboretum owes its origin to Mr. James Arnold, a merchant of New Bedford who died in 1868, leaving to the trustees of his estate \$100,000 to be devoted to the advancement of agriculture or horticulture. One of these trustees was George B. Emerson, the author of "The Report on the Trees and Shrubs of Massachusetts." Mr. Emerson, realizing the benefit which the world might derive from the establishment of a scientifically managed collection of trees in the neighborhood of Boston, proposed to turn over Mr. Arnold's legacy to the President and Fellows of Harvard College to be used to develop and maintain an arboretum, provided they would devote to this purpose a part of the farm in West Roxbury which had been given to the university by Mr. Benjamin Bussey. This plan was carried out in 1872, and 125 acres were set aside for the Arnold Arboretum, in which the University undertook to grow a specimen of every tree and shrub able to support the climate of eastern Massachusetts. In December, 1882, a contract was made between the university and the city of Boston under which the city agreed to add certain adjoining lands to the arboretum, to construct and maintain under the direction of its park commission a system of carriage-drives and walks

309. Map of the Arnold Arboretum, Jamaica Plain, Mass., a Department of Harvard University.



planned under the direction of Frederick Law Olmsted, to police the grounds and to assume all taxes which might be levied on the property during the thousand years for which the contract was made. In return for this assistance, the university agreed to open the arboretum to the public from sunrise to sunset during every day of the year, reserving, however, entire control of all the collections and of the grounds with the exception of the drives and walks. Work on the roads was begun by the city in 1885, but through various delays in construction, the planting of the principal collections of trees and shrubs was not undertaken until the following year. In 1894, seventy-five acres, known as Peter's Hill, and a part of the Bussey farm, were added to the arboretum by the President and Fellows of the university, and in 1898 were opened to the public by an encircling road built by the park department of the city. This contract with the city of

been understood by its management, is to increase the knowledge of trees and other woody plants. To accomplish this, something more than the collection of living plants hardy in eastern Massachusetts contemplated by the trustees of James Arnold's will was necessary, and the Arnold Arboretum as now organized is, first, an out-of-door museum in which the public can see the trees and shrubs of the north temperate zone conveniently arranged; second, a dendrological station and laboratory in which the scientific study of trees is carried on, and third, a bureau of publication, exploration and exchange through which botanical exploration in different parts of the world is undertaken and the results and products of these explorations made known and distributed.

In the arrangement of the out-of-door museum—the living collection of trees and shrubs—the species to facilitate study have been arranged in groups of genera



310. *Kalmia* in bloom at the Arnold Arboretum.

Boston is of great value to the arboretum, for, as it cannot be moved from its present location without the consent of the university and the city, there is little chance that, however valuable the land may become, the people of Boston will ever consent to give up a public park of unusual character and great beauty. The assumption of all taxes by the city during 1,000 years insured by this contract may become an important contribution to the arboretum.

The Arnold Arboretum occupies 220 acres of meadow, hill and valley. It forms one of the series of Boston parks with which it is connected by a broad parkway. It is close to the Forest Hills station of the New York, New Haven & Hartford Railroad, and it can be reached from all parts of the city by two lines of electric cars. Its natural features are a broad meadow along the northeastern boundary, and three high hills separated by narrow valleys through one of which flows a small stream. One of these hills is covered by a remarkable growth of hemlock trees, and natural woods, in which large individuals of many of the trees of eastern New England are found, cover other parts of the arboretum.

The purpose of the Arnold Arboretum, as this has

and families in a natural sequence whenever conditions of soil and situation have made this possible, a further attempt being made to arrange the planted groups in harmony with the native woods and the other natural features of the ground. All the groups of trees, shrubs, and all the natural woods are easily reached by grass paths which extend to all parts of the grounds. In the case of the trees of North America, several individuals of each species have been planted, but want of space has generally made it impossible to plant more than one individual of an Old World species. In the groups of American trees, one specimen is planted with abundant space for the full development of its branches and the others are arranged in a compact group to show their habit under such conditions.

For the convenience of students, the shrubs of genera in which there are no hardy trees, and all vines, have been arranged in a sequence of genera in long parallel beds near one of the principal entrances; but the shrubs belonging to genera in which some of the species are hardy trees have been planted in connection with the groups of trees of these genera. In addition to the shrubs in the general shrub collection, supplementary



collections of several of the large genera of shrubs have been established, usually in sheltered positions, in which are planted new or imperfectly known species or species that require unusual care or special protection.

The collections of the Arnold Arboretum are rich in the woody plants of eastern North America, northern Europe, Siberia, China and Japan, and contain the largest number of species and varieties of these plants to be found in any American collection; and gradually the Arboretum, with its hills and valleys, its native woods and varied vegetation, has developed into one of the most beautiful of all the public gardens of the world.

A large part of the trees and shrubs planted in the Arboretum has been raised in its nurseries from seeds collected in those parts of the region occupied by the species in which the climate most resembles that of New England. A record of the origin and history of all the plants is kept on the cards of a catalogue, and the position of every tree permanently planted in the groups is recorded on the sheets of a large scale map, and with this is kept the detailed history of each tree. Labels giving the Latin and English names and the region that they inhabit are placed at the height of the eye on the trunks of prominent native trees standing near drives and walks, and these labels are found on the trunks of many of the planted trees in the different groups. Metal labels with raised letters are used for the plants in the shrub collection and for shrubs and small trees near some of the walks. Wooden stakes giving their names are placed before many shrubs and small trees; and to every plant, whether otherwise labeled or not, a small zinc label is attached.

In order to make the Arnold Arboretum a scientific station and something more than a collection of living trees, an herbarium of woody plants intended eventually to represent the ligneous vegetation of the world and a library now containing 29,000 bound volumes and 6,000 pamphlets have been formed. An herbarium and library connected with such an institution are essential for the determination and correct labeling of the living collections and make possible original scientific work. A report on the forest wealth of the United States, the reports of state and national commissions appointed to study American forest conditions, the illustrated "Silva of North America," the "Manual of the Trees of North America," a "Forest Flora of Japan," "Trees and Shrubs," a monograph of the genus *Lonicera*, a monograph of the pines of Mexico, many of the articles on trees and shrubs in this Cyclopaedia, the ten volumes of Garden and Forest, the Jesup collection of North American woods in the American Museum of Natural History in New York, are some of the contributions to knowledge which the arboretum as a scientific station has been able to make. For several years, it has been actively engaged in bibliographical studies, and the results of these studies are being published in the "Bradley Bibliography," of which two volumes have appeared. An elaboration of the woody plants of China is in progress, based largely on the collections of E. H. Wilson, one of the arboretum explorers, and is now being published by the arboretum in the "Plantæ Wilsonianæ."

In connection with its work in search of material for its collections, officers and employees of the arboretum have visited nearly every part of North America, have traveled in Peru and Chile, and explored the Caucasus, Japan, Korea, and northern and western China. Through these explorations, the Arnold Arboretum has been able to introduce into the gardens of the United States and Europe a large number of new plants or plants that have been long lost to cultivation, and through these introductions it has established relations in all countries with the principal botanic gardens, the important nurserymen and many individuals interested in trees and their cultivation.

The work the Arnold Arboretum attempts and the demands which are made on it are national in scope and extent, but for a national American arboretum a more temperate and equable climate than that of Massachusetts is desirable. Its situation, however, in the midst of a population famous for its generosity and actively interested in horticulture, and the stability it enjoys from its connection with a great university, and from its contact with the city of Boston, are favorable to it. It is impossible, however, to cultivate in one collection the trees which grow naturally or can be made to grow in all the different regions of the United States, and the American national arboretum of the future must first of all be an institution, like the Arnold Arboretum,

of long life and continuous control; and this central institution properly equipped with laboratories and material for research must be in a position to establish branches in Florida, Arizona, California and in some central regions of the continent, for in such branches managed by the central institute, it would be possible to collect and to study nearly all the trees of the world suitable for



311. Trees still standing in the Humphrey Marshall collection.

different parts of the country, and so make possible in the United States an arboretum really national in character.

Herbaria are chiefly valuable when they supplement collections of living plants; and it is now becoming gradually acknowledged that accurate knowledge of trees and of many other groups of plants can be obtained only by a comparative study of the plants themselves. The opportunity for this will be found only in establishments in which plants in large groups can be assembled and grown under conditions favorable for their best development. Today the palms of the tropics, especially those of the Old World, can be satisfactorily studied only in the great collection of these plants gathered together in the botanic garden at Buitenzorg in Java. Some groups of northern trees and shrubs can now best be observed in the Arnold Arboretum, but to obtain exact information of others the student must make long and sometimes difficult journeys. Until, for example, collections of the cactaceæ and of plants like the agaves and yuccas are assembled in a region favorable to their growth, like southern New Mexico or Arizona, it will be impossible to obtain a true understanding of these plants which, when grown in northern greenhouses or in regions unsuited to their peculiar needs, more often mislead than illuminate. Comprehensive collections of the species of eucalyptus, acacia and other Australasian plants established in California would be of great value to that state; and collections of tropical and subtropical plants in southern Florida would immensely benefit not only



the southern part of that state but all the West Indies and other tropical countries.

#### *A nationalized arboretum.*

The arboretum, therefore, worthy to be considered national in scope and accomplishment in a country of such varied climates as North America must consist of a number of stations in different parts of the country under one management and with one central head from which the work of the different stations should be directed and superintended and which should be the bureau of publication of the results obtained in them. The position of the central station in the country is of little importance in comparison with its permanence, endowment and freedom from all dangerous influences. Such conditions of permanence and freedom in this country will best be obtained in connection with one of the great endowed universities rather than with the national or with any state government, for political association is not conducive to the best scientific research, and for the next hundred years at least, and until a real knowledge of the vegetation of the earth has been obtained, the National Arboretum must be organized primarily for research.

By the information it could accumulate, such an institution would be able to aid the agricultural experiment stations and state universities, which are the natural and proper organizations for popularizing the results of long-sustained scientific investigations, for which they are not equipped and which, with the uncertainty of their resources, they cannot hope successfully to carry on. Forestry and landscape-gardening are based on a knowledge of trees, and in the study of trees are found pleasures which increase with knowledge and endure through life.

The Arnold Arboretum endeavors to popularize its knowledge by the publication of Bulletins of Popular Information and by courses of popular field instruction; and it should further be the duty of a national Arboretum to aid in the establishment of arboreta in connection with agricultural colleges and experiment stations, on the grounds of universities not equipped with botanic gardens, and on the grounds of high-schools. Collections of trees properly labeled are needed in every institution of learning and in every large center of population. Until such collections are established, the people of the United States can hope to know little of the beauty and value of their native trees and of those exotic trees which can safely be introduced into different parts of the country.

C. S. SARGENT.

**ARBORICULTURE.** Arboriculture is the growing or cultivation of trees. It is distinct from silviculture, which grows trees in forest plantations for the production of a timber-crop. Silviculture is a part of forestry.

What constitutes a tree is not easy to explain in a short and well-defined statement. A given species may assume a tree-like habit or remain shrubby, according to the climatic conditions, soil and other circumstances. Usually a tree is defined, under normal conditions, as a woody plant rising from the ground with a single stem and attaining a certain height, fixed by some at 20, by others at 15 feet, or even less. A more exact definition has been given by B. E. Fernow: "Trees are woody plants the seed of which has the inherent capacity of producing naturally within their native limits one main erect axis continuing to grow for a number of years more vigorously than the lateral axes and the lower branches dying off in time."

Trees are the most prominent feature of the vegetable world and surpass all other organic beings in height, magnitude and longevity. The greatest height known has been reached by *Sequoia sempervirens*, which attains 340 feet. Not very far less is *Eucalyptus amygd-*

*dalina*, of which the highest tree actually measured is given as 325 feet; it is, therefore, the tallest of the hardwood trees. The sequoias, however, are of more majestic and gigantic appearance than the eucalyptus on account of their massive trunk (see *Sequoia*). *Pseudotsuga taxifolia* and *Pinus Lambertiana* occasionally attain 300 feet. A number of other conifers, chiefly American, grow to a height of 150 to 300 feet. Some deciduous trees, as *Platanus occidentalis*, several species of oak and *Liriodendron Tulipifera* exceed 150 feet in height. The jequitiba of southern Brazil (*Couratari legalis*, one of the Myrtaceæ) is also a gigantic tree (see Bot. Gaz. 31, p. 352).

The greatest diameter has been observed in *Castanea vesca*, of which a tree with a partly decayed trunk at the foot of Mt. Etna in Sicily measures more than 60 feet in diameter. After this the greatest diameter observed is in *Taxodium mucronatum*, about 40 feet, and in *Platanus orientalis* about the same, in *Sequoia gigantea* 35 feet, in *Taxodium distichum* 30 feet, and somewhat less in *Adansonia digitata*.

The age attributed to many of the tallest trees is based more or less on speculation, and opinions often differ widely. *Dracena Drac* is believed to reach 6,000 years of age, *Adansonia digitata* 5,000, *Taxodium mucronatum* and *Platanus orientalis* 4,000, *Cupressus sempervirens* and *Taxus baccata* 3,000, *Castanea sativa*, *Quercus pedunculata*, *Sequoia gigantea* and *Cedrus Libani* more than 2,000 years.

Although the trees are the most conspicuous features of the vegetable kingdom, they represent only a small percentage of it as regards the number of species. In the United States, where about 600 trees occur, they represent only about 3½ per cent of the whole phanerogamic flora, in Europe even less. As a rule, towards the tropics the number of tree-like species increases, towards the arctic regions it decreases. Remarkably rich in trees is the flora of Japan, where the proportion of trees to the whole phanerogamic flora is more than 10 per cent, which percentage surpasses by far that of any other country in the temperate regions.

Trees belong to many different natural orders, but of the orders of monocotyledonous plants only a few contain trees and none of them is hardy North. None of the larger orders contains trees only, but there are some which consist exclusively of woody plants and include a large proportion of trees, as Pinaceæ, Fagaceæ, Salicaceæ, Juglandaceæ, Magnoliaceæ, Sapindaceæ, Elæagnaceæ, Ulmaceæ, Hamamelidaceæ, Lauraceæ, Anacardiaceæ, Ebenaceæ, Styracaceæ and others.

The uses of trees are manifold, and a country from which the forests have been destroyed becomes almost uninhabitable and worthless to mankind. The forests furnish wood and timber, exercise beneficial influences on the climate, act as regulators of the waterflow, prevent erosion and also the removal of soil by the wind. Besides furnishing wood and timber, many trees yield other products of great economic importance, especially the numerous kinds bearing fruits. The æsthetic value also of the tree must not be underrated, although it cannot be counted in money.

The science of trees and shrubs is *dendrology*. The art of growing trees is arboriculture, while the rearing and maintaining of forests and the production of timber-crops is silviculture. Arboriculture is sometimes used in a broader sense, like dendrology, to include also the growing of shrubs. Orchard culture is a branch of arboriculture or of horticulture, and deals with the cultivation of fruit trees; it is usually included under pomology, which comprises both the science and practice of fruit-growing.

As ornamental subjects, trees are more permanent, easier of cultivation and cheaper in the long run than herbs. It is curious to note how little attention the average gardener who has the care of a park or garden gives to the most prominent feature of his domain. He





IX. Arboretum.—Plantation of American oaks at the Arnold Arboretum: *Solidago canadensis* underplanting.





usually knows fairly well the greenhouse plants and herbaceous perennials, which cost most in time and money, but the trees and shrubs he often disregards. This is apparently due to the fact that after being once planted, and often not by himself, the trees and shrubs do not need his perpetual care, and usually grow without his aid and interference.

To the landscape gardener a thorough knowledge of trees is absolutely essential. He ought to know the ornamental properties of the trees, their rate and mode of growth, their peculiarities in regard to soil, situation and climate. As the trees are, after the surface of the ground, the most permanent element of the landscape, they ought to be planted with careful deliberation as to the intended artistic effect and their fitness to the soil and climatic conditions, for mistakes in planting of trees are afterwards not easily corrected and rarely without injury to the original artistic design. The available number of trees from which selection may be made is large. There are in American and European nurseries and gardens more than 600 species in cultivation that are hardy in the northern and middle states. About 250 of them are American, more than 200 from eastern Asia, about 100 from Europe and 70 from western and central Asia. About forty natural families are represented, of which the most important are the Pinaceæ, Fagaceæ, Salicaceæ, Rosaceæ, Leguminosæ, Juglandaceæ, Sapindaceæ, Urticaceæ, Magnoliaceæ, and Oleaceæ. The number of all the cultivated varieties and garden forms is, of course, considerably larger than that of the botanical species and may be estimated at about 3,000. Comparatively few horticultural varieties are found in American nurseries as compared with European, but this need not be regretted, as horticultural varieties are mostly merely curious or monstrous forms. In planting, one must rely chiefly on the types and use the horticultural varieties sparingly, for restfulness should be the prevailing character of the masses and groups of trees.

ALFRED REHDER.

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#### The cultivation of trees.

From earliest times man's instinct has been to seek the protection of trees. In locating his home the first necessity has been the proximity of water; second, pasture for his flocks; third, the presence of trees; in warm countries it has been necessary to provide protection from the hot sun's rays, in cool countries for the sake of fuel and protection from the elements. As civilization has progressed and man has developed more elaborate abodes, he still desires the protection of trees to make his home more comfortable, to protect it from the winter wind, or the summer sun, or both.

To meet the needs in different localities, as one or another protection may be more important, different kinds of trees are used. In the extreme North, the coniferous evergreens act as windbreaks twelve months in the year. In the south Atlantic and Gulf regions, the broad-leaved evergreens give shade the year through.

In the intermediate country and overlapping both, the deciduous trees afford much summer protection and a little winter protection. The chief æsthetic value of trees is due to the suggestion of comfort that they give. In winter, a house snuggling against a group of evergreens may be attractive, and yet, if lacking a well-placed shade tree, may in summer appear glaring or otherwise uninviting. These feelings are the same with regard to native woodlands or man-made clumps more remote from dwellings. The different kinds of forest attract because of suggestions of comparative comfort and of pleasures. To those who have lived in the heart of a large city all their lives, such scenes are likely to be unattractive because of lack of suggestiveness. Some of the interesting and varied forms of trees are displayed in Figs. 312 to 359.

In planting trees for ornament, these elements of pro-



312. A group of old sugar maples, with irregular and broken heads.

tection suggest two uses, that of windbreaks and that of producing shade at appropriate places. In addition are the partial hiding of buildings from important viewpoints, enhancing the beauties of the building or permitting only the most desirable features to be seen, covering the outlines of ugly buildings, or completely hiding objectionable objects, either nearby or distant; forming frames for distant views or nearby objects; making knolls and hills look higher by groves on their tops, or valleys look deeper because of wooded sides; making irregular sky lines either by accentuating existing conditions by planting tall trees on the high places and low trees in the low places, or in level countries making a similar sky line by tall and short trees; or forming irregular and natural appearing boundaries to lawns or meadows.

To accomplish any of these results, some trees are inherently better suited than others; climate and soil, however, may make their use impracticable or impossible. Coniferous evergreens make the ideal windbreak and screen, but they are satisfactory only in the north-eastern section of the country and on the Pacific Coast, the hot sun of the South, the dry winds of the central plains and the smoke of cities making most species impossible in those regions. The broad-leaved evergreens are next in importance, but they are adapted only to the south Atlantic and Gulf seaboard, and the Pacific Coast north of San Francisco. For adaptabilities see special lists, for no other sweeping generalizations of adaptabilities can be made except that the use of bronze, yellow or variegated-leaved trees, and trees of unusual drooping habit or of other striking form, should be limited to special times and places. A tree to be satisfactory for ornamental planting must suit the



climate and maintain the appearance of healthy growth on the soil where planted, must be hardy, and must be free from serious insect and fungus attacks.

The location of trees is a detail of the design of the place. This is intimated in the preceding paragraphs and more fully discussed under Landscape Gardening, but a few cautions may be in order. Do not so surround the house with trees that they exclude all the sunshine. Except in the extreme South, use deciduous trees next the house so as to have full benefit of the winter sun. Plant the evergreens at a little distance. For specimen trees of the larger kinds, plant 50 to 100 feet apart, depending on the kind. For thickets and quick masses of foliage, the same kinds may be planted 15 feet apart. Theoretically, planting more trees than are ultimately necessary and then thinning is excellent. Practically, it is dangerous as there is not one chance in ten that it will be done in time. Plant irregularly both as to distance and direction unless the design is strictly formal, in which case plant with mathematical precision.

#### *When and how to plant.*

There is great difference of opinion as to the best time to plant. In climates with the temperatures of Boston, Rochester, Chicago and farther north, spring planting is probably best for most plants. Fall planting is increasingly more satisfactory as one goes south. On the western plains where strong, dry winter winds prevail and the soil is either so dry or freezes so hard that a newly planted tree cannot replenish the moisture taken out by the winds, spring planting is most successful. The character of soil may also have its influence. Magnolias and tulip trees should always be planted in spring. Coniferous evergreens should be



313. A commanding white oak on a bank margin.

planted either when growth has started in spring or, when vigorous, in late summer or early fall. Other evergreens should be planted when entering the period of most active growth so as to be able to form roots quickly to support the foliage that is always present. The period of generous moisture in air and soil is most favorable for the planting of evergreens. In adverse seasons, these conditions may be in a measure produced by liberal watering of the soil and frequent spraying of the tops. Deciduous trees should be planted

when dormant, in order that roots may become well formed before there is foliage to support.

Large holes should be prepared for planting, at least 2 feet larger in diameter than the spread of the roots of the lifted tree, and 2 feet deep. If the soil is good, no further special preparation is necessary beyond a liberal mixture of well-rotted manure or raw bone-meal with the soil to be replaced in the hole, and supplying new topsoil to replace any subsoil excavated in digging the hole. In poor ground, a hole at least 6 feet across and 2 feet deep should be dug for a tree up to 8 feet high, and for larger trees proportionately larger holes to give them good ground for beginning growth. It is becoming common to dynamite holes for trees. Just how far this is desirable is yet problematical. In tough subsoils, it appears to be eminently successful. It seems reasonable to suppose that in most subsoils such a loosening would be permanently beneficial. Careful observers have noticed that trees usually thrive better on filled ground than on nearby soil where the land has been undisturbed, even though the fill appears poor in comparison. This does not have reference to city ash and garbage dumps. The ashes are too inert to support tree growth, the dump is frequently poisonous. In large plantings, the watering of deciduous trees and the staking of trees under 10 feet is usually omitted in the moist regions in which strong winds do not prevail, the replacing of any losses being considered more economical than this additional expense. Larger trees need special attention.

The size of trees to choose varies with the kind, the purpose, and the need for quick results. Trees may be successfully transplanted from one- or two-year-old seedlings to those 12 or 16 inches through and 40 feet high, success depending largely on the skill of the planter. Usually trees 6 to 12 feet high are best for deciduous trees, 3 to 6 for coniferous. Some species succeed better with small sizes, as tulip tree, magnolias and hollies. Nursery-grown trees that have been frequently transplanted are best, as they transplant with less loss because they have an abundance of fibrous roots. Collected stock of some kinds is satisfactory for mass-planting but the loss will run from 50 to 90 per cent, depending on kind and condition. Trees that are very small are not desirable to use, as they grow no better than larger nursery-grown trees and the cost of cultivation is more when planted permanently than when in the nursery row. Trees above the sizes mentioned are expensive to handle and the loss is likely to be greater. When immediate results are important, these are worth using with a mixture of smaller trees to take their place in case they should be short-lived.

#### *Pruning and tree-doctoring.*

At planting, all broken limbs should be removed as well as any crossing through the head or below it. If the top is still crowded, some limbs may be removed by cutting them off at the nearest fork. Heading-in or shortening the limbs is undesirable with most species. The magnolias and tulip tree are exceptions to this; they need severe shortening-in when transplanted. All roots should have the broken ends cut off with a smooth, clean cut, as this freshly cut surface seems to facilitate the formation of new rootlets or at least to prevent decay. If a newly planted tree is very slow in starting, it is sometimes induced to grow by a severe pruning.

Desirable varieties of shade trees seldom need any heading back. An annual inspection with slight pruning to shape the tree and remove surplus branches is all that will be required. A tree should be grown into shape, not pruned into shape, and should be allowed to develop its own characteristics.

Evergreen trees, with the exception of the evergreen oaks and *Magnolia grandiflora*, should be trained so that their foliage rises directly from the turf. As it



grows old, the white pine is likely to bare its trunk in spite of other training. Spruces and other coniferous trees are ruined if pruned to show the trunk. Figs. 318, 319. Many deciduous trees are also most attractive when their lower limbs rest on the ground, as beeches, the Norway maples, hornbeams and many more, any tree in fact whose natural habit will permit such a form.

Old trees, owing to neglect, or more often, improper pruning, frequently need the saw. Protruding stubs should never be left, whether the tree is large or small. The cut should always be made close to the remaining limb and parallel with it. It will not require over two years for the callus to show all around a properly made cut. If it does not show then, the work should be done over again. All dead wood should be kept out. Crossing limbs, even if large, should be removed. A tree should not be dehorned, i.e., cut back to stubs 3 or 4 inches or more in diameter, except as a last resort for a failing tree.

Pruning is employed for two distinct ends: to train and shape a young tree as it grows; and to re-form or adapt a tree of some maturity, especially if somewhat decrepit. The so-called "tree-doctoring" or "tree-surgery" is applied especially to the latter phase. A tree that has become weakened by transplanting, or from lack of proper nutrition, from lack of proper fertility, or scarcity of water, or from other undetermined causes, may often be forced into active vigorous growth by a severe cutting-back. It may even be allowable, in such cases, to pole or dehorn a tree; that is to remove most of the small limbs, cutting the large ones so close to the tree as to leave stubs as large as one's wrist or arm or even larger. It never happens that several trees in a row need such treatment unless their feeding-ground has been greatly depleted.

Trees that have been badly pruned, broken by wind, storms or otherwise bruised or mistreated, frequently have badly decayed spots in their trunks and limbs. It has become the custom to "doctor" such trees,—that is, thoroughly to clean out rotten wood, treat the exposed surface with a solution of corrosive sublimate or sulfate of copper to kill any fungous growth that may be present, with bisulfide of carbon or other insecticide for insects, and then coat the surface with tar as a preservative. After this the cavity is carefully filled with concrete of the strength commonly used in construction work. It is absolutely essential to success that the joint between the wood and cement be water-tight. The surface should also be given a smooth finish of the general outline that the tree would assume had it grown normally. The finished surface should coincide with the inner edge of the cambium layer so that the growth of the tree will proceed over the cement just as it would over a properly cut stub. Zinc caps are frequently used both to cover cement fillings to keep out the water and to cover large cuts when the wood is solid but when it will take several years to heal on account of the size of the wound. Cavities must be absolutely clean, thoroughly disinfected, and the filling positively water-tight or decay will begin behind the filling and the tree will be destroyed while every confidence is being felt that it is safe. The cement work is frequently reinforced with rods of iron. Its principal value is to hold the cement from cracking. The only value of such cement work is as a preventive of decay where there are cavities. When properly done, it gives a smooth surface over which the growth may proceed. The supporting value of the cement to the tree is slight.

With many hardwood trees in important locations such treatment is warranted, but at the present time many trees are thus treated that should be cut down, while many others are left that should have attention. The first requisite to warrant the treatment of a large cavity is a good type of tree in an important location, for example a large tree protecting the home from the

mid-afternoon sun, or a bad individual in an avenue of otherwise good specimens. In large plantations, treatment of a preventive nature is of course warranted, but the filling of large cavities is not worth the cost except to those to whom money is little object. It is better to start new trees than to spend fifty dollars on patching up an old one. One must exercise careful judgment in selecting old trees for treatment, to make sure that the tree is worth it. Trees worth doing work on are the oaks, sugar, swamp and Norway maples, hickory, ash, elm and the slow-growing native trees. Those not worth treating in this way are the poplars, willows, silver- and ash-leaved maple and sycamore or plane



314. Picturesque old apple trees.

tree. A street tree with a large cavity would better not be doctored unless it is of special value and of a kind likely to last a long time.

Badly branched trees often show a tendency to split in the crotches. It is well to attend these trees before they begin to split and either chain or bolt the offending limbs together. They may be chained by putting lag-screws in the limbs, drawing the limbs together and dropping a link of the chain over the turned up end of the screw. Rods and turn-buckles may be used in the same way, the bolts for the rods being put through the limbs, not around them. Because bolts have to be placed closer to the weak point than the other remedies, they are not so effective but are often useful. If a tree splits, there is danger of decay. The splitting should be anticipated and prevented whenever possible.

The best time for pruning is not a question of invariable rule. The period of most active growth, in most places June, is usually regarded as the best time. The period of starting into leaf is probably the worst time, although the maples are about the only good shade trees that seem much affected by pruning at this season.

Large cuts or wounds should be immediately painted with a good grade of paint or with tar, care being taken to cover the exposed wood but not to allow the paint to come into contact with the cambium layer, or growing part of the bark.

Root injuries should be as zealously guarded against as injuries to the top. If a large part of the roots must be removed, the top should be correspondingly thinned. Changes of grade are a great source of damage to shade-trees, even when the roots are not actually touched. The filling of 2 or 3 feet of soil over the roots of a tree is, for most varieties, as sure death to the roots as cutting them off close to the trunk. This filling prevents the aëration of the soil and smothers the soil life on which healthy root-action seems to depend. This may be

prevented by a good layer of loose stones, open at intervals to the air, placed over the surface before filling, or, in some cases, by the use of agricultural tile drains on the old surface at close intervals and so arranged as to facilitate a free circulation of fresh air through the tiles.

#### *Street trees.*

In the development of towns and cities, the need of trees as a protection against wind has been reduced to a minimum since the closely built houses protect one another. This close building, however, has brought about another untoward condition that needs ameliorating; this is the replacing of the vast extent of green, common to the open country, by a motley array of discordant colors. Many of these colors have been demonstrated experimentally and practically to have exciting and debilitating effects on the physical condition of persons. Part of the great utility of parks is to afford urban residents relief from this color excitement. As far as possible, the soothing green needs to be



315. A group of surviving hemlock spruces.

taken into the city streets to rest the tired nerves through the effect on the eye. Also, the shade helps to reduce the temperature by absorbing the sun's rays; the large amounts of water the tree transpires also helps to cool the air. These beneficial effects make it worth while to expend effort and money to secure well-shaded streets. Figs. 323, 324.

The conditions in urban communities are adverse to tree growth. Streets are narrow and the trees crowded; roadway and sidewalk are paved with impervious materials preventing both water and air getting into the soil, and effectually keeping in sewer-gas and illuminating-gas that may be discharged into it from below. The air is dust-laden from constant traffic, and, what is far worse, contaminated by soot and poisonous compounds from numberless badly-fired chimneys. As though this were not enough, there are the self-styled tree-trimmers, knowing nothing of the work, then the linemen cutting ruthlessly, caring nothing for the tree, and with an occasional gnawing horse adding its dem-

olition. And the sewer-layer, pipe- or conduit-layer and finally the curb-setter do their worst. After all of these, come the insects and diseases that affect trees everywhere and which here find an easy prey because of the fewer birds in city streets and the weakened condition of the trees.

The first essential to successful street tree-planting is competent municipal control of all such work. The street trees should be under the care of an unpaid commission of three or five men, one named every two years by a local court, or by the mayor, for a term of six or ten years, and confirmed by the legislative body. Such commissioners usually need to be trained, and therefore they should have considerable experience in their work before coming into full responsibility. The restrictions on the appointment of the executive officer should be stringent, so that only thoroughly trained and experienced men could be employed. The expert should have the full confidence of the commission and be the leader in the work. To fill such a position, a man should have thorough knowledge of trees and the soils and conditions under which they grow, their characteristics, æsthetic values and habits of growth under city conditions, the methods of aiding trees to withstand these conditions, and a knowledge of the insects and diseases to which the different species are liable and the methods of combating them. The work is neither forestry nor pomology, as it has nothing whatever to do with the products of tree growth or the growing of trees for their fruits.

Powers vital to the success of this commission are the right to plant suitable kinds of trees in a proper way, and to collect benefits for work so done; to control absolutely all pruning, removal and care of trees; and the right to invade private grounds for the control of insects and diseases. Of course, sufficient funds must be available to support the work.

Many city streets are too narrow from building-line to building-line for satisfactory planting. There is absolutely no excuse for this in the newer sections. There should be at least 100 feet from building-line to building-line on any street and on principal streets considerably more. Forty feet may be all that is needed for roadway and sidewalks, at present. The abutting dwellers need the air-space provided by the remaining area which is legitimately used as front lawns. This will leave ample space for trees. If the city grows and more space is needed for traffic, it can be secured with no sacrifice to buildings and the dwellers in the interval have had better living conditions. It is this arrangement that makes Washington such a beautiful city, and the lack of it on Fifth Avenue that is costing New York City so much money to widen that thoroughfare. In the older parts of cities, species must be chosen that are appropriate to the width of the street. Most kinds should be planted not closer than 40 feet apart and such varieties as oaks, elms and sycamores would be better at 50 feet. Most planters use 35 and 40 feet because of the public demand for quick shade, and at the greater distances the trees look far apart when first planted. Theoretically, the planting double the number of trees needed at maturity or the placing of fillers of a quick-growing inferior type, is desirable; but practically it is dangerous, as there are not many cases in which public opinion will tolerate the thinning at the proper time. In city work an excavation 2 feet deep, with the removal of at least 2 cubic yards of dirt, should be made for each tree. This should be filled with good top-soil mixed with well-decomposed manure. Of most varieties, trees 10 to 12 feet high and 1½ to 2 inches caliper should be used. These should be nursery-grown. They should have been frequently transplanted and have a well-developed head, 6 to 8 feet from the ground. The roots should be abundant and fibrous. In planting, the roots should be spread out and separated to their full length, the ground worked all in amongst them, and then thor-



oughly firmed by tramping. Before the hole is completely filled, the tree should be well watered and the remainder of the soil put in loosely. A strong stake 8 feet long should be placed beside the tree when planted. At least 30 inches of this should be in the ground. The tree may be attached to the stake by a piece of old garden hose attached to each side of the stake and put around the tree in such a manner as to make a cross between the stake and the tree.

All young trees should be protected by boxes or guards. Many forms are used. Any of them are good if the box reaches from the ground to a height of 5 feet and will prevent horses biting the trunks and boys swinging on the guard.

#### Notes on ornamental trees.

*Acer Negundo* (box elder). Too short-lived, brittle and subject to insect attack. Its use may be warranted in semi-arid and very cold regions.

*Acer platanoides* (Norway maple). Moderate grower, healthy, but too dense for close city streets.

*Acer rubrum* (swamp maple, scarlet maple). A good-sized tree, good grower, fine foliage, especially brilliant in autumn. Also a bright red in spring due to blossoms and young leaves. Not suited to the interior of large cities.

*Acer saccharinum* (silver maple, soft maple). Rapid grower, but too brittle and short-lived, and the shallow roots prevent the growth of grass under it and also destroy sidewalks.

*Acer saccharum* (sugar maple). Does not thrive on heavy clay soils or under severe city conditions but most excellent where it does grow. Moderate grower, doing best north of the 40th parallel.

*Ailanthus altissima* (ailanthus, tree of heaven). A large, handsome tree, the staminate and pistillate flowers appearing on different trees, the latter very ill-smelling. A most useful tree in the center of large cities. The staminate form only should be planted.

*Celtis mississippiensis* (southern hackberry). An excellent tree in those regions in which the "witches-broom" does not attack it. One of the promising trees to withstand the hot winds of the plains as far north as Denver. A large tree and good grower.

*Celtis occidentalis* (hackberry). A good tree where the disease known as "witches' broom" does not attack it. It is for regions north of the 36th parallel what the foregoing species is for the region south of it.

*Frazinus americana* (ash, white ash). A good tree for suburban conditions. Moderate grower, attaining large size.

*Ginkgo biloba* (ginkgo, maidenhair tree). An excellent tree of peculiar pyramidal form when young. Moderate grower, attains good size and is free from insect and fungus attacks.

*Gleditsia triacanthos* (honey locust). A large, quick-growing, handsome tree. Except for its thorns, this tree would probably be a most desirable tree for the semi-arid regions of the West. There is a thornless form that may sometimes be obtained, which is good



316. *Pinus ponderosa*.  
Giant specimens 225 ft. high, grown in the deep, moist soil of the Yosemite Valley.

*Liquidambar styraciflua* (sweet gum). A handsome and valuable native tree but little used. Moderate grower, good size, handsome fall coloring. A little hard to transplant, especially in large sizes. Does not succeed well under extreme city conditions, and is not adapted to the extreme northern sections.

*Liriodendron tulipifera* (tulip tree). Miscalled yellow poplar, and tulip poplar. A handsome, large, quick-growing tree, little used, but valuable except for extreme city conditions and much of the country north of the 40th parallel. A little hard to transplant, especially in large sizes, and should be moved only in spring.

*Magnolia grandiflora*. A broad-leaved evergreen of large size, adapted to the extreme South. A good lawn tree as far north as Washington.

*Magnolia acuminata* (cucumber tree). A handsome tree of moderate size, good for suburban conditions south of Washington and St. Louis.

*Magnolia tripetala* (umbrella tree). A handsome tree of moderate size, good for suburban conditions south of Washington, and St. Louis.

*Melia azedarach* (umbrella tree). A small, attractive tree, good for temporary effects from North Carolina south and west.

*Nyssa sylvatica* (sour gum, tupelo). A large, handsome tree, adapted to suburban conditions. Brilliant fall foliage and winter berries.

*Platanus occidentalis* (sycamore, buttonwood). A large tree, rapid-growing, open-topped, and almost scraggly in its growth. Considered an untidy tree by some on account of its seed-balls and the bark which is shed in large flakes. The white trunk, after the bark is shed, is unusual and attractive. In some regions it is subject to a blight just after the leaves start in spring. A good tree for severe city conditions.

*Platanus orientalis* (plane tree, oriental plane). A more compact grower than the foregoing and a little better suited to street purposes, but not quite so rugged and imposing as the foregoing. An excellent street tree.

*Populus deltoides*, including var. *caroliniana* (cottonwood and Carolina poplar). These two trees are much used for street planting in many places but are entirely unsuited for the purpose. Although the growth of a severely pruned tree is large in any one year, it is the custom to remove a half of this each year so that the net gain in growth is no more than an average tree. Even with this pruning it is liable to be broken by a moderate wind storm, and without the pruning it is even more liable to be broken. Their roots are as bad as willow roots about finding and clogging sewers. Wide-awake cities prohibit the planting of these trees.

*Populus nigra* var. *italica* (Lombardy poplar). A tall, short-lived, fastigiate



317. Conifer forms — Pine and spruces.

tree, suitable for narrow streets in the heart of a large city.

*Quercus alba* (white oak). A most picturesque tree, attaining the largest size. The gem of American trees, and not so slow-growing as usually considered. Dead leaves hang on most of the winter. Figs. 313, 322.

*Quercus bicolor* (swamp white oak). A large, handsome oak of moderately rapid growth, suited to moist situations. It seems to succeed under city conditions. A desirable shade tree, almost as handsome as the white oak and a little faster grower.

*Quercus coccinea* (scarlet oak). Comparable to the red oak but not quite so sturdy and vigorous under all conditions, but with a little more brilliant autumn coloring and leaves more finely cut.

*Quercus laurifolia* (laurel oak, water oak). The standard street tree for the South. A large, handsome, deciduous tree, not so desirable as the live oak, but of more rapid growth.

*Quercus Michauxii* (cow oak). A good oak for thin gravelly lands. Not so desirable as the other oaks on



318. Spanish Fir.—*Abies Pinsapo*, showing the verdure from top to base.

good ground and not adapted to the extreme northern sections.

*Quercus macrocarpa* (mossy-cup oak). A handsome and satisfactory tree, not so large as some of the others. One of the most promising for the plains.

*Quercus nigra* (possum oak, water oak). Another good oak south of Norfolk. A little more upright in growth than *Q. laurifolia*, but not quite so desirable except possibly in its more northern limits.

*Quercus palustris* (pin oak). A quick-growing, good-sized tree, with pendulous branches when old. Handsome cut leaves, brilliant in autumn. One of the best. Its pendulous branches may sometimes be a rather serious objection. Dead leaves hang on well into the winter. Fig. 323.

*Quercus phellos* (willow oak). A large, handsome tree, moderately fast-growing, satisfactory south of Washington in regions in which it is not attacked by a growth resembling "witches' broom" of the celtis.

*Quercus rubra* (red oak). Almost the best street tree. Large, symmetrical, rapid in growth, fine autumn foliage, head not too dense. It is exceeded only by the elm in rapidity of growth among the trees suited for street planting and not by that in the southern half of the country.

*Quercus virginiana* (live oak). A large evergreen. The best street tree for the South, but slower in growth than *Q. laurifolia*.

*Sterculia platanifolia* (varnish tree). A small tree of reasonably rapid growth bearing bright yellow flowers.

It has a tropical suggestion. Good only for the South and its principal value is in its possibilities for the Southwest, especially semi-arid Texas.

*Tilia americana* (basswood, American linden). A large, handsome, quick-growing tree. Young trees are sometimes affected by a disease at the base of the trunk, but the tree is well worth growing except in regions in which the difficulty is known to be present.

*Ulmus americana* (elm, white elm). The shade tree of New England and deservedly ranked first there. It loses its preëminence as one goes from New England, but a large, quick-growing tree worth using except in the extreme South. Drops its foliage too early to be the ideal shade tree in the middle states and southward. It is subject to the attacks of the elm-leaf beetle in regions in which that has been introduced.

F. L. MULFORD.

### The conifers in particular.

The cone-bearing trees (*Pinaceæ* and allies) are decidedly the most important order of forest trees in the economy of civilized man. They have furnished the bulk of the material of which our civilization is built. The remarkable combination of strength and stiffness with the smallest weight compatible, and the abundance and gregariousness of their occurrence, give them this important position.

From the standpoint of the horticulturist, the conifers also take a prominent place among the materials for landscape gardening effects, and, in the more practical use, as windbreaks. Their evergreen habit—for all except the larch and ginkgo tribes are evergreen—and their conical form, especially in earlier periods of life, with a branch system persisting to the base for a long time, are the elements that make them desirable. To these graces may be added the peculiar form and striking coloring of their foliage, which, in combination with deciduous trees or in clumps by themselves, or in single specimens, offer striking effects.

There are two types of natural or native beauty in the conifers—the symmetrical and verdurous beauty of the young specimen (Figs. 318, 319), and the picturesque and rugged beauty of the old and timeworn tree (Figs. 315–317). Aside from these, there are also odd, grotesque and formal cultivated varieties, as typified in the weeping spruce (Fig. 320), the columnar junipers, and the various dwarf pines and spruces.

The majority of the species belonging to this group, as well as their greatest numerical development, is found in the temperate zones, only a few belonging to subtropical or tropical countries, among which are the araucarias, from South America; the dammara, dactyidium, and phyllocladus, from Australia, and neighborhood.

### Kinds and adaptations.

The order Coniferae comprises nearly 40 genera, and about 300 species. Our own native flora, with 15 genera and not less than 100 species and subspecies, is among the richest, the bulk of these being found on the Pacific coast. The Atlantic side offers 28 species, representing the genus *Pinus* with 12 species out of 39; 1 *Larix* out of 3; 3 *Piceas* out of 7; 2 *Tsugas* out of 5; 2 *Abies* out of 12; 1 *Taxodium*; 1 *Thuja* out of 2; 1 *Chamaecyparis* out of 3; 3 *Juniperus* out of 11; 1 *Tumion* (*Torreya*) out of 2; 1 arborescent *Taxus* out of 2; being without representatives of the genus *Pseudotsuga*, *Sequoia*, *Libocedrus*, and *Cupressus*. There are to be added a large number (not less than 400) of nurserymen's varieties, some of which have been enumerated in Bulletin 17 of the Division of Forestry, United States Department of Agriculture.

There are also a number of exotic conifers that promise satisfactory results if used in suitable localities, climate and soil. The Norway spruce (*Picea ex-*



*celsa*, Fig. 356) recommends itself by its elegant gothic form, often with pendulous branchlets, its very rapid growth, and its wide adaptation to soils and climates, together with its ease of propagation and cheapness. It excels most of the American spruces in form and rapidity of growth. Like all conifers, after the twenty-fifth to fortieth year it must pass through a period of change in form, during which it loses, for a time, its shapeliness. The Scotch pine (*Pinus sylvestris*) has nothing to recommend it which may not be found in native species, except, perhaps, adaptation to the dry climate of the West, and cheapness. The Austrian pine, on the other hand, is an acquisition by its stout growth in its youth, although the red pine (*Pinus resinosa*) would probably do as well; so far, its small cones and seed have made the latter expensive. The European larch outgrows the native northern one easily, but *Larix occidentalis*, from the interior basin, will probably do as well or better. There is no particular commendation for the European fir, but the Nordmann fir, from the Caucasus, is a most decided acquisition, by its beauty and adaptation; so is the most graceful of all spruces, *Picea orientalis*, while the Spanish *Abies Pinsapo* (Fig. 318) will always attract attention by its peculiar shape and foliage.

Of other ornamental forms that are without representatives in the United States and hence fill vacancies, may be mentioned as capable of adaptation and more or less in use, from South America, the araucarias; from Africa and eastern Asia, *Cedrus Deodara*, *libani*, *atlantica*, *Abies Apollinis* and *cilicica*; from Korea, the promising, more densely foliated white pine, *P. koraiensis*; from China, *Cunninghamia*, *Biota*, *Glyptostrobus*, *Cephalotaxus*, *Podocarpus*, *Pseudolarix*, and, above all, that interesting remnant of former ages, the maiden-hair-tree, *Ginkgo biloba*, which will maintain itself anywhere along the Atlantic coast if propagated from seed of the proper localities. Japan has furnished a number of additions, especially *retinosporas*, *torreyas*, *taxus*, various *pinus*, *piceas* and *tsugas*, with the peculiar *Sciadopitys verticillata*, the umbrella pine, and, the most acceptable of all, the graceful *Cryptomeria japonica*.

As with all introductions from one country to another, nay, from one climatic region to another, caution is advised, so it may be laid down as a rule, that exotics should be used with great discretion, and, until their adaptation is amply demonstrated, only in a subordinate way. If it is in general true that perennial plants can be transplanted with permanent success only into similar climatic conditions, it must be especially true with the conifers, which do not lose their foliage, and hence must be able to bear summer as well as winter conditions. The long-leaf pine of the South, most striking of our pines, may, therefore, not be transplanted far beyond its northern limit, and, if one desires to utilize any of the Pacific coast species in the East, one will have to secure them at least from the highest and driest altitudes and exposures, or if, as in the case of some species, like the Douglas fir and Engelmann spruce, their field of distribution covers the dry slopes of the Rocky Mountains as well as the moist slopes of the coast ranges, one may be successful if one chooses the plant material from these drier slopes.

Of the many native species, a number that are not of any particular value may be discarded, although the distinction could be more readily accomplished from the economic point of view than from the standpoint of the horticulturist and landscape gardener, for almost every one has a distinctive feature of either form or adaptation to soil or other interest. For each climatic region the choice must be different; hence it would be impossible to give, in the brief space of an article, intelligent advice as to best selections. In general, besides climatic limitations, the following considerations may serve in the choice of native species:

The pines, as a rule, are not to be placed on compact clay soil, and on account of their taproot, not on shal-

low soils, on which they soon become spindly; they thrive best on loose, sandy soils, and can endure dry soils, the white pine adapting itself perhaps best to the clay soils without detriment to its development. On wet soils pines are, as a rule, decidedly out of place, although the red pine (*P. resinosa*), of the North, and the loblolly (*P. Tæda*), and some other southern species are capable of supporting such conditions. For such situations here, however, the cedar tribe furnishes better material,—the *chamæcyparis*, *thuyas* and *taxodium*. These trees of the bog and swamp are, however,—it should not be overlooked,—capable of thriving even better on drier soils. They are merely indifferent to moisture conditions at the foot.

The shallow-rooted spruces are trees of the higher mountain ranges, and are, therefore, more adapted to moist and cool situations, although some of them, the



319. A well clothed conifer.—*Abies venusta*.

Norway spruce, the blue spruce of Colorado and the northern white spruce will—the former, at least, during its juvenile period—endure more droughty situations. The firs, too, are rather more species of northern climates and high altitudes, the red fir, so-called (*Pseudotsuga taxifolia*), which is not a fir proper, being, perhaps, best capable of supporting drier and hotter situations. The most ornamental, and, in many respects, most serviceable of the firs, *Abies Nordmanniana*, from the Caucasus, develops its magnificent dense and dark green foliage in the warm but moist climate of Washington, while our most ornamental *Abies concolor* from Colorado will thrive even in the drier atmospheres of the middle states. The fine firs of the Pacific coast will probably not thrive anywhere in our drier and hotter eastern climates for any length of time, unless placed in cool and shady situations.

The Douglas fir (*Pseudotsuga taxifolia*) is, perhaps,

most readily acclimated if seed is secured from the dry slopes of Colorado. The Lawson cypress (*Chamaecyparis Lawsoniana*), with its graceful pendulous branches and foliage, and the pyramidal *Libocedrus decurrens* are unquestionably desirable additions to our ornamental stock, while the sequoias, especially *S. gigantea*, the big tree, seems not to be able to support persistently our eastern climate.

One important feature which enters into consideration when grouping conifers is the relative endurance



320. A "weeping" or drooping form of Norway spruce. This is a so-called horticultural variety, to be planted only sparingly.

of shade or tolerance which the species exhibit, thereby indicating their use in various positions. The yews and firs are the most tolerant of shade, together with the hemlocks; next may be placed the spruces, arborvitæ (*Thuja*), and junipers, while the pines are mostly intolerant of shade, excepting the white pine, which is the most shade-enduring of the pines; the larch and the bald cypress are the most light-needing of all, and will perish soon if placed under the shade of any other trees. All species, to be sure, are capable of more shade-endurance when young and on deep, moist soil. Their relative shade-endurance under the same conditions remains, however, the same, and may be studied in the forest by observing

#### Propagation.

Most conifers ripen their fruit in the fall, September to November, and are best gathered soon after or before ripening. The pines require two years (some three years) to mature their cones. White pines ripen fruit in the first two weeks of September, and the cones opening shed the seeds at once, the empty cones remaining on the branches. The cones of the firs fall apart upon ripening, hence must be gathered before being quite ripe. Spruces and hemlocks shed seeds from time to time, opening and closing their cones according to the weather through the winter into spring. Some pines, like *Pinus pungens* and *P. serotina*, keep their cones closed for years, and artificial heat must be employed to make them open and give up their seed. In gathering seeds for the trade, such artificial heat is frequently applied with pines in specially constructed seed-roasters; such seed should be carefully inspected, as it sometimes suffers from improper use of the heat.

The proportion of germinating seeds, and the vitality, i.e., the ability of retaining germinative power, varies greatly not only with the seasons in the same species, but from species to species.

The lowest germination percentage and vitality is found in firs and larch, which show rarely more than 50 per cent of good seed, and soon lose their vitality, while spruce and pine, when entirely fresh, may show as much as 95 to 100 per cent germination, and retain vitality for two to five years, losing each year a proportion. Norway spruce five years old still having 10 per cent germination.

In trade, a germination percentage for spruce of 75 to 80; pine, 70 to 75; fir, 30 to 50; larch, 20 to 40, should be acceptable.

Seeds are best kept in a dry, cool garret in tight bags or boxes, excluding the air as much as possible.

All seeds require a short rest or after-ripening of two to four weeks before they are ready to germinate, and some, like the taxus and juniper, lie over, even in nature, for a year or more before they germinate. The latter should be prepared for sowing by macerating them, and removing the pulp in hot water, then mixing with sharp sand in bags, and by friction freeing the seed from the pulp.

In the seed-bed somewhat more care is required than with most other species of trees. A thoroughly mellow, well-pulverized seed-bed of light loamy sand, possibly enriched with well-decomposed manure (cow-dung better than horse-dung) is required, the covering of the seed varying, according to size, from a mere sprinkling for larch to  $\frac{1}{4}$  inch for the heavy-seeded pines. They may be sown as soon as the weather is settled, in northern latitudes the second or third week in May, best in rows not more than 6 inches apart, and preferably in dry weather, when the soil does not clog, for clogging or baking of the earth sometimes prevents seeds from germinating. Mulch between the rows with pine needles or sphagnum moss, or other fine mulch, to reduce necessity of watering and weeding. Conifer seeds need very little water for germination. The seedlings, on the other hand, for the first three months, until they have made their crown bud, need to be either kept well watered or else protected against the drying effects of sun and wind by shading, for which purpose lath screens are best. These latter must be lifted for airing after the sun is gone, especially in muggy weather, to avoid damping-off. For wintering, a covering with conifer branches or very clean meadow hay is advisable (the latter is likely to bring in weeds).

For growing small quantities, the use of boxes, as described by Jackson Dawson, of the Arnold Arboretum, in Proceedings of the Massachusetts Horticultural Society, is highly commendable. In well-drained boxes, sow the seed soon after gathering, pile four or five deep in a pit or sheltered place, cover with boards, and when cold weather comes, cover up with leaves or hay. About the middle of April, move them into a place where they get the early morning sun. Keep the seedlings well watered and free from weeds, and shaded as described. Winter the seedlings in same manner as the seed-boxes,



321. A "weeping" tree, representing a grotesque horticultural variety.—*Ulmus scabra* var. *horizontalis*.

well covered up. They are ready for transplanting next spring, when they are making their first or second set of true leaves.

Since pine and spruce seedlings take about seven to ten pounds of phosphoric acid, ten to twenty pounds of potash and fifteen to thirty pounds of lime, besides



twenty pounds of nitrogen, per acre from the soil, for continuously used nurseries the addition of mineral materials in the shape of bone-meal and wood-ashes may become desirable.

A large number of seedlings may be grown in a small space; thus 30,000 Norway spruce may be grown on a square rod, requiring about two pounds of seed. The quantity of seed sown depends, in part, upon the length of time it is expected to leave seedlings in the seed-bed, besides size and quality of seed; the quantities vary from one-fourth to one-half pound per 100 square feet if sown in drills, and the yield of seedlings will vary from 2,000 to 25,000 seedlings, according to species and seasons.

#### *Transplanting and pruning.*

Conifers, like any other trees, may be transplanted at any time of the year, provided the necessary care is taken in moving the plant. This care is least required, as with other trees, in the fall and early spring, when activities of root and foliage are, if not at rest, at least reduced. Which of these seasons is preferable depends on the locality, and the dependent character of the season. On the whole, spring planting will probably be preferable in most parts of the United States which do not suffer from dry spring winds. In localities of the Southwest, which have commonly a dry spring followed by a rainy season in July, this latter time



322. An ideal shade tree.—White oak.

should be chosen. There is a belief that planting in August is specially favorable. There is no reason for this belief, unless favorable weather (a rainy season) follows.

Conifers may be transplanted later than deciduous trees, even after the buds have started, excepting the larch, which buds out very early; with this species, fall planting may be recommended. Cloudy weather, rather than rainy or very dry, should be chosen, especially when transplanting into nursery rows.

Young trees are naturally more readily and successfully transplanted than older ones, with which there is more difficulty in securing the whole root-system when taking them up. Since, however, the seedlings develop slowly for the first one or two to three years, they should be left in the seed-bed for that length of time, root-pruned, and then transplanted into nursery rows. Although those with a shallow root-system, like spruces and firs, may be moved even when 30 to 40 feet in height, it is best, even for ornamental purposes, not to take them more than 3 to 4 feet in height. In forestry, one- to four-year-old plants, according to species, from 2 to 12 or 15 inches in height, are preferred for reasons of economy.

Much greater care than with deciduous trees is necessary, when transplanting without an earth-ball, in keeping the root fibers from drying out; a large amount of loss in transplanting is explained from neglect in this respect. As soon as taken up, the roots should be



323. Good street trees.—Pin oaks.

immersed into a loam-puddle, or kept protected by wet sphagnum moss or canvas until set into their new place.

The question of trimming when transplanting must be considered with more care than is necessary with broad-leaved trees, which possess much greater recuperative power. It should be confined to the smallest amount, smoothing bruised roots, and if for proper proportioning pruning at the top becomes absolutely necessary, shortening the leader rather than branches. Larch will stand more severe pruning than most other conifers. From the artistic as well as physiological point of view, it is barbarism to remove the lower branches, which the tree needs to shade its trunk and standing room, and often, when deprived of the same, will replace first before starting again, in its height growth. Attention should, however, be especially paid to preventing double leaders, which are detrimental to future form-development; cut them out as early as possible, preferably in the bud. Laterals may be somewhat shortened in while standing in the nursery, to lengthen the time during which the lower branches are to persist. Breaking out buds is, as with all trees, the best method, provided the pruner has an eye for his business. Even in after-life, when pruning is performed to keep the tree shapely, the minimum use of the pruning-knife should be the rule.

There are three marked periods in the development of conifers—the juvenile period, when the entire tree is a crown, branched symmetrically to the base, the perfection of symmetry; then follows the adolescent stage, when the lower branches die out, a period of unshapeliness; followed by the virile stage, when the straight, cylindrical shaft bears the crown at one-third or one-half of the upper length of the bole. The trimming during the adolescent stage requires most consideration. It is, in most cases, best to take off only the lowest, dying or dead branches, as it becomes necessary.

In pruning, cut as closely as possible to the trunk,



324. Effect of trees on city street compared with no trees.

even cutting into the bark, also removing the swelled portion on which the branches are usually inserted, when the callousing will be more rapid and satisfactory in shape.



325. Trimmed by linemen.

preserving a dense interior foliage, while the pines are bound to thin out.

#### Enemies.

There are a number of dangers and damage from insects to which conifers are exposed. Drought and frost are most dangerous to seedlings in the seed-bed. These are obviated by proper location of the seed-bed (protection against sun and wind), by covering with a mulch of moss, straw, pine-straw or the like (which also prevents the heaving out by frost and the washing out by rain, to which young seedlings are liable). By shading and watering the danger of drought is overcome, although at the same time that of damping-off is invited. The cause of this disease, consisting in the reddening of the

needles and their falling off, is a fungus which can be combated by spraying. Birds may be kept away from the seeds by mixing them with red oxide of lead, by lath screens, and the usual methods.

Various fungi and insects, too many to mention, some polyphagous, others more or less specific, are at work during the various stages of development. A host of leaf-miners, sawflies and caterpillars destroy the foliage, and weevils sap the young shoots. *Bos-trichi*, or bark-beetles, mine under the bark, mostly of trees that are sickly from other causes; borers

enter the wood of the boles. Tortrices bore into the base of leaders and cause them to break off. The best remedies against most of these are preventives, namely providing the trees with such chances of vigorous growth, or satisfactory soil conditions, that they are able to ward off or overcome the enemies. Otherwise, watching and destroying the enemies in time, and the usual remedies to kill them, may be employed. Literature: Veitch, "Manual of Conifers;" Carrière, "Traité des Conifères;" Beissner, "Handbuch der Nadelholzkunde;" Fernow, "Care of Trees."



327. Same tree as Fig. 326 five years later, showing unattractive bushy top, and bad stumps that will decay instead of healing.

B. E. FERNOW.

#### Transplanting large trees (Figs. 328-332).

Moving large trees divides itself into two classes: First, with a ball of earth; second, with the earth dissected out from the roots with or without a ball remaining in the center.

Start at or near the ends of the roots where they are 1 inch in diameter or less. In practice, this results in about 30 feet spread of roots on a tree 12 to 15 inches in diameter. An elm 18 inches in diameter on very thin gravelly soil was found to have a root 6 inches in diameter at 15 feet from the trunk, extending toward a horse-shed and cultivated field where it would get more food and water. A trench is dug to below the roots, which may be  $1\frac{1}{2}$  or 3 feet. An under-cut is made and the soil caved down by a picking bar or fork with round pointed tines. The earth and roots will be mixed at the bottom of the trench. The roots must be carefully picked up with the fingers, bound in bundles and tied out of the way. This operation is the point of greatest failure as it takes considerable time, patience and skill, to avoid breaking the roots. There are many chances to break a root after it has been carefully dissected out. The roots must be promptly lifted up or they will be broken by the shovel in digging out the loose soil at the bottom of the trench. The bundles must be untied and rearranged where the roots cross. This proceeds until a tree is dug in to a ball about 6 to 8 feet. The tree is then tipped over by tackle, cleaving the roots from the subsoil.

The amount of earth left in the center depends upon the strength of the truck, character of the roads and power for



326. Showing need of city control. This tree on a city street being trimmed for firewood.



328. Moving a tree in winter, with a large ball of frozen earth.



hauling. To leave a mass of earth 6 to 7 feet wide, 15 inches deep, is practicable with two teams and 6-inch tires over hard dirt roads. Such a ball is helpful because there are more roots left undisturbed and they help support the tree during the first summer, especially if the ball is kept to the proper degree of moisture. Larger balls, 8 and 10 feet in diameter, 15 to 20 inches deep, can be carried only by more expensive trucks with much wider wheels, and with deciduous trees the advantage is slight as compared with carrying a full circle of roots 30 to 40 feet wide.

The trees are readily picked up by the trunk which is protected by cushions and clasped by slats, and chains tightened by screws. A cradle is hinged at the front axle and tips the tree over in a horizontal position which is necessary on account of overhead wires and bridges. There are one or two screws about 9 feet long, 2½ inches in diameter. Tipping is accomplished by these screws or tackle or both. The roots on the lower side of the tree are tied back underneath the axle.

In transporting, the roots are wrapped in straw and burlap. They can be exposed to the air for a day without serious injury, as roots ½ inch in diameter do not get dried out and killed in that time. In passing under wires, these can be lifted by a T-shaped pole and disentangled from the branches by proceeding a few feet at a time. Dangerous high tension electric wires must be handled by linemen employed by the electrical company. It is sometimes necessary to raise the wires or take them down and drive over them.

In planting, the truck is drawn into the hole and stopped at such a distance from the center that the tree when swung over will be in the right position. The holes should be made of such a depth as to keep the roots as near the surface as possible. Allowance must be made for the bending of the downward roots below the center of the ball. The most frequent mistake is to get the tree too deep, especially the roots at the outside of the ball, which will often drop to the bottom of the hole and be 18 inches deep; whereas when dug there were some at the surface, some 6 inches deep and a few 18 inches deep. After the tree is stood up in the hole by means of the tackle and screws, earth is packed under the center by packing - sticks. This is difficult and there are liable to be air-holes left vacant. A stream from a hose will help to wash mud into these spaces. It is best to leave the bundles of side roots tied up while this is going on. Before the bundles of side roots are untied, the bottom of the hole should be filled up, if necessary, so that these are 2 to 8 inches below the surface. Spread out the side roots and cover with earth.

Anchoring the tree is important. It is easily done by three or four anchor posts 4 feet deep with a crosspiece 3 feet long. Wires should be put through rubber hose and twisted around the tree. The tree is liable to settle,

the anchor posts move, the tree lean and require straightening and tightening of the wires by further twisting.

Pruning is important, made so by cutting back the tree from 2 to 8 feet all around. It is best to cut the most at the apex and the least at the sides, to make the shade as wide as possible. If cut back to an even outline, the tree will make a dense growth and look more solid the first year. If the thinning-out method is used, the thinning is liable to be too great in the center of the tree, as it is easy to reach, and the tree has to thicken up over

a period of four years by making sprouts in the center, the outer branches remaining thin, especially if the tree is not fed and watered enough.

Wrapping the trunk with straw may be necessary with thin-barked trees, especially in warm and dry climates. The bark is liable to dry out and die on the southwest side. The wrapping

and anchors may be removed after two years or more.

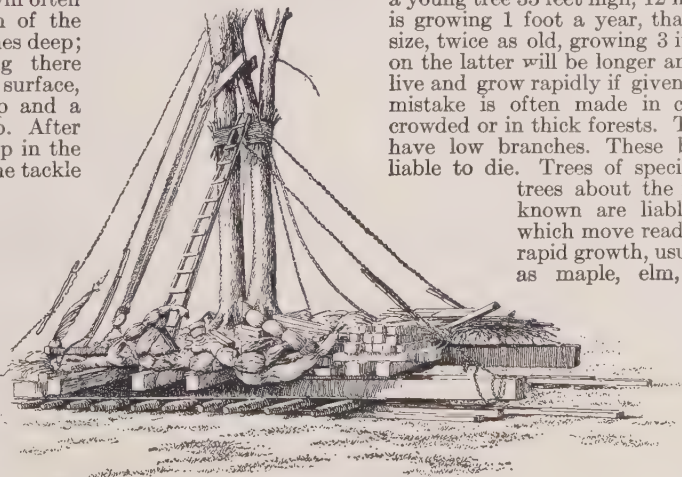
A mistake is often made in choosing trees within two miles, whereas, the area to draw upon is over fifteen or twenty miles radius which will contain much better trees, the time on the road being a comparatively small item in the total cost. Trees are often chosen which are growing on thin or rocky soil or in swamps saturated within 6 inches of the surface, both giving much less amount of roots than trees in a friable soil 3 feet deep. In a country of hills and valleys, the best trees may often be found in terraces or benches above the river bottom or in the river bottom if drained to allow roots to be 3 feet deep. Trees are often chosen which are too old and have made a short, slow growth. It is better to move a young tree 35 feet high, 12 inches in diameter, which is growing 1 foot a year, than to take a tree the same size, twice as old, growing 3 inches a year. The roots on the latter will be longer and less flexible. Each will live and grow rapidly if given favorable conditions. A mistake is often made in choosing trees which are crowded or in thick forests. The latter may appear to have low branches. These branches are weak and liable to die. Trees of species difficult to move and

trees about the moving of which little is known are liable to be chosen. Trees which move readily are those of soft wood, rapid growth, usually native in moist soils, as maple, elm, linden, poplar, locust, catalpa, horse-chestnut, birch, apple and pin oak. The following are trees about which less is known: Pepperidge, sassafras, plane, chestnut, beech, tulip, white oak, black oak, liquidambar, ailanthus, hickory, walnut and ash. The chestnut,

beech, magnolia, tulip tree, black oak and walnut do not indicate by their behavior when small that they are readily moved. It is to be presumed that the ailanthus and ash are easily moved. No species has proved itself impossible to move. It is merely a matter of getting the right proportion of roots and top and nursing the tree through the convalescence until it has reestablished itself. In moving trees it may be better to move three



329. A large tree removed from its place. The roots are now to be wound in burlap or other material.



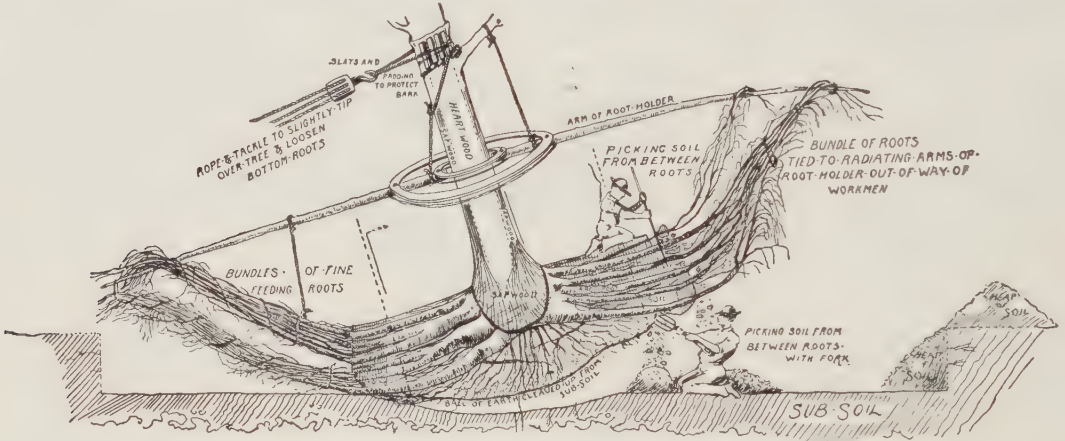
330. The roots wrapped, and the tree being moved on skids.

trees 8 inches in diameter, 35 feet high, than one tree 16 inches in diameter, 35 feet high. From three smaller trees there will result a wider mass of foliage, and it will be easier for those not equipped with large tree-moving apparatus to handle the three smaller trees.

If the earth is dissected out from the roots, two trees 8 inches in diameter could be carried by one team. They can be loaded on a low stone truck or handy wagon, the trunks of the trees resting on two benches which lessens the breakage of roots and top. Trees can be loaded by the men, the tree being tipped over on the truck which stands beside the hole.

9 feet in diameter with trees 10 to 18 inches, on a low truck consisting of a platform hung under four heavy wheels, the tree being lashed fast to a collar and pole on the rear axle, and pulled over to the rear and then the platform chained fast to the rear axle. The roots outside the ball are usually cut off. With elm trees carrying a slender top this method succeeds, although the trees are often slow in recovering. It succeeds with maples, but they are likely to grow slowly or die back until the tree reestablishes a balance, after several years.

Deciduous trees can be moved in midsummer in full



331. Diagram to illustrate the operation in the removal of a large tree for transplanting.

The tree is shifted into position by the men lifting on the trunk, or it may be lifted by a shear pole derrick or single pole. Many people hesitate about moving large trees and wait fifteen years for a result they could easily secure in this manner, by collecting wild trees in the vicinity.

Root-pruning a year in advance may aid in moving a tree, but is not essential. If a trench is to be dug at a radius of 4 feet all the way around a tree 10 inches in diameter, it is better to move the tree with a wider spread of roots and take good care of it. A root-pruned tree is likely to be neglected and suffer for moisture. The tree can be root-pruned three-quarters of the way around for one season and perhaps be in better condition for moving. This is more likely to be beneficial with a tree with long coarse roots and with few fibers in the center, like a black oak. A mistake is frequently made in assuming that a ball of earth is all that is essential, regardless of the amount of fibrous roots in the ball and of its area to gather rainfall as compared with the top. Frequently trees dug around the roots cut off at a diameter of 10 feet, have the tree-mover sent for when they should have a spread of roots of 30 feet. The ball-of-earth method with deciduous trees usually consists in carrying a ball of earth 7 to

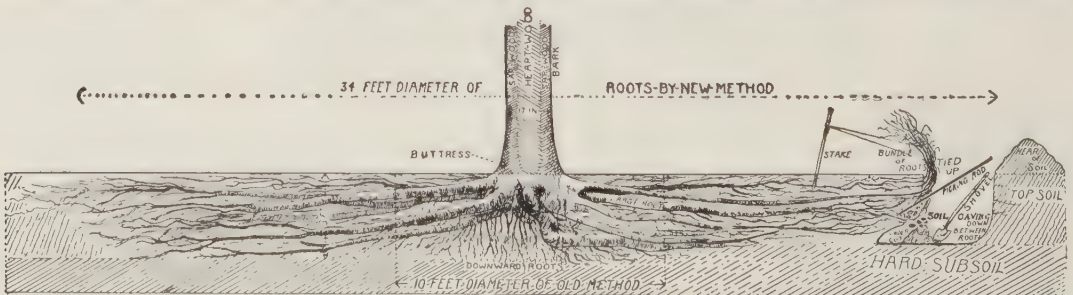
leaf. Norway maples 7 inches in diameter were well watered to fill them with sap; the next day they were dug with roots spreading 15 feet, leaving a ball of earth 5 feet in diameter in the center. The tree was tipped back and a platform or stone boat moved under, on which it was moved. After planting the trees were watered about four times, once in ten days. The ball of earth became dry very quickly. The bundles of outer roots did not send out fibers for about two weeks. Trees with less fibers in the center would probably not succeed so well. See also *Drainage* and *Evergreens* for further discussion.

HENRY HICKS.

#### Types of insect injury to trees.

Trees of all sorts are liable to injury by many kinds of insects, so many indeed that it is difficult to present a satisfactory account of their depredations without going into great detail. A few insects stand out preëminently, however, among the more common and widespread tree pests and a selected series of these will serve as examples of the various ways in which the trees may be injured by these animals.

Destructive forest- or shade-tree insects may be grouped into two classes, according to the way in which



332. Diagram to show how and where the digging is begun.



they feed, based on the fact that one series feed by chewing and consuming the tissue of the trees, while the members of the other class derive their nourishment from the juices or sap of the trees which they suck out by means of needle-like sucking mouthparts. Most insects pass through three, or at least two, preparatory stages, very different from the adult, before they reach maturity. They hatch from eggs deposited by the adult female, as larvæ (grubs, caterpillars, maggots, and so on) and in this larval stage feed till they attain their full size. The larval stage is, therefore, the most destructive one. When full grown, the larva usually changes to a resting condition or pupal stage (chrysalis), and during this time does not feed. Finally the adult appears and the life-cycle is complete. Many insects undergo a single



333. Lepidopterous caterpillar. ( $\times \frac{3}{4}$ )

generation every year, but a number grow more rapidly, producing several broods each season, while a few require two years or more to mature.

Insects provided with chewing mouthparts may feed on the leaves and are then known as defoliators; or they may feed on the bark, cambium, sapwood, heartwood, or roots, in which case they are known as borers. Caterpillars, beetle grubs and saw-fly larvæ are the most important insects of the latter kind.

Among the insects with piercing mouthparts, some suck the juices of leaves, while others affect the twigs and branches, or even the roots. Plant-lice and scale insects are the most important insects of this kind.

#### *Methods of destroying tree-pests.*

There are five widely different methods of destroying insects which injure trees, and the selection of an appropriate method must depend primarily on the feeding-habits of the species to be dealt with.

(a) *All defoliators*, such as caterpillars (Fig. 333), saw-fly larvæ (Fig. 334), and those beetle larvæ that feed externally upon the leaves, are best killed by the application of an arsenical poison (Figs. 335, 336). This is applied preferably by some sort of a spray-pump that throws a fine mist or spray of water in which the arsenical has been mixed. Such spraying machines may be obtained in sizes to suit any needs, from hand-pumps holding a quart of liquid to power sprayers equipped for spraying extensive woodlands thoroughly and rapidly. The most satisfactory poison is arsenate of lead, an insoluble arsenical which can be mixed with water in the proportion of six to ten pounds to each 100

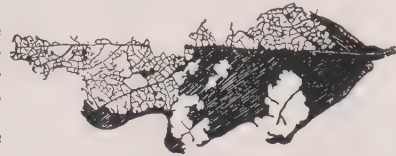


334. Sawfly caterpillar. (Natural size.)

gallons of water and sprayed upon foliage without danger of damage to the leaves. It is sold commercially as a white paste and is easily handled. This substance is far superior

to paris green, london purple, and the like. It should be applied only in sufficient amount to show after drying as whitish specks upon the surface of the leaves. (b) *Plant-lice*, since they feed by inserting their beaks into the tissues of the leaves, and other soft parts, are not affected by arsenicals and must be destroyed by spraying with what is known as a contact insecticide, one that kills through the application upon the surface of the insect's body. The most generally used, and one of the best contact insecticides is kerosene emulsion. This is prepared by dissolving half a pound of common laundry soap in one gallon of hot water and then adding two gallons of kerosene while stirring or churning the mixture violently. The creamy mass thus formed thickens on cooling and must be diluted with nine times its volume of water before being sprayed upon the

plants. Scale insects feed like plant-lice, by inserting their delicate beaks into the tissue of the tree and sucking out the sap, but usually occur on the thin bark of the branches and twigs rather than on the leaves. Each insect secretes a scale-like covering beneath which it lives while growing, and, even when adult, the female never leaves her position beneath the scale. As the scaly covering is of a waxy nature, these insects are not so easily destroyed by contact insecticides as are plant-lice, although kerosene emulsion is sometimes effective, especially in the case of young insects which have not yet secreted a thick scale. Many older or more resistant scales cannot be destroyed in this way and they may be killed when the trees are in a dormant condition by a spraying with lime-sulfur wash prepared as follows: Water, forty gallons; fresh lime, twenty pounds; flowers of sulfur, fourteen pounds. These are boiled together for one hour and then applied as a spray to the branches and twigs. This wash should never be sprayed upon trees when in leaf.



335. Injury by leaf-eating caterpillar of small size.

(c) *Bark-beetles*.—These are small insects that live during the larval stages beneath the bark of the trunk and branches of trees. The parent insects enter the bark and excavate a small tubular gallery through the cambium or inner bark. Along the sides of this, the eggs are laid and the developing larvæ eat out sinuous burrows through the cambium. They thus interfere with the sap-flow and cause a general weakening or even death of the tree. Bark-beetles are liable to attack sickly or dying trees, and the only feasible method of lessening their depredations is to remove and burn such trees or branches as are affected, in addition to improving in all possible ways the conditions under which the tree is growing, bearing in mind that healthy trees are much less likely to be troubled by these insects than are weak, poorly nourished ones.

(d) *Wood-borers*.—The larvæ of certain beetles and moths subsist upon the woody tissues of trees, excavating galleries through the wood of both living and dead trees. Such larvæ are usually whitish, often with brown head and have powerful jaws, by means of which they can cut through the solid wood. They may attack trunk, branches, or twigs, some working in the sapwood, others in pith, while a few feed mainly on the heartwood. Insects of this kind are the most difficult to combat as they feed where they cannot be reached by means of insecticides during the greater part of their life. Due to their concealed position, they are not so readily noticed and may frequently cause irreparable damage to trees before their presence is recognized. Besides cutting out the individual larvæ or destroying them in their burrows by means of a piece of wire, no general method of destruction can be recommended. It is important, however, to maintain the trees in as healthy condition as possible, and to remove all dead or dying timber in order to reduce the number of breeding-places for the insects.

(e) *Leaf-miners*.—To this class belong some of the



336. Injury by leaf-eating caterpillar of large size.

members of several different groups of insects, certain small moths, a few saw-flies and a small number of flies and beetles. All of the leaf-miners are very small insects whose larvæ feed upon the parenchyma of the leaf, leaving intact the upper and lower epidermis. In this position they are protected from most sorts of



337. Tussock moth larva. ( $\times \frac{1}{2}$ )

insecticides, although in some cases, spraying with a contact insecticide containing some tobacco compound in combination with soap may be efficacious. One formula recommended is: water, 800 gallons; nicotine, or "blackleaf 40," one gallon; laundry soap, thirty-two pounds. Ordinarily, leaf-miners do not present a serious menace to trees, but the presence of their blotch-like or serpentine galleries, which show as faded areas, often greatly disfigure the leaves.

*Some of the more important shade-tree pests.*

#### A. Defoliators.

The tussock moth, *Hemerocampa leucostigma* (Fig. 337), is perhaps the most abundant caterpillar on trees, particularly in thickly settled districts. The eggs are laid in the fall in white fluffy masses the size of a dime on the trunks of infested trees and hatch in the early summer. The larvæ bear several pencils of long black hairs placed at each end and have four brush-like tufts of pale yellow hairs above, with a bright red head. These pupate early in July in crevices in the bark and the adults soon emerge to lay the eggs for a second generation of caterpillars which will mature before fall into moths that deposit the over-wintering eggs. The female moth is without wings and lays her mass of eggs on the bark where she emerges from her pupa case. These caterpillars feed on all sorts of trees except evergreens, but seem to be most destructive to maple, elm and American linden. Two related caterpillars have been imported from Europe into Massachusetts, the gypsy moth and brown-tail moth, and although these are at present confined to that neighborhood, they will undoubtedly become widespread before many years have elapsed. The gypsy caterpillars feed on many kinds of trees, preferring oaks; they may be recognized by a double line of round spots down the middle of the back, blue, followed by red ones. Their life-cycle is like that of the tussock moth, except that there is only one generation passing the winter as a mass of woolly, dull ochre-yellow eggs attached to the bark. The brown-tail is a brownish caterpillar with white spots, passing the winter in small woven silk nests containing many caterpillars. The nests are attached to the tips of the twigs of infested trees. Orchard trees suffer most severely from this species, although all sorts of broad-leaved trees are attacked.



338. Cocoon of bag-worm. ( $\times \frac{1}{2}$ )

Another common caterpillar of very different habits is the American tent-caterpillar, *Malacosoma americana*. This is an inconspicuous brownish moth which over-winters as a band-like mass of eggs placed around twigs of cherry and a number of other trees. These hatch in very early spring and the larvæ spin silken nests in small forks of the branches from which they crawl out to feed upon the opening leaves. They mature

in early summer and the eggs are laid in midsummer for the next season's brood.

The bag-worm, *Thyridopterix ephemeraformis*, is a defoliator at times very destructive, although each larva in his dependent bag does not have a wide range of operations. Fig. 338. Hand-picking and arsenical sprays are the remedies.

The caterpillars of the mourning cloak, *Ewanessa antiopa* (Fig. 339), are a very common pest of elm and other shade trees. They are black, coarsely spiny caterpillars with red spots along the back, and feed more or less in colonies, usually defoliating single branches at a time. The butterfly passes the winter as an adult, appearing in very early spring, and laying its eggs in May. The caterpillars from these eggs become full-grown before July, and the butterflies of another generation appear in July to lay eggs which will give rise to the hibernating butterflies of the next winter.



339. *Ewanessa antiopa*. ( $\times \frac{1}{2}$ )

A common saw-fly which occurs on willows is the American saw-fly, *Cimbex americana*. The larvæ are much like the defoliating caterpillars of moths and butterflies in appearance and feed in the same way, destroying the entire leaf-tissue. The larvæ are pale green, with a blackish line down the back. When mature, they descend to the base of the tree, where they spin parchment-like brown cocoons in which to pass the winter on the ground among fallen leaves. In the spring, they transform and the adult saw-flies deposit their eggs singly in slit-like cuts made into the tissue of the leaf.

Pine trees often suffer from the depredations of saw-fly larvæ of the genus *Lophyrus* which devour the needles, near the bases of which they later spin their small cocoons.

Many saw-fly larvæ feed only on the leaf from one side, leaving the epidermis of the other side intact. Arsenical sprays for the destruction of such species must be directed against the side of the leaves attacked, usually the under surface.

Among defoliating beetle larvæ, the imported elm-leaf beetle, *Galerucella luteola* (Fig. 340), is probably most important. This occurs only in the eastern states but is gradually spreading into the middle West. The small, yellow, two-striped adults live through the winter and deposit their bright yellow eggs in small masses on the under side of elm leaves in early spring. These eggs hatch into black and reddish slugs which feed on the under surface of the leaves, leaving only the veins and upper epidermis. The leaves then dry up and may fall off. The larvæ, now changed to a yellow color, descend to the surface of the ground to pupate and soon emerge as a summer generation of beetles. There are two or three annual broods, according to the latitude.



340. Larvæ of elm-leaf beetle. Holes made by adults, surface marks by larvæ.

#### B. Plant-lice and scale insects.

There are many kinds of plant-lice (Fig. 341), but all pass through very similar life-cycles. In general, this is as follows: the winter is passed as a large, shining, elongate-oval egg attached to a twig or branch. This gives rise in the spring to a soft-bodied wingless female aphid that gives birth to living young aphids, which in turn reproduce in the same way. These suck the juices from leaves, petioles or tender twigs and thus sap the vital-



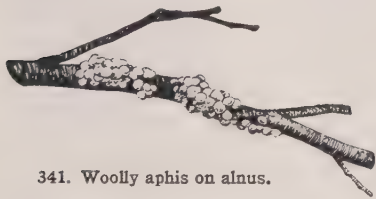
ity of the tree. In addition, the leaves may be disfigured by a sticky substance, known as honey-dew, secreted by the insects. In the fall, both females and winged males are produced and the female lays a single winter egg. On account of their method of reproduction, plant-lice multiply very rapidly, especially in damp seasons. Some species have a more complicated life-cycle, producing winged individuals in the summer which migrate to another food-plant, later to return in the fall to the original one.

A few plant-lice living in colonies produce galls, curled leaves, or other malformations on the leaves or twigs of infested trees.

Scale insects exhibit a greater variety in their seasonal history; some pass through a single generation each year, while others multiply more rapidly, passing through a number of generations annually. The winter is sometimes passed in the egg state, but more commonly as a partly grown insect.

One of the commonest and most destructive scales is the oyster-shell scale, *Lepidosaphes ulmi*. This occurs on the thin bark of a great variety of trees, appearing as a very small, elongate, flattened body, pointed at one end and rounded at the other, with the upper surface more or less distinctly ridged in a transverse direction.

There is a single generation annually, the females maturing in late summer and depositing a mass of eggs which remains beneath the scale through the winter, hatching



341. Woolly aphid on alnus.

ing in the spring and producing full-grown insects by midsummer. Sometimes this species is so abundant that the smaller branches appear as if covered by a gray incrustation.

The San José scale, *Aspidiotus perniciosus*, is another important scale, which has been introduced into many parts of the United States. It is very destructive, primarily to certain orchard trees, but injures many thin-barked shade trees as well. The scale is very small, round in the female and oval in the male, with a minute nipple-shaped projection near its center. The females do not lay their eggs till the young insects are ready to hatch, so that they practically produce living young. These develop rapidly, five or six broods maturing each season, of which the last hibernates in the half-grown condition. In mass, the scales form a gray, granular crust, covering the branches and twigs.

In some parts of the country, maples grown for shade trees suffer great injury by the cottony maple scale, *Pulvinaria innumerabilis*. This scale is most conspicuous on the twigs in early summer, at which time the females are depositing their eggs. It then bears a tuft of fluffy waxen substance resembling a bit of white cotton. The young scales appear soon after, when they migrate to the leaves and feed till early fall before returning to the twigs, where they finally pass the winter in a half-grown condition.

Practically all sorts of trees suffer at times from scale insects, of which there are many kinds. The common forms are divisible into two groups, the soft scales and armored scales. The former are soft and convex like the cottony maple scale, in which the "scale" is the back of the insect itself; the latter are usually smaller, like the San José scale, in which the "scale" is a separate waxen cover secreted by the insect.

#### c. Bark-beetles.

These insects are small black or brown beetles that live in the larval stages beneath the bark, feeding on the inner bark and cambium, and all have very similar

habits. The parent beetle enters the bark through a small hole about the size of a pencil-lead, and excavates a single primary or egg-gallery through the cambium, usually grooving the sapwood. This tunnel varies from one to several inches in length, and along its sides the female cuts out little pockets, in each of which an egg is laid. On hatching from the eggs, the larvæ excavate individual mines usually more or less perpendicular to the egg-gallery. When full grown, the white legless grub-like larvæ pupate in cells excavated in the bark, from which the beetles emerge by chewing out a circular tunnel to the surface. Trees from which beetles have emerged appear as though the bark had received a charge of buck-shot, from the presence of the small circular emergence holes. Some forms, like the genus *Dendroctonus*, attack fine healthy coniferous trees and kill much valuable timber, but shade trees are more commonly attacked by the species that live in the bark of deciduous trees, more particularly those that are in a sickly condition.



342. Flat-headed borer.  
(Natural size.)

A common form is the hickory bark-beetle, *Eccoplogaster quadripinosa*, that attacks hickories. The beetles appear in June and July, to excavate the primary galleries which extend vertically for an inch or two. Forty or fifty eggs are placed in notches on the sides and the larvæ bore out at right angles, thus girdling the cambium and weakening or killing the branch. This species undergoes only one generation annually, although some others pass through two or more each season. There are many other kinds, all scarring the bark or surface of the wood in a similar way.

#### D. Wood-borers.

The larvæ of many beetles and moths, and of a few wasp-like insects, injure trees by excavating their food-burrows through the solid wood.

Birches, grown for shade or ornamental trees, often suffer great injury from the presence of a flat-headed borer, the bronze birch-borer, *Agilus anxius*. The small elongate bronze-green beetles appear in May or June and deposit their eggs on the branches, at first near the crown of the tree. The larvæ penetrate the bark, beneath which they cut irregular flattened galleries till grown, when they cut out cells in the wood in which to pass the winter before emerging in the spring. The upper parts of the tree suffer first and begin to die, and the following year the larvæ appear nearer to the ground. Chestnut is attacked by *Agilus bilineatus*, the two-lined chestnut-borer.

Most other kinds of trees suffer similar injury from related beetles, many of which multiply also in dead trees and stumps.

Another flat-headed borer, the larger flat-headed pine-borer, *Chalcophora virginienensis* (Figs. 342, 343), extends its flattened burrows deep into the wood of the tree, a method of feeding exhibited by many borers of this group attacking deciduous trees also. The larvæ grow to a length of 2 inches before cutting out their transformation cells in the bark.

Round-headed borers are similar in habits, but belong to another family of beetles in which the larvæ are less distinctly flattened near the head and excavate more nearly cylindrical burrows.

One of our commonest species is the locust-borer, *Cyrtene robiniae*, which attacks yellow locust trees. The elongate medium-sized black beetles, with brilliant yellow markings, appear in the early fall to deposit



343. *Chalcophora virginienensis*, adult of flat-headed borer.  
(Natural size.)

their eggs on the bark of the trees. The eggs soon hatch into larvæ which feed for a time and then over-winter in a small cell beneath the bark. Next year they bore through the living wood and transform in August to beetles. This species can destroy healthy locust trees rapidly and is a very serious pest wherever the tree is grown. All infested trees should be pruned or felled and burned to destroy the larvæ, in the fall or winter. Sugar maples suffer from a similar insect, as do practically all sorts of trees.

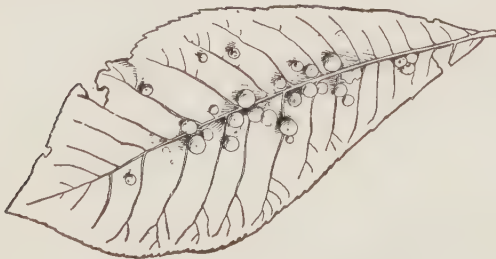


344. Injury to tip of white pine sapling by white-pine weevil. ( $\times \frac{1}{2}$ )

White pine trees are commonly deformed by the larvæ of the white-pine weevil which feed exclusively beneath the bark of the terminal shoots of young trees of this species. (Fig. 344.)

The carpenter moth, *Prionoxystus robinix*, is a large common mottled gray insect with pale yellow black-headed and black-speckled larvæ 2 inches in length, that bore in the branches of many kinds of trees. Oak suffers most, but maple, ash, locust, willow and cottonwood are often infested. The moth lays its eggs on the bark late in the summer, and for two or three seasons the larvæ feed on the wood, cutting large circular burrows. They transform in the burrow, the pupa working its way partly through the bark for the eclosion of the moth. The brown pupa-case may then remain projecting from the mouth of the burrow for some time. A related European insect, the leopard moth, *Zeuzera pyrina*, has recently become abundant along the northern Atlantic coast region, attacking elm and all sorts of other trees and shrubs. It feeds in the same way and bids fair to become one of our worst shade-tree pests. The larvæ of many other moths injure trees in a more or less similar way.

The pigeon horn-tail is a large cylindrical yellow-brown and black insect with grub-like larvæ that bore



345. Phylloxera galls on chestnut. ( $\times \frac{1}{2}$ )

in elm, maple, and other trees. The females insert their eggs deep into the tree by means of a needle-like ovipositor. They frequently fail to extricate the ovipositor and may be seen dead, but still attached to the tree trunks.

#### E. Leaf-miners.

Small larvæ belonging to several orders of insects live as miners in leaves, the most abundant forms often greatly disfiguring the foliage of affected trees.

Deciduous trees of all sorts are affected by the leaf-mining larvæ of various small moths, but it is very difficult to distinguish the different species without minute study. Oaks are particularly susceptible and are commonly disfigured by the sinuous or irregularly rounded mines that appear as pale streaks or blotches. Even pines suffer from such larvæ, which enter a needle and eat out the tissue, causing the tip to dry and become yellow. Occasionally insect larvæ cause malformations

or swellings of the leaves or twigs, known as galls. (Figs. 345, 346.)

Yellow locust suffers from a leaf-mining beetle larva, *Odontota dorsalis*, that eats out almost all of the leaf parenchyma, causing the leaves to dry and shrivel. Related species affect oak and basswood. Members of another family, belonging to the genus *Brachys*, also mine in leaves of oak, chestnut, and so forth.

One leaf-mining saw-fly is of considerable importance, *Kaliofenusa ulmi*, the larvæ of which eat out the parenchyma of elm leaves between the lateral veins, causing them to assume a seared appearance in spots (Fig. 347). Another closely related species mines in the leaves of the hawthorn (*Crataegus*). The latter may be satisfactorily killed by a spray of tobacco-water, but the species on elm is more resistant. The larvæ of these species enter the ground later in the summer to spin their cocoons.

C. T. BRUES.



346. Mite-galls on maple. ( $\times \frac{1}{2}$ )



347. Leaf-miners' galleries in elm. ( $\times \frac{1}{2}$ )

#### Some types of tree diseases.

Disease in plants is the result of any derangement in the normal form, structure or physiology of the organism. The disease condition becomes manifest by different symptoms, according to the nature of the disorder. Such symptoms as stag-head, cankers, leaf-spots, witches' brooms, and so on, are examples of the effect produced in the tree by some disease-producing agent or combination of agents. The variety of functional disorders alone that may arise in trees is large. Such causes as insufficient or excessive soil water, malnutrition, excessive heat or cold, or rapid variations in temperature are capable of producing effects called physiological diseases. On the other hand are those diseases that are produced by the activities of parasites, such as certain of the fungi, and bacteria. Accurately to place a new or little-known disease in one of these two classes is often difficult for the expert, even after much study. There is relatively less known concerning the physiological diseases of trees than of those caused by parasites, not because of their less importance so much as of the difficulty of studying them. It is to be deplored that the diseases of forest, shade and ornamental trees have not received their due share of study and investigation by pathologists.

#### How fungi cause diseases of trees.

The fungi consist of a group of plants that do not contain chlorophyll, upon which all green plants depend for the synthesis of carbohydrates. Consequently, not being able to manufacture their own food, the fungi must secure it from their environment, by dissolving and utilizing organic materials from dead or living plant or animal bodies. By far the vast majority, luckily, belong to the class of scavengers which attack dead organic material and utilize it for food. These forms are called saprophytes. Other species of the fungi attack living plants and, through their activities, produce the disorders that are termed diseases. These are known as parasites or pathogens.



In brief, the general action of the fungi that cause tree diseases is as follows: The fungus exists in two stages, the vegetative and the fruiting. The vegetative stage consists of a mycelium, which is an aggregate of long much-branched microscopic threads of fungous cells. This mycelium penetrates and grows in the body of the tree, extracting nutriment from it by dissolving the different structures it can utilize. In this process the tissues of the tree are destroyed and the fungus obtains food for its further development. In time, after sufficient food has been stored in the mycelium, the fungus forms its fruiting bodies. In the case of the larger number of the heart- and sap-wood rots, this fruit body consists of a shelf-like or toadstool-like structure on the exterior of the tree. In these fruiting structures are borne millions of microscopic spores or seeds of the fungus, which are distributed largely by the wind. If by chance one of these spores finds lodgment on an exposed wound in the bark of a tree which it is capable of infecting, it will under proper conditions germinate, producing a mycelium that will penetrate the tissues of the new host.

#### Seedling diseases.

The young seedlings in the nursery beds are often attacked by certain soil organisms that cause a decay of the stem at the surface of the ground, allowing the plant to wilt and fall over. This type of disease is called "damping off," in many cases it is caused by the fungus *Pythium de Baryanum*. This disease is largely induced by very moist soils, a moist atmosphere, high temperature, and little ventilation. By growing seedlings in light sandy soils, well watered but not excessively, and by aerating the beds well to reduce the humidity of the atmosphere around the plants, this trouble is practically avoided. Soils in which it has once occurred should be abandoned, however. In greenhouses in which this disease is often troublesome and the precautionary measures mentioned above difficult to maintain it may be necessary to sterilize the soil with formaldehyde or by steam heat immediately before sowing the seed.

#### Leaf diseases.

Very little serious damage is caused by most leaf diseases of trees other than the unsightly appearance produced. There are a few leaf diseases, however, that are of more or less importance in the United States. Conspicuous among these is the anthracnose disease of oak and sycamore leaves, caused by the fungus *Gnomonia veneta*. Throughout northeastern United States in recent years the plane-tree (*Platanus occidentalis*) has been almost universally affected and the trees often completely defoliated before the first of July. Early in the season the disease becomes manifest by the production of rapidly enlarging brown blotches which are usually produced along the veins of the leaf. If examined closely, the numerous spore clusters can be seen. These clusters are composed of innumerable microscopic conidia which serve for the dissemination of the fungus.

The twigs are commonly affected also and on these, as well as the fallen leaves, the fungus winters over. The same fungus produces a similar disease on oaks, especially the white oak, and is often epidemic in certain regions. As a measure of prevention, all fallen leaves

and twigs from diseased trees should be carefully collected and burned. All diseased twigs should be pruned off and burned. If desirable, the trees may be sprayed with standard bordeaux mixture from the time the leaves begin to unfold, at periods of two or three weeks, until the first of July.

The tar-spot disease of the maple caused by *Rhytisma acerinum* is a conspicuous disease but seldom causes serious damage to the tree. Fig. 348. The diseased spots appear as blotches of tar on the upper surface of the leaves. Burning the diseased leaves will materially lessen the chances of attack the coming year since the pathogen winters in them.

Maple trees, at least in the north-eastern states, have suffered during the past few summers from a physiological trouble called leaf-scorch. The leaves of one side or the whole of the tree turn brown between the veins and finally dry up. This disease has been ascribed to over-transpiration of the leaf-tissues at a time of year when the roots cannot furnish enough water to the tree to compensate the loss. Thus the leaf-cells are killed by desiccation and the brown blotches appear. It is advised that artificial watering during hot, dry weather will materially lessen the severity of the trouble, especially under city conditions.

#### Canker diseases.

A diseased condition of the limbs or trunk of a tree that results in the death of an area of the bark is termed a canker. These cankered areas may be either sunken or enlarged, and the terms necrotic and hypertrophy cankers are used respectively to designate these characters. Not all cankers are produced by parasitic organisms; some are the result of malnutrition, winter injury, sun-scorch, insects, and the like.

By far the worst epidemic disease of trees in America is the chestnut-canker now prevalent in many of the eastern states. In all, a total loss of \$25,000,000 has been ascribed to this disease between the time it was first noticed, in 1904, on Long Island, and the year 1912. The cankers produced on the chestnut are caused by the fungus *Endothia parasitica*. Fig. 349. At present, the question of the origin of this disease in the United States is undetermined. The fungus works rapidly in the bark and sap-wood, killing the tissues. Fruiting bodies of two types are formed on the diseased bark, a conidial stage that appears as long yellow tendrils of gelatinous matter and the reddish yellow to dark brown cushion-like stromata that contain the ascospores. These latter spores are ejected in large numbers at every rainy period throughout the spring, summer, and fall and are carried by the wind, readily causing new infections. On the individual tree, the fungus is rapidly spread by the washing down of the conidia into wounds in the bark. The cankered areas soon cause the death of the parts above by girdling the limb and, in most cases, complete death of the tree follows in two or three years. The state of Pennsylvania has taken steps to eradicate this disease by seeking out diseased trees and compelling owners to cut all affected trees in the western half of the state. The extremely virulent nature of the disease, however, has led more conservative pathologists to question the advisability of expending large sums of money with so slight a chance of ultimate or complete success. The



349. Canker disease of the chestnut produced by the fungus, *Endothia parasitica*. The conidial tendrils are produced from the numerous ruptures shown in the bark.



348. Maple leaf affected by the tar-spot fungus, *Rhytisma acerinum*.

problem of saving individual trees in affected regions has not been solved. The very nature of the disease precludes spraying, and tree surgery methods have not given anything more than temporary success. Incipient cankers are so difficult to locate and, by producing conidia



350. Stem of white pine tree attacked by the white pine blister-rust fungus, *Cronartium ribicola*. The fruiting stage is here shown in the process of rupturing the bark.

when only three or four weeks old, serve to spread the fungus so rapidly over the tree that human efforts so far have failed.

**Rust diseases.**

The most destructive and important rust diseases of trees are those caused by different species of the *Peridermium* on coniferous trees. These rust fungi attack the needles, twigs, or limbs of coniferous trees, often producing defoliation or complete death of the tree. Notable among these diseases is the white-pine blister-rust caused by the *Peridermium* stage of the fungus *Cronartium ribicola* (Fig. 350) which has its *Cronartium* stage on species of currants and gooseberries. The fungus is not native to this country but has recently been imported from Europe. In Europe the disease has practically exterminated the white pine (*Pinus Strobus*) in many localities, and in this country the danger of a similar destruction of this species is now being faced, if the fungus acts with the same virulence as in its native environment. In 1912 the Federal Board of Horticulture placed a quarantine on most of the countries of Europe, which prevents anyone bringing white pine trees from these countries into the United States. The fungus attacks white pine from one to twenty years old, the mycelium growing in the bark and usually producing a swelling.



351. Black spruce attacked by the dwarf mistletoe, *Arceuthobium pusillum*, causing witches' brooms.

The orange-yellow fruiting bodies burst through the bark in one to five years after infection. The spores from the pine can affect the gooseberry or currant leaves only. On these hosts other kinds of spores are borne in the fall which can infect the white pine only and thus the yearly cycle is completed. The black currant (*Ribes nigrum*) is by far the most virulently affected in this country, and it is advised that plants of this species are therefore extremely dangerous to the white pine industry and their culture should be discouraged. By keeping currants and gooseberries at least 500 feet away from white pines, a partial safeguard is provided against the passing of the fungus from one host to the other. All plants affected by this fungus should be imme-

diately destroyed. Consult Bureau of Plant Industry, U. S. Dept. of Agric., Bulletin 206 for further details.

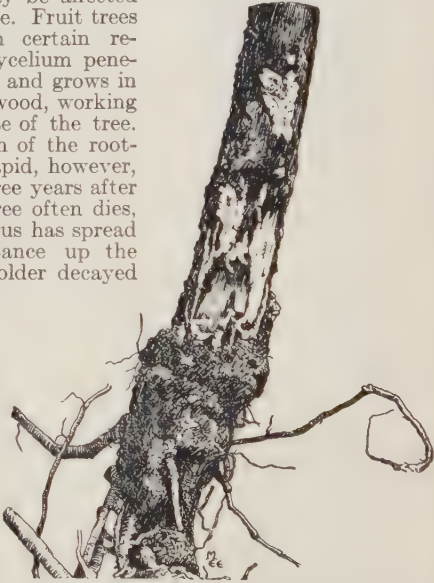
#### Witches' broom diseases.

Excessive branching at any point on a limb, forming a compact cluster of short stubby branches, is often caused by numerous agents, both insect and fungus, as well as by the mistletoes. In the South, especially, trees of many species are disfigured by these witches' brooms caused by the American mistletoe, *Phoradendron flavescens* and related forms. In the northern states the dwarf mistletoe, *Arceuthobium pusillum* (Fig. 351) causes similar brooms on the black spruce (*Picea Mariana*). Witches' brooms on red cedar (*Juniperus virginiana*) are caused by the rust *Gymnosporangium nidus-avis*.

#### Root diseases.

The principal root disease of trees that is widely distributed throughout the United States is that caused by the mushroom *Armillaria mellea*. Fig. 352. The mycelium of this fungus grows in the soil on decaying wood as a saprophyte, but can also become parasitic, killing trees over large areas. Almost any of our indigenous trees may be affected with this disease. Fruit trees often suffer in certain regions. The mycelium penetrates the roots and grows in the bark and wood, working up into the base of the tree.

The destruction of the root-system is so rapid, however, that two or three years after infection the tree often dies, before the fungus has spread any great distance up the trunk. In the older decayed parts of the root and in the soil, the mycelium is aggregated into long black, flattened strands called "rhizomorphs," or more commonly termed, "shoe-strings."



352. Base of young white pine tree attacked by *Armillaria mellea*. Note the cake of earth around the tree due to the exudate of resin, also the white mycelium felts within the bark and the enlarged resin vesicles induced by the fungus. The slender strands clinging to the cake of earth are the "shoe strings."

which forms the surrounding soil into a cake. The disease may be recognized by the gradual yellowing of the foliage, decay of the roots, presence of the "shoe-strings" in the soil, and the appearance of the honey-yellow mushrooms around the base of the tree. No practical method of treatment is known. Diseased trees and the mushrooms should be destroyed.

Other soil organisms may enter through wounds in roots and cause diseases. Such a disease may, after becoming established in the roots, continue to spread up the trunk. Thus wounded root-systems are as dangerous a source of infection as wounded branches. Roots often suffer from winter injury largely because the wood ripens from the top of the tree downward, and when severe conditions are undergone early in the winter before the new wood of the roots has ripened, it is killed.



*Heart-rot diseases.*

Most of the wood-rotting fungi belong to a class known as the wound parasites. By far the most universally distributed and destructive of these is the shelf fungus, *Fomes igniarius* (Figs. 353, 354), which causes the white heart-rot of deciduous trees. Infection may occur in any part of the tree where wood is exposed. The mycelium, by dissolving the lignin of the woody elements, first causes a brown decay that is later succeeded by a whitish decomposition, at which stage very little of the original woody structures is left. This decomposition of the heartwood takes place rapidly and often the tree is blown over. The fruiting bodies of this fungus are produced usually at the point of infection. They consist of large hoof-shaped bodies, carbonaceous and rough on the upper surface, and brown beneath. The under surface is full of small holes which are the openings of long vertical tubes, on the inner surface of which the spores are borne. These spores sift out of the tubes and are distributed by the wind.

Another fungus commonly met with, and acting similarly, is *Fomes fomentarius*. This is also at times a wound parasite but works mostly in the sapwood first and later spreads into the heartwood. A yellowish white, soft decay is produced. Large sheets of a chamois-skin-like character are often found in trees rotted by this fungus. These sheets are compact masses of the mycelium which have filled up the long cracks produced by the shrinking of the diseased wood. The sporophores are essentially different from those of *F. igniarius*, being light gray and smooth on top and light gray-brown beneath, with relatively large pores. Numerous other shelf fungi occur as wound parasites and do more or less damage where the bark, when wounded, was not protected until the natural callus could form. Some of the fungi which are wound parasites of living trees continue a saprophytic life in structural timbers, causing their ultimate destruction.

*Winter injury, sun-scald and drought*

Many misconceptions are prevalent concerning the real effect of freezing and sun-scald on trees. The injury by freezing in trees is due to the action of low temperature upon the water in the cells of the tree or to the tension pressures induced. As the temperature approaches freezing, the water in the cell begins to pass out into the intercellular spaces and there accumulates. The lower the temperature goes, the more water is extracted from the cell and stored in the intercellular spaces as ice crystals. When a certain temperature is reached, the amount of water withdrawn is such that the living elements of the cell can no longer survive, and are killed. This specific minimum temperature varies for different species of trees, accounting for the difference in susceptibility to winter injury. The living tissues of the tree constitute the bark and sapwood, and when areas of these tissues are killed, serious damage is done to the tree. Either enough damage is done to the roots, trunks, or twigs to cause ultimate death the coming summer, or the areas that were killed serve as infection courts for the various wound parasites like the heart-rot or sap-rot fungi. In the case of sun-scald, the action is exactly similar, with the exception that the water is removed from one side of the tree by excessive heat during the growing season, instead of by freezing. The cracking and splitting of the bark of trees may be due to the tension pressure set up in the bark by the contracting of the woody cylinder in circumference during periods of low temperature.

Norway maple trees planted for shade are especially susceptible to sun-scald because they are grown close together in the nursery to a large size and then, when planted out, they are often injured by the hot sun. Care should be taken not to attempt to grow trees farther north than their natural range, which is an

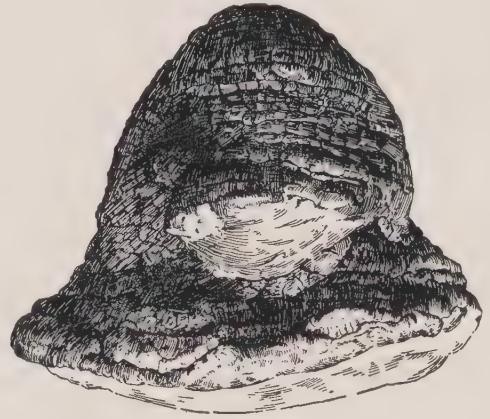
indication of their ability to withstand the minimum temperatures.

Trees suffer in dry seasons from drought. Water is transpired from the leaves of a large tree, in great quantities. The hotter and dryer the atmosphere, the more water is transpired. Thus it happens that during continued droughts there is not sufficient soil-water present for the roots to supply the requisite quantity to compensate for this large loss, and the leaves are killed by dessication. Dead tops or stag-head ultimately result in cases in which such conditions continue year after year. Artificial watering in such cases will relieve this condition and largely prevent the trouble.

Excessively wet soil will also act in a similar way. Tree roots in saturated soil are unable to take up water because they are suffocated by the lack of oxygen. Hence the tops suffer as from drought.

*Smoke and gas injury.*

In manufacturing districts in which large quantities of smoke are produced, extensive injuries to trees as well as other vegetation often result. The injurious property of the smoke is mainly due to the sulfur



353. Sporophore of *Fomes igniarius* var. *nigricans*. Spore-bearing surface shown by the lighter color.

dioxide that it contains. This gas, when dissolved in the cell-sap of the leaf or the soil-water, produces sulfuric acid, which is poisonous to the tree.

The roots of trees are also injured by escaping sewer-gas or illuminating gas, which either poisons or suffocates the roots. Trees killed by escaping gas in the soil usually shed their outer bark in large patches near the base, the inner bark remaining tightly appressed to the tree.

Trees that come into contact with electric wires are injured in proportion to the strength of the current and the duration of the contact. Often trees are killed in cities from this cause.

Gases arising from recently laid creosoted paving-blocks or macadam bound with tar often cause defoliation of nearby trees, by the poisoning of the cell-contents of the leaves.

*Sanitary measures for the prevention of diseases.*

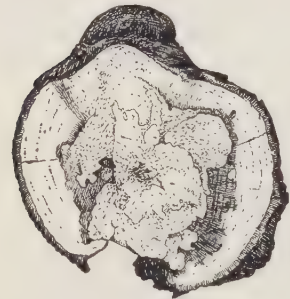
(1) As a first means of preventing disease in trees, one should buy clean stock from nurseries regularly inspected by state agents. Stock should be bought from nurseries in this country, owing to the great danger of importing diseases which might become epidemic. (2) In addition, one should use his influence in getting his neighbors to eradicate diseased trees and diseased parts of trees. Clean stock grown in a well-cared-for neighborhood is the problem half solved. (3) The litter of leaves or twigs under a diseased tree should be collected

each fall and carefully burned in order to prevent the wintering over of harmful fungi. (4) Care should be taken that all wounds made in pruning or by accident be immediately treated with some waterproof adhesive to prevent infection by wound parasites. In the absence of anything like accurate knowledge concerning better preparations, coal or gas tar and lead paint are to be recommended. The tar will last longer than the paint. The whole idea of wound-protection is to bridge over the time lapsing between the injury and the natural healing of the wound by the callus. Wounds previously treated should be gone over at least once a year and a new coating applied if necessary.

#### *Prevention of leaf diseases.*

Although the most of the damage done by leaf diseases is mainly to the appearance and not to the life of the tree, it may even be desirable to prevent the unsightly appearance of leaf-spot or other diseases of that

nature. If, after the sanitary methods described above fail to control the disease, it is desired to spray, this can be done at some little expense if the trees are not too large. Bordeaux mixture, full strength or half strength, applied three or four times after the leaves begin to show, at intervals of about three weeks, will probably tend to lessen infection in most cases. Spray mixtures should be applied a few hours previous to general rain periods, the advance of which can be predicted



354. Cross-section of maple limb affected by *Fomes igniarius*. Note that the frost crack was possibly the infection court. A young sporophore is shown just emerging at the top of the picture. ( $\times \frac{2}{3}$ )

by observing the government weather maps. General directions about spray mixtures and spraying machinery is now attainable from almost any one of the State Agricultural Experiment Stations.

#### *Treatment of diseased trees.*

When the woody part of the tree is the diseased area, tree-surgery methods must be used. Badly diseased limbs and twigs should be pruned off flush. Never leave a stub. Wounds so made should immediately be coated with a waterproofing. Decayed parts of larger limbs or trunks should be carefully dug out with a gouge and mallet, being sure to remove far back on all sides of the cavity into apparently healthy wood. The growing mycelium of the fungus is advancing some distance beyond the decayed area, in what appears as healthy tissue, and must be removed to effect a stoppage of the decay. Cavities thus made may be filled with concrete or left open, provided, in either case however, that the entire surface exposed is carefully painted with a waterproofing paint or tar. Diseased roots may be treated in the same way. At the present time no method of treating diseased trees internally is known. The ideas of quacks who may advance such treatments should be doubted, for in the majority of cases such treatments will prove to be harmful. The matter of chemo-therapy for the cure of tree diseases is not without hopeful outlook, but much careful investigation by experts must be forthcoming before such methods can be evolved.

W. H. RANKIN.

#### *Choice of trees for special purposes.*

The following lists include trees of proved hardiness and are not intended to be complete but merely suggestive, and chiefly for the northeastern United States and Canada.

### 1. TREES WITH SHOWY FLOWERS.

#### *A. Blooming in early spring before or with the leaves.*

*Acer rubrum* (fls. blood-red).  
*Amelanchier canadensis* (fls. white).  
*Cercis canadensis* (fls. rosy pink).  
*Cornus florida* (fls. white, also pink).  
*Cornus mas* (fls. yellow).  
*Magnolia denudata* (fls. white).  
*Magnolia Soulangiana* (fls. white to purple).  
*Prunus americana* and other plums (fls. white).  
*Prunus Avium* and other cherries (fls. white).  
*Prunus Davidiana* (fls. pink, also white, the earliest of all *Prunus*).  
*Prunus pendula* (fls. pinkish, branches pendulous).  
*Prunus Sargentii* (fls. light pink).  
*Prunus serrulata* (fls. white to pink).  
*Pyrus baccata* and other species (fls. white to pink).  
*Salix* (staminate plants with yellow catkins).

#### *AA. Blooming late in spring after the leaves.*

*Æsculus Hippocastanum*, and other species (fls. white or red).  
*Catalpa speciosa* (fls. white).  
*Cladrastis lutea* (fls. white).  
*Cornus kousa* (fls. white).  
*Crataegus* (fls. white).  
*Fraxinus Ornus* (fls. white).  
*Laburnum* (fls. yellow).  
*Magnolia hypoleuca* (fls. white).  
*Pterostyrax* (fls. white).  
*Robinia* (fls. white or light pink).  
*Syringa vulgaris* (fls. white to purple).  
*Tamarix parviflora* (pink).

#### *AAA. Blooming in summer and autumn.*

*Aralia chinensis* and *A. spinosa* (fls. Aug. and Sept.).  
*Castanea dentata* (fls. white; July).  
*Gordonia pubescens* (fls. white; Sept., Oct.).  
*Kœlreuteria paniculata* (fls. yellow; July, Aug.).  
*Oxydendrum arboreum* (fls. white; July, Aug.).  
*Rhus semialata* (fls. white; Aug., Sept.).  
*Robinia neomexicana* (fls. light pink; Aug.).  
*Sophora japonica* (fls. white; Aug.).  
*Syringa japonica* (fls. white; July).  
*Tamarix gallica* (fls. pink; Aug., Sept., if severely cut back).

### 2. TREES WITH SHOWY FRUITS.

*Acer pseudoplatanus* var. *erythrocarpa* (fr. bright red).  
*Acer rubrum* (fr. bright red in May and June).  
*Ailanthus altissima* var. *erythrocarpa* (fr. red).  
*Cornus florida* (fr. scarlet).  
*Cotinus coggygria* (ample feathery panicles).  
*Crataegus mollis* and others (fr. scarlet or red).  
*Hippophaë rhamnoides* (fr. yellow).  
*Ilex opaca* (fr. red).  
*Magnolia hypoleuca* (fr. scarlet).  
*Magnolia tripetala* (fr. pink).  
*Pyrus baccata* and allied species (fr. yellow or scarlet).  
*Rhus typhina* (fr. scarlet).  
*Sassafras* (fr. dark blue with red stems).  
*Sorbus americana* and *aucuparia* (fr. red).  
*Taxus baccata* (fr. scarlet).

### 3. TREES VALUED FOR FOLIAGE EFFECTS. (See also Section 5, Evergreens, next page.)

#### *A. With colored foliage.*

*Acer Negundo* var. *argenteo-variegatum* (the most effective of hardy variegated trees).  
*Acer Negundo* var. *aureo-marginatum* (lvs. yellow).  
*Acer palmatum* var. *atropurpureum* (lvs. purple).  
*Acer platanoides* var. *Reitenbachii* (lvs. becoming dark red in summer).  
*Acer platanoides* var. *Schwedleri* (lvs. bright red in spring).  
*Acer pseudoplatanus* var. *Worleei* (lvs. yellowish).  
*Betula alba* var. *purpurea* (lvs. purple).  
*Fagus sylvatica* var. *purpurea* (lvs. purple).  
*Populus alba* var. *nivea* (lvs. white beneath).  
*Populus deltoides* var. *aurea* (one of the best yellow-leaved trees).  
*Quercus pedunculata* var. *atropurpurea* (lvs. purplish).  
*Quercus pedunculata* var. *Concordia* (lvs. yellowish).  
*Salix alba* var. *argentea* (lvs. silvery white).  
*Tilia tomentosa* (lvs. white beneath).  
*Ulmus campestris* var. *argenteo-variegata* (lvs. whitish).

#### *AA. With large, bold foliage.*

*Acanthopanax ricinifolium*.  
*Acer insigne*.  
*Acer macrophyllum*.  
*Aralia chinensis* and *A. spinosa*.  
*Asimina triloba*.  
*Catalpa speciosa*.  
*Magnolia macrophylla*.  
*Magnolia tripetala*.  
*Paulownia tomentosa*.  
*Quercus dentata*.







X. Arboriculture.—*Picea pungens*, the Colorado blue spruce.



## TREES VALUED FOR FOLIAGE EFFECTS, continued.

AAA. *With small, narrow, or finely cut foliage.*

Acer palmatum var. dissectum.  
 Acer platanoides var. Lorbergii.  
 Acer saccharinum var. Wierf.  
 Alnus glutinosa var. imperialis.  
 Betula pendula var. dalecarlica.  
 Elæagnus angustifolia.  
 Fagus sylvatica var. asplenifolia.  
 Gleditsia triacanthos.  
 Gymnocladus canadensis.  
 Hippophaë rhamnoides.  
 Juglans regia var. laciniata.  
 Quercus pedunculata var. filicifolia.  
 Salix nigra.  
 Sambucus nigra var. laciniata.  
 Tamarix gallica, etc.  
 Taxodium distichum.

## 4. TREES WITH BRILLIANT AUTUMNAL TINTS.

Acer rubrum (scarlet).  
 Acer saccharum (scarlet and orange).  
 Cornus florida (scarlet).  
 Cercidiphyllum (yellow and purple).  
 Crataegus (mostly scarlet and orange).  
 Fraxinus americana (yellow or violet-purple).  
 Liquidambar (scarlet).  
 Liriodendron (bright yellow).  
 Nyssa sylvatica (scarlet).  
 Oxydendrum arboreum.  
 Quercus alba (vinous purple).  
 Quercus coccinea, palustris (scarlet).  
 Rhus (mostly scarlet).  
 Sassafras (orange and scarlet).

## 5. EVERGREEN TREES.

A. *Conifers.*

Abies.	Pinus.
Chamaecyparis	Pseudotsuga.
Juniperus virginiana.	Thuja.
Picea.	Tsuga.

AA. *Broad-leaved evergreens (only Ilex opaca and Rhododendron hardy in the N.).*

Ilex opaca.	Persea carolinensis.
Magnolia glauca (not fully evergreen as far north as it is hardy).	Prunus caroliniana.
	Prunus lusitana.
	Quercus virginiana.
Magnolia grandiflora.	Rhododendron maximum.

## 6. DECIDUOUS TREES VALUED FOR THEIR WINTER EFFECTS.

Acer Negundo (branches light green).  
 Acer pennsylvanicum (striped bark).  
 Betula nigra (flaky reddish brown bark).  
 Betula papyracea (smooth, silvery white bark).  
 Crataegus viridis, C. nitida and other species (red fruit).  
 Fagus sylvatica (keeps its dead leaves).  
 Gleditsia (large, flat pods).  
 Hippophaë rhamnoides (yellow berries).  
 Liquidambar (corky branches).  
 Pyrus prunifolia (scarlet or yellow fruit).  
 Quercus alba, pedunculata and tinctoria (keep their leaves).  
 Quercus macrocarpa (corky branches).  
 Rhus typhina (scarlet fruit).  
 Salix vitellina (yellow branches).  
 Sorbus americana and S. aucuparia (scarlet fruit).

## 7. VERY TALL TREES.

Gleditsia triacanthos.	Populus deltoides.
Juglans nigra.	Quercus macrocarpa.
Liriodendron Tulipifera.	Quercus palustris.
Picea excelsa.	Quercus rubra.
Pinus strobus.	Quercus velutina.
Platanus occidentalis.	Taxodium distichum.
Populus balsamifera.	Ulmus americana.

## 8. COLUMNAR OR NARROW PYRAMIDAL TREES.

Abies (most species).  
 Acer saccharinum var. pyramidale.  
 Acer saccharum var. monumentale.  
 Betula pendula var. fastigiata.  
 Carpinus betulus var. fastigiata.  
 Cephalotaxus Harringtonia var. koraiana.  
 Chamaecyparis Lawsoniana.  
 Chamaecyparis nutkaensis.  
 Juniperus communis var. saccata.  
 Juniperus virginiana (especially var. pyramidalis).  
 Liriodendron Tulipifera var. pyramidalis.  
 Picea (most species).  
 Populus alba var. Boileana.

## COLUMNAR OR NARROW PYRAMIDAL TREES, continued.

Populus nigra var. italica.  
 Quercus pedunculata var. pyramidalis.  
 Robinia pseudacacia var. pyramidalis.  
 Sorbus hybrida.  
 Taxodium distichum (especially var. imbricarium).  
 Taxus baccata var. fastigiata.  
 Thuja.  
 Ulmus campestris var. monumentalis.  
 Ulmus scabra var. fastigiata.

## 9. ROUND-HEADED TREES.

Acer platanoides var. globosum.  
 Æsculus Hippocastanum var. umbraculifera.  
 Catalpa bignonioides var. nana.  
 Fraxinus excelsior var. globosa.  
 Morus alba var. nana.  
 Prunus Mahaleb var. globosa.  
 Robinia Pseudacacia var. umbraculifera.  
 Ulmus campestris var. gracilis.  
 Ulmus campestris var. umbraculifera.

## 10. WEEPING TREES.

Acer saccharinum var. Wieri.  
 Betula alba var. pendula.  
 Crataegus monogyna var. pendula.  
 Fagus sylvatica var. pendula.  
 Fraxinus excelsior var. pendula.  
 Fraxinus parvifolia var. pendula.  
 Gleditsia triacanthos var. pendula.  
 Prunus pendula.  
 Prunus serotina var. pendula.  
 Quercus pedunculata var. Dauvessei.  
 Salix babylonica.  
 Salix blanda.  
 Salix vitellina var. pendula.  
 Sophora japonica var. pendula.  
 Sorbus aucuparia var. pendula.  
 Tilia petiolaris.  
 Ulmus scabra var. pendula.

## 11. CITY TREES. (See also No. 12.)

Ailanthus altissima (pistillate tree).  
 Carpinus.  
 Celtis occidentalis.  
 Crataegus oxyacantha.  
 Fraxinus americana.  
 Fraxinus excelsior.  
 Ginkgo biloba.  
 Gleditsia triacanthos.  
 Platanus orientalis.  
 Populus deltoides.  
 Populus nigra var. italica } (often attacked by borers).  
 Prunus serotina.  
 Robinia Pseudacacia (often attacked by borers).  
 Sophora japonica.  
 Tilia tomentosa.  
 Tilia ulmifolia.  
 Ulmus americana.  
 Ulmus campestris.

## 12. SHADE AND AVENUE TREES.

Besides the trees enumerated under city trees, No. 11 (which are to be recommended as street trees in the cities), the following trees are good avenue subjects:

Acer platanoides.	Quercus alba.
Acer rubrum.	Quercus coccinea.
Acer saccharinum.	Quercus imbricaria.
Acer saccharum.	Quercus palustris.
Æsculus carnea.	Quercus rubra.
Æsculus Hippocastanum.	Quercus phellos.
Catalpa speciosa.	Quercus rubra.
Liquidambar styraciflua.	Tilia americana.
Liriodendron Tulipifera.	Tilia dasystyla.
	Tilia ulmifolia.

## 13. TREES FOR SEASIDE PLANTING.

Ailanthus altissima.	Populus deltoides var. carolinensis.
Crataegus oxyacantha.	Populus tremuloides.
Elæagnus angustifolia.	Quercus rubra.
Hippophaë rhamnoides.	Salix alba.
Juniperus virginiana.	Salix caprea.
Picea alba.	Sassafras.
Pinus nigra.	Tamarix.
Pinus sylvestris.	

## 14. TREES FOR DRY SITUATIONS AND DRY CLIMATES.

Acer campestre.	Pinus divaricata.
Acer ginnala.	Pinus rigida.
Alnus rugosa.	Pinus sylvestris.
Betula pendula.	Quercus coccinea.
Cornus mas.	Quercus Prinus.
Elæagnus angustifolia.	Quercus rubra.
Fraxinus pubescens.	Quercus velutina.
Pteleodendron amurense.	Ulmus effusa.

## 15. TREES FOR WET SOIL.

Acer rubrum.	Picea mariana.
Acer saccharinum.	Pinus rigida.
Alnus glutinosa.	Populus (most species).
Alnus maritima.	Quercus alba.
Betula alba.	Quercus bicolor.
Betula nigra.	Quercus palustris.
Carya laciniosa.	Quercus phellos.
Chamaecyparis thuyoides.	Salix (most species).
Nyssa sylvatica.	Taxodium distichum.
Picea alba.	

ALFRED REHDER.

## Choice of street trees for special regions

## TREES FOR THE EASTERN PART OF THE CONTINENT.

## Street trees for New England and northern New York.

URBAN.	SUBURBAN.
Acer platanoides.	Acer rubrum.
Platanus orientalis.	Acer saccharum.
Quercus rubra.	Fraxinus americana.
Tilia americana.	Platanus occidentalis.
Ulmus americana.	Quercus alba.
	Quercus palustris.

## From New York City and Pennsylvania southward even to Georgia along the mountains.

URBAN.	SUBURBAN.
Acer platanoides.	Acer rubrum.
Ginkgo biloba.	Acer saccharum.
Platanus occidentalis.	Fraxinus americana.
Platanus orientalis.	Liquidambar styraciflua.
Quercus coccinea.	Liriodendron Tulipifera.
Quercus palustris.	Quercus alba.
Quercus rubra.	Quercus bicolor.
Tilia americana.	
Ulmus americana.	

## The coast region from Norfolk southward and along the Gulf of Mexico, except southern Florida.

URBAN.	SUBURBAN.
Liquidambar styraciflua.	Magnolia acuminata.
Quercus laurifolia.	Magnolia grandiflora.
Quercus nigra.	Magnolia tripetala.
Quercus phellos.	Nyssa sylvatica.
Quercus virginiana.	

## North central states.

URBAN.	SUBURBAN.
Celtis occidentalis.	Acer rubrum.
Native oaks.	Acer saccharum.
Tilia americana.	Fraxinus americana.
Ulmus americana.	Platanus occidentalis.

## Add to the above list for points south of Cleveland, Chicago and Omaha.

URBAN.	SUBURBAN.
Acer platanoides.	Liquidambar styraciflua.
Ginkgo biloba.	Liriodendron Tulipifera.
Platanus orientalis.	Platanus occidentalis.
Quercus coccinea.	
Quercus palustris.	
Quercus rubra.	

Most points in northern Alabama, northern Mississippi, southern Arkansas, Oklahoma, and part of Texas back of the coast region are adapted to the trees of both the northern list and the list for the south Atlantic and Gulf coast regions.

F. L. MULFORD.

## Ornamental trees for the middle and southern states.

## Deciduous trees.

*Acer saccharinum* (*A. dasycarpum*) and *A. Negundo*, the latter extensively used for street planting.—*Broussonetia papyrifera*, formerly planted along streets, but objectionable because of the many suckers which they produce, as is also *B. Kazinoki*.—*Cercis canadensis*. Valuable as an early spring-flowering tree.—*Celtis Bungeana*. One of the most distinct trees; an excellent shade tree.—*Catalpa*. Seldom planted South as an ornamental tree, because of the repeated attacks of caterpillars. The latter are frequently used for fish

bait.—*Cladrastis tinctoria*. Very desirable as a flowering lawn tree.—*Cornus florida*. The white-flowering species is among the most attractive of our early spring-blooming trees and is largely used in landscape work. The pink- and red-flowering forms are exceedingly beautiful.—*Crataegus*. Taking into account the various shapes, the foliage and the bright-colored fruit in fall and winter, the best are: *C. Phænopyrum* or Washington thorn, *C. arborescens*, *C. spathulata* and *C. æstivalis* or apple haw.—*Chilopsis saligna*, known as *C. linearis*, is one of the best for dry soils. The typical species produces lilac-colored flowers, but several forms have lately been produced with flowers ranging from light lilac to lilac-purple with yellow stripes inside. A pure white-flowering form is very striking but is of more dwarf habit.—*Diospyros virginiana*. Sometimes planted for shade or for its fruit. Adapts itself to nearly all soils. There are many forms varying both in the foliage and size and shape of fruit.—*Fagus grandifolia* is frequently used for street planting in sandy soils. The red-leaved forms of the European species are of little value South, the purple tint of the foliage fading to a dull green at the approach of warm weather.—*Fraxinus acuminata* and *F. pubescens*. Both thrive best in rich soils and are very desirable for street planting, being seldom attacked by insects.—*Ginkgo* or *Salisbury* is sometimes used for avenues and street planting where a rigid pyramidal tree is required. The foliage is one of its attractions, being shaped like the maidenhair fern.—*Gleditsia triacanthos*. The fertile tree is sometimes planted for its large falcate pods, which are relished by many for the saccharine acidulated pulp. The finely pinnate foliage is very ornamental.—*Halesia tetraptera*. In the middle sections of the South and in rich, dry soils it grows to a small tree, but in the mountain districts in rich soils along the water-courses, trees 40 to 50 feet high are frequently found. Valuable for landscape planting.—*Carya* or *Hicoria*. The pecan is the best southern nut tree and is very largely planted for its nuts. It is often planted in avenues for its beauty.—*Carya myristiciformis* is scarce, but its foliage is more attractive than that of any other species.—*Hovenia dulcis*. The foliage and the fleshy red peduncles in autumn make it an excellent shade and ornamental tree.—*Ilex polycarpa*. A handsome tree when grown in partial shade; the bark blisters in full sun.—*Juglans*. *J. nigra* is one of the most valuable ornamental and economic trees and is extensively planted for avenues. The Persian or English walnut and its many forms are being more largely planted than of old, but are often injured by late spring frosts following a warm period during February. *J. Sieboldiana* is a very ornamental tree and very productive at an early age. *J. cinerea* is suited only to the mountain regions of the South.—*Kalreuteria paniculata*. Very desirable for its pinnate foliage and panicles of yellow flowers, which are succeeded by bladder-like fruits.—*Lagerstramia indica*. The crape myrtle is one of the most characteristic features of southern homes. It has become almost naturalized South. If trained to a single stem, it will form a tree 25 to 30 feet high; otherwise it affects the bush form. It is conspicuous for its shining brown bark and the profusion of its beautifully crimped and fringed flowers, which are produced from April until August. The colors vary from a pale to a dark pink, purplish red, pure white and glowing crimson. No other flowering tree can surpass it in beauty, and by a judicious selection of the various colored flowers a grand effect is produced in landscape work.—*Liriodendron Tulipifera*. One of the most valuable and rapid-growing shade and ornamental trees; thrives best in rich soil. Trees taken from woods transplant badly. They should be grown in nursery and occasionally transplanted until sufficiently large for using in street planting.—*Liquidambar*. A most symmetrical shaped tree; adapts itself to all soil; valuable for street planting. Some trees



assume a deep purple or crimson tint in the foliage during autumn, others a golden yellow.—*Magnolia*. Of the native deciduous species, *M. acuminata* is the most desirable for street and avenue planting. All the species are voracious feeders and thrive best in rich soils. *M. macrophylla*, or umbrella magnolia, seldom grows beyond 25 feet, but is conspicuous for the length and size of its leaves. This tree is called umbrella tree South, whereas this name applies to *M. tripetala* at the North. *M. Fraseri*, ear-leaved magnolia or wahoo of the western North Carolina mountaineers, is also a very ornamental tree. *M. tripetala* is objectionable in gardens owing to the unpleasant odor of its flowers. Few Chinese species, with the exception of *M. hypoleuca*, attain the size of a tree. *M. denudata* and *M. Soulangeana* can be trained to a single stem and made to attain a height of 25 feet. All the other varieties may be classed as shrubs. The flowers are often injured by late spring frosts.—*Melia Azedarach* (Pride of India, Chinaberry). Almost naturalized South. It is of very rapid growth and begins to flower at an early stage. The flowers are delightfully fragrant, with the perfume of the lilac. Extensively planted for shade trees. The umbrella form, known as Texas umbrella, assumes a dense, spreading head with drooping foliage. It is of unique appearance and can be used with great effect in landscape work.—*Morus*. *M. rubra* is frequently planted for shade; it is valuable for its wood, which is of great durability for posts. *M. alba* is naturalized in many sections. A form of *M. rubra* discovered in middle Georgia some years ago and called the Stubbs mulberry, from the discoverer, produces enormous crops of large, rich vinous fruit. This and the Hicks and Downing varieties are often planted for feeding poultry and hogs. They should not be planted near dwellings, owing to the dropping of the fruit.—*Nyssa sylvatica*. Only desirable in landscape work for the brilliant red tint of its autumn foliage.—*Oxydendrum arboreum*. Desirable for its flowers and highly colored autumn foliage.—*Parkinsonia aculeata*. Retoma or horse bean of southern Texas. A small tree with green bark, feathery foliage and yellow flowers. Valuable for shrubberies.—*Paulownia tomentosa*. Rapid-growing. Almost naturalized in some sections of the South. The foliage in young trees is very large. Flowers pale violet, very fragrant, in long panicles; they open before the leaves appear.—*Peach*. There are many ornamental varieties which are exceedingly handsome while in bloom, especially the double-flowering crimson, white and pink; others are desirable for their peculiar growth, as Pyramidalis, which is as erect as a Lombardy poplar. Weeping, willow-leaved, and golden-leaved varieties are interesting.—*Prunus*. Hortulana or Chicasaw plums are sometimes planted for ornament, though commonly for fruit. *P. virginiana* is abundant everywhere but

not valued owing to being usually infested with tent caterpillars. *Prunus Pissardii* is the best purple-leaved tree for the South, as it retains its color during summer.—*Pinckneya pubens*. This very ornamental small tree is seldom seen under cultivation, as it grows naturally in wet and boggy soils.—*Pyrus coronaria*. The crab-apple, a small tree with very fragrant flowers in spring, is excellent for shrubberies.—*Platanus occidentalis*. One of the most desirable trees for street planting.—*Populus*. The variety used most freely for street planting is *P. deltoides* or *P. monilifera*, commonly known in the South as cottonwood. It is of rapid growth and thrives in nearly all soils that are not too arid. All southern nurserymen catalogue the Carolina poplar, but the stock is not always true to name.—*Pterocarya fraxinifolia*, or Caucasian wing-fruited walnut, is a very rapid-growing tree, with spreading branches and pinnate foliage. Very ornamental when

covered with pendulous racemes of small winged nuts, which, however, are of no economic value.—*Quercus*. Nearly

all the species of the middle and eastern states are found more or less abundant in the middle South, but the most valuable purely southern species are as follows: *Q. phellos*, or willow oak, with lanceolate leaves; *Q. aquatica*, or water oak, with leaves almost

perennial, oblong and obtusely lobed. Both are largely planted for streets and shade, as they grow very rapidly and in almost any soil. *Q. falcata*, *Q. laurifolia*, *Q. phellos* and *Q. Muhlenbergii* are desirable. *Q. virginiana*, or live oak, is a very large tree, seldom exceeding 50 feet in height but covering a large circumference. It is native along

the seacoast and adapts itself to inland sections, where it does not attain the great size of the coast region. There is no southern tree, except *Magnolia grandiflora*, that is more admired, especially when planted in avenues.—*Sapindus marginatus*. The globose yellow berries are retained during winter. Berries when boiled produce a saponaceous fluid.—*Stillingia sebifera*. Naturalized on the coast of Georgia and South Carolina. The acuminate rhomboidal leaves give the tree a unique appearance. Requires rich soil and is valuable in landscape work.—*Symplocos tinctoria*. Not common. Should be available for shrubberies.—*Tilia pubescens*. A large tree occasionally found in rich soils along the seacoast. Differs little in general from *T. americana*, but seems to be better suited to the middle South. Very desirable for street planting or shade.—*Toxylon*, or *Maclura*, is naturalized in many sections of the middle South. Grows to a height of 30 feet and the fertile trees are very ornamental when laden with their large, globular fruit. The wood is very lasting when used for posts and takes a beautiful polish.—*Ulmus americana* is perhaps more largely planted for streets and avenues than any other deciduous tree.—*Viburnum prunifolium* (black haw or possum haw). In very rich



355. Avenue of live oaks, Audubon Park, New Orleans.

for fruit. *P. virginiana* is abundant everywhere but



soils sometimes attains a height of 15 to 20 feet. The dark blue berries are retained during winter. Desirable for shrubberies.

#### Broad-leaved evergreen trees.

*Camellia japonica*. Although these magnificent plants are usually seen in bush form, they can be trained to single stems and attain a height of 20 or more feet in the coast region, where they have found a congenial soil and climate. The typical single red variety, a tree of which is growing at Charleston, S. C., and planted in 1808, being the first introduced, is now upwards of 20 feet high. The double-flowering sorts, while usually of vigorous growth, do not attain the size of the single red.—*Cinnamomum Camphora*. In southern Louisiana and middle Florida trees grow to a height of 50 feet; in the middle South they affect the bush form or when trained to single stems exceed 15 to 20 feet. For the extreme South it is recommended for street planting.—*Cyrilla racemiflora*. Specimens are occasionally found on shady banks of streams, where the soil is very rich, that will grow 20 feet high, but the tree form must be secured by pruning. The foliage assumes a bright red or bronze tint in winter.—*Eriobotrya japonica*. Flowers produced in January, and if not frost-killed are followed by a golden yellow plum-like fruit of good flavor. Reaches a height of 20 or more feet in the coast belt.—*Gordonia Lasianthus*. A stately tree found only in shallow swamps or turfy soils. The roots spread almost entirely near or upon the surface of the ground, which makes it difficult to transplant trees taken from the woods. Trees grown from seed in pots are best for planting, but a rich moist soil is necessary to their growth.—*Ilex*. *I. opaca* and *I. Dahoon* are among the most valuable evergreen trees, the former being the best where a large tree is desired. Specimens taken from the woods should not exceed one foot in height, as larger sizes almost always fail in transplanting.—*Ligustrum*. *L. japonicum* often forms a tree 25 feet high. Berries blue-black, retained during winter.—*Magnolia*. *M. grandiflora* is justly considered the glory of southern broad-leaved evergreen trees. There are many forms, based on the size and shape of the leaves and the flowers. The superb white flowers, which are seen from May until August and occasionally upon some trees as late as October, vary from 4 to 12 inches in diameter. Thrives as far north as Washington, D. C. *M. glauca* has white flowers 2 to 3 inches in diameter and delightfully fragrant.—



356. A Norway Spruce.—  
*Picea excelsa*.

*Osmanthus fragrans* var. *ruber* and *O. Aquifolium* var. *ilicifolius*, can be trained to single stem. The flowers of the first are delicately fragrant and produced twice a year.—*Persea carolinensis*. Planted for shade in rich soils in the coast belt.—*Photinia serrulata*, or Chinese evergreen thorn, has white flowers and dark red autumn foliage.—*Prunus carolinensis*. Known south as Carolina Cherry, Caro-

lina laurel, mock orange, etc. One of the most ornamental southern trees.—*Quercus Suber*. Acorns were distributed by the United States Patent Office in 1860, and many large trees are now found in several sections of the South, where they have fruited. Some small plantations are made for the purpose of producing cork. It grows well in comparatively poor and stony soils.—*Sabal Palmetto* is now freely used for street and avenue planting on the coast. It is conspicuous for its tropical appearance. It is not entirely successful further than 40 miles from the seashore.

#### Conifers or narrow-leaved evergreens.

*Abies*. Of this section few specimens are found below the Piedmont region. Occasionally the Norway spruce grows to a moderate size.—*Cedrus Deodara*. An admirable tree and of rapid growth, 40 to 50 feet. *C. atlantica*. 25 to 30 feet.—*Cunninghamia lanceolata*. Foliage resembles an araucaria.—*Cupressus*. *C. sempervirens* has many forms, from the compact, spiral or shaft-like shape to more spreading habit. *C. lusitanica* or cypress of Goa, has numerous forms with foliage of an ashy green and pendulous branches, to others of a more dark tint and rigid form. Of *Chamaecyparis Lawsoniana* there are endless forms, from a compact, erect habit and vivid green foliage to those of open or pendulous shape and with glaucous or golden foliage. *Cupressus funebris* has varied less in its seedlings.—*Juniperus*. The Irish juniper is of fine pyramidal form, and reaches a height of 15 feet. *J. excelsa*, *J. chinensis* and *J. thurifera* differ in the tint of their foliage and are all of tall growth.—*Libocedrus decurrens*. The California arborvitæ, with its graceful feathery foliage and conical shape, is one of the most ornamental of conifers.—*Pinus*. Few of the exotic species are suitable to the South. *Pinus excelsa*, or Bhotan pine, is undoubtedly the best adapted to the middle South of all kinds.—*Retinispora* is a valuable group of Japanese cypress, but with the exception of *R. obtusa*, *R. Fulleri*, *R. plumosa* and *R. squarrosa Veitchii*, all are of dwarf habit.—*Thuja*. The Asiatic section is better adapted to the middle South than the American species. Of the former the best forms are known to nurseries as *Biota pyramidalis* and var. *aurea*, reaching a height of 15 to 18 feet. *B. japonica* var. *filiformis* (*Thuja orientalis*) is a remarkable variety, with thread-like foliage and compact habit to 10 to 12 feet.

In the foregoing list of Coniferæ no mention is made of species or varieties of low or shrub-like growth, such as *Podocarpus*, *Cephalotaxus*, *Thuyopsis*, and *Sciadopitys*, of which there are many good specimens in various parts of the south. Araucarias are also omitted, owing to their liability of failure from extreme heat or other unfavorable climatic conditions. This applies also to *Sequoia*, and *Frenelas* (properly *Callitris*); these frequently make an extraordinarily rapid growth until late in autumn, and are often injured by a cold wave early in winter.

P. J. BERCKMANS.

#### Trees on the Great Plains.

The Plains, lying mostly west of the Missouri River, are not absolutely treeless, as strangers often suppose, but the whole vast area is dotted here and there with small groves, or narrow belts that fringe the borders of the streams. The number of native species, however, is much smaller than in the rich tree flora of the north-eastern United States and Canada. The number of species cultivated for shade and ornament, for a long time, at least, must be relatively small, owing to climatic and other causes. In general, the people of the Plains are necessarily more interested at present in planting trees for profit than for pleasure, but in the older parts are already to be found many fine public parks and private grounds. To a large extent, however, their point of view is that of forestry rather than horticulture.



In studying the forest trees of the Great Plains of central North America, it is found that most of the species have migrated out upon the Plains from the great forest body of the Mississippi Valley. These trees found their way upon the Plains by way of the forests that border the Missouri River and its tributaries. As we pass down the river, along the eastern edge of the Plains, the forest belt becomes larger and larger, until it eventually merges into the great body of forest trees lying on the easterly side of the Mississippi Valley. The principal trees that have come upon the Plains by this route are the common red cedar, papaw, half a dozen willows, one cottonwood, basswood, two or three elms, hackberry, mulberry, three ashes, wild apple, four or more species of hawthorns, junberry, wild cherry, choke cherry, wild plum, coffee bean, honey locust, redbud, sycamore, two species of buckthorns, buckeye, one maple, box elder, sumach, two species of walnuts, five or six hickories, nine or ten oaks, ironwood, blue beech, and one birch. But ten species of trees have come from the Rocky Mountain forests, and these have made much less impression upon the forests of the Plains than those that came from the eastern forests. In this list are the bull-pine, the western red cedar, four species of cottonwoods, the buffalo berry, a maple, and two birches.

Although the present forest area of the Plains is not relatively great, it is large enough to be seriously considered in regard to its preservation. There is danger that with the habit acquired by our people in the thickly wooded parts of the United States of cutting down forest trees wherever found, much of this small forest area will be destroyed. It is much easier to preserve an area of forest growth than to create it anew. First, all forest fires must be kept down. When a mass of woodland adjoins the open prairie, fire-guards should be made so that the fires will not sweep into the forest growth. The greatest destroyer of the forests of the Plains in the past has been fire, as it swept over the prairies into woodland. Second, it is absolutely necessary to keep out certain kinds of stock. Swine, if herded in large numbers, will inevitably destroy the trees. They prevent the growth of small trees, and eventually destroy those of larger growth. Cattle, in large numbers, are equally destructive. In fact, when the attempt is made to preserve uninjured the trees in a forest, it is necessary to keep out stock of all kinds, excepting possibly during limited portions of the year. Third, it is necessary to cut out the trees for use with very great care. A forest should be a permanent crop, and the cuttings should be so made that the forest as a whole is not injured. Trees should be cut here and there in such a way that the young trees which are left have an opportunity for growing into usable timber.

Care should be taken to encourage the tendency to spreading which is so strong in nearly all parts of the Plains. With a little care every present living forest area may be made to extend itself spontaneously, or nearly so. The forest should be effectually inclosed by a fence, placed at some distance from its outer border, leaving a belt of unoccupied land between the trees and the fence. This will grow up with weeds, and mingled with these will be the seedling trees springing from the seeds blown or carried from the forest area. In this way the border of the forest will be gradually extended. This can be helped by plowing up these inclosed belts of land, giving better opportunity for the starting of seedling trees. With the weeds and little trees will spring up low shrubs of various kinds. These need give no trouble, for this is merely Nature's way of taking possession of the soil. Little, if any, cultivation need be given to such a nursery belt, as the weeds which spring up, while unsightly, will serve the useful purpose of sheltering the little trees, and eventually the trees will rise above, and choke them out. Grass, however, forming a tough sod, is harmful to the little trees, far more so than the ordinary weeds.

There are many places in which actual planting must be resorted to. In looking about for a site for the new forest plantation, it must be remembered that the best conditions for tree growth are usually to be found near the natural forests. Where there are natural forests, the planting should be around their borders, so as to extend them in much the same way as indicated in the preceding paragraph in regard to natural spreading. Where there are no natural forests at all, it is necessary to select the more favorable places for planting. Since the natural forests on the Plains occupy the depressions rather than the hilltops or the slopes, this should give



357. A good field elm.

one a hint as to what must be done. Wherever the land slopes into a depression, one may find favorable conditions for growing trees. These depressions, generally called "draws," may be filled with trees, and when once a growth of a few acres is secured it will not be difficult to extend the forest far up the hillside slopes. On the western parts of the Plains similar positions should be taken under the irrigation ditches. In the selection of trees for the formation of forest areas, one should also take a hint from nature. The rule, which is a very excellent one for the plainsman to follow, is to plant on his farm the kinds that he finds in the nearest forest, and to give his planted trees as nearly as possible the same conditions as those under which they grew in the native forest. On the eastern third of the Plains, the walnut, white oak, shellbark hickory, white elm, red elm, hackberry, white ash, wild cherry, catalpa and honey locust are recommended for planting. On the extreme eastern parts bordering the Missouri River, many more kinds can be planted, but as one passes westward toward the borders of the Sand Hill region the list grows smaller. On the central Plains the list is reduced, and also somewhat changed in species. The two elms may be planted, as also the hackberry, the green ash in place of the white ash, wild cherry, honey locust, and in many places the bull-pine. On the western Plains, especially that portion lying west of the main body of the Sand Hills, and having an elevation above the sea of from 3,000 to 4,000 feet, the list is still smaller. The white elm is still included, also the hackberry, the bull-pine, and in many places the red cedar.

The trees mentioned are of the more durable and profitable kinds. But on all parts of the Plains persons must often have quick-growing trees, which soon produce fuel, but which have little, if any, value for other purposes. In the eastern part of the Plains, the black willow, almond willow, common cottonwood, silver maple, and box elder are useful trees for this purpose. One should not condemn the use of these easily grown, soft-wooded trees. A forest is a crop, and there is no reason why a farmer may not plant a more quickly growing crop if he wishes, but he should at the same time plant the more enduring kinds given in the preced-

ing lists. On the central Plains the quickly grown trees may include the same willows and cottonwood and also the box elder. The silver maple will not do well in the greater part of this central region. On the western Plains the list is essentially the same as for the central portion: namely, the willows, cottonwood, and the box elder, to which may be added, here and there, one or more of the western species of cottonwood.

The horticultural point of view is to be considered. About country homes the first trees are usually cottonwood, silver maple and box elder, followed later by green ash and white elm. Very commonly the red cedar is planted with the first-mentioned species, and often Scotch and Austrian pines are added. It must be remembered that the settler's house on the Plains stands in the open instead of being hemmed in by forest trees, as in the eastern parts of the American continent. The settler's problem is to surround his house with trees, not to clear the trees away. In towns and cities the cottonwood, silver maple and box elder are generally the pioneer trees, since they produce a shade sooner than any others, and later these are gradually replaced by



358. *Phoenix canariensis*. One of the most serviceable palms in California.

green ash and white elm. Hackberry, black walnut and buttonwood are occasionally planted with good success. The species which are most largely used for wind-breaks for orchards and other plantations are common cottonwood, willow (a variety of *Salix alba*), silver maple and box elder. The first mentioned, because of its easy propagation, rapid growth and extreme hardiness, is the favorite tree for this purpose. When landscape gardening is attempted, the Scotch and Austrian pines, Norway spruce and red cedar are generally used, and to these are often added one or more species of the Rocky Mountain spruces. The most generally used deciduous tree for this purpose is the white elm (which here attains to a singular beauty of form and foliage), to which are occasionally added bur oak, black walnut and Russian olive (*Eleagnus*), and in proper situations, the white willow. The coniferous trees of greatest value for ornamental purposes on the Plains are the Austrian pine, Scotch pine and red cedar. With proper care these may be grown on all parts of the Plains where water enough to maintain life may be obtained. On the extreme eastern border, the Norway spruce and even the balsam fir have proved valuable. Among deciduous trees the white elm holds first place, followed by the hackberry (which is not so much planted as it deserves) and the green ash.

CHARLES E. BESSEY.

**TREES FOR PLANTING ON THE GREAT PLAINS.** The asterisks (\*) indicate those trees that are not native to the regions.

1. *For the eastern plains.*

*Abies balsamea*.  
*Abies concolor*.  
*Acer platanoides*.  
*Ailanthus altissima*.  
*Carya ovata*.  
*Catalpa speciosa*.  
*Celtis occidentalis*.  
*Fraxinus americana*.  
*Gleditsia triacanthos*.  
*Juglans nigra*.  
*Picea alba*.

*Picea excelsa*\* (Fig. 356).  
*Picea pungens*.  
*Pinus austriaca*.  
*Pinus sylvestris*.  
*Prunus serotina*.  
*Quercus alba*.  
*Robinia Pseudacacia*.  
*Salix vitellina*.  
*Ulmus americana* (Fig. 357).  
*Ulmus fulva*.

and the following quick-growing but temporary trees:

*Acer Negundo*.  
*Acer saccharinum*.  
*Populus Sargentii*.

*Salix amygdaloides*.  
*Salix nigra*.

2. *For the central plains.*

*Catalpa speciosa*.  
*Celtis occidentalis*.  
*Fraxinus lanceolata*.  
*Gleditsia triacanthos*.  
*Picea canadensis*.  
*Pinus divaricata*.

*Pinus scopulorum*.  
*Prunus serotina*.  
*Robinia Pseudacacia*.  
*Ulmus americana*.  
*Ulmus fulva*.

and the following quick-growing but temporary trees:

*Acer Negundo*.  
*Populus Sargentii*.

*Salix amygdaloides*.  
*Salix nigra*.

and in the southern parts:

*Elæagnus angustifolia*.  
*Maclura aurantiaca*, Nutt.

*Pinus austriaca*.  
*Pinus sylvestris*.

also black walnut and bur oak if seed is planted where tree is to stand permanently.

3. *For the high western plains.*

*Celtis occidentalis*.  
*Juniperus scopulorum*.  
*Pinus divaricata*.

*Pinus scopulorum*.  
*Robinia Pseudacacia*.  
*Ulmus americana*.

and the following quick-growing but temporary trees:

*Acer Negundo*.  
*Populus acuminata*.  
*Populus Sargentii*.

*Salix amygdaloides*.  
*Salix nigra*.

and nearer the mountains:

*Acer Negundo*.  
*Acer platanoides*.  
*Elæagnus angustifolia*.  
*Fraxinus lanceolata*.

*Gleditsia triacanthos*.  
*Juglans nigra*.  
*Populus Sargentii*.  
*Tilia americana*.

Seeds or seedlings grown in the region in which they are to be planted are the most reliable. Young trees or seedlings succeed better than older and larger ones. Varieties native in moist climates or in foreign countries should be avoided unless their adaptability has been proved. Young plants, like young animals, are easily killed and must have extra care.

C. L. WATROUS.  
 C. E. BESSEY.

**Trees grown for shade and ornament in California.**

The mild and equable climate of California allows a wide range of available species from which to select trees for shade, ornament and shelter. There is, nevertheless, some considerable variation in the species, which are characteristic of the plantings in different parts of the state, that has arisen from variations in soil and climatic conditions.

On account of the long rainy season, the low humidity of the atmosphere and the relatively high mean, and freedom from low winter minima in temperatures, the trees that thrive best in middle California are those indigenous to the arid and semi-arid warm temperate regions of the globe, e. g., southern Australia, the Mediterranean region, south Africa, northern Mexico and Chile, together with those native species which deserve a place. As one goes into the southern part of the state, some of these species drop out and others markedly



characteristic of arid regions take their place. The reverse of this is true, as one goes north, where many trees of the temperate humid regions also thrive in this state, particularly in the relatively humid climate of the coast, and are offered by our nurserymen.

### I. THE SPECIES HERETOFORE MOST EXTENSIVELY PLANTED IN CALIFORNIA.

The following trees are perhaps the commonest species found in the plantings:

- |                                      |   |
|--------------------------------------|---|
| 1. <i>Eucalyptus globulus</i> .      | 15. <i>Araucaria Bidwillii</i> .        |
| 2. <i>Cupressus macrocarpa</i> .     | 16. <i>Araucaria excelsa</i> .          |
| 3. <i>Pinus radiata</i> .            | 17. <i>Populus deltoides</i> var.       |
| 4. <i>Robinia Pseudacacia</i> .      | <i>carolinensis</i> .                   |
| 5. <i>Acacia melanoxylon</i> .       | 18. <i>Juglans californica</i> and      |
| 6. <i>Schinus Molle</i> .            | <i>species</i> .                        |
| 7. <i>Acacia decurrens</i> var.      | 19. <i>Salix babylonica</i> .           |
| <i>dealbata</i> .                    | 20. <i>Acer saccharinum</i> .           |
| 8. <i>Acacia decurrens</i> var.      | 21. <i>Eucalyptus robusta</i> .         |
| <i>molliis</i> .                     | 22. <i>Eucalyptus viminalis</i> .       |
| 9. <i>Melia Azedarach</i> var.       | 23. <i>Eucalyptus rostrata</i>          |
| <i>umbraculiformis</i> .             | (Fig. 360).                             |
| 10. <i>Phoenix canariensis</i>       | 24. <i>Acer macrophyllum</i> .          |
| (Fig. 358).                          | 25. <i>Pittosporum</i> <i>species</i> . |
| 11. <i>Magnolia grandiflora</i> .    | 26. <i>Cedrus Deodara</i> and           |
| 12. <i>Ulmus racemosa</i> and        | <i>species</i> .                        |
| <i>species</i> .                     | 27. <i>Betula alba</i> .                |
| 13. <i>Cordylina australis</i> (Fig. | 28. <i>Grevillea robusta</i> .          |
| 359) and <i>species</i> .            | 29. <i>Washingtonia filifera</i> .      |
| 14. <i>Acer Negundo</i> , and var.   | 30. <i>Cinnamomum Camphora</i>          |
| <i>californica</i> .                 |   |

### II. TREES BEING MOST EXTENSIVELY PLANTED IN CALIFORNIA AT THE PRESENT TIME.

The following list, arranged in sequence according to the actual number of sales made during the season of 1911-12, is compiled from data furnished by W. B. Clarke, of the California Nursery Company, at Niles. The percentages refer only to the twelve species here enumerated, and not to the total number of trees sold by the nursery, which has a large and varied assortment of species, many of which are more suitable and more effective than those for which there is, at present, the greatest demand.

	Per cent.
<i>Eucalyptus globulus</i> .....	40.8
<i>Cupressus macrocarpa</i> .....	12.0
<i>Platanus orientalis</i> .....	11.4
<i>Eucalyptus rostrata</i> .....	10.2
<i>Populus nigra italica</i> .....	6.2
<i>Pinus radiata</i> .....	5.0
<i>Acacia decurrens dealbata</i> .....	3.5
<i>Acacia melanoxylon</i> .....	3.0
<i>Populus deltoides</i> var. <i>carolinensis</i> .....	2.2
<i>Robinia Pseudacacia</i> var. <i>Decaisneana</i> .....	2.0
<i>Acer saccharinum</i> .....	2.0
<i>Schinus Molle</i> .....	1.7

### III. SELECTIONS FOR SPECIAL PURPOSES.

The following lists are from species now offered in the California trade and are intended to be suggestive only, and not by any means complete. New species and varieties are constantly being added to the nursery stocks, some of which will be found particularly well adapted to certain conditions of climate and soil, and will doubtless replace others now in use.

#### 1. For subtropical effect.

That there is in California strong appreciation of subtropical effects in gardening is shown by the great demand for dracenas and such large-leaved plants as palms, magnolias, bananas and rubber trees. That the effect produced by the planting of such trees so often fails to be satisfactory is largely due to one or both of two causes,—either unsuitable location of the specimens, or choice and association of unsuitable species. To prevent a repetition of the first-named error, the prospective tree planter is recommended to consult the article on Landscape Gardening; and to avoid the second, a selection from the following list is suggested, with the addition of such large-leaved herbaceous plants as cannas, colocasia, cynaras, funkias, *Gunnera scabra*, pampas grass, veratrums, agaves, yuccas, aloes,

*Woodwardia radicans* and *Rodgersia podophylla*, together with such shrubby plants as bamboos, giant reed, the choicer varieties of castor-bean, *Senecio grandifolius*, *Polygonum sachalinense* and *P. Sieboldii*.

#### A. Small trees or tall shrubs.

<i>Acanthopanax ricinifolium</i> .	<i>Erythra armata</i> .
<i>Aralia chinensis</i> .	<i>Musa Ensete</i> .
<i>Aralia chinensis</i> var. <i>mandschurica</i> .	<i>Prunus Laurocerasus</i> .
<i>Aralia spinosa</i> .	<i>Ricinus cambodgensis</i> .
<i>Arundinaria falcata</i> .	<i>Ricinus macrophyllus</i> .
<i>Chamærops humilis</i> .	<i>Ricinus sanguineus</i> .
<i>Dicksonia antarctica</i> .	<i>Ricinus zanzibarensis</i> .
<i>Eriobotrya japonica</i> .	<i>Tetrapanax papyrifera</i> .

#### AA. Larger trees.

<i>Catalpa bignonioides</i> .	<i>Livistonia australis</i> .
<i>Catalpa ovata</i> .	<i>Magnolia grandiflora</i> .
<i>Catalpa speciosa</i> .	<i>Paulownia tomentosa</i> .
<i>Cordylina australis</i> .	<i>Phoenix canariensis</i> .
<i>Cordylina Banksii</i> .	<i>Phoenix dactylifera</i> .
<i>Cordylina indivisa</i> .	<i>Phoenix reclinata</i> .
<i>Cordylina stricta</i> .	<i>Phoenix Roebelenii</i> ( <i>P. humilis</i>
<i>Corynocarpus</i> .	var.)
<i>Erythra edulis</i> .	<i>Phoenix sylvestris</i> .
<i>Eucalyptus calophylla</i> .	<i>Phytolacca dioica</i> .
<i>Eucalyptus ficifolia</i> .	<i>Trachycarpus excelsus</i> .
<i>Ficus Carica</i> .	<i>Tristania conferta</i> .
<i>Ficus macrophylla</i> .	<i>Washingtonia filifera</i> .
<i>Gymnocladus canadensis</i> .	<i>Washingtonia robusta</i> .
<i>Jubæa spectabilis</i> .	

*Eucalyptus globulus* can also be used effectively if cut down periodically when the falcate leaves begin to appear; it will continue to shoot up vigorously from the same root for several years. *E. robusta* is useful for screen purposes if cut down before it becomes straggling. This can also be said for *E. polyanthemus*, *E. rudis*, *E. Risdonii*, and many others. *E. polyanthemus* is certainly more beautiful than *E. globulus* and would not need to be cut down so frequently.

#### 2. Trees with ornamental flowers (for California)

In making the following grouping, arranged according to relative hardiness, it has been impossible to give precise information as to the exact degree of frost-tolerance of the several species, as only meager published data on the subject are to be found.

#### A. Susceptible to light frost.

The following would probably succumb to a temperature of 28° F.:

<i>Eucalyptus calophylla</i> .	<i>Jacaranda ovalifolia</i> .
<i>Eucalyptus ficifolia</i> .	

#### AA. Susceptible to heavy frost.

The following are not likely to stand a temperature of 20° F. Some of them may succumb at 25° F., particularly when young.

<i>Acacia Baileyana</i> .	<i>Acacia salicina</i> , etc.
<i>Acacia cyanophylla</i> .	<i>Bursaria spinosa</i> .
<i>Acacia decurrens</i> var. <i>dealbata</i> .	<i>Eucalyptus cornuta</i> .
<i>Acacia elata</i> .	<i>Eucalyptus corymbosa</i> .
<i>Acacia falcata</i> .	<i>Eucalyptus polyanthemus</i> .
<i>Acacia longifolia</i> .	<i>Eucalyptus sideroxylon</i> var.
<i>Acacia nerifolia</i> .	<i>pallens</i> .
<i>Acacia pendula</i> .	<i>Hymenosporum flavum</i> .

#### AAA. Hardy.

<i>Acacia pycnantha</i> .	<i>Magnolia Soulangeana</i> .
<i>Æsculus carnea</i> .	<i>Magnolia stellata</i> .
<i>Æsculus Hippocastanum</i> .	<i>Paulownia tomentosa</i> .
<i>Albizia Julibrissin</i> .	<i>Prunus Armeniaca</i> (double.-fld.)
<i>Catalpa bignonioides</i> .	<i>Prunus cerasifera</i> var. <i>atro-</i>
<i>Catalpa ovata</i> .	<i>purpurea</i> .
<i>Catalpa speciosa</i> .	<i>Prunus japonica</i> .
<i>Cercis canadensis</i> .	<i>Prunus Persica</i> (white.-fld.,
<i>Cercis Siliquastrum</i> .	double red.-fld., dark.-fld.,
<i>Cratægus mollis</i> .	etc.).
<i>Cratægus monogyna</i> (vars.	<i>Prunus spinosa</i> (double.-fld.).
<i>Paulii</i> , <i>punicea</i> , <i>alba plena</i> ,	<i>Pyrus Halliana</i> .
etc.).	<i>Pyrus ioensis</i> (Bechtel's double
<i>Kœlreuteria paniculata</i> .	crab).
<i>Laburnum vulgare</i> .	<i>Robinia hispida</i> .
<i>Lagunaria Patersonii</i> .	<i>Robinia Pseudacacia</i> and var.
<i>Magnolia acuminata</i> .	<i>rosea</i> .
<i>Magnolia grandiflora</i> .	<i>Sorbus Aucuparia</i> .
<i>Magnolia Kobus</i> .	

## 3. Trees with colored foliage.

## A. Glaucous.

## B. Susceptible to frost (20° F. and perhaps less).

Acacia Baileyana.	Eucalyptus polyanthemus.
Acacia dealbata.	Eucalyptus Risdonii.
Acacia glaucescens.	Eucalyptus sideroxylon var.
Acacia salicina.	pallens.
Cocos australis.	Leucadendron argenteum.
Erythea armata.	Phoenix dactylifera.
Eucalyptus globulus (pollarded to produce suckers).	Washingtonia Sonora.

## BB. Hardy.

Cedrus atlantica var. glauca.	Picea pungens var. glauca.
Cedrus Deodara var. glauca.	Sequoia sempervirens var.
Picea pungens var. cerulea.	glauca.

## AA. Purple or bronze.

## B. Susceptible to 25° F.

Ricinus cambodgensis.	Ricinus communis var. Giosonii
-----------------------	--------------------------------

## BB. Hardy.

Acer platanoides var. Reiten- bachii.	Fagus sylvatica var. purpurea.
Acer platanoides var. Schwed- leri.	Fagus sylvatica var. purpurea Riversii.
Betula alba var. atropurpurea.	Prunus cerasifera var. atro- purpurea.
Cryptomeria japonica var. elegans.	Prunus Persica, var.

## 4. Wide-spreading trees for shade, mostly with rounded outline.

It frequently happens that the owner of a California garden desires a wide-spreading tree in the back or one corner of his domain, under which to swing a hammock on a hot day; such trees are also useful in the school-yard, affording welcome shade in which the children can eat their lunch.

## A. Deciduous, all hardy.

## B. Growth rapid or medium.

## C. Suckers likely to be troublesome.

Populus alba.	Ulmus americana.
Robinia Pseudacacia.	Ulmus racemosa.

## CC. Suckers not troublesome.

## D. Requiring a great deal of water.

Salix babylonica.

## DD. Requiring not much water.

Acer macrophyllum.	Acer saccharinum.
Acer Negundo.	Acer saccharinum var. Wieri.
Acer Negundo var. californicum.	Carya illinoensis (Pecan).
Acer platanoides.	Fraxinus americana.
Acer platanoides var. Reiten- bachii.	Fraxinus velutina.
Acer platanoides var. Schwed- leri.	Quercus lobata.
Acer pseudoplatanus.	Quercus pedunculata.
	Ulmus campestris.

## BB. Growth somewhat slow.

Acer campestre.	Quercus coccinea.
Æsculus carnea.	Quercus Kelloggii.
Æsculus Hippocastanum.	Quercus lobata.
Castanea sativa.	Quercus macrocarpa.
Fagus sylvatica var. purpurea.	Quercus rubra.
Juglans Sieboldiana.	Sophora japonica.
Liriodendron Tulipifera.	Tilia americana.
Melia Azedarach var. umbra- culiformis.	Tilia europæa.
Platanus orientalis.	Ulmus campestris.

## AA. Evergreen.

## B. Growth rapid: trees susceptible to 25° F.

Acacia decurrens dealbata.	Acacia decurrens mollis.
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## BB. Growth somewhat slow: trees hardy.

Arbutus Menziesii.	Quercus agrifolia.
Ficus Carica.	Quercus Suber.
Olea europæa.	Schinus Molle.
Pinus Pinea.	

## 5. Ornamental trees affording but little shade.

## A. Outline long or nearly columnar.

## B. Deciduous.

Populus nigra var. italica.	Betula alba.
-----------------------------	--------------

## BB. Evergreen.

Jupressus sempervirens.	Juniperus communis var. hi- bernica.
Cupressus sempervirens var. fastigiata.	Taxus baccata var. fastigiata.

## AA. Outline conical or spiral, usually pointed.

## B. Coniferae, with mostly narrow leaves.

## C. Deciduous: hardy.

Larix decidua.	Taxodium distichum.
Larix leptolepis.	Taxodium mucronatum.

## CC. Evergreen.

## D. Susceptible to severe frost (about 20° F.).

Agathis robusta.	Araucaria Cunninghamii.
Araucaria Bidwillii.	Araucaria excelsa.
Araucaria brasiliana.	Araucaria imbricata.
Araucaria Cookii.	Pinus canariensis.

## DD. Hardy.

Abies balsamea.	Picea excelsa.
Abies cephalonica.	Picea mariana var. Doumetti.
Abies concolor.	Picea torano.
Abies nobilis.	Picea pungens.
Abies Nordmanniana.	Pinus contorta.
Abies Pinsapo.	Pinus Coulteri.
Cedrus atlantica.	Pinus densiflora.
Cedrus Deodara.	Pinus Laricio var. austriaca.
Cedrus Libani.	Pinus monophylla.
Cephalotaxus drupacea.	Pinus Pinaster.
Cephalotaxus Fortunei.	Pinus radiata.
Chamaecyparis Lawsoniana.	Pinus Sabiniana.
Cryptomeria japonica	Pinus sylvestris.
Cryptomeria japonica var. elegans.	Podocarpus Totara.
Cunninghamia sinensis.	Pseudotsuga Douglasii.
Cupressus Goveniana.	Sciadopitys verticillata.
Cupressus macrocarpa.	Sequoia gigantea.
Cupressus guadalupensis.	Sequoia sempervirens.
Libocedrus chilensis.	Taxus baccata.
Libocedrus decurrens.	Thuja gigantea.
Picea ajanensis.	Thuja orientalis.
Picea canadensis.	Thujopsis dolabrata.
Picea Engelmannii.	Torreya californica.
	Torreya nucifera.

## BB. Foliage broad.

## C. Deciduous: hardy.

Betula alba.	Ginkgo biloba.
Betula lenta.	Quercus Cerris.
Betula lutea.	Quercus nigra.
Betula papyracea.	Sorbus Aucuparia.
Betula populifolia.	

## CC. Evergreen.

## D. Susceptible to severe frost (probably 20° F. and even less).

Cinnamomum Camphora.	Grevillea robusta.
Corynocarpus laevigatus.	Scaevola diversifolia.
Cryptocarya Miersii.	Tristania conferta.

## DD. Hardy.

Acacia melanoxylon.	Laurus nobilis.
Cerasus lusitanica.	Pittosporum crassifolium.
Ilex Aquifolium.	Quercus Suber.
Lagunaria Patersonii.	Umbellularia californica.

## AAA. Outline more or less rounded, but trees not as wide-spreading nor as shade-giving as in Class 4.

## B. Deciduous.

## C. Susceptible to frost (25° F.).

Phytolacca dioica.

## CC. Hardy.

Æsculus glabra.	Juglans californica.
Fraxinus americana.	Juglans nigra.
Fraxinus excelsior.	Koeleruteria paniculata.
Fraxinus Ornus.	Paulownia tomentosa.
Gymnocladus canadensis.	Robinia Pseudacacia.

## BB. Evergreen.

## C. Probably susceptible to severe frost (20° F., or less).

Acacia cyanophylla.	Eucalyptus ficifolia.
Alectryon excelsum.	Eucalyptus globulus.
Bursaria spinosa.	Eucalyptus maculata var. cit- riodora.
Eucalyptus calophylla.	Eucalyptus robusta.
Eucalyptus cornuta.	Hymenosporum flavum.
Eucalyptus corymbosa.	Maytenus Boaria.
Eucalyptus corynocalyx.	



cc. *Hardy.*

*Acacia pycnantha.*  
*Eucalyptus amygdalina.*  
*Eucalyptus Gunnii.*  
*Eucalyptus leucocylon.*  
*Eucalyptus obliqua.*  
*Eucalyptus rostrata.*  
*Eucalyptus rudis.*  
*Eucalyptus viminalis.*

*Jubaea spectabilis.*  
*Phoenix canariensis.*  
*Phoenix reclinata.*  
*Phoenix sylvestris.*  
*Pittosporum eugenoides.*  
*Pittosporum tenuifolium.*  
*Pittosporum undulatum.*

AAAA. *Drooping trees.*B. *Deciduous.*

*Acer saccharinum* var. *Wieri*  
*laciniatum.*  
*Betula pendula elegans.*  
*Betula pendula laciniata.*  
*Betula pendula Youngii.*  
*Crataegus monogyna* var. *pendula.*  
*Fagus sylvatica* var. *pendula.*  
*Fraxinus excelsior* var. *aurea*  
*pendula.*  
*Fraxinus excelsior* var. *pendula.*  
*Morus alba* (Teas' weeping).

*Populus grandidentata* var.  
*pendula.*  
*Prunus fruticosa* var. *pendula.*  
*Quercus lobata.*  
*Salix babylonica.*  
*Salix babylonica* var. *Lickii.*  
*Sophora japonica* var. *pendula.*  
*Sorbus Aucuparia* var. *pendula.*  
*Tilia americana* var. *pendula.*  
*Tilia europaea* var. *pendula.*  
*Ulmus americana* var. *pendula.*  
*Ulmus campestris* var. *pendula.*  
*Ulmus scabra* var. *pendula.*

BB. *Evergreen.*

*Cupressus funebris.*  
*Cupressus lusitanica.*

*Schinus Molle.*

6. *Trees for streets, avenues and roadsides in California.*

The number of tree species suitable for street planting is limited by the necessarily heavy restrictions, as to height, spread, sewer-penetration and sidewalk-raising, imposed by municipal street departments. In European cities the first-named objections are overcome by means of frequent and systematic pruning to a uniform standard; when this necessity can be obviated by the selection of trees which naturally keep within the desired bounds, the labor of maintaining them in a slightly condition is minimized and the result much more pleasing.

For town streets not more than 60 feet in width, it is important to have trees that will not give too much shade and prevent the rapid drying of the roadway after showers, nor be so tall nor wide-spreading as to obstruct the view and shut out sunshine, rendering the adjacent houses dark, cold and damp. On this account, trees with narrow or pyramidal outline are in many cases preferable to those with wide-spreading habit, and, generally speaking, deciduous trees are more suitable than evergreen, although at the time of losing their leaves they make more litter. Exception may be made in favor of such evergreen species as certain palms and cordylines, some acacias and a few other species mentioned below.

It is not wise to use trees of very rapid growth on town streets; they soon become too large and require frequent trimming, which is usually equivalent to mutilation, and are likely to interfere with sewers.

It cannot be said that street planting in California towns has, in most cases, been satisfactory. In spite of the much larger variety of suitable material than is available in most of the states, there are few examples of good street planting to be met with. In most of the

towns the eye is greeted with a few straggling trees, of which perhaps not more than two are of one kind, recalling F. A. Waugh's apt simile of "nine monstrosously different buttons in a row down the front of a Prince Albert coat." There are many pleasing exceptions, however, although few are entirely satisfactory. The repeated attempts to improve the appearance of a town by planting trees along the streets should be encouraged on every occasion, and the object of this discussion is to render assistance by pointing out how some of the mistakes may be avoided. The unsatisfactory results of street planting, so often met with, can generally be traced to one or all of three causes:

(1) Choice of unsuitable species.

(2) The mixing of several species on the same block and even in front of the same lot.

(3) Crowding of trees.

This last-mentioned source of trouble is perhaps the cause of more failures than the first. When trees are once growing, few persons have the heart to thin out the species for the proper distance apart; finally, a newcomer, without personal feeling in the matter and noting only that there is too much shade and too little light, cuts down the whole row and a gap is left in what may have been a fairly uniform block. Spreading avenue trees of large size should not stand closer than 50 feet apart; smaller trees, on narrower streets, should have 40 feet, unless they are slender species such as cordylines or washingtonias, when 20 feet may be sufficient. As a

rule, one small tree to a 50-foot lot will be found ample; if the whole street is planted uniformly with the same species, and at this same distance, the result will be much more pleasing than if four or five trees are planted in front of every house.

This question of spacing can be determined only by the species in use. If 20 feet is added to the diameter of the spread of the crown, an approximate spacing can be secured. For example, cork elms often attain a 60- or 75-foot spread and should be spaced, accordingly, 80 to 100 feet apart. This advice is given from data gathered in various towns where closer plantings were in order, and have already demonstrated how the air, light and heat are shut off by too crowded plantings.

In towns where the climate is very mild, with few extremes trees are planted only for decorative effect and not for shade,—hence these extreme distances may be used even for species which do not attain great size.

On the other extreme in the interior California valleys, the distances may have to be shortened to allow for the extreme

heat, but trees should never be set so closely that the circulation of air is hindered, except of course for wind-break plantings, which are not found on streets as a rule.

A. *For city and town streets.*B. *Small trees suitable for streets 60 feet wide or less.*C. *Deciduous.*D. *Growth rapid or moderate.*

*Aesculus carnea.*  
*Betula alba.*  
*Betula lutea.*

*Betula populifolia.*  
*Catalpa bignonioides.*  
*Catalpa ovata.*

*Catalpa speciosa.*  
*Koeleruteria paniculata.*  
*Paulownia tomentosa.*



359. *Cordyline australis* or "dracena palm."  
 Common in California.

DD. *Growth slow.*

*Cratægus mollis.*  
*Cratægus monogyna.*

CC. *Evergreen.*D. *Growth rapid or moderate.*E. *Palms and arborescent Liliacæ.*

*Cordyline australis.*  
*Cordyline Banksii.*  
*Cordyline indivisa.*  
*Cordyline stricta.*  
*Erythea edulis.*

*Livistona australis.*  
*Trachycarpus excelsus.*  
*Washingtonia filifera.*  
*Washingtonia robusta.*

EE. *Evergreen trees other than palms and arborescent Liliacæ.*

*Acacia falcata.*  
*Acacia lineata.*  
*Acacia neriifolia.*

*Myoporum lætum.*  
*Pittosporum eugenioides.*  
*Pittosporum tenuifolium.*

DD. *Growth slow.*

*Alectryon excelsum.*  
*Bursaria spinosa.*  
*Cinnamomum Camphora.*  
*Eucalyptus ficifolia.*  
*Ilex Aquifolium.*  
*Jacaranda ovalifolia.*

*Ligustrum lucidum.*  
*Magnolia grandiflora.*  
*Maytenus Boaria.*  
*Olea europæa.*  
*Pittosporum crassifolium.*  
*Tristania conferta.*

BB. *Larger trees for streets, avenues and boulevards 80 to 100 feet wide.*c *Deciduous.*D. *Growth rapid or moderate.*

*Acer macrophyllum.*  
*Acer saccharinum.*  
*Carya (Pecan).*  
*Fraxinus americana.*  
*Fraxinus velutina.*

*Gymnocladus canadensis.*  
*Platanus orientalis.*  
*Quercus pedunculata.*  
*Robinia Pseudacacia.*  
*Ulmus campestris.*



360. *Eucalyptus rostrata*; 11 yrs. planted; 86 ft. high. California.

DD. *Growth slow.*

*Gleditsia triacanthos.*  
*Liriodendron Tulipifera.*

*Tilia americana.*  
*Tilia europæa.*

CC. *Evergreen.*D. *Palms and bananas.*

*Erythea edulis.*  
*Livistona australis.*  
*Musa Ensete.*

*Trachycarpus excelsus.*  
*Washingtonia filifera.*  
*Washingtonia robusta.*

DD. *Evergreen trees other than palms and bananas.*

*Acacia elata.*  
*Acacia melanoxylon.*  
*Angophora intermedia.*  
*Angophora subvelutina.*  
*Eucalyptus amygdalina* var.  
*angustifolia.*  
*Eucalyptus calophylla.*  
*Eucalyptus corymbosa.*  
*Eucalyptus ficifolia.*

*Eucalyptus polyanthemus.*  
*Eucalyptus rudis.*  
*Eucalyptus sideroxylon* var.  
*pallens.*  
*Ficus macrophylla.*  
*Syncarpia laurifolia.*  
*Tristania conferta.*  
*Umbellularia californica.*

BBB. *For avenues and boulevards without sidewalks or with wide spaces between sidewalk and driveway.*

For this purpose almost any of the larger and more ornamental species enumerated in the other lists may be selected. Spreading coniferous trees, with broad bases (such as *Sequoia gigantea*, etc.), may often be used to advantage, as well as the wide-spreading feather-palms (*Phoenix* and *Jubæa*).

AA. *For country roads.*B. *Deciduous.*

*Acer campestre.*  
*Acer macrophyllum.*  
*Acer Negundo.*  
*Acer Negundo* var. *californicum.*  
*Acer platanoides.*  
*Acer saccharinum.*  
*Æsculus carnea.*  
*Æsculus Hippocastanum.*  
*Carya (Pecan).*  
*Ginkgo biloba.*  
*Juglans californica.*  
*Juglans Sieboldiana.*

*Liriodendron Tulipifera.*  
*Paulownia tomentosa.*  
*Phytolacca dioica.*  
*Populus nigra* var. *italica.*  
*Quercus lobata.*  
*Quercus pedunculata.*  
*Robinia Pseudacacia.*  
*Sophora japonica.*  
*Taxodium distichum.*  
*Tilia americana.*  
*Tilia europæa.*  
*Ulmus campestris.*  
*Ulmus racemosa.*

BB. *Evergreen.*

*Acacia melanoxylon.*  
*Acacia decurrens* var. *dealbata.*  
*Arbutus Menziesii.*  
*Cinnamomum Camphora.*  
*Cryptomeria japonica.*  
*Eucalyptus botryoides.*  
*Eucalyptus calophylla.*  
*Eucalyptus capitellata.*  
*Eucalyptus cornuta.*  
*Eucalyptus diversicolor.*  
*Eucalyptus leucoxylon.*  
*Eucalyptus rostrata.*

*Eucalyptus rudis.*  
*Eucalyptus viminalis.*  
*Ficus macrophylla.*  
*Olea europæa.*  
*Pinus radiata.*  
*Quercus Suber.*  
*Schinus Molle.*  
*Sequoia gigantea.*  
*Sequoia sempervirens.*  
*Sterculia diversifolia.*  
*Tristania conferta.*  
*Umbellularia californica.*

7. *Trees that have been tried in California but have proved unsatisfactory.*

There are many species that have failed to give satisfaction in some localities because of peculiarities of climate or soil; there are some, also, that have proved unsatisfactory on account of habit; from among these may be mentioned:

*Acacia* species. Nearly all acacias stump-sprout badly, so that for temporary planting they should be avoided. When planted in narrow parkings, they are very likely to raise sidewalks also, but this can be remedied by frequent root-prunings, which they stand admirably.

*Acacia melanoxylon* is generally debarred from the citrus belt as a breeder of scale: when mature it is said to suffer quickly from the effects of drought. In the moister climate of the immediate vicinity of the coast, near San Francisco, however, it proves entirely satisfactory.

*Ailanthus altissima*, has a bad reputation on account of its disagreeable odor, but as this is found only in the staminate trees, it can be avoided by planting none but the pistillate (fruit-bearing) trees.

*Cratægus* species. Of all these species, *C. Oxyacantha* is perhaps the one most commonly used, and through the Santa Clara Valley and Bay regions is disfigured,



in most cases, by sooty mold fungus, resulting from scale infestations. This can of course be remedied, but, in the average case, at considerable more expense than would be warranted.

*Eucalyptus corynocalyx* becomes straggling and unsightly with age.

*Eucalyptus globulus* and, in fact, almost all species of the genus, are frequently debarred by town ordinance from growth within 60 or even 70 feet of a sewer, on account of the remarkable length and penetrating power of their roots.

*Eucalyptus robusta*, a species which is exceedingly handsome as a young tree, has been extensively planted along roadsides and streets in the warmer parts of the state. When mature, it becomes straggling and exceedingly brittle, breaking up in an unsightly way.

*Eucalyptus rudis*. This species has a pendent habit when older that often causes a severe splitting of the crown. As the trees are very picturesque, they are often desirable, provided reasonable attention can be given to prevent this.

*Ficus macrophylla* is injurious to sidewalks.

*Grevillea robusta* has brittle wood and is usually much broken in heavy winds, but can be used with satisfaction if kept well cut back.

*Melia Azedarach* var. *umbraculiformis* is unsatisfactory in the immediate vicinity of the coast; as a sidewalk tree it is exceedingly untidy when losing leaves, and is also very much subject to scale insects.

*Paulownia tomentosa* is sometimes objected to on account of the somewhat untidy appearance of the persistent seed-pods, which require no little labor if all are to be removed after flowering.

*Phoenix dactylifera* and *P. reclinata* both sucker objectionably.

*Populus alba*, *Robinia Pseudacacia* and *Ulmus racemosa* are exceedingly troublesome when used as sidewalk trees on narrow streets; their surface roots often break the cement or asphalt sidewalks, and the suckers come up in the midst of lawns several yards away from the parent tree.

*Schinus Molle* should be avoided in the citrus belt, as it is found to harbor and become a nursery for scale insects. As a street tree it is also unsatisfactory, becoming too large and straggling, and requires too much pruning to keep it within bounds; its large surface roots often break cement and asphalt sidewalks.

The species of *Phoenix* and *Jubæa* should be avoided on account of their low, wide-spreading habit, except for avenues and boulevards where there is no sidewalk or where there is from 20 to 30 feet space between sidewalk and driveway.

#### 8. Trees for alkali soils.

There are many places in those parts of the state that enjoy a high temperature and low rainfall, where the percentage of alkali salts in the soil is too great for the cultivation of most of our ornamental trees, and where it is very important that some shade-producing species be grown.

#### A. Tolerant of strong "black" alkali (sodium carbonate).

The most alkali-tolerant tree of those yet tested is *Kalreuteria paniculata*, a small species 15 to 30 feet high, with feathery, pinnate leaves and ornamental yellow blossoms.

#### AA. Tolerant of medium alkali (chiefly "white" alkali).

*Acacia melanoxylon*.  
*Ailanthus altissima*.  
*Albizia lophantha*.  
*Casuarina equisetifolia*.  
*Eucalyptus amygdalina* var.  
*angustifolia* (apparently the  
least sensitive of the eu-  
calyptus).

*Eucalyptus rostrata* (Fig. 360).  
*Eucalyptus sideroxylon* var.  
*rosea*.  
*Phoenix dactylifera*.  
*Platanus orientalis*.  
*Populus Fremontii*.  
*Quercus lobata*.  
*Robinia Pseudacacia*.

*Acer macrophyllum*.  
*Acer Negundo* var. *californicum*.  
*Cinnamomum Camphora*.

*Gleditsia triacanthos*.  
*Ulmus* species.  
*Washingtonia filifera*.

#### AAAA. Tested and found unsuitable.

Most of those trees of the humid regions, e.g., the eastern states and northern Europe, which have been tried on alkali soils, have been found to suffer and to remain dwarf and stunted. This is particularly true of *Liriodendron Tulipifera*, *Quercus pedunculata* and species of *Tilia*.

Since writing the above, the following additional information on the alkali tolerance of ornamental trees has been secured through the investigations of R. H. Loughridge of the Agricultural Experiment Station at Berkeley, and has been placed at our disposal.

Total amount of salts found in the upper 4 feet of soil in which the following trees were growing, expressed in tons per acre:

	Tons per acre in depth of 4 feet.
<i>Kalreuteria paniculata</i> .....	32
<i>Platanus orientalis</i> .....	21 1/2
<i>Eucalyptus angustifolia</i> .....	20
<i>Eucalyptus angustifolia</i> .....	20
<i>Washingtonia</i> (species not stated) .....	7 1/2
<i>Phoenix dactylifera</i> .....	5
<i>Cinnamomum Camphora</i> .....	3 1/2

JOS. BURTT DAVY.  
B. Y. MORRISON.†

#### ARBOR VITAE: *Thuja*.

**ÁRBUTUS** (ancient Latin name). *Ericaceæ*. Ornamental woody plants grown for their handsome evergreen foliage and for their attractive flowers and fruits.

Trees or shrubs with the bark of the branches and younger sts. smooth, and usually red, exfoliating: lvs. alternate, petioled, serrate or entire: fls. monopetalous, globular or urn-shaped, 5-toothed; stamens 10, included; anthers with a pair of reflexed awns, the cells opening by a terminal pore; ovary 5-, rarely 4-celled, cells with many ovules: fr. a globose, many-seeded, berry-like drupe with mealy flesh, mostly granulose outside.—Twelve species in W. N. and Cent. Amer., S. and W. Eu., Asia Minor, N. Afr., and Canary Isls.

The stems and branches are conspicuous by their red smooth bark peeling off in large thin plates, the evergreen foliage, rather large and usually lustrous flowers, white to red, in terminal panicles followed by attractive red fruits. They are of great decorative value for parks and gardens in warm-temperate regions; especially beautiful when adorned with the clusters of white flowers or bright red berries.

Arbutuses grow best in well-drained soil in somewhat sheltered positions not exposed to dry winds. They are very handsome greenhouse shrubs, thriving well in a sandy compost of peat and leaf soil or light loam.

Propagation is by seeds sown in early spring or in fall, or by cuttings from half-ripened wood in fall, placed in sandy peat soil under glass; they root but slowly. Increased also by budding or grafting, usually veneer-grafting, if seedlings of one of the species can be had for stock. Layers usually take two years to root.

#### A. Panicles short, nodding: lvs. usually serrate.

**Unêdo**, Linn. **STRAWBERRY TREE**. From 8–15 ft.: lvs. cuneate, oblong or oblong-lanceolate, 2–3 in. long, glabrous, green beneath: fls. white or red, ovate: fr. scarlet, warty, 3/4 in. broad. Sept.–Dec. S. Eu., Ireland. L.B.C. 2:123. R.B. 31:36. G.C. III. 14:329. Var. **integerrima**, Sims. Lvs. entire. B.M. 2319. Var. **rûbra**, Ait., and var. **Crôômii**, Hort., have red fls. Gn. 26, p. 506; 33, p. 320. F.S.R. 2, p. 375.—Very beautiful in autumn when the tree bears its large scarlet frs. and at the same time its white or rosy fls. Roots and lvs. astringent.

#### AA. Panicles erect: lvs. usually entire.

**Ménziesii**, Pursh (*A. procera*, Douglas). **MADRONA**. Fig. 361. Occasionally 100 ft. high; trunk with dark

reddish brown bark: lvs. rounded or slightly cordate at the base, oval or oblong, 3-4 in. long, glabrous, glaucous beneath: fls. white, in 5-6-in.-long panicles: fr. bright orange-red,  $\frac{1}{2}$  in. long. Spring. W. N. Amer. B.R. 21: 1753. S.S. 5:231. P.M. 2:147. G.F. 3:515; 5:151. Mn.



361. *Arbutus Menziesii*. ( $\times \frac{1}{2}$ )

3:85. B.M. 8249. R.H. 1893, pp. 149, 150.—The hardest and probably the handsomest species of the genus; it stands many degrees of frost. Fig. 361 is adapted from Pacific Railroad Rept.

**arizónica**, Sarg. (*A. xalapensis* var. *arizónica*, Gray). Fig. 362. Tree, 40-50 ft.: trunk with light gray or nearly white bark: lvs. usually cuneate at the base, oblong-lanceolate,  $1\frac{1}{2}$ -3 in. long, glabrous, pale beneath: fls. white, in loose, broad panicles 2-3 in. long: fr. globose or oblong, dark orange-red. Spring. Ariz. G.F. 4:318 (adapted in Fig. 362). S.S. 5:233.—The contrast between the white bark of the trunk, the red branches, and the pale green foliage makes a very pleasant effect: fr. and fls. are also very decorative.

*A. Andrachne*, Linn. From 10-30 ft.: lvs. oval-oblong, usually entire, yellowish green beneath: fls. yellowish white: fr. bright red. Greece, Orient. B.M. 2024. B.R. 2:113. G.C. III. 4:724. R.H. 1911, p. 307 (habit).—*A. andrachnoides*, Link (*A. Andrachne*  $\times$  Unedo. *A. hybrida*, Ker. *A. serratifolia*, Lodd. *A. Milleri*, Hort. *A. photinifolia*, Hort.). Lvs. serrate: panicles drooping: fls. white. B.R. 8:619. L.B.C. 6:580. G.C. II. 9:211. F. 1879, p. 50.—*A. canariensis*, Lindl. Height 10-30 ft.: lvs. oblong-lanceolate, serrate, glaucous beneath: panicles erect: fls. greenish white. Canary Isls. B.M. 1577.—*A. densiflora*, HBK. Height 20 ft.: lvs. oblong or ovate, serrate, downy beneath: fls. white. Mex.—*A. hybrida*, Ker=*A. arachnoides*.—*A. laurifolia*, Hook.=*A. Menziesii*.—*A. laurifolia*, Lindl.=*A. xalapensis*.—*A. Milleri*, Hort.=*A. andrachnoides*.—*A. mollis*, HBK. Shrub or small tree: lvs. oblong, serrate, pubescent beneath: fls. white, often tinged greenish red. Mex. B.M. 4595.—*A. pilosa*, Grah.=*Perettia pilosa*.—*A. procera*, Douglas=*A. Menziesii*.—*A. serratifolia*, Lodd., not Salisb.=*A. andrachnoides*.—*A. texana*, Buckl.=*A. xalapensis*.—*A. tomentosa*, Pursh=Arctostaphylos tomentosa. *A. Uva-ursi*, Linn.=Arctostaphylos Uva-ursi.—*A. xalapensis*, HBK. (*A. laurifolia*, Lindl.). Height 10-20 ft.: lvs. oval or ovate-lanceolate, entire or crenately serrate, glabrous or downy beneath: fls. reddish: corolla abruptly contracted above the middle. Mex., Texas. S.S. 5:232. B.R. 25:67.

ALFRED REHDER.

**ARBUTUS, TRAILING:** *Epigaea repens*.

**ARCHANGÉLICA** (Greek, *chief angel*, from fancied medicinal virtues). *Umbelliferæ*. GARDEN ANGELICA. A genus of 15-20 species of strong-smelling coarse herbs closely allied to Angelica, but differing in highly technical characters associated with the oil-tubes in the fruit.

**offinàlis**, Hoffm. A European and Asian biennial or perennial, known also as *Angelica Archangelica*;

stout herb, with ternately decompound lvs. and large umbels of small fls.—The sts. and ribs of the lvs. were once blanched and eaten, after the manner of celery, and they are still used in making of sweetmeats. Little known in this country, although it is offered by American dealers. Its chief value to us is its large foliage. Seeds may be sown in the fall as soon as ripe, or the following spring. They are slow to germinate. Root used for its aromatic and carminative properties.

**ARCHONTOPHÆNIX** (Greek, *majestic phoenix*). *Palmææ*, tribe *Arécææ*. Showy and elegant palms, completely spineless, and with tall stout trunks, which are conspicuously ringed by the annular scars of the fallen leaves.

Leaves divaricate, terminal, forming a large crown, pinnately divided; the segms. entire or toothed; in very young specimens the lvs. are undivided or simply bipartite; midrib prominent, the nerves more slender; rachis keeled above, convex beneath, the petiole slightly tomentose, and channeled above: infl. appearing much below the lvs., consisting of 2 long, flattened, ultimately pendent and deciduous spathes, inclosing the short-peduncled and much-branched, pedulous spadices: fls. monœcious, sessile on the branches of the spadix; in male fls. the 8 perianth segms. are unique in the family; female fls. with 3 perianth segms., sometimes more: fr. a drupe, globose or elliptic-globose, containing a single fibrous seed.—There are about 10 species, all natives of the Australian or Malayan region. G.C. II. 22:427.

As *Seaforthia elegans*, the second species is well known to all florists and decorators as one of the most graceful and stately palms in cultivation. Both species have become very popular in California for outdoor cultivation (see G. C. III. 27:109), where the second species fruits, seeds and germinates readily.



362. *Arbutus arizonica*. ( $\times \frac{1}{2}$ )

In the North, they are grown in a temperate house, in a rich soil containing a good percentage of fibrous material and sand mixed with an equal part of rich loam. They require plenty of water.



Propagation is by seeds, which sprout readily in pans or boxes if placed in a warm moist house.

A. *Lf.-segms. whitish underneath.*

**Alexándrae**, H. Wendl. & Drude (*Ptychospérma Alexándrae*, F. Muell.). Trunk 70–80 ft.: lvs. several ft. long; rachis very broad and thick, glabrous or slightly scurfy; segms. numerous, the longer ones  $1\frac{1}{2}$  ft. long,  $\frac{1}{2}$ –1 in. broad, acuminate and entire or slightly notched, green above, ashy glaucous beneath: infl. about 1 ft. long, the fls. greenish yellow: fr. ovoid-globular. Queensland. F.S. 18:1916.—Seldom ripening fr. on plants cult. outdoors in Calif. and rather tender when young.

AA. *Lf.-segms. green on both sides.*

**Cúnninghamii**, H. Wendl. & Drude (*Ptychospérma Cúnninghamii*, H. Wendl. *P. elegans*, Blume. *Scaforthia elegans*, Hook.). Trunk and general habit like the preceding, but the segms. acuminate and entire or scarcely notched: fls. shell-pink, followed by globular berry-like drupes. Queensland and New S. Wales. B.M. 4961, 7345, the first as *Scaforthia elegans*, the second as *Ptychosperma elegans*.—Hardier than the preceding, and fruiting freely in outdoor specimens in Calif.

N. TAYLOR.†

**ÁRCTIUM** (from Greek word for bear, probably alluding to the shaggy bur). *Compositæ*. BURDOCK. A few coarse perennials or biennials of Temp. Eu. and Asia, some of them widely distributed as weeds. Involucre globular and large, with hooked bristles, becoming a bur: receptacle densely setose: pappus deciduous, of short serrulate scales: lvs. alternate, large and soft, whitish beneath: plant not prickly: fls. pinkish or purplish in summer.

**Láppa**, Linn. (*Láppa mājor*, Gaertn.). COMMON BURDOCK. The burdock is a common and despised weed in this country, although it is capable of making an excellent foliage mass and screen. In Japan it is much cult. for its root, which has been greatly thickened and ameliorated, affording a popular vegetable. It is there known as gobo (see Georgeson, A. G. 13, p. 210). Roots collected from plants of the first year's growth are used as an alternative in blood and skin diseases. The seeds and fresh lvs. are used medicinally to a limited extent. *A. minus*, Schk., a European weed, widely naturalized in E. N. Amer. is apt to be confused with *A. Láppa*. N. TAYLOR.†



363. *Arctostaphylos Uva-ursi*. ( $\times \frac{1}{2}$ )

About 20 species in N. and Cent. Amer., 1 species also in N. Eu. and N. Asia. Includes *Comarostaphylis*.

They are handsome evergreen shrubs, though generally with less conspicuous flowers and fruits than those of the allied genus *Arbutus*. Some Central American species, however, as *A. arbutoides*, *A. arguta* and *A. polifolia* are beautiful in flower, and well worth a



364. *Manzanita*.—*Arctostaphylos manzanita*. ( $\times \frac{1}{2}$ )

place in the greenhouse or in the garden in temperate regions; of the American species, *A. Pringlei*, *A. viscida* and *A. bicolor* are some of the handsomest. Only the trailing species are hardy North. For culture, see *Arbutus*.

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A. *Trailing or creeping: lvs.  $\frac{1}{2}$ –1½ in. long: fls. in short and rather few-fl'd. clusters.*

1. **Uva-ursi**, Spreng. (*Arbutus Uva-ursi*, Linn.). BEARBERRY. Fig. 363. Lvs. obovate-oblong, tapering into the petiole, retuse or obtuse at the apex: fls. small, about  $\frac{1}{4}$  in. long, white tinged with red. Northern hemisphere, in N. Amer. south to Mex. Em. 2:431. Gn. 14:68 (habit).—Hardy trailing evergreen shrub, like the following valuable for covering rocky slopes and sandy banks. Cuttings from mature wood taken late in summer root readily under glass. Lvs. are employed in medicine chiefly for their action on the kidneys and bladder.

2. **nevadensis**, Gray (*A. californica*, Hort.). Lvs. ovate or obovate-lanceolate, abruptly petioled, acute or mucronate at the apex: fls. in short-stalked clusters, white or tinged with red. Calif., in the higher mts. G.W. 13:326 (habit).

AA. *Erect shrubs: lvs. usually 1–2 in. long: fls. in mostly many-fl'd. paniced racemes.*

B. *Lvs. glabrous, rarely minutely pubescent.*  
c. *Pedicels glabrous.*

3. **pungens**, HBK. From 3–10 ft.; glabrous or minutely pubescent: lvs. slender-petioled, oblong-lanceolate or oblong-elliptic, acute, entire, green or glaucescent: fls. in short, umbel-like clusters: fr. glabrous, about  $\frac{1}{4}$  in. broad. Mex., Low. Calif. B.R. 30:17. B.M. 3927.

4. **manzanita**, Parry (*A. pungens*, Authors). Fig. 364. Shrub or small tree, to 30 ft.. lvs. ovate, usually obtuse and mucronulate at the apex, glabrous, dull green: fls. in prolonged paniced racemes: fr. glabrous,  $\frac{1}{4}$ – $\frac{1}{2}$  in. broad. W. N. Amer., from Ore. south. G.F. 4:571. G.C. III. 44:163. B.M. 8128.

cc. *Pedicels glandular.*

5. **glauca**, Lindl. From 8–25 ft.. lvs. oblong or orbicular, obtuse and mucronulate at the apex, glaucescent or pale green: fls. in prolonged paniced racemes; pedi-

**ARCTOSTAPHYLOS** (Greek, bear and grape). *Ericaceæ*. MANZANITA. Ornamental shrubs grown for their evergreen foliage and also for their attractive flowers and fruits.

Shrubs or rarely small trees: lvs. alternate, entire, evergreen: fls. small in terminal often paniced racemes; calyx 4–5-parted, persistent; corolla urceolate, 4–5-toothed; stamens 8 or 10, included; anthers with a pair of awns, the cells opening with a pore; ovary 4–10-celled, 1 ovule in each cell: fr. a red, usually smooth mealy berry or rather drupe with 4–10 coherent nutlets.—

cels glandular: fr. minutely glandular. Calif.—Intro. 1891. Lvs. used medicinally like those of *A. Uva-ursi*.

6. *viscida*, Parry. From 5–15 ft.: lvs. broad-ovate or elliptic, abruptly mucronulate, acute or rounded at the base, glaucous: fls. in slender and spreading, paniced racemes; pedicels viscid; corolla light pink: fr. depressed, about  $\frac{1}{4}$  in. broad, smooth. Ore. to Calif.

BB. Lvs. more or less pubescent.

c. Branchlets usually bristly-hairy: lvs. dull grayish or bluish green above.

7. *tomentosa*, Douglas. From 2–6 ft.: lvs. oblong-lanceolate or ovate, acute, sometimes serrulate, pubescent beneath, pale green: fls. in rather dense and short, usually paniced racemes; pedicels short: fr. puberulous, glabrous at length. W. N. Amer. B.R. 21:1791. B.M. 3320.—The hardest of the erect species.



365. *Arctotis grandis*. ( $\times \frac{1}{3}$ )

8. *Pringlei*, Parry. Shrub: lvs. broad-ovate or elliptic, usually abruptly mucronulate, pubescent, sometimes glabrous at length, glaucous: paniced racemes peduncled, usually leafy at the base, many-fl.; slender pedicels and calyx glandular-pubescent: fr. glandular hispid. Calif., Ariz.

cc. Branchlets tomentose: lvs. bright green and lustrous above.

9. *bicolor*, Gray. From 3–4 ft.: lvs. oblong-oval, acute at both ends, entire and revolute at the margin, glabrous and bright green above, white-tomentose beneath: fls. in nodding, rather dense racemes; pedicels and calyx tomentose; corolla  $\frac{1}{3}$  in. long, rose-colored: fr. smooth. Calif.

10. *diversifolia*, Parry (*Comarostaphylis diversifolia*, Greene). Shrub, 5–15 ft.: lvs. elliptic or ovate to oblong, 1–2½ in. long, acute, cuneate at the base, spinulose-dentate, often revolute at the margin, grayish pubescent or tomentose beneath: racemes terminal, usually several, 1½–4 in. long, tomentose; pedicels slender;

corolla  $\frac{1}{4}$  in. long, light pink: fr. ovoid,  $\frac{1}{4}$  in. long, scarlet. Low. Calif. May, June: fr. in Aug., Sept. Mn. 5:231.

*A. alpina*, Spreng.—*Arctous alpina*.—*A. arbutoides*, Hemsl. Five to 6 ft.: lvs. lanceolate, oblong, ferrugineously pubescent beneath: panicles erect, loose. Guatemala. B.R. 29:30.—*A. arguta*, Zucc. (*A. nitida*, Benth.). Five to 6 ft.: lvs. oblong-lanceolate, serrate, glaucous and glabrous: panicles loose, erect. S. Mex. B.R. 31:32. B.M. 3904 (as *A. nitida*).—*A. californica*, Hort.—*A. nevadensis*.—*A. nitida*, Benth.—*A. arguta*.—*A. polifolia*, HBK. Height 1–3 ft.: lvs. linear-lanceolate, glaucous and puberulous beneath: fls. red, in loose, erect racemes. Mex.

ALFRED REHDER.

**ARCTÔTIS** (Greek for *bear's ear*, alluding to the achene). *Compositæ*. Herbs with long-peduncled heads and more or less white-woolly herbage, of 30 or more African species: achenes grooved, with scale-like pappus: involucre with numerous imbricated scales: receptacle bristly.—Two species, both treated as annuals, are sold in this country. Cultivation simple.

*breviscapa*, Thunb. (*A. leptorhiza* var. *breviscapa*, DC.). Stemless or nearly so (6 in. high), half-hardy, readily prop. from seeds, and to be grown in a warm, sunny place: lvs. usually longer than the scape, incised-dentate: scape hirsute, bearing one large fl. with dark center and orange rays.

*grândis*, Thunb. Fig. 365. A beautiful annual, forming a bushy clump 2–2½ ft. high: lvs. much shorter than the scape, repand dentate: fls. 2½–3 in. diam., white or white and pale violet.—May be the same as *A. stœchadifolia*, Berger.

*A. Gámbletonii*, Hook. f. Ray fls. deep orange-red. Namaqualand, S. Afr. B.M. 7796.

N. TAYLOR.†

**ARCTÔUS** (Greek, *boreal*, referring to its distribution). Syn. *Mairània*. *Ericacææ*. Ornamental flat shrub, rarely cultivated in rockeries for its bright green foliage and scarlet or black fruits in autumn.

Prostrate glabrous shrub: lvs. alternate, serrate, deciduous: fls. in small terminal racemes; calyx 4–5-parted; corolla urceolate with 4–5-toothed recurved limb; stamens 8–10, included, anthers with a pair of short awns, cells opening with a pore; ovary 4–5-celled: fr. a globose juicy drupe with 4–5 separate nutlets.—One circumpolar species.

This is a plant lying flat on the ground, with shreddy bark, thin deciduous leaves clustered toward the end of the branches, small white flowers appearing before or with the leaves, followed by lustrous, black or red fruits. Adapted for rockeries where it will probably succeed best in peaty soil and in a half-shady position. Propagation is by seeds and by cuttings.

*alpinus*, Niedenzu (*Arctostaphylos alpina*, Spreng. *Mairània alpina*, Desv.). Lvs. obovate or oblanceolate, narrowed into the short petiole,  $\frac{1}{2}$ –1½ in. long, reticulate, serrate: fls. 2–4,  $\frac{1}{2}$  in. long, white tinged pinkish or greenish: fr.  $\frac{1}{4}$  in. across, globose, bluish black. N. Amer., N. Eu., and N. Asia. S.E.B. 6:880. B.B. 2:573. M.D.G. 25:138 (habit). Var. *rûber*, Rehd. & Wilson. Fr. bright red, not changing to black. Rocky Mts., W. China.—This variety is handsomer than the type on account of the bright color of the fr.

ALFRED REHDER.

**ARDÍZIA** (*pointed*, alluding to the stamens or corolla-lobes). Including *Icacorea*. *Myrsinacææ*. Trees and shrubs, some of which are grown in their juvenile state as pot subjects, or as outdoor specimens in warm climates.

Flowers white or rose, usually in cymes, with 5-parted (sometimes 4- or 6-parted) rotate corolla, 5 stamens attached to the throat of the corolla, with very large anthers and a 1-seeded drupe the size of a pea: lvs. entire, dentate or crenate, thick and evergreen.—Probably more than 200 species in the tropical and subtropical parts of both hemispheres, one of which (*A. crenulata*) is a popular berry-bearing conservatory



and table plant, and a half-dozen others of which are sometimes seen in collections.

*Ardisia crenulata* is in great demand as a Christmas plant. The other species are seldom seen in this country. They are nearly always propagated from seed, but a plant can be secured more quickly, and better, from a cutting. When plants are over three years old, they often lose their foliage and become "leggy." Good plants can be obtained from the bushy tops by girdling them near the branches, and covering the pieces from which the bark has been removed with wet moss; the moss will be well filled with root in about six weeks, when the tops may be taken off and potted, keeping them in a tight case until they grip the soil. These plants, from which the tops have been removed, are excellent material from which to obtain cuttings, and they will break quite readily if placed in a close, warm atmosphere, about 65°. Cuttings should be taken from young shoots of half-matured wood, and placed in a cutting-bed with a top and bottom temperature of 70°. If these conditions are followed they will root in a month, after which they may be transferred to small pots. Loam, peat and sand in equal parts is the best potting material. As the plant increases in size and vigor, decomposed manure should be added to the mixture, about a fourth part of manure being sufficient. A night temperature of 65° should be maintained for securing the best results.—The advantage of the cutting over the seedling will be apparent, the cutting branching near the pot, whereas the seedling will grow a few inches of stem first. Care should be exercised in selecting the plants from which to propagate, since those grown from seed will vary somewhat in the size and number of berries they produce, and only the best should be selected as stock plants. As soon as the plants show signs of flowering, they should be given more air, and wetting overhead should be avoided until the berries are set. They should at all times be kept in a light position near the glass; during the summer months, however, they should be shaded with cheese-cloth on bright sunny days. About the 1st of October, the berries will be well developed and should be given plenty of sunshine to color them well. The temperature may be lowered to 50° or 55°, as growth is not wanted at this season. Waterings with soot-water will be beneficial, a handful to an ordinary watering-pot. This produces a fine color on the leaves and berries.—The large brown scale is the greatest enemy of this plant; and the best means to keep this in check is to fumigate with cyanide of potassium. Several fumigations will effect a cure. The temperature of the house should never be over 60° when fumigated. (Geo. F. Stewart.)

A. Fls. red or rose-colored.

*crenulata*, Lodd. (*A. crenata*, Sims. *A. crispa*, Hort.). Fig. 366. As cult., a compact and neat shrub, with lance-oblong, wavy-margined, alternate lvs. and drooping clusters of small coral-red, long-lasting, handsome frs: fls. in terminal panicles, sweet-scented. Probably native to E. Indies or China. B.M. 1950. L.B.C. 1:2. Mn. 1:58. A.F. 13:558. Var. *variegata*, Hort., has variegated lvs.

*humilis*, Vahl. Lvs. lance-oblong, shining: frs. shining black. India.

*Oliveri*, Mast. Lvs. nearly sessile, recurved, oblanceolate and acuminate, 6-8 in. long, entire: fls. pink, in large, dense heads, like an ixora, the limb rotate, ½ in. across. Costa Rica. G.C. II. 8:681.—Elegant stove plant.

AA. Fls. white.

*japonica*, Blume. Lvs. short-oblong or somewhat cuneate, whorled, serrate: fls. on red pedicels in drooping racemes: berries white. Dwarf. Japan.—Probably hardy in the N.

*polycéphala*, Wall. Lvs. bright green, red or wine-colored when young, opposite: fr. black. E. Indies.

AAA. Fls. purple or black-dotted.

*Pickeringia*, Torr. & Gray (*Icacorea paniculata*, Sudw.). MARLBERRY. Glabrous, to 24 ft.: lvs. oblanceolate to lance-oblong, entire, narrowed to a petiole: panicle many-flid.; corolla-lobes oval and becoming reflexed: fr. as large as peas, black and shining. E. Fla. Intro. 1891.

*A. umbellata* is offered in this country as coming from India. The *A. umbellata*, Baker (of the botanists), is a Madagascar plant, and it is doubtful whether it is cult. in this country. Species with white fls. are *A. acuminata*, Willd., B.M. 1678; *A. capitata*, Gray: *A. mamillata*, Hance; *A. punctata*, Roxbg.; *A. villosa*, Wall. Species with red or reddish fls. are *A. macrocarpa*, Wall.; *A. paniculata*, Roxbg., B.M. 2364; *A. serrulata*, Swartz; *A. Wallichii*, DC. Recently described ardisias are: *A. gigantifolia*, Stapf., with elliptic lvs. 12-14 in. long and 8 in. broad: fls. small, rose-colored, in long-stalked loose panicle. S. China. *A. Brandneriana*, Linden, dwarf, with green-shaded crenulate lvs. Congo.

L. H. B.



366. *Ardisia crenulata*. (× ½)

ARÈCA (said to be latinized form of Malayan name). *Palmaceæ*, tribe *Arècæ*. A graceful and well-known group of spineless palms, the trunks solitary or forming a ring-like clump.

Leaves at first bipartite, and only after several years forming the beautiful and gracefully pinnate adult lvs., which form large terminal clusters; lfts. slender, lanceolate or linear, acuminate; rachis 3-angled, convex on the back, the upper face and the petiole concave: spadix very much branched, appearing from the lowest lf.-base, and by the falling of this ultimately being separated from the lf.-cluster; spathes 3, 1 inclosing the fls., the other 2 usually bract-like: fls. monœcious, the female solitary, surrounded by numerous slender spikes of male fls. which are fragrant and white, and much smaller than the female: fr. ovoid, orange-colored, surrounded by the persistent, coriaceous perianth.—There are only about 14 species, confined to the Asiatic and Australian tropics, all the 30 or more species usually credited to the genus belonging in *Acanthophœnix*, *Chrysalidocarpus* (*A. lutescens*), *Dictyosperma*, *Euterpe*, *Hyophorbe*, *Kentia* (Howea), *Oncosperma*, *Phœnicophorum* and others. From Pinanga, the most closely related genus, *Areca* is distinguished by having not more than 6 stamens and by the female fls. being much larger than the male.

*Areca* is commercially a very important genus on account of the betel nut (*A. Catechu*). The fibrous spathes and the covering of the fruit are used in packing; the seeds contain a dye, and, most important of all, are the source of the masticatory "betel nut" of the East. Medicinally, their principal use is for expelling tape-

worms. More than seventeen varieties of the nut are known in India alone, where the trade in the nuts (seeds) exceeds \$30,000,000 yearly. It is also used extensively for medicinal purposes.

The cultivation of arecas is not difficult. They must be grown in a tropical house with a day temperature of 75° to 85° and a night temperature of not less than 60°. Young plants thrive in a mixture of peat or leaf-mold and loam, while older plants will do best in a mixture of loam and sand, equal parts, mixed with a liberal amount of well-rotted cow- or horse-manure. Water freely, at least every other day. As young plants, they form beautiful decorations and when old are perhaps the most graceful and delicately foliaged palms in cultivation. G.C. II. 22:427.



367. Areca Catechu.

A. *Sts. solitary and exceeding 40 ft. in adult trees.*

**Catechu**, Linn. **BETEL NUT**. Fig. 367. *St.* solitary, 40–100 ft.; lvs. 4–6 ft., forming a large crown, but with 1 or 2 of the lowest usually pendulous; lfts. numerous, 1–2 ft., upper confluent, quite glabrous: spathe, flattened and, smooth in age, become fibrous when old: fr. 1½–2 in., ovoid, smooth, orange or scarlet. Asia and Malayan Isls.—Frequent in American tropics.

AA. *Sts. usually numerous, often forming a ring, usually not over 25 ft.*

B. *Young growth red: lfts. appearing in bunches of 3.*

**Issemanii**, Hort. Resembles a red-stemmed chrysalidocarpus: young lvs. very dark red, becoming green; fronds slender, arching, with curving pinnae: fls. and fr. unknown. Oceanica (?). R.H. 1898:261. (as *Linosyadix Micholtziana*).

BB. *Young growth green: lfts. not in bunches of 3.*

**Álicea**, F. Muell. *Sts.* several from the same rhizome, 9 ft. or more high, and slender: lvs. 3–6 ft. long; segms. acuminate, several confluent, especially at apex, bright shining green on both sides: fls. paniculate, the panicle coming from between the lvs. Queensland.

**triandra**, Roxbg. Trunk 15–25 ft. high, 1–2½ in. thick, usually several together, and frequently sending out basal offshoots, cylindrical: fronds 4–6 ft. long; segms. with 6 primary nerves about 1 line apart; petiole about 1 ft. long: fls. as in *A. Catechu*: fr. about as large as an olive, orange-scarlet. India.

*A. alba*, Bory=Dietyosperma alba.—*A. Baueri*, Hook. f.=Rhopalostylis Baueri. B.M. 5735.—*A. elegantissima*, Hort. Trade name(?).—*A. furfuracea*, Hort.=Dietyosperma furfuracea.—*A. gigantea*, Hort.=Pinanga ternatensis.—*A. gracilis*, Roxbg.=Pinanga gracilis.—*A. gracilis*, Thouras=Dypsis pinnatifrons.—*A. gracilis*, Giseke=Drymophloeus appendiculatus.—*A. grandiformis*, Hort.=Trade name(?).—*A. lutescens*, Bory=Chrysalidocarpus lutescens.—*A. madagascariensis*, Mart. A rare species, with small trunk and few lvs. Madagascar.=Dypsis madagascariensis.—*A. monostachya*, Mart.=Bacularia monostachya. B.M. 6644.—*A. montana*, Hort. B.M. 3874 (as Euterpe).—*A. Nibung*, Griff.=Oncosperma filamentosum.—*A. oleracea*, Jacq.=Oreodoxa oleracea.—*A. pumila*, Blume=Nenga Wendlandiana. B.M. 6025.—*A. rubra*, Hort.=Dietyosperma rubra.—*A. rubra*, Bory=Acanthopanax rubra.—*A. Sanderiana*, Hort. Trade name(?).—*A. sapida*, Soland.=Rhopalostylis sapida. B.M. 5139.—*A. speciosa*, Hort. Trade name(?).—*A. tigularia*, Jack.=Oncosperma filamentosum.—*A. Verschaffeltii*, Hort.=Hyophorbe Verschaffeltii.

N. TAYLOR.

**AREGÈLIA** (named in honor of the botanist, C. von Regel). *Bromeliaceae*. Epiphytic hothouse plants with the serrate lvs. arranged in a rosette: fls. in a simple

dense head among the inner lvs. of the rosette, which are often colored, violet, blue or white.—A genus of about 25 species, inhabiting Guiana and Brazil. The species below are sometimes referred to *Nidularium*. For cult., see *Billbergia*.

A. *Length of fl. 1¼ in. or less.*

**tristis**, Mez (*Nidularium marmoratum*, Hort., not Morr. *N. triste*, Regel. *Karátas tristis*, Baker). Lvs. 6–12, from 6–12 in. long and half as broad in the middle, green dappled with brown, somewhat scurfy beneath: fl. purple: bract-lvs. narrow-linear: fr. oblong, white.

AA. *Length of fl. 1½ in. or more.*

B. *Lvs. not barred.*

C. *The lvs. densely scaly.*

**Morreniana**, Mez (*Karátas Morreniana*, Ant. *Nidularium Morrenianum*, Makoy). Lvs. many in a dense rosette, with few very minute spines, not striped, densely scurfy beneath: fls. many, dark purple: bract-lvs. linear-lanceolate.

CC. *The lvs. free from scales or nearly so.*

**Carolinæ**, Mez (*Nidularium Carolinæ*, Lem. *N. Meyendorffii*, Regel. *Karátas Carolinæ*, Ant. *Guzmania pica*, Hort. *Billbergia Carolinæ*, Beer. *B. olens*, Hook.). Lvs. several to many, strap-shaped, rather thick, finely spiny-toothed, 12 in. long, bright green on both surfaces, the bract-lvs. bright red: fls. blue-purple, in a short head nestling in the bright lf.-cup. B.M. 5502. I.H. 7:245.

**princeps**, Mez (*Nidularium princeps*, Morr. *N. spectabile*, Hort. *Karátas princeps*, Baker. *K. Meyendorffii*, Ant. *A. princeps*, Mez.). Lvs. 15–20, about 10–12 in. long, broadest at the middle, firm, spiny-toothed, lightly glaucous: fls. numerous, violet-purple, surrounded by about 8–10 oval, bright red bract-lvs.

BB. *Lvs. conspicuously barred on the back.*

**Binotii**, Mez (*Nidularium Binotii*, Regel. *N. Makoyanum*, Regel. *Karátas Binotii*, Ant.). Lvs. 15–20, strong-spiny, scurfy and transversely banded on the back, the inner ones similar in color: fls. many, white—Not to be confounded with *Bromelia Binotii*.

**spectabilis**, Mez (*Karátas spectabilis*, Ant. *Nidularium spectabile*, Moore. *N. eximium*, Hort.). Fig. 368. Lvs. 10–15 in. long, about 1½ in. broad, serrulate, barred on the back, the apex rounded, apiculate, with a red apical spot: fls. milky, pale blue at the apex. Brazil. B.M. 6024.

GEORGE V. NASH.†



368: Aregelia spectabilis. (x1/6)







XI. Arboriculture.—A palm plantation, with *Corypha umbraculifera* in the foreground.



**ARENARIA** (*arena*, sand, where many of the species grow). Including *Alsine*, *Cherleria* and *Moehringia*. *Caryophyllaceæ*. Low herbs, mostly with white flowers, usually forming mats, and suitable for borders, carpets, and lawn clumps; many of them also used for rockwork and alpine gardens; spring- or summer-flowering.

Annual or perennial, with opposite entire, narrow exstipulate lvs.: fls. small, terminal or clustered, or sometimes axillary; sepals 5; petals 4 or 5, entire or slightly notched, sometimes wanting; stamens 10 (rarely 8); styles mostly 3: fr. a small caps., opening by valves as many or twice as many as the styles.—Perhaps 130–150 species, as the genus is here defined, throughout the world but rare in the tropics. Only the perennial species are commonly cult. Of easiest cult. in almost any soil. Prop. by division; also by seeds, and rare species sometimes by cuttings. Many species of arenaria may be found in the collections of alpine-garden and rock-garden fanciers; but the prevailing cult. kinds are accounted for below. Related genera are *Cerastium* and *Stellaria*. Monogr. by F. N. Williams, Journ. Linn. Soc. 33:326 (1897–8).

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A. *Petals usually wanting or rudimentary.*

1. **sedoides**, Froel. (*Cherleria sedoides*, Linn.). Minute green moss-like carpeter, 1 or 2 in. high: fls. unisexual or polygamous, greenish, inconspicuous. Mts., Eu.—A choice rock-cover in alpine gardens. Prop. by division or seeds.

AA. *Petals usually present and prominent.*B. *Fls. purplish.*

2. **purpurascens**, Ramond. Alpine, tufted and decumbent: lvs. ovate-lanceolate, acuminate: fls. on short tomentose pedicels, 2 or 3 on a branch, the purplish corolla exceeded by the sepals. Pyrenees.—A carpeter.

BB. *Fls. white (sometimes purple in No. 16).*C. *Lvs. ovate-oblong or lanceolate.*

3. **balearica**, Linn. Very low (3 in. high), creeping, with small ovate glossy thick and ciliated lvs.: fls. single on long peduncles; sepals erect. Balearic Is., Corsica.—Not hardy in latitude of New York City.

4. **aretioides**, Portens. Densely cespitose, and making a good green carpet: lvs. oblong-lanceolate, obtuse and short-mucronulate, grooved above and 3-nerved beneath: fls. solitary, with 4 sepals.—High Alps.

5. **tetraquetra**, Linn. Carpeter, 3–6 in., pubescent: lvs. ovate, keeled, 4-rowed: fls. in heads, with sepals stiff and ciliate and nearly equaling petals. France.

6. **lanceolata**, All. Cespitose-procumbent, the sts. ascending: lvs. lanceolate, rounded at base, acute, flat, many-nerved below: fls. 1–3, the sepals lanceolate-acute, equaling the petals. High Alps.

7. **macrophylla**, Hook. Sts. decumbent and angled, pubescent: lvs. lanceolate or lance-oblong, mostly acute: peduncles slender, 1–5-flid., the sepals lanceolate-acuminate. Labrador and Vt. to the Pacific. Intro. 1881.

CC. *Lvs. linear or awl-like.*D. *Sepals obtuse.*

8. **grœnlandica**, Spreng. Annual: very low, forming mats, the decumbent or erectish sts. bearing 1–5 fls.: lvs. linear and obtuse,  $\frac{1}{2}$  in. or less long: sepals and petals blunt, the latter sometimes notched. High altitudes and latitudes, but coming to the seacoast in parts of New Eng., and ranging down the mts. to N. C. Intro. 1884.—A neat little alpine.

9. **graminifolia**, Schrad. A foot or less high: lvs. long and filiform, rough-margined: fls. in 3-forked loose pubescent panicles; petals obovate, exceeding calyx. Eu.

DD. *Sepals acute, pointed or even awned.*

E. *Blossoms solitary, or mostly in 2's or 3's.*

10. **grandiflora**, Linn. Fig. 369. Ten in. or less high: lvs. flat-awl-shaped, 3-nerved and ciliate, the radical ones crowded: fls. large, solitary or in about 2's or 3's, long-stalked. Eu.—Runs into many forms.

11. **montana**, Linn. Smaller: lvs. linear or nearly so: fls. large, solitary, very long-stalked; sepals acuminate, less than the corolla. S. W. Eu.

12. **Rosànii**, Tenore. (*Alsine Rosànii*, Fenzl). Low (1–2 in.): lvs. linear-lanceolate and mucronate, hairy, striate: sts. erect, hirsute, about 3-flid.: fls. white, with obovate petals and striate longer sepals. Italy.

EE. *Blossoms 5–7 (or more) together.*

13. **pinifolia**, Bieb. (*Alsine pinifolia* var. *gracilis*, Fenzl). Cespitose, the branches ascending: lvs. narrowly awl-shaped or bristle-like, often curved: fls. large, in 5–7-flid. corymb, the pedicels equaling the calyx or shorter; sepals linear, hairy, 3-nerved: petals obovate-oblong, exceeding calyx. Asia Minor.—A dwarf compact plant with small pine-like foliage which becomes rosulate on sterile shoots, producing many pure white fls.; an attractive edging and rockery plant.

14. **véna**, Linn. (*Alsine véna*, Bartl.). Dwarf, 1–3 in. high: lvs. linear-subulate, flat, strongly 3-nerved, erect: fls. on filiform peduncles, with strongly 3-nerved sepals. Eu. and Rocky Mts.—Excellent little rock plant. Var. *cæspitosa*, Hort., is a compact, leafy form, making dense moss-like masses; all summer.

15. **juniperina**, Linn. (*Alsine juniperina*, Fenzl. *A. juniperifolia*, Hort.?). Cespitose, nodes often swollen: sts. simple, bearing clusters: lvs. awl-like, mucronate, keeled, about 1-nerved, often recurved and persisting: fls. with lanceolate-acuminate 3-nerved sepals, and longer linear-cuneate white petals. E. Eu. and Asia Minor.—Variable.

16. **aculeata**, Wats. Sts. 4–6 in. high: lvs. stiff and sharp, glaucous: fls. fascicled, white, but often purple. W. Amer. Intro. 1889.

17. **Franklinii**, Douglas. Sts. 3–5 in. high, nearly or quite glabrous: lvs. in 3–6 pairs, narrow-subulate, sharp-pointed: fls. in dense cymes at the top of the st. W. Amer. Intro. 1881.

L. H. B.

**ARÉNGA** (derivation unknown). *Palmaceæ*, tribe *Arécææ*. Tall, usually spineless palms with a thickish, ringed trunk, the upper part of which, and the leaf-stalks are often covered with long black fibers.



369. *Arenaria grandiflora*. ( $\times \frac{1}{3}$ )

Leaves pinnate, the lfts. regularly placed on the rachis, sometimes confluent at their bases, the jagged or cut-off appearance of the lfts. peculiar to this genus and Caryota among the horticultural palms, the margin irregularly toothed above the middle; the lvs. paler beneath than above; petiole flattish or convex; fls. monocious, numerous, and with 2 or more bracts beneath each sessile fl.; spadix 6-10 ft. long in some species, usually smaller, coming from among the lvs. and developing downwards; when the last fl.-cluster reaches maturity some at

least of the species die, notably *A. saccharifera*: fr. the size of an apple and somewhat resembling it, containing 2 or 3 oblong and usually dark brown seeds. G.C. II. 22:522.

Arengas are graceful palms, all natives of tropical Asia and Australia, and so far as known are of only eight species. *A. saccharifera* is an important economic plant in India, the black fiber at the leaf-bases known as gomuta fiber being widely used for filters and in the caulking of ships. The sap yields "arenga sugar" after the plant is ten to twelve years old. For culture, see *Areca*.

*Arenga saccharifera*, in a young state, is surpassed in beauty by most palms. Specimens eight to ten years old, however, show their characteristics well, and from that period till they begin to flower (which they do from the top of the stem downwards in the axils of the leaves), they are among the most striking subjects for high and roomy conservatories. The temperature should not be allowed to fall below 55° F. during the coldest weather. (Oliver.)

A. Trunks at least 20 ft. or more.

*saccharifera*, Labill. Trunk 20-40 ft. high; lvs. very many, frequently 20-28; petioles smooth; lfts. 115, on each side, fasciculate, in 4's or 5's, linear-ensiform, 3-5 ft. long, 1- or 2-auricled at the base, the lower auricle the longer, 2-lobed or variously dentate at the apex, white or silvery beneath: branches of the spadix long, fastigate, pendulous: male fls. purple, 1 in. long. Malaya.

*obtusifolia*, Mart. Trunk 20-30 ft. high, 1-1½ ft. thick: fronds 9-13, 12-16 ft. long; petiole thickly spiny, especially on the margins, scarcely more than 1 ft. long; segms. 1½ in. apart, 2-3 ft. long, 1½-2 in. wide, alternate, lanceolate-linear, unequally acutely dentate, attenuate, 2-auricled at the base, the lower auricle the larger, glaucous beneath: branches of the spadix short, lax, nodding. Java.

AA. Trunks not over 10 ft.

Engleri, Becc. About 5 ft. tall; lvs. numerous, with a great many lfts. about 16 in. long and 1 in. wide, much constricted at the base and irregularly toothed at the apex: infl. much branched, borne among the lvs., not more than 1½ ft. long; fr. about ¾ in. diam. Formosa.—Not as yet common in this country, but interesting among arengas for its small size.

*A. Borrètti*, Hort., reported from E. Indies, is a name frequently appearing in hort. literature, not certainly referable.

N. TAYLOR.†

**ARETHUSA** (the nymph *Arethusa*). *Orchidaceæ*. Handsome terrestrial tuberous orchids.

Scapes leafless or with a single lf. 1- to few-fl.; fl. wapping, the sepals and petals nearly alike, arching over

the column; lip erect, narrow, entire, adnate to the base of the elongated erect column, and produced into a short spur.—Three species, 2 in N. Amer. and 1 in Japan.

*bulbosa*, Linn. Fig. 370. A very pretty hardy orchid, 8-10 in., with one linear, nerved lf. and a bright rose-pink fl. on an erect scape, the lip recurved and bearded. Bogs, N. C., N. and W.; not common. May, June. Mn. 5:141.—Requires a moist and shady, cool situation and open, porous soil. A shady nook on north slope of rockery, where it can be watered in dry weather, is an ideal place. Prop. is by the solid bulbs.

*A. sinénsis*, Rolfe. A terrestrial tuberous herb 4-9 in. high; fls. white and red. W. China. B.M. 7935.

GEORGE V. NASH.†

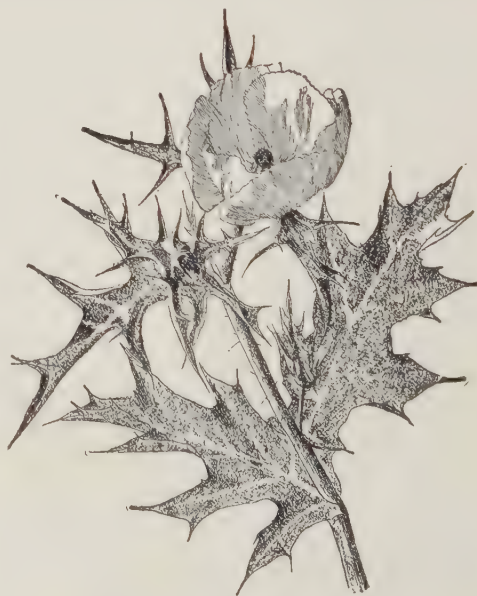
ARËTIA: *Douglasia*.

**ARGEMONE** (Greek name for an eye disease for which a plant was reputed a remedy). *Papaveraceæ*. ARGEMONY. Prickly garden annuals, grown for the showy yellow, white or purplish poppy-like flowers.

Coarse herbs with yellow juice and sometimes with spotted lvs.: fls. large, short-lived; sepals 2 or 3; petals 4-6; stigmas 6 or less, radiate, sessile or nearly so: pod oblong or ellipsoid, prickly or bristly, opening at top by 3-6 valves.—About 10 species of N. and S. Amer., cult. as annuals, although sometimes biennial or even perennial. Argemonies are easy to manage from seeds sown where the plants are to stand, or transplanted from pots. They need a light soil and full sunny exposure. Monogr. by Fedde, Engler's Pflanzenreich, hft. 40 (1909).

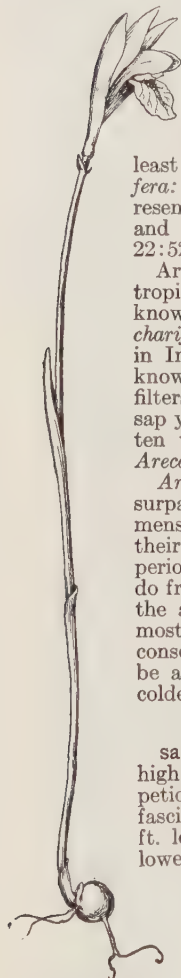
A. Fls. yellow or yellowish.

*mexicana*, Linn. (*A. speciosa*, Hort.). PRICKLY POPPY. Fig. 371. A moderately prickly-stemmed herb, 1-2 ft. high, sprawling, glaucous: lvs. coarsely sinuate-pinnatifid; fls. sessile or nearly so, the petals obovate and an inch or less long, orange or lemon-colored, to



371. *Argemone mexicana*. ( $\times \frac{1}{2}$ )

2½ in. across when expanded. Trop. Amer., but naturalized in eastern and southern states and in many parts of the world. B.M. 243.—Not much used in this country for medicinal purposes. The plant is said to possess emetic, cathartic, anodyne and narcotic properties; the oil from the seeds acts as a mild cathartic. Var. *ochroleuca*, Lindl. Petals yellowish white, and style longer. Texas. B.R. 1343.



370. *Arethusa bulbosa*. ( $\times \frac{1}{2}$ )



AA. Fls. white (rarely purple).

**grandiflora**, Sweet. Fig. 372. Glabrous and glaucous, 1-3 ft. high, almost destitute of prickles, stout: lvs. sinuate-pinnatifid, the lobes only weakly spinescent, white-veined: bracts scattered along the fl. branches:



372. *Argemone grandiflora*. ( $\times \frac{1}{2}$ )

fls. 3-6 near together, 4 in. across: caps.-valves scarcely crested. S. W. Mex. B.R. 1264. L.B.C. 16:1546. B.M. 3073.—Very showy.

**platyceras**, Link & Otto. Robust,  $1\frac{1}{2}$ -4 ft., very spiny, the lvs. glaucous: lvs. sinuate-pinnatifid, spiny: fl.-bracts aggregated below the fls.; petals truncate, large, white (rarely purple), the fls. 2 in. or more across: caps.-valves crested or spiny. Var. **hispida**, Prain (*A. hispida*, Gray). Petals rounded; sepals and caps. densely prickly: plant hispid. Var. **hispido-rosea**, Fedde. Petals rounded, rose or rosy white; sepals narrow, sparsely prickly. Var. **Huntemánii**, Fedde. Petals rounded, white: plant stout.—The species is very variable and widely distributed in N. and S. Amer. Likely to appear in cult. in several forms; all of them have thick and densely prickly caps.-valves.

**álba**, Lestib. (*A. mexicana* var. *albiflora*, DC.). Slender, 1-3 ft., somewhat glaucous: lvs. glabrous, pinnate-lobed and sinuate, the lobes oblong-acute, spiny toothed: fls. solitary or 2-3 together, on naked peduncles, 3 in. across, white; petals oblong, narrowed at base, truncate at top. Southern states and south. B.M. 2342 (as *A. albiflora*).—Sparingly run wild. Caps.-valves thin, reticulate spiny. L. H. B.

**ARGYRÆIA** (silvery, referring to the under side of the lvs.). *Convolvulacæ*. SILVER WEED. Asiatic tender climbers allied to *Ipomœa*, sometimes grown in the open.

Lvs. usually large, silvery, tomentose or villous beneath: cymes usually few-flid.; corolla campanulate; sepals 5.—They require too much room before flowering to be popular in Amer. *A. cuneata* is one of the dwarfest and most floriferous kinds. Prop. by cuttings or seeds, the former over bottom heat. About 25 species.

**tiliæfolia**, Wight (*Rhexia tiliæfolia*, Hort.). Fls. white, violet or rose-purple, widely funnelform: lvs. ovate-cordate, 2-3 in. diam., shortly acuminate or obtuse. Prop. is from seeds. E. Indies.—Intro. 1890 by Peter Henderson & Co.

**cuneata**, Ker-Gawl. Two to 5 ft.: st. downy: fls. large, bright but deep purple, on hairy peduncles which are shorter than the lvs.: lvs. obovate-cuneate, emarginate, glabrate. E. Indies. B.R.: 661.

*A. Pierreana*, Hort. (?). Corolla funnel-shaped, white tinted with rose. Tonquin. R. H. 1906:560. See p. 3566. N. TAYLOR.†

ARIA: *Sorbus*.

**ARIOCÁRPUS** (*Aria-like fruit*). *Cactacæ*. Top-shaped succulent desert plants, mostly buried in the ground, the broad aerial part covered with angular tubercles bearing no spines: fls. from the center of the plant, large, white or pink: fr. small, naked; seeds black, roughened.—A genus of 6 or 7 species confined to Cent. Mex., except a single species in S. W. Texas. A very distinct genus, easily distinguished from *Mamillaria* by its tubercles.

A. Upper surface of tubercle with a broad and deep wool-bearing longitudinal groove, which widens below.

**fissuratus**, Schum. (*Anhalonium Engelmännii*, Lem.). LIVING ROCK. The flat tubercle-covered top 2-5 in. across, tapering below into a thick root; tubercles imbricated and appressed, triangular in outline,  $\frac{1}{2}$ -1 in. long and about as wide at base, the upper surface fissured in bands, the outer ones forming an elevated margin: fls. central, about 1 in. long and broad, shading from whitish to rose. On limestone hills in the "Great Bend" region of the Rio Grande in Texas, and extending into Mex. I.H. 16, p. 73, and fig. Contr. Nat. Herb. 13, pl. 62.

**Llódii**, Rose. Fig. 373. Plant body with rounded top, 4 in. or more in diam.: tubercles imbricated,  $\frac{1}{2}$  in. broad at base, the upper portion rounded, obtuse, broader than thick, the whole surface fissured, but not in definite bands: fls. purple, about  $1\frac{1}{2}$  in. long; petals broad, apiculate. This species differs from *A. fissuratus* in shape and surface of tubercles, in its round top, and more southern range. Cent. Mex. Contr. Nat. Herb. 13, pl. 63.

**Kotschubeyanus**, Schum. (*A. sulcatus*, Schum.). Plants nearly concealed by the ground, often less than 1 in. broad at top, with a deep thick root: fl.-tube nearly  $\frac{1}{2}$  in. long; petals  $\frac{1}{2}$  in. long, rose-pink. Cent. Mex.—Much smaller than the last two. Only recently re-intro. into cult. A very distinct species. *A. McDowellii*, Haage & Schmidt, is the same or a near species.

AA. Upper surface of tubercle not grooved.

**retusus**, Scheidw. (*Anhalonium prismaticum*, Lem.). The flat top 3-8 in. across: tubercles imbricate, but squarrose-spreading, sharply triangular-pyramidal and very acute, with a sharp, cartilaginous tip, which usually disappears with age and leaves the older tubercles blunt or retuse,  $\frac{3}{4}$ -1 in. long and about as wide at base, the upper surface almost plane and smooth, except that it is more or less pulverulent, and often bears a small tomentose tuft just behind the claw-like tip: fls. rose-color. Mts. of Mex. —*A. trigonum*, Schum. and *A. furfuraceus*, Thompson, are similar species sometimes in cult. J. N. ROSE.

**ARISÆMA** (Greek-made name, of no particular significance). *Aracæ*. INDIAN TUR-NIP. DRAGON ARUM. Odd hooded aroids, sometimes grown in hardy borders and some species as pot-plants.

About 60 widely distributed herbs, with



373. *Ariocarpus Lloydii*. ( $\times \frac{1}{4}$ )

tuberous roots, and a spathe rolled in or convolute about the spadix below, and often arched over it: fls. unisexual, the pistillate on the lower part of the spadix, and each consisting of a 1-loculed ovary, and generally ripening into a showy berry. Some species are native, and several of them are hardy in the open; others are cult. under cover, as recommended for *Arum* (which see). Monogr. by Engler in De Candolle's *Monographiæ Phanerogamarum*, Vol. II.

A. Lfts. 7-11.

**Dracóntium**, Schott. DRAGON-ROOT. Sending up a solitary lf. 1-2 ft. high, pedately divided into oblong-lanceolate pointed lfts.: spadix long-pointed and projecting beyond the greenish spathe: scape much shorter than the lf. Low grounds in E. Amer.—Occasionally grown in borders and rock-work.



374. Jack-in-the-Pulpit, *Arisæma triphyllum*. ( $\times \frac{1}{4}$ )

AA. Lfts. 3.

**triphyllum**, Torr.

JACK-IN-THE-PULPIT. INDIAN TURNIP. Fig. 374. Usually dioecious: lvs. usually 2, with ovate or elliptic-ovate lfts.: spadix club-shaped and covered by the arching purplish spathe. Common

in woods. V. 14:179.—Tuber or corm flattish and large, very acrid, often employed as a domestic remedy. Berries red and showy, ripening in early summer. Planted in a moist, shady place, the lvs. remain until fall; but in exposed places they die down early in summer. This and the last are very interesting native plants of easy cult., prop. by tubers and by seeds.

**fimbriatum**, Mast. FRINGED CALLA. Lf. solitary, the petiole a ft. or less high, sheathed below; lfts. broad-ovate and acuminate, short-stalked: scape as long as the petiole, bearing a large, purple-limbed, white-streaked, long-pointed spathe: spadix ending in a long and gracefully drooping, feather-like appendage. E. Indies. G.C. II. 22:689; III. 15:763. B.M. 7150. Mn. 8, p. 59. G. 25:626.—A handsome and striking pot-plant, blooming in summer. Grows in rich soil. Dry off the tuber when the lvs. turn yellow after flowering, and keep dry in sand or earth until spring.

Other species are: *A. anomalum*, Hemsl. Lfts. 3, broad-ovate, acuminate: spathe small, purplish and streaked, arching over the short spadix: suggests *A. triphyllum*. Malaya. B.M. 7211. —*A. concinnum*, Schott. Lf. solitary, with 10 or more lfts.: spathe colored, tailed. India. B.M. 5914. —*A. curvatum*, Hook. = *A. tortuosum*. —*A. Fargèsii*, Bouchet. Spathe striped longitudinally with broad purple-brown bands alternating with bands of silvery white. W. China. —*A. flavum*, Schott. Lvs. pedate: spathe green to yellow. Himalaya. B.M. 7700. —*A. galeatum*, N. E. Br. Lf. solitary, with 3 lfts.: spathe purple inside. India. B.M. 6457. —*A. Griffithii*, Schott. Lvs. 2; lfts. 3, nearly orbicular: spathe very large with a spreading and wrinkled limb several inches broad, and rich purple with green veins. India. B.M. 6491.—One of the handsomest of all arisæmas. —*A. japonicum*, Blume. Lvs. pedate: spathe green, white striped. B.M. 7910. —*A. nepenthoides*, Mort. Lf. pedate, of 5 narrow lfts.: spathe auricled. India. B.M. 6446. —*A. ringens*, Schott. Lfts. 3, ovate-acuminate: spathe purple, arched. Japan. Perhaps hardy in the open. Gn. 37, p. 577. G. 17:182. —*A. Sieboldii*, De Vriese. = *A. ringens*. —*A. speciosum*, Mort. Lfts. 3: spathe large and very dark purple; spadix with a very long, string-like tip. India. Gn. 37:576. B.M. 5964. G.C. II. 12:585. —*A. tortuosum*, Schott. Lvs. usually 2, with several or many lfts.: spathe purple outside; spadix long-tailed but erectish, greenish. India. B.M. 5931 (as *A. curvatum*). —*A. utile*, Hook. Lvs. 2, with 3 crenate lfts.: spathe reddish, green-ribbed; spadix purple: tubers eaten by natives

in India. B.M. 6474. —*A. viridiflorum*, Franch., has recently been offered in Eu., from China. It has pedate lvs., and a striped spathe. —*A. Wrayi*, Hemsl. Lf. solitary, pedate, the lfts. lanceolate: spathe green or whitish; spadix slender, recurved. India. B.M. 7105.

L. H. B.

**ARISÆRUM** (old Greek name). *Araceæ*. Three or four variable species of arum-like plants of the Mediterranean region. Differs from *Arisæma*, its nearest ally, in having the margins of the spathe connate rather than convolute, and in other technical characters. For culture, see *Arum*.

**vulgare**, Targ. (*Arum Arisærum*, Linn.). A foot high: lvs. cordate or somewhat hastate, long-stalked: spathe purple, incurved at the top.—Has many forms and names. Can be grown in the open with protection.

*A. proboscideum*, Savi. Lvs. hastate; scape less than half the petiole: spathe 1-1  $\frac{1}{4}$  in. long, pale gray, with a long olive tail 5-6 in., the mouth of spathe small, olive-purple. Italy. B.M. 6634. G.W. 5, p. 512.

GEORGE V. NASH.†

**ARISTËA** (name refers to the stiff leaf-points). *Iridacææ*. Mostly blue-flowered spring- or summer-blooming greenhouse herbs or sub-shrubs, and grown in the open far south.

Leaves distichous in basal rosettes, those on the st. alternate: fls. clustered in spikes, not lasting; the perianth with a short tube and oblong, spreading, nearly equal segms. that twist up spirally after flowering; stamens short-stalked, borne on the throat of perianth-tube: fr. an oblong or cylindrical 3-valved caps.—About 30 species in Afr. Of easy cult. Prop. by seeds and division. Not showy.

**Écklonii**, Baker. Herb, 1  $\frac{1}{2}$  ft.: lvs. linear but not rigid, 18 in. or less long: fls. in many clusters that form a loose panicle with a flattened rachis; limb of blue perianth  $\frac{1}{2}$  in. long: caps. cylindrical, less than 1 in. long. Cape Colony.—Reported in Calif., where it is said to make dense dark green clumps, with *Sisyrinchium*-like fls. in spring.

**fruticosa**, Pers. (*Nivènia fruticosa*, Baker). Dwarf shrub: st.-lvs. linear, 2 in. or less long: fls. in a single cluster; perianth blue, the tube  $\frac{1}{2}$  in. long. Cape Colony.

L. H. B.

**ARISTOLÒCHIA** (named for supposed medicinal virtues). *Aristolochiaceæ*. BIRTHWORT. Perennial herbs or shrubs, many climbing, remarkable for the very odd-shaped flowers, some species grown in the open, but most of them cultivated as odd glass-house subjects.

The corolla is wanting, but the calyx is corolla-like, tubular, mostly variously bent, and commonly tumid above the ovary and contracted at the mouth, superior; stamens commonly 6, short and adnate to the style, which is fleshy and lobed: fr. a naked 6-valved caps.; seeds flat.—About 180 species of warm



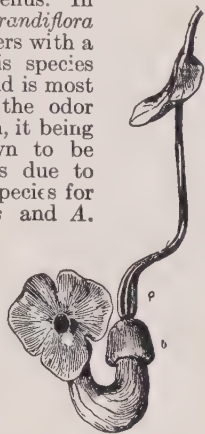
375. *Aristolochia macrophylla*. ( $\times \frac{1}{6}$ )

and temperate regions throughout the earth; mostly woody twiners. Many species are evergreen. The tender species are cult. for the strikingly irregular and grotesque fls. The fls. are usually fetid in odor, often very disagreeable. Many species are grown in botanic gardens and in the collections of fanciers, but those usually cult. or planted are to be found in the treatment which follows.

These plants are mostly climbing vines, *A. macro-*



*phylla* being perhaps the best known vine for shade purposes. It is vigorous and of rapid growth, and has never been known to be attacked by fungoid or insect enemies. For covering outbuildings quickly it has no equal, owing to the heavy growth of foliage and its adaptability to any situation. The flowers are peculiar in shape, giving rise to the popular name, Dutchman's pipe. These are inconspicuous, however, compared with the tropical species of this genus. In contrast with the foregoing, *A. grandiflora* var. *Sturtevantii* has gigantic flowers with a tail sometimes 3 feet long. This species must be cultivated under glass and is most suitable for large structures as the odor when in bloom beggars description, it being such that flies have been known to be deceived, thinking its origin was due to putridity. There are other fine species for indoor culture as *A. brasiliensis* and *A. Goldieana*. These are best propagated from cuttings taken from well-matured wood in early spring or at pruning time. A rich soil is desirable and preference is given to planting the roots in a border or bed that they may be trained up rafters or pillars of warmhouses. Pot culture does not give good results. Another very pretty species is *A. elegans*. This is not odorous, can easily be procured from seeds, which are freely produced under cultivation. It will bloom the first year under glass, and may be cut back to give light to other plants in winter. The outdoor *A. macrophylla* (often known as *A. Sipo*) produces good seed; this seems to be the only way to increase it as hardwood cuttings do not root readily. (E. O. Orpet.)



376. Flowers of Dutchman's Pipe, *Aristolochia macrophylla*, showing the ovary at a, and the swelling of the calyx-tube at b. (×%)

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## A. Plant not climbing, herbaceous.

1. *Serpentaria*, Linn. VIRGINIA SNAKEROOT. Height 2 ft. or less, pubescent, with short rootstocks and aromatic roots: lvs. ovate or oblong, cordate or halberd-form, acuminate: fls. near the root, solitary, S-shaped, much enlarged above the ovary, greenish. E. U. S.—Occasionally cult. Roots used in medicine. Reputed remedy for snake-bites. Var. *hastata*, Duch. Lvs. narrow, sagittate or hastate. Southeastern states.

2. *Clematidis*, Linn. Two ft. or less tall, glabrous: lvs. reniform-pointed, ciliate on the margins: fls. axillary and clustered, straight, greenish. Eu.—Rarely cult., and occasionally escaped.

## AA. Plant twining, mostly woody.

## B. Cult. in the open.

3. *macrophylla*, Lam. (*A. Sipo*, L'Her.). DUTCHMAN'S PIPE. PIPE VINE. Figs. 375, 376, 377. Very tall, twining, glabrous: lvs. very large, broadly reniform or rounded, becoming glabrous: fls. solitary or 2 or 3 together in the axils, U-shaped, enlarged above the ovary, with a 3-lobed, spreading flat limb, purplish. Eastern states. B.M. 534. Gng. 1:53. G.F. 5:509 (habit).—An excellent vine for porches, the great lvs. affording a dense shade.

4. *tomentosa*, Sims. Much like the last, but very tomentose: lvs. less rounded: fls. yellow, with reflexed

lobes, the closed orifice purple. N. C. to Ill. and S. B.M. 1369.

5. *californica*, Torr. Silky pubescent, 6–10 ft.: lvs. ovate-cordate, 2–4 in. long, obtuse or acutish, short-petioled: fls. U-shaped, little contracted at the throat, the limb 2-lobed, with the upper lip of 2 broad, obtuse lobes and a thickening on the inner side. Calif.

6. *moupinensis*, Franch. Branches slender, densely silky, becoming smoothish: lvs. cordate, 5 in. or less long, hairy above, grayish pubescent beneath, the petiole about  $2\frac{1}{2}$  in. long: fls. solitary on axillary peduncles, the tube  $1\frac{1}{2}$  in. long, abruptly curved so that the blossom appears U-shaped as it hangs, pale green outside and yellowish inside, the limb obliquely 3-lobed,  $1\frac{1}{4}$  in. across, yellowish and purple-marked. From the Moupin region of W. China. B.M. 8325.—A rapid grower, reaching 15 ft. in one season. A good pillar and post plant, hardy in England. Allied to *A. Kaempferi* (see supplementary list).

7. *triangularis*, Cham. Glabrous: lvs. triangular-acute, 3-nerved, pellucid-punctate, the petioles prehensile, the blade 4 in. long by 3 in. broad: fls. solitary, ovoid-inflated at base and then making a sharp angle, the tube funnelform and the limb small and truncate and not large, purple-spotted. Brazil.—A climber reported in S. Calif.

8. *argentina*, Griseb. Herbaceous, glabrous; st. angular-sulcate: lvs. cordate-deltoid, obtuse, pedately 7-nerved: fls. solitary on axillary peduncles, glabrous without and somewhat puberulent within, the tube ovoid at base, bent, the parts of limb broadly ovate and obtuse. S. Amer. Reported in S. Calif.

BB. Cult. in greenhouse or warmhouse.

c. Fl.-limb of 2 narrow divergent lobes.

9. *ridicula*, N. E. Br. Very slender, stiff-hairy throughout: lvs. round-reniform, cordate: fls. axillary and solitary, 2 in. long aside from the limb, with a long sac at the base of the tube, pale yellow with dull purple veining; limb of 2 spreading, deflexed, narrow lobes, glandular, reminding one of donkeys' ears. Brazil. B.M. 6934. G.C. II. 26:361.

cc. Fl.-limb of 3 narrow lobes.

10. *tricaudata*, Lem. Lvs. 5–8 in. long, oblong-acuminate, rugose, ciliate: fls. solitary; tube short and somewhat inflated at the rounded base, suddenly bent; limb wide and concave, maroon-red outside and very dark purple-brown inside, produced into tails 4 in. long. Mex. I.H. 14:522. R.B. 20:37. B.M. 6067.—A fine species of shrubby habit, producing quantities of fls. all over the older parts of the growths, down to the base of the old st. A striking plant when well grown under sunny conditions in a temp. of 50–55° F.

ccc. Fl.-limb 2-lipped, the lips unlike and one of them usually ample and flowing: fls. large.

D. Blossoms with one or more long hanging tails.

11. *grandiflora*, Swartz (*A. gigas*, Lindl.). PELICAN-FLOWER. SWAN-FLOWER. GOOSE-FLOWER. DUCK-FLOWER. Figs. 378, 379. Downy climbing shrub: lvs. cordate-acuminate; peduncles striate, exceeding the petiole, 1-fld.: the fl.-bud is "bent like a siphon in the tube, so as to resemble the body and neck of a bird, while the limb, in that state, resembles the head and beak thrown back upon the body, as a pelican when that bird is at rest, whence



377. Longitudinal section of flower of Dutchman's Pipe, showing the ovary, and the short column of stamens at q. (×1)

the name" (Hook. in B.M., vol. 74): the great expanded cordate-ovate limb several inches across, wavy-margined, purple-blotched and veined, terminating in a long and slender ciliated tail: strong-scented. Var. *Stürtevantii*, W. Wats., is the form chiefly known in cult., being very large-flid., often 20 in. diam., and with a tail 3 ft. or more long. W. Indies, Cent. and S. Amer. B.M. 4368-9. B.R. 28:60. F.S. 4:351-2. G.F. 3:597-599 (adapted in Fig. 379). A.F. 10:157. G.C. III. 19:73. Gng. 3:23. Gn. 50:378. Var. *Hookeri*, Duch. (*A. gigantea*, Hook.), is glabrous, inodorous, with a short-tailed fl. B.M. 4221.

DD. Blossoms not tailed, although perhaps bearing long more or less erect point-appendages.

12. *Goidieana*, Hook. Whole plant dying down to a large fleshy rootstock: glabrous: lvs. ovate-cordate or triangular-cordate, acuminate, the base deeply cut: fls. very large, greenish outside but brown-veined and blotched inside, the lower part of the tube straightish and 8 in. long, the upper part sharply bent over and a foot long, with a funnel-shaped, spreading limb a foot or more across, and indistinctly 3-lobed, each lobe terminated by slender appendages; stamens 24. W. Afr. B.M. 5672. G.C. III. 7:521; 21:337. G.M. 33:286.

13. *brasiliensis*, Mart. & Zucc. Glabrous: lvs. cordate-reniform, obtuse, with deep sinus at base: peduncle 8-10 in. long, 1-flid.: fl. very large, dingy yellow, with marks and reticulations of purple, the limb strongly 2-lipped; tube strongly bent, purple inside; upper lip 4 in. long, violet within, hairy; lower lip not longer than the upper, 5-7 in. wide. Var. *macrophylla*, Duch. (*A. ornithocéphala*, Hook.). Lvs. large: upper lip 5 in. long, lanceolate-acuminate, projecting from the inflated headlike tube like the long beak of a bird; lower lip on a stalk 2 in. long, then expanding into a flattened, wavy, beautifully marked limb 4 in. long and 4-6 in. across. Brazil. B.M. 4120. Gn. 45, p. 289.—A most odd and interesting species, not infrequent in fine establishments.

14. *élegans*, Mast. CALICO FLOWER. Slender, glabrous, the fls. borne on the pendulous young wood: lvs. long-stalked, reniform-cordate, 2-3 in. across, with wide sinus and rounded basal lobes, the tip obtuse: fls. solitary, long-stalked, the tube yellow-green, 1½ in. long, the limb cordate-circular, 3 in. across, purple and white blotched, white on the exterior, the eye yellow: not strong-smelling. Brazil. G.C. II. 24:301; III. 22:123. B.M. 6909.—A small-flid. and graceful, free-blooming species. A most desirable decorative climber for a warm greenhouse of 55° F. but does not thrive so well in a stove. It is entirely devoid of the unpleasant odor which is characteristic of the fls. of this genus. In Fla. it self-sows freely; and the hanging basket-like frs. are very attractive.

15. *cymbifera*, Mart. & Zucc. (*A. labiata*, Sims). Glabrous: st. striate: lvs. reniform, obtuse and deeply cut at the base, pedately 7-9-nerved, long-stalked: fls. long-stalked, 8-10 in. long, strongly 2-lipped; the upper lip short and lanceolate, acute or acuminate; the lower lip (which, by position of fl. may seem to be the upper) very large, dilated at base, and produced into a long, boat-shaped (whence the name, from *cymba*, a boat)

usually 2-lobed projection; fl. creamy white, marked and blotched with maroon. Brazil. B.M. 2545. P.M. 6:53 (as *A. hyperborea*, Paxt.).

*A. altissima*, Desf. Fls. 2 in. or less long, brownish. Sicily and Algeria. B.M. 6586.—Would probably be hardy with protection in the middle states.—*A. angustica*, Jacq. Lvs. long-cordate: fls. small, 1-2 in. long, with a long-pointed limb. Colombia. B.M. 4361. F.S. 4:344.—*A. barbata*, Jacq. Lvs. oblong and cordate: fls. 2½ in., purple. Venezuela. B.M. 5869.—*A. caudata*, Booth=*A. macroura*.—*A. ciliata*, Hook., and *A. ciliata*, Benth.=*A. fimbriata*.—*A. clypeata*, Lindl. & André. Lvs. triangular-ovate, pointed: fls. with a large, oval, purple-spotted, tailless limb. S. Amer. I.H. 17:40. B.M. 7512.—*A. Duchartrei*, André=*A. Ruiziana*.—*A. fimbriata*, Cham. A free-flowering greenhouse species: lvs. small, cordate-orbicular: fls. small, the little limb glandular-ciliate. Brazil. B.M. 3756 (as *A. ciliata*).—*A. hians*, Willd. Lvs. round-cordate: fls. bronze-green, with lobed limb and a hairy beak. Venezuela. B.M. 7073. Allied to *A. brasiliensis*.—*A. Kämpferi*, Willd. Tall-climbing: lvs. ovate-cordate or hastate, variable: fls. solitary, tomentose, with narrow rim, yellow outside, purple inside. Japan. Probably hardy in the N.—*A. longicaudata*, Mast. Lvs. ovate and cordate: fls. cream-colored with purple markings, with a large sac-like tube, hairy at the throat, with no expanded limb but a very long tail. S. Amer. G.C. III. 8:493.—*A. longifolia*, Champ. Branches climbing, from a woody rootstock: lvs. thick, linear-lanceolate: fls. U-shaped, with a 2-lobed purple limb 2½ in. across. Hong Kong. B.M. 6884.—*A. macroura*, Gomez. Lvs. reniform, lobed: fl. dark maroon, 6-spurred, the lip with a twisted cusp. Brazil. B.M. 3769 (as *A. caudata*).—*A. macroura* × *brasiliensis*, a garden hybrid.—*A. odoratissima*, Linn. Lvs. cordat-ovate: fl. solitary, purple, sweet. Jamaica. —*A. pónica*, Linn. Erect or ascending from a globose rootstock: lvs. large, broadly ovate: fls. very large, curved, greenish purple, ill-smelling. Asia Minor.—*A. ringens*, Vahl. Lvs. round-reniform: fl. 7-10 in. long, green marked with dark purple, hairy inside, with 2 long lips, one of which has a much-expanded limb. Brazil. B.M. 5700.—*A. Ruiziana*, Duch. Lvs. reniform-cordate: fls. with tube 1 in. or less long, the cordate-ovate limb 3 in. across, and brown-spotted. Brazil. B.M. 6880 and G.C. 1868:516 (as *A. Duchartrei*).—*A. sacata*, Wall. Lvs. long-ovate: fls. small, U-shaped, with a very narrow rim (suggesting the Dutchman's pipe), red. India. B.M. 3640.—*A. Sälpinx*, Mast. Lvs. ovate-lanceolate: fls. small, with a trumpet-shaped, somewhat 2-lipped mouth, purplish. Paraguay. G.C. II. 26:457.—*A. unguifolia*, Mast. Lvs. 3-lobed: fls. small, brownish and reddish, with a ciliate, tongue-like lip. Borneo. G.C. II. 14:117. B.M. 7424.—*A. Westlandii*, Hemsl. Lvs. oblong-lanceolate: fl. pendulous, with a spreading purple-marked limb 5 or 6 in. across. China. B.M. 7011. A greenhouse climber producing its fls. on the old parts of the plant near the ground.

L. H. B.

**ARISTOTELIA** (after the Greek philosopher Aristotle). *Elaeocarpaceæ*. Woody plants sometimes grown in the open in warm countries.

Leaves evergreen, nearly opposite, entire or toothed: fls. polygamous; sepals 4-5, valvate; petals of the same number: berries small, edible.—A genus of 7 species of trees and shrubs from the southern hemisphere, allied to *Elaeocarpus*. Prop. by ripened cuttings, under bell-jar or closed frame.



378.  
*Aristolochia grandiflora*,  
var.



379. *Aristolochia grandiflora*. (×8)



**racemosa**, Hook. f. NEW ZEALAND WINEBERRY. Small tree, 20 ft.: lvs. glossy, ovate or cordate-ovate, thin and membranous: fls. white in many-fld. panicked racemes. New Zeal.—Cult. somewhat in S. Calif.

**Mâcqui**, L'Her. Shrub, to 7 ft.: lvs. almost opposite, dentate, smooth, shining, oblong and acute at the apex: fls. inconspicuous, greenish, axillary. Chile.—Grown for its foliage. A variegated form, less hardy than the type, is known. Occasionally found in botanical and other collections, particularly in Calif. N. TAYLOR.†

**ARMENIACA**: *Prunus*.

**ARMÈRIA** (an old Latin name). *Plumbaginaceæ*. SEA PINK. THRIFT. Small perennial herbs, with rosettes of narrow evergreen leaves on the ground, planted along borders and walks, used for continuous low edgings and in rock-gardens; sometimes grown as pot-plants.

Scape naked, simple, 2–12 in. high, on which is borne a compact head of pink, lilac or white fls., the head being subtended by small bracts, forming a kind of involucre; fls. with plaited funnel-shaped dry calyx, the lobes pointed; 5 petals nearly or quite distinct and tapering at the base; 5 stamens opposite the corolla parts; styles 5, hairy below the middle: fr. a utricle inclosed in the calyx.—About 50 species in Eu., W. Asia, N. Afr. and 1 in N. Amer., much confused.

Armerias are of easiest culture, being hardy and free growers. Propagation is by division of the stools; also by seeds.

A. *Calyx-tube usually pilose all over.*

**vulgâris**, Willd. (*A. maritima*, Willd.). COMMON THRIFT. Fig. 380. Lvs. linear, 1-nerved, somewhat obtuse, glabrous or slightly ciliate: scape low, somewhat villose; calyx-tube about the length of the pedicel and decurrent on it, the limb nearly equal to the tube, with very short ovate, blunt or aristate lobes. Eu. and Amer., along the seacoast. Var. **alba**, Hort. White. Var. **rûbra**, Hort. Fls. dark rose-red. Var. **purpurea**, Hort. Purple-red. Var. **Laucheana**, Voss. Light rose-color. Var. **grandiflora**, Hort. Large-fld., light rose-red. Var. **splendens**, Hort. Bright pink. *A. argentea*, Hort., is perhaps another form, with small white fls.; also a white-lyd. form.

**sibirica**, Turcz. Lvs. linear, 1-nerved, obtuse, glabrous: scape rather taller, thicker; calyx-tube longer than pedicel, the limb about length of tube, with triangular, short-mucronate lobes; involucre brown; fls. white. Siberia.

**júncea**, Girard (*A. setacea*, Delile). Outer lvs. of rosette narrow-linear and subdentate, the inner ones longer and filiform: head small, with pale involucre, the pedicel much shorter than the calyx-tube; calyx-limb short, the lobes ovate-obtuse and aristate; fls. pink. Eu.

AA. *Calyx-tube glabrous, or pilose only on the ridges.*

B. *Lvs. elliptic-lanceolate or broader.*

**latifolia**, Willd. (*A. cephalotes*, Link & Hoffm., not Hook.). Glabrous and glaucous: lvs. broad-oblong, 5–7-nerved, the margin remotely denticulate: head large, the involucre dry; calyx-limb long, with very small or no lobes and long teeth; fls. bright pink. S. Eu. B.M. 7313. P.M. 11:79 (as *Statice Pseudo-armeria*).—*A. formosa*, Hort., probably belongs here.

**mauritanica**, Wallr. (*A. cephalotes*, Hook., not Link & Hoffm.). Lvs. broad-spatulate or elliptic-lanceolate, 3–5-nerved, glaucous green, the margin scarious-white: heads large (2–3 in. across), the involucre brownish, the calyx short-toothed and aristate; fls. pink. Eu., Algeria.

BB. *Lvs. linear-lanceolate or narrower.*

**alpina**, Willd. Glabrous: lvs. linear-lanceolate; equaling the scape, 1-nerved or obscurely 3-nerved: head large, the involucre pale brown; pedicels shorter than

calyx-tube, the tube equaling the oblong long-aristate lobes; fls. deep rose. Mts., Eu.

**purpurea**, Koch. Lvs. linear, long, 1-nerved, blunt: outer involucre-scales mostly blunt, the inner very blunt and weak: pedicels as long as calyx-tube, limb equaling the tube, and the lobes ovate-aristate; purple. Cent. Eu.

**plantaginæa**, Willd. Glabrous: lvs. linear-lanceolate, 3–7-nerved, acute or acuminate: scape tall; head dense and globular, the involucre white; pedicels as long as calyx-tube, the lobes ovate and long-aristate and as long as tube; pink. Cent. and S. Eu. Var. **leucantha**, Boiss. (*A. dianthoides*, Hornem. & Spreng.), has white fls.

**argyrocephala**, Wallr. (*A. undulata*, Boiss.). Glabrous: outer lvs. in rosette, short and lanceolate or linear-lanceolate and 3-nerved and often sinuate, the inner ones linear or setaceous and 1–3-nerved: head large, the involucre white; pedicel nearly as long as calyx-tube, the calyx-limb with long-triangular aristate lobes; fls. white, showy. Greece. L. H. B.†

**ARMERIÁSTRUM**: *Acantholimon*.

**ARNATTO**: *Biza*.

**ARNÈBIA** (Arabic name). *Boraginaceæ*. Annual or perennial hispid herbs, grown as flower-garden or border subjects.

Erect or diffuse: root sometimes yielding red tint: lvs. alternate: fls. yellow or violet, in racemes or cymes, the color changing with the age of the blossom; corolla slender-tubed, with 5 obtuse lobes, the throat devoid of scales; stamens included; style usually bifid: fr. normally of 4 erect nutlets.—A dozen species in Asia and N. Afr. of easy cult. in gardens.

**echioides**, DC. (*Macrotomia echioides*, Boiss.). PROPHET-FLOWER. Hardy perennial, 3–12 in. high, short-hairy, with spreading, obovate-oblong lvs.: fls. in a scorpioid raceme or spike, yellow, with purple spots, fading to pure yellow. Caucasus, Armenia, etc. B. M.

4409. G.C. II. 11:689.—Blooms in spring. In full sun or in rather dry ground, it is difficult to keep this charming plant in a healthy condition; partial shade is essential to its welfare. One can grow luxuriant specimens on the northern slope of a rockery or close to a building on the east or north side. Prop. by seeds, division, or by root-cuttings.

**cornûta**, Fisch. & Mey. ARABIAN PRIMROSE. Annual, 2 ft., bushy: lvs. lanceolate or linear-oblong, pointed: fls.  $\frac{3}{4}$  in. across, yellow and black-spotted, changing to maroon and then to yellow. Orient. G.C. III. 7:52. J.H. III. 31:29. A.F. 5:400. A.G. 11:181 (1890).—An attractive and not very common annual, easily grown in the open.

*A. Griffithii*, Boiss. Annual, 9–12 in.: lvs. narrow-oblong, obtuse, ciliate: fls. long-tubed, with a black spot in each sinus. India. B.M. 5266.—*A. macrothyrsa*, Stapf. Perennial, 1 to nearly 2 ft.: fls. yellow in dense thyrses. Armenia. L. H. B.†

**ÁRNICA** (ancient name). *Compósitæ*. Perennial herbs sometimes seen in borders or rockeries.

With clustered root-lvs. and opposite st.-lvs. and large, long-peduncled yellow heads: involucre bracts all equal,



380. *Armeria vulgaris*. (X  $\frac{1}{4}$ )

thin, in a single, rarely double series. Native to Eu., Asia, and N. Amer., about 10 species.—Tincture of the European *A. montana* is used in medicine. Grown mostly as alpine or in rockwork; some species also grow well in the common border. Prop. by division, and rarely by seeds.



381. *Arnica montana*. ( $\times \frac{1}{2}$ )

st. leafy, strict. Rocky Mts. and W.

*montana*, Linn. MOUNTAIN TOBACCO. MOUNTAIN SNUFF. Fig. 381. A foot high, the st. sparsely hairy: radical lvs. oblong-lanceolate, glabrous and entire: heads 3-4, large. Eu. B.M. 1749. J.H. III. 34:441. Gn. 24, p. 394. G. 29:215.—The best known species in cultivation and can be grown in the open border, but none of the arnicas is common in American gardens.

*A. Clusii* = *Doronicum Clusii*.

L. H. B.  
N. TAYLOR.†

**ARONIA** (modification of *Aria*, a subgenus of the allied genus *Sorbus*). *Rosaceæ*. CHOKEBERRY. Ornamental shrubs grown for their attractive white flowers and for their handsome fruits, and also for the bright autumnal tints of the foliage.

Low plants: lvs. deciduous, short-petioled, finely and crenately serrate, glandular on the midrib above, convolute in bud; fls. in small corymbs, white; calyx 5-lobed, petals 5, spreading; stamens numerous; ovary 5-celled, woolly at the top, with 5 styles united at the base, the carpels connate but partly free on their ventral suture: fr. a small pome, flesh without grit-cells, top hemispherical.—Three closely related species in E. N. Amer. Closely related to *Sorbus*, which is easily distinguished by the sharply or doubly serrate, often pinnate lvs. folded in bud and without glands above, by the usually 2-3-celled ovary with the carpels connate on their ventral suture, otherwise often partly free, and by the conical top of the fr.: quite distinct in general

appearance and habit and suggesting more an affinity with *Amelanchier*.

The aronias are small shrubs with simple deciduous leaves turning bright red in autumn and with white flowers in small corymbs followed by berry-like, red, purple or black fruit. Well adapted for borders of shrubberies and quite hardy North. *A. melanocarpa* is handsomest in foliage and bloom, particularly the var. *grandifolia*; its fruit ripens in August, but soon shrivels and drops, while *A. atropurpurea* and *A. arbutifolia* have showier and usually more numerous fruits; those of *A. atropurpurea* ripen in early September and shrivel at the beginning of the winter, while those of the last-named species ripen later and remain plump and bright far into the winter.

They prefer moist situations, but *A. melanocarpa* also grows well on drier and rocky soil. Propagation is by seeds sown in fall or stratified; also by suckers and layers, or by greenwood cuttings under glass.

*arbutifolia*, Spach (*Sorbus arbutifolia*. Heynh. *Pyrus arbutifolia*, Linn. f. *A. arbutifolia*, Ell. *A. pyrifolia*, Pers. *Mespilus arbutifolia* var. *erythrocarpa*, Michx.). RED CHOKEBERRY. Upright shrub, 6-10 ft. high: lvs. short-petioled, oval to oblong or obovate, acute or abruptly acuminate, crenately serrate, glabrous above except some glands on the midrib, whitish or grayish green and tomentose or pubescent beneath,  $1\frac{1}{2}$ -3 in. long; corymbs tomentose, few- to many-fld.,  $1-1\frac{1}{2}$  in. broad; fls. white or tinged red,  $\frac{1}{2}$ - $\frac{1}{2}$  in. across: fr. subglobose or pear-shaped, bright or dull red, about  $\frac{1}{4}$  in. across. April. May. N. Y. to Minn., to Fla. and La. B.M. 3668. G.F. 3:417. G.W. 5, p. 245.

*atropurpurea*, Brit. (*Sorbus arbutifolia* var. *atropurpurea*, Schneid.). PURPLE CHOKEBERRY. Shrub, to 12 ft., closely allied to the last: lvs. oblong to obovate, grayish pubescent beneath,  $2-3\frac{1}{2}$  in. long; corymbs tomentose, many-fld.: fr. ovoid to subglobose, purplish black, about  $\frac{1}{2}$  in. high. May, June. Nova Scotia to Fla.

*melanocarpa*, Spach (*Sorbus melanocarpa*, Heynh. *Pyrus nigra*, Sarg. *A. nigra*, Koehne. *Pyrus arbutifolia* var. *nigra*, Willd.). BLACK CHOKEBERRY. Low shrub, rarely to 6 ft.: lvs. oval to obovate, abruptly acuminate or obtuse, pale green and glabrous or nearly so beneath: calyx and pedicels glabrous or nearly so: fr. globose, about  $\frac{1}{2}$  in. across, shining black. Nova Scotia to Ont., south to Fla. and Mich. April-June. B.B. 2:237. Var. *grandifolia*, Schneid. (*Pyrus grandifolia*,



382. *Aronia melanocarpa* var. *elata*. ( $\times \frac{1}{2}$ )

Lindl.). A taller, more vigorous shrub with larger, obovate or broadly obovate lustrous lvs. and larger fls. in larger corymbs. B.R. 14:1154. Var. *elata*, Rehd. Fig. 382. Similar to the preceding, but lvs. narrower, generally oblong-obovate, acute. Var. *subpubescens*, Schneid. Lvs. pubescent beneath when young.

*A. floribunda*, Spach (*Pyrus floribunda*, Lindl.). Hybrid between *A. arbutifolia* and *A. melanocarpa*, similar to *A. atropurpurea*, but usually more glabrescent. B.R. 12:1006. G.W. 5, p. 246.—It is of garden origin and several forms of it are in cult.

**ARONICUM:** *Doronicum*.

ALFRED REHDER.



**ARPOPHYLLUM** (*cimiter* and *leaf*). *Orchidaceæ*. Epiphytic evergreen orchids, with 1-lvd. sts. arising from creeping rhizomes: lvs. coriaceous or fleshy: fls. numerous, sessile, in dense cylindric spikes; sepals and petals nearly alike, spreading; lip adnate to base of the erect column, narrowed above the somewhat saccate base; pollinia 8.—About 6 species, natives of Mex., Cent. Amer., and W. Indies.

**gigantæum**, Lindl. Sts. stout, up to 1 ft. tall: lvs. 12–16 in. long: spike dense, up to 1 ft. long; fls. rose-purple, the broadly obovate lip deeper. Mex. and Guatemala.

**spicatum**, Llav. & Lex. Fig. 383. Sts. up to 8 in. tall: lvs. up to 1 ft. long: spike dense, 3–6 in. long; fls. less than  $\frac{1}{2}$  in. across, numerous; sepals and petals rose-purple; lip bright purple. Mex. B.M. 6022.

GEORGE V. NASH.

**ARRACACIA** (Spanish name of the plants). *Umbelliferae*. Also spelled *Arracacha*. Twenty to 30 species of perennial herbs closely allied to *Conium*, with calyx-teeth very small or wanting, petals broad, acuminate and inflexed, white to dark purple, fls. in large compound umbels: lvs. pinnately compound or decomposed. *A. xanthorrhiza*, Bancr. (*A. esculenta*, DC.), produces edible tuberous roots much eaten by residents of N. S. Amer.; these tubers have branches or lobes the size of carrots, and are boiled. *A. Dugesii*, Coulter & Rose, Cent. Amer., is reported as a botanic-garden plant. It is tall and coarse, aromatic: lvs. much decomposed, segm. linear.

**ARRHENATHERUM** (Greek *arren*, masculine, and *ather*, awn, in reference to the awned staminate flower). *Gramineæ*. OAT GRASS. Tall perennials with flat blades and long narrow panicles: spikelets 2-fl'd., the lower staminate, its lemma bearing a geniculate twisted dorsal awn, the upper perfect, short-awned or awnless. Species 6, Medit. region. One species, tall oat-grass (*A. elatius*, Beauv.), is cult. as a meadow grass. Dept. Agric., Div. Agrost. 20:95. There has been recently intro. into the eastern states a variety (var. *tuberosum*, Halac. *A. bulbosum*, Presl) that bears at the base of the culms a short chain of corms. A variegated form of this has been offered under the name *A. bulbosum variegatum*. A. S. HITCHCOCK.

**ARROW-ROOT**. An edible starch, derived from the rhizomes of various scitamineaceous plants, as *Maranta*, *Curcuma*, *Tacca*, *Canna*. The West Indian arrow-root is mostly from *Maranta arundinacea*. The Brazilian is from *Manihot utilissima*. The East Indian is chiefly from *Curcuma angustifolia*. Potato and maize starches are also a source of arrow-root. In the United States starch is secured from Cassava (*Manihot utilissima*) and is used as a substitute for arrow-root. See *Cyclo. Amer. Agric.*, Vol. II, p. 199, with figure of *Maranta arundinacea*.

**ARTABOTRYS** (Greek, *suspended grapes*, alluding to the clustered fruit suspended by the hooked peduncle). *Annonaceæ*. CLIMBING YLANG-YLANG. TAIL-GRAPE. Woody tropical climbers or scrambling shrubs, remarkable for their curiously hooked peduncles, and prized for the fragrance of their flowers.

Leaves smooth, evergreen, alternate: petals 6 in 2 series, both series valvate or edge-to-edge, in most species flat but in certain Malayan and African species terete or club-shaped, with a broad excavated base, above which they are constricted and connivent over the essential parts, which they almost conceal, the flat or terete limb above the constriction usually spreading and ascending, sometimes slightly incurved: stamens typically annoneaceous, closely packed, wedge-shaped or oblong with 2 dorsal pollen-sacs on the back of the thick filament and connective produced above them in the

form of a dilated hood or cap: ovaries several, seldom numerous, each with 2 erect basal ovules side by side; styles variable, sometimes oblong or club-shaped and reflexed, sometimes erect or very small; ripe carpels separate, borne in a cluster on the hardened torus or receptacle, either sessile or stipitate, more or less plum-like or olive-like, and normally containing 2 flattened seeds with hard bony testa, rising side by side from the base, grooved around the margin and containing the wrinkled albumen characteristic of all *Annonaceæ*. E. Asia, the Malay Archipelago, and Trop. Afr.—About 40 species thus far described, several of them cult. in tropical countries and grown in conservatories for their fragrant fls.

Several of the most common species have been confused. *Artabotrys uncinatus* was described by Lamarck under the name *Annona uncinata* in 1786. It was supposed to be identical with *Artabotrys odoratissimus*, R. Br., the type species of the genus, which was established in 1819. Its flowers, however, are described as having ovate-lanceolate petals with a brownish red upper part



383. *Artabotrys spicatum*. ( $\times \frac{1}{6}$ )

(or limb), and with broad claws at the base, cottony, concave within at the base and constricted between the claw and the blade. It is consequently to be identified with *Artabotrys odoratissimus* of Blume, which is distinct from *A. odoratissimus*, R. Br., and which was described as *A. Blumei* by Hooker & Thomson; while *A. odoratissimus* of Hooker & Thomson is to be referred to *A. hamatus* of Blume; and *A. intermedius*, Hassk., is regarded as a variety of *A. odoratissimus*, R. Br.

A. Shape of petals lanceolate or ovate, flat.

B. Petals glabrous, more than an inch long.

**odoratissimus**, R. Br. CLIMBING YLANG-YLANG. ALANG-ILANG SONGSONG. TAIL-GRAPE. ALANG-ILANG DE CHINA. A woody climber or half-scandent shrub: young branches puberulous, at length glabrous: lvs. short-petioled, oblong or oblong-lanceolate, acuminate, acute at the base, thin, coriaceous, both sides glabrous, glossy, reticulate between the lateral nerves: hooked peduncles 1- or 2-fl'd., extra-axillary, usually opposite a lf. or subterminal; fls. rather large, greenish to yellow, very fragrant; petals flat, glabrous, or silky-puberulous at the base, thick and coriaceous, lanceolate to oblong-lanceolate, nearly 2 in. long when full-grown, constricted near the base and connivent over the essential parts, widely spreading above the constriction, inner petals similar to the outer but slightly smaller; stamens numerous, short and thick, wedge-shaped, with the connective broadly dilated above the 2 pollen-sacs, which are adnate on the back of the fleshy filament and open extrorsely by longitudinal fissures; ovaries

glabrous, several, each with 2 erect ovules at the base; styles linear-oblong or club-shaped: berries plum-like, clustered on the hardened receptacle, oblong, narrowed at the base, nearly sessile, with a small point at the apex, smooth, yellow and fragrant when ripe. S. China, Formosa, India, Ceylon, Burma, Philippine Isls. B.R. 423.—A species widely cult. in the warm countries of the eastern hemisphere and in conservatories, for its fragrant fls. and frs. This species is tender in Cent. Fla. and should be banked with dry sand. It needs rich soil and should be well fertilized each year. Easily prop. by seeds.

BB. *Petals tomentose or pubescent, not exceeding an inch in length.*

C. *Fr. ovoid, sharp-pointed: petals ovate-lanceolate, brownish red, pubescent.*

**uncinatus**, Safford (*Annona uncinata*, Lam.). Fig. 384. A shrub with climbing divaricate branches; young branches slightly pubescent at first, at length glabrous, more or less zigzag; lvs. lanceolate or oblong-lanceolate, acuminate, usually acute at the base, glabrous on both



384. *Artabotrys uncinatus*.  
( $\times \frac{1}{2}$ )

sides, glossy, and with short thick petioles, 5–10 in. long by 2–3 in. broad: hooked peduncles glabrous, curved downwards almost like a spiral, somewhat flattened, usually opposite a lf., often with the portion of the branch above it more or less aborted, so as to make it appear terminal; calyx 3-parted, the divisions ovate-acute; petals 6, ovate-lanceolate, brownish red on the upper part, with broad claws, woolly or pubescent (“cottonneux”), concave within and constricted between the claw and the limb, the 3 outer petals about  $\frac{3}{4}$  in. long, somewhat larger than the inner, and relatively broader; ovaries about 8–12, gradually tapering upward to the obtuse stigmatic apex, clothed with minute hairs, and containing 2 basal collateral erect ovules: frs. several, rounded-ovoid, abruptly pointed at the apex, nearly sessile, about the size of a walnut inclosed in its hull, at length smooth, lightly punctate, and inclosing 2 oblong seeds truncated at the base, rising side by side from the base, more or less compressed and bearing a marginal groove around the periphery of the hard bony testa.—This species was described by Lamarck from specimens collected by Sonnerat in the E. Indies and Madagascar (see figs. Dunal Anon. pls. 12. 12a). It is very closely related to

*A. odoratissimus*, R. Br., from which it apparently differs in the broader shape, reddish brown color, and “cottony” indumentum of its petals. If, as supposed by many botanists, the two species are identical, the specific name *uncinatus* of Blume, which it more closely resembles, the latter, set apart by Hooker & Thomson as a distinct species under the name *A. Blumei*, must yield to the earlier specific name, and *A. odoratissimus*, R. Br., be retained as a species distinct from Lamarck’s though supposed by its author and his followers to be identical with it. *A. uncinatus*, like its very close ally, *A. odoratissimus*, is frequently planted in the warm regions of the eastern hemisphere for the sake of its fragrant fls.

CC. *Fr. tapering at both ends: petals linear-lanceolate, tomentose.*

**hamatus**, Blume (*A. odoratissimus*, Hook. f. & Thomson). A large scrambling shrub with elongate sarmentose glabrous branches; lvs. oblong-lanceolate, obtusely acuminate, acute at the base, 2–4 in. long by 1–1½ in. broad, coriaceous, glabrous, delicately veined on both surfaces: hooked peduncles flattened, glabrous, spirally curved, several-fl’d. but usually all but one of the fls. abortive; pedicel curved, clothed with short pubescence and bearing at the base a sessile ovate caducous bracteole; fls. yellowish ferrugineous; calyx minute, subtomentose, deciduous, deeply 3-parted, the divisions broadly ovate-acute, spreading and reflexed; outer and inner petals of equal length, 1 in. long, linear-lanceolate, obtusely acuminate, thickish, tomentose, excavated and constricted at the base, conniving over the essential parts and almost concealing them, the limb, above the constriction, curving somewhat inward, with a raised median line along the back and a groove within, the outer petals somewhat broader than the inner; receptacle plano-convex, clothed with minute hairs; stamens numerous, thick, club-shaped, obtuse, the connective swollen and rounded above the pollen-sacs; ovaries few, about 5–8, linear-oblong, glabrous, tapering upward into the terete style; mature hardened receptacle bearing 3–5 fruiting carpels 2–2½ in. long and 1 in. diam., tapering toward both ends, obtusely acuminate, rather smooth, marked with longitudinal lines within from the base to the apex and spotted with greenish and white, at length turning red; seeds 2, erect, side by side, oval, with a hard bony pericarp surrounded by a marginal groove, and a large ruminant albumen. Java, common at the base of high mts.—Widely diffused in India and Ceylon, and planted for the sake of its fragrant fls., often scrambling over garden walls. Closely allied to this species is *Artabotrys intermedius*, Hassk., which grows in the botanical gardens of Buitenzorg, on the island of Java. Its calyx is described as silky within, its petals as green and covered with fine tomentum, the exterior ones a little broader and longer than the inner (an inch long), and ovate-lanceolate in shape, and the ripe carpels obovoid and acutish.

AA. *Shape of petals cylindrical or club-shaped, fleshy: peduncles several-fl’d.*

**suaveolens**, Blume. BUFFALO THORN. DURIE CARABAO. SUSONG DAMULAG. A large woody climber or scrambling shrub: young branches puberulous: lvs. elliptic-oblong to oblong-lanceolate, 2–5 in. long by 1–1½ in. broad, acuminate, at the acute or obtuse base usually narrowed into a short glabrous petiole, coriaceous or subcoriaceous, glabrous or pubescent on the midrib beneath, glossy above, conspicuously veined on both sides: peduncles short, recurved or hooked, flattened and fasciated, puberulous, several-fl’d.; fls. very fragrant, small, yellow, borne on pedicels  $\frac{1}{2}$  in. long or less; petals all similar, about  $\frac{1}{2}$  in. long, fleshy, terete or club-shaped, broad and concave at the base, where they connive to form a dome-shaped covering over the essential parts; stamens many, short and thick,



wedge-shaped, with a very broad truncate or flattened connective above the two pollen-sacs; ovaries few, about 3-5, broadly ovoid, subcompressed, terminating in a small stigma and containing 2 basal ovules; fruiting carpels 2 or 3, oblong, obtuse, slightly contracted at the base, sessile; seed usually solitary. All Malayan provinces at low elevations, common; distribution from Sylhet to Burma; also occurring in the Philippines.—The natives use this plant to form hedges and fences, interweaving the long sarmentose branches, which form an effective barrier against cattle and buffalo. Often planted near houses on account of the exquisite fragrance of its fls. Suitable for forming inclosures in Fla., Porto Rico, Hawaii, and S. Calif.

W. E. SAFFORD.

**ARTEMISIA** (*Artemisia*, wife of Mausolus). *Compositæ*. WORMWOOD. A large genus of aromatic and bitter herbs and small shrubs, mostly in the northern hemisphere, and most abundant in arid regions.

Leaves alternate, often dissected: heads small and mostly inconspicuous, numerous, and generally nodding, with yellow or whitish florets, wholly discoid, the involucre imbricated in several rows.

In the West, many of the species, particularly *A. tridentata*, are

known as sage brush. Grown for their medicinal properties or for foliage effects. The drug product of the artemisias is large. *A. Absinthium* is the chief source of absinthe; *A. Barrelieri*, Bess., of Spain, is said to be used in the preparation of Algerian absinthe; *A. Cina*, Berger, of the Orient, is the source of santonica. The garden kinds are perennials and thrive in the most ordinary conditions, even in poor and dry soil. Propagation is mostly by division.

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A. Heads with two kinds of florets (heterogamous).

B. Disk-fls. with both stamens and pistils, but the ovary abortive (not producing seed); style usually entire.

1. **Dracunculus**, Linn. TARRAGON. ESTRAGON. Herb; green and glabrous, with erect, branched sts. 2 ft. high: radical lvs. 3-parted at the top; st.-lvs. linear or lanceolate, entire or small-toothed: panicle spreading, with whitish green, nearly globular fl.-heads. Eu. R. H. 1896, p. 285.—Tarragon lvs. are used for seasoning, but the plant is little grown in this country. The lvs. may be dried in the fall, or roots may be forced in a coolhouse in the winter. Prop. by division; rarely produces seed. See *Tarragon*.

2. **canadensis**, Michx. Herb, 2 ft. or less high, glabrous or very nearly so: lvs. usually 2-pinnate, with filiform, plane lobes: fls. in a long, narrow panicle, with numerous small greenish heads. Wild on banks and plains in the northern part of the country.

3. **filifolia**, Torr. Shrubby, canescent, 3 ft. or less high, very leafy, the branches rigid: lvs. 3-parted into linear filiform segms., scarcely  $\frac{1}{8}$  in. wide: panicle long and leafy. Plains, W.—Plant has a purplish, mist-like aspect when in fr.

BB. Disk-fls. perfect and fertile; style 2-cleft.

c. Receptacle hairy.

D. Racemes not 1-sided.

4. **frigida**, Willd. Herb, 8-12 in., with a woody base, silvery canescent: lvs. much cut into linear lobes: heads small and globular, with pale involucre, in numerous racemes. Plains and mts. W. Intro. 1883.—Good for borders. Known in Colo. as "mountain fringe," and used medicinally.

5. **sericea**, Web. Sub-shrub or more usually a creeping woody perennial with finely divided silky foliage: lf.-segms. distinctly stalked: fl.-heads in solitary or paniculately branching racemes, yellowish white. Summer. Siberia.

6. **argentea**, L'Her. Shrubby, erect, 1-2 ft.: lvs. white-silky, 2-pinnate, the lobes linear or lanceolate: heads globular, tomentose, nodding, in racemose panicles. Madeira.—Useful for rockwork.

7. **Absinthium**, Linn. WORMWOOD. ABSINTHIUM. Almost shrubby, 2-4 ft. high, spreading and branchy, white-silky: lvs. 2-3-parted into oblong, obtuse lobes: heads small and numerous, in leafy panicles.—Wormwood is native to Eu., but it occasionally escapes from gardens. It is a common garden herb, being used in domestic medicine, especially as a vermifuge. Wormwood tea is an odorous memory with every person who was reared in the country. See *Absinthe* and *Wormwood*.

DD. Racemes 1-sided.

8. **arborescens**, Linn. Shrubby, 1-2 ft., the sts. erect and angled: foliage finely dissected, silvery white, the upper lvs. almost sessile, the lower petiolate: fls. in somewhat 1-sided racemes, bright yellow. Medit. region.—Hardy only as far north as Washington, D. C.

cc. Receptacle not hairy.

D. Lvs. white or silvery throughout.

9. **Stelleriana**, Bess. (*A. endoviciana*, Hort.). OLD WOMAN. DUSTY MILLER. BEACH WORMWOOD. Fig. 385. Herb, 2 ft., from a woody creeping base, densely white tomentose: lvs. pinnatifid, with obtuse lobes: heads large and many-fld., in a racemose-glomerate infl. N. E. Asia and on the Atlantic coast from Mass. to Del.—Attractive from its whiteness. Useful for borders.

10. **Purshiana**, Bess. (*A. gnaphalodes*, Nutt. not Hort.). Sts. and lvs. white-woolly on both sides, differing from *A. ludoviciana* in which the lvs. are usually glabrate above when old: lvs. acute or acuminate, overtopped by the spicate-paniculate infl. of white fls. Missouri R. to the Pacific.



386. *Artemisia pontica*.  
( $\times \frac{1}{2}$ )



385. *Artemisia Stelleriana*, one of the  
Dusty Millers.

DD. *Lvs. white on 1 side only or green throughout.*

11. *Abrótanum*, Linn. SOUTHERNWOOD. OLD MAN. Shrubby, 3-5 ft., green and glabrous, the st. much branched and rather strict: lvs. 1-3-pinnately divided, the divisions fine-filiform: panicle loose, with yellowish white heads. Eu.—Southernwood is grown for its pleasant-scented foliage; and it sometimes escapes into waste places. See *Southernwood*.



387. *Artemisia vulgaris*.  
( $\times \frac{1}{2}$ )

ful plant with fragrant foliage. G. 29:409.—Mugwort is grown for the ornament of its foliage. There are variegated-lyd. and golden-lyd. varieties. It was once a domestic remedy. Variable.

14. *ludoviciana*, Nutt. WESTERN MUGWORT. WHITE SAGE. Erect or ascending herb, 2-3 ft., white-tomentose or lvs. becoming greenish above: lvs. linear to oblong, the lower ones toothed or parted, the upper ones entire: heads small, bell-shaped, paniculate. Plains and banks, W. Intro. 1891.

AA. *Heads with perfect fls. throughout: receptacle not hairy.*

15. *arbúscula*, Nutt. SAGE BRUSH. Shrubby, a foot or less high: lvs. short, wedge-shaped, 3-lobed, the lobes obovate and often 2-lobed, canescent: panicle simple and strict, often spike-like, the 5-9-fl. heads erect. Plains and mts., Colo. and Wyo., N. W.

16. *tridentata*, Nutt. SAGE BRUSH. Shrubby, reaching height of 12 ft. although often only a foot high, branchy, canescent: lvs. wedge-shaped, 3-7-toothed or lobed, truncate at the summit, the uppermost ones narrower: heads 5-8-fl. Plains, W. Intro. 1881.



388. *Artemisia lactiflora*. No. 13.

12. *pónica*, Linn. ROMAN WORMWOOD. Fig. 386. Shrubby, erect, 1-4 ft.: lvs. canescent below, pinnatisect, the lobes linear: panicle open and long, with small, globular, nodding, whitish yellow heads. Eu.—Roman wormwood is used for the same purposes as *A. Absinthium*, and is more agreeable. A source of absinthe.

13. *vulgáris*, Linn. MUGWORT. Fig. 387. Herb, erect, paniculately branched, the sts. often purplish: lvs. white-cotony beneath but soon green above, 2-pinnately cleft, with lanceolate lobes; upper lvs. sometimes linear: heads many, oblong, yellowish. Eu. and N. Amer., and naturalized in eastern states.—A white-fl. form has been sold as *A. lactiflora*. Fig. 388. It is a beautiful

17. *sacròrum*, Ledeb. Annual or biennial, shrubby below: lvs. long-petioled, ovate, pinnatisect and the segms. again pectinate, hoary or white-pubescent, the rachis winged: fls. 15-20 in the head, the heads nodding and in separate slender racemes. S. Russia, Siberia, etc. Var. *viride*, Hort., with green foliage, is the attractive SUMMER FIR recently intro., grown as an annual for its neat pyramidal form (3-5 ft.) and much dissected rich green foliage.

*A. Baumgarteni*, Bess. Compact, shrub-like, with small lvs. and yellow fls. standing erect above the lvs. S. Eu.—*A. lanáta*, Willd (*A. pedemontana*, Balbis). Low caespitose plant with finely cut, silvery foliage for which it is chiefly grown. Spain.

N. TAYLOR.†



389. Globe artichoke.

ARTHROPÒDIUM (Greek, *joint* and *foot*, alluding to jointed pedicels). *Liliaceæ*. Herbaceous perennials, allied to *Anthericum*, grown in the open in the South and otherwise in greenhouses.

Tufted herbs 1-3 ft. high, with fibrous fleshy roots: lvs. linear or lanceolate, crowded at base of st.: scape simple or branched; fls. white or violet, in racemes or panicles, on pedicels jointed at the middle; perianth persistent, the segms. 6 and distinct and 3-nerved; stamens 6, shorter than perianth: fr. a subglobose caps., 3-valved.—About 10 species in Austral., New Zeal., etc. Cult. and prop. as for *Anthericum*, requiring no special treatment.

*cirrhatum*, R. Br. Glabrous, to 3 ft.: lvs. numerous, deep green, 2 ft. or less long: scape stout, naked, bearing a much-branched panicle often 1 ft. long; fls. white, star-shaped, 1 in. or less in diam., the segms. oblong-lanceolate, acuminate; filaments bearing 2 tendril-like appendages (whence the name). New Zeal. B.M. 2350.—Reported in S. Calif. L. H. B.

ARTHROTÁXIS: *Athrotaxis*.

ARTICHOKE (*Cynara Scolymus*, Linn.). *Compositæ*. The artichoke (or the Globe artichoke, to distinguish it from the Jerusalem artichoke) is a strong thistle-like plant (Fig. 389), grown for the edible flower-heads (Fig. 390). It is native in southern Europe and northern Africa, and is not hardy in the northernmost parts of the United States. It is perennial, but the plantation should be renewed every two or three years. See *Cynara*.

The artichoke is propagated by seed or by suckers. The latter is the preferable method, for a good strain or variety may thus be perpetuated. The buds or shoots are detached from the old crown in spring before growth begins. Seeds produce bearing plants the following year, although heads may be secured the same autumn if the season is long and if the seeds are started early under glass.

The soft fleshy receptacle of the flower-head and the thickened base of the scales (or involucre bracts)



are the edible parts. They are sometimes eaten raw, but are usually boiled and served with drawn butter or sauce. The leaves are sometimes blanched after the manner of sea-kale and cardoon, and are cooked as a pot-herb.

In the southern states and California, the artichoke is grown without difficulty. In California, particularly, it thrives as a field crop. In northern gardens, even professional and skilled gardeners have usually given



390. Edible heads of artichoke. ( $\times \frac{1}{2}$ )

Instead of covering with manure or litter, place a cap or miniature tent over the crown to give it air and freedom of breathing. The flower-heads are now regularly and commonly found on sale at the green grocers' in our larger eastern cities, and the supply comes mostly from California. The large seeds may need special treatment to make them germinate promptly. The better way, undoubtedly, for the home gardener who may wish to try a few plants, is to secure sucker plants from one of the big seedsmen or professional plant-growers. Set them in fairly good warm soil, 3 feet each way, or 4 by 2, and give clean cultivation. Protect the crowns during winter as suggested, and in following spring thin to about three shoots. Edible heads may be expected in July. They are gathered for use before the flower-heads open. It is better to cut the old stalk down to the ground after the head is removed, for the root is not then weakened and new shoots will spring up. There are a number of varieties, Large Green Paris being the one mostly mentioned in California. In parts of Europe the artichoke is grown with special skill, but it has never been a prominent vegetable in American gardens.

T. GREINER.

**ARTICHOKE, JERUSALEM** (*Helianthus tuberosus*, Linn.). *Compositæ*. The Jerusalem artichoke is the subterranean stem tuber of a native sunflower. Fig. 391. The plant is coarse and upright, and persists as a weed when once introduced. It does not need excessively rich soil, nor high culture, succeeding on any warm well-drained land without attention. It is planted much after the manner of potatoes, and it will grow and produce its many smallish, white, edible tubers.



391. Tuber of Jerusalem artichoke. ( $\times \frac{1}{2}$ )

In late fall, the plants may be pulled up, exposing to view the tubers that are clustered around the roots near the main stalks so that they can be easily gathered with the help of a hoe or potato hook, if wanted for use as a culinary vegetable; or, if grown for hog-feed, the hogs may be turned right into the field and allowed to dig their own. All farm stock seems to like the artichoke tubers. If shredded or ground and mixed with meals, they make a good winter ration, as a variety, for poultry. More prolific than common potatoes, and far more

easily grown, the artichoke is one of the crops that may be considered for cultivation as a succulent vegetable to feed to cattle, swine, and other farm animals during winter. Raw or boiled and served cold with oil and vinegar, this tuber also makes a very palatable winter or spring salad, and for this purpose it finds a limited sale in our markets. The chief commercial demand for it is for seed purposes. Frost has no injurious effect on the tuber in the ground, and the easiest way to winter it, therefore, is by leaving the plants alone until spring and then digging the tubers. If already harvested, they may be pitted like potatoes, beets, or other roots, and will require very little covering. Mammoth White French is said by some propagators to be an improved strain of the Jerusalem artichoke. If there is danger of the plant spreading and becoming a weed, hogs, when given a chance at it, will soon clear the land of the tubers. It was cultivated by the Indians. See *Helianthus*.

T. GREINER.

**ARTOCÁRPUS** (*artos*, bread, and *carpos*, fruit). *Morææ*. BREAD-FRUIT. Milky-juiced tropical trees, some of them yielding edible fruits, ornamental in foliage.

Leaves alternate, large, thick, entire or pinnate; dioecious; staminate fls. on long spikes, the sepals and

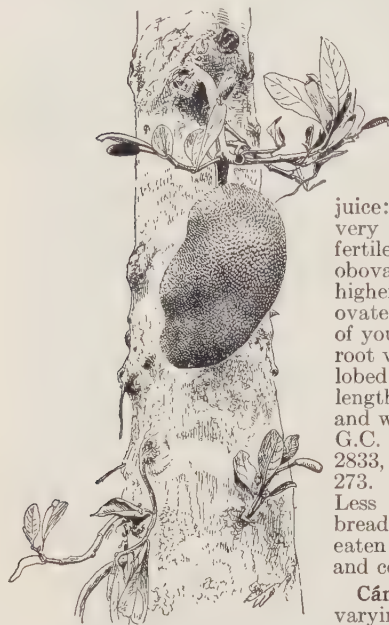


392. Bread-Fruit.—*Artocarpus incisa*, showing a fruit of edible size. ( $\times \frac{1}{2}$ )

stamens 2; pistillate fls. in globular heads, with simple 1-ovuled ovary and bifid stigma; fr. a large fleshy mass or syncarp, formed of the aggregated fls.—A genus of 40 species containing many tropical fr. plants, originally from the E. Indies, sometimes cult. with difficulty in northern botanic gardens for their great economic interest, and throughout the world in the tropics. They need a hot, moist atmosphere, much water, and perfect drainage. Prop. slowly by cuttings of young lateral growth. Bread-fruit seeds are boiled and eaten.

*incisa*, Linn. f. (*A. communis*, Forst.?). BREAD-FRUIT. Fig. 392. Tree, 30-40 ft., with a viscid, milky juice; branches fragile; lvs. 1-3 ft. long, leathery, ovate, cuneate and entire at base, upper part 3-9-lobed; male fls. in a dense club-shaped yellow catkin, 10-16 in. long; female fls. in a subglobular echinate head, having a spongy receptacle; fr. 4-6 in. diam., typically mucated, but in the best cult. varieties reticulated only, and often seedless. Gt. 39, p. 273. Gng. 5:233, and

B.M. 2869-2871, where the romantic story of its transfer to the W. Indies is told.—Sparingly cult. in S. Fla. and in greenhouses of botanic gardens. Eaten cooked, as a vegetable rather than as a fruit; widely used in tropics.



393. Jack-Fruit.—*Artocarpus integrifolia*.

**integrifolia**, Linn. f. JACK-FRUIT OR TREE. Called also JACA. Fig. 393. Tree, 30 ft., with milky juice: lvs. 4-6 in. long, very various; those of fertile branches nearly obovate, entire; those of young shoots from the root very narrow, or 2-3-lobed: fr. attaining a length of 18 in. or more, and weight of 30-40 lbs. G.C. III. 20:717. B.M. 2833, 2834. Gt. 39, p. 273. Gn. 35, p. 455.—Less palatable than the bread-fruit, and usually eaten only by natives and coolies.

**Cannonii**, Bull. Lvs. varying from cordate to deeply 3-lobed, 1 ft. long, red beneath, bronzy crimson and purple above, very showy. Society Isls. F.S. 21:2231, 2232.—Perhaps better included under *Ficus Cannonii*, according to Nicholson, but here retained in *Artocarpus*.

N. TAYLOR.†

**ARUM** (ancient name). *Araceæ*. WILD GINGER. Tuber-bearing low herbs, of few species, in Eu. and W. Asia, most of them grown in pots.

Lvs. simple, the petiole sheathed at the base: spathe convolute, variously colored, mostly including the short spadix; pistillate fls. at the base. Monogr. by Engler in DeCandolle's *Monographia Phanerogamarum*, Vol. II.

Arums are grown usually as oddities, mostly under the general name of callas. Some of the species are hardy; others, as *A. palæstinum*, are tender, and require glass-house treatment. The kinds are managed in essentially the same way as the fancy-leaved caladiums. Plant the tubers sufficiently deep that roots may form from near the top. Give rich soil, and water freely when growing or in bloom. The hardy species should be well mulched in late fall. They thrive best in partially shaded places and in rich soil. Propagation is by natural offsets; also by seeds or berries, which some species produce freely. Some of the species are acrid-poisonous.

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detruncatum, 3.

Dioscoridis, 2.  
elongatum, 5.  
gratum, 5.  
immaculatum, 6.  
intermedium, 6.  
italicum, 7.  
maculatum, 6.  
Malyi, 6.  
mammatum, 7.  
nigrum, 5.

Nordmannii, 5.  
orientale, 5.  
palæstinum, 4.  
pictum, 1.  
sanctum, 4.  
spectabile, 2.  
syriacum, 2.  
variolum, 5.  
vulgare, 6.  
Zelebori, 6.

A. Mature lvs. cordate, oblong-ovate.

1. **pictum**, Linn. f. (*A. corsicum*, Loisel). Lvs. appearing in spring, long-petioled, light green: spathe bright violet, swollen at the base: spadix purple-black, exceeding the spathe. Corsica, Balearica, etc.—Hardy.

AA. Mature lvs. hastate or sagittate.

B. Tuber round-flattened or oblate, the lvs. and peduncles arising from a depressed center: lvs. appearing before the spathe.

2. **Dioscoridis**, Sibth. & Smith (*A. spectabile*, Regel. *A. syriacum*, Blume. *A. cyprium*, Schott). Lf.-blade oblong-triangular or ovate-triangular: spathe-tube pale within, the limb 6-8 in. long, lanceolate-oblong, and colored with large lenticular purple spots: spadix short, included. Asia Minor.—Runs into many forms, with variously marked spathes. Pots.

3. **detruncatum**, Mey. Lvs. more or less truncate at the base, the blade shorter than in the last: spathe yellowish green and purple-spotted, large (10-15 in. long) and short-stalked, the limb acuminate. Persia.—Hardy.

4. **palæstinum**, Boiss. (*A. sanctum*, Hort.). BLACK CALLA. SOLOMON'S LILK. Lvs. cordate-hastate, 6 in. broad across the base and about equal in length, the middle lobe broad-ovate and nearly blunt: spathe about the length of the lf., with a short green tube, and an elongated lance-oblong tapering limb, which is greenish on the outside and continuous black-purple within, the tip sometimes recurving: spadix shorter than the spathe, the upper part dark-colored. Palestine. B.M.



394. *Arum maculatum*. (×¼)

5509. Gn. 45, p. 311; 59, p. 317; 71, p. 102.—Perhaps the most popular arum at present, being grown in pots as an oddity.

5. **orientale**, Bieb. A foot high: lvs. brownish, broadly hastate-sagittate, the front lobe oblong-acute: spathe-tube oblong-ovoid and white within, the limb ovate to oblong and intense black-purple (rarely pale), resembling *A. maculatum*.—A hardy species from Asia Minor, running into many forms. Some of the plants



referred here are *A. nigrum*, *A. variolatum*, *A. Nordmannii*, *A. gratum*, Schott; *A. elongatum* and *A. albispathum*, Ster. (not *A. albispathum*, Hort., which is *A. italicum*).

**BB.** *Tuber ovoid or oblong, propagating horizontally, the lvs. and peduncles arising from the apex: lvs. appearing before or with the spathe.*

**6. maculatum**, Linn. (*A. vulgare*, Lam.). LORDS-AND-LADIES. CUCKOO-PINT. WAKE

ROBIN (in England). Fig. 394. About a foot high: lvs. usually black-spotted, hastate or sagittate, the front lobe triangular-ovate, about as high as the spathe: spathe somewhat contracted above the base, the margins of the limb becoming inrolled, spotted with purple: spadix shorter than the spathe, purple. Eu.—A hardy species, of many forms. A form with spotted lvs. and whitish tube with medial purple zone, is *A. immaculatum*, Reichb., and *Zelebör*, Schott. Var. *angustatum*, Engler (*A. intermedium*, Schur. *A. Malyi*, Schott) has a narrow light purple spathe. Var. *alpinum*, Engler (*A. alpinum*, Schott & Kotschy) has peduncles longer, and an ovate-lanceolate spathe.

**7. italicum**, Mill. (*A. cylin-draceum*, Gasp.). Fig. 395. Larger than the last: lvs. hastate, nearly truncate below, light-veined: spathe scarcely swollen below, the limb erect and not expanding and including the short spadix (tip sometimes deflexed after flowering), yellowish or white and faintly striate. Eu. B.M. 2432.—A hardy species; also grown in pots. In the open, the lvs. appear in the fall. A very variable species. Var. *canariense*, Engler (*A. canariense*, Webb & Berth.), has narrow lf.-lobes and spathe. Var. *concinatum*, Engler (*A. concinatum* and *A. marmoratum*, Schott), has broad gray-spotted lvs. Var. *byzantinum*, Engler, (*A. byzantinum*, Schott), has spathe-tube oblong, white inside and purple at the mouth, and an acuminate purple or green limb. Var. *albispathum*, Hort., has a white spathe.

L. H. B.

**ARÚNCUS** (old name). *Rosaceæ*. GOAT'S-BEARD. Ornamental tall perennial herbs, cultivated chiefly for the large showy panicles of white flowers and also for the handsome much-divided foliage.

Leaves bi- to tripinnate with minute or wanting stipules: fls. dioecious, small; calyx 5-lobed; petals 5; stamens many; pistils commonly 3: the follicles dehiscent, glabrous, usually 2-seeded; seeds minute, dull.—Two species in N. Amer., N. and W. Eu., N. Asia to Japan. Formerly usually referred to *Spiræa*, which differs chiefly in its shrubby habit, simple, rather small lvs., and 5 pistils.

They are tall perennial herbs with large compound leaves and small white flowers in slender spikes forming large terminal panicles. The species in cultivation is hardy North; it prefers rich rather moist soil and grows well in half-shady situations. Propagation is by seeds, which germinate readily, and also by division of older plants.

**sylvester**, Kostel. (*A. Aruncus*, Karsten. *Spiræa Aruncus*, Linn.). Tall (5–7 ft.), erect branchy herb: lvs. large, 2–3-pinnate; fls. ovate to lanceolate, sharply and doubly serrate, 1–2½ in. long: fls. about ½ in. across: follicles deflexed in fr. May–July. Rich woods, N.

Amer., N. Eu. and Asia.—A desirable hardy border plant of easy cult. Var. *Kneiffii*, Zabel. Lfts. linear-lanceolate, irregularly serrate or incised, long-acuminate: fls. as in the type. M.D.G. 1897:260.—Very graceful form with its finely cut foliage.

*A. astilboides*, Maxim. (*Spiræa Aruncus* var. *astilboides*, Maxim.). Similar to the preceding, but lower and smaller in every part: lfts. more deeply serrate, ¾–1½ in. long: infl. less compound, with denser oblong branchlets: follicles erect. Japan.—Apparently not in cult.; the plant cult. under the name of *Spiræa astilboides* is *Astilbe astilboides*, Lem., which is a true *astilbe*.

ALFRED REHDER.

**ARUNDINÀRIA: Bamboo.**

**ARÚNDO** (an ancient Latin name for *A. Donax*). *Gramineæ*. REED. Tall reed-like grasses with broad

flat blades and large plume-like terminal panicles: spikelets 3–4-fld.; glumes narrow, acute; rachilla naked; lemmas long-pilose.—Species about 6, in the warmer regions of the Old World.

**Dónax**, Linn. GIANT REED.

Figs. 396, 397. Tall and stout,

as much as 20 ft., from large knotty rootstocks: blades numerous, cordate-clasping and hairy-tufted at base, 2–3 in. wide on main st.: panicle 1–2 ft.; spikelets 6 lines long. G. 2:419. Gn. 1, p. 391; 3, p. 493; 8, p. 199; 17, p. 407; 27, p. 307. G.M. 50:253. G.W. 2:337; 3:416; 8:613.—Cult. for ornament because of the regularly placed lvs. and the large plumes. A smaller less hardy variegated form with white-striped lvs. is cult. under the name of var. *variegata* (var. *versicolor*; var. *picta*). G. 18:137. Var. *macrophylla* has large glaucous lvs.

**conspícua**, Forst. f. Sts. lower and more slender: blades long and narrow, 2–4 ft.: panicle 1–2 ft., silvery or yellow-white; spikelets 1–3-fld. B.M. 6232. F. 1874:61. G. 1:344; 9:64; 19:21. Gn. 49, p. 229; 66, p. 121. G.M. 55:408. G.W. 15:51. Native of New Zealand.—Less hardy than *A. Donax*.

A. S. HITCHCOCK.

**ÁSARUM** (ancient obscure name). Including *Hexastylis*. *Aristolochiææ*. ASARABACCA. Low, nearly stemless herbs, sometimes planted in wild borders and used as ground-cover in shady places.

Perennial: sts. creeping, with odd purplish or brown fls. on the surface of the ground (or nearly so), underneath the heart-like or kidney-like lvs.: corolla wanting or merely rudimentary, but calyx corolla-like, with a regular 3-parted limb; stamens 12, with tips on the filaments projecting beyond the anthers: ovary inferior, maturing into a rather fleshy globular caps.—A dozen or more species in the temperate parts of the northern hemisphere. The asarums inhabit rich, shady woods, spreading on the ground, and the fls. are unseen except by the close observer. They are of easy culture if transplanted to rich, moist places. They make attractive carpets in borders and groves. The species described are sold by dealers in native plants. Some of the species are reported to have medicinal properties. Several species of doubtful validity have been described from the southern states.

396. *Arundo Donax*.



395. *Arum italicum*. (×¼)



A. *Plant markedly pubescent.*

**canadense**, Linn. WILD GINGER. CANADA SNAKE-ROOT. Lvs. about 2 to a plant, thin, kidney-shaped, pointed, with a deep and open sinus, not mottled: fl. slender-stalked, with lance-acuminate calyx-lobes an inch or more across at the expanded mouth, chocolate-brown; style 6-lobed. Frequent in woods E. B.M. 2769. A.G. 13:517.

**Härtwegii**, Wats. Tufted, loose-pubescent: lvs. large and thick, cordate, with rounded basal lobes, mostly acute at the apex, margin ciliate, glabrous and mottled above: fl. stout-stalked, the lobes often ovate and long-pointed, the ovary inferior; styles 6. Sierra Nevada, 4,000–7,000 ft. altitude.

**europæum**, Linn. Lvs. kidney-shaped, evergreen, dark green, the petiole 3–5 in.: fls. greenish purple,  $\frac{1}{2}$  in., with incurved lobes; styles 6, and grooved or 2-parted, recurved. Eu.

AA. *Plant slightly or not at all pubescent.*

**caudatum**, Lindl. WILD GINGER. Rather slender, with long rootstocks, sparingly pubescent: lvs. cordate-kidney-shaped, and more or less cupped or cucullate, acute or obtusely: fls. slender-stalked, the calyx-lobes oblong or triangular and attenuate; styles united. Pacific coast.—Evergreen.

**Lémmonii**, Wats. Like the last, but lvs. plane or flat, rounded at apex, less pubescent, calyx-lobes short. Sierra Nevada.

**virginicum**, Linn. Lvs. broad-ovate or orbicular, rounded at the top, the sinus narrow: fl. short-stalked, purple, the calyx-lobes broad and rounded; styles 6, 2-lobed; anthers not pointed. Va., S. in mts.

**arifolium**, Michx. Lvs. thickish and usually mottled, orbicular to hastate, obtuse: fls. stout-stalked, urn-shaped and much contracted at the throat; styles 6, 2-lobed; anthers pointed. Va., S.

L. H. B.

**ASCLEPIAS** (ancient Greek and Latinized name). *Asclepiadaceæ*. MILKWEED. SILKWEED. Perennial milky-juiced herbs, sometimes used in the hardy border or wild garden.

Erect, with deep thick and hard perennial roots: lvs. opposite or verticillate (rarely alternate), entire: fls. gamopetalous, the corolla segms. generally strongly reflexed; stamens 5, attached to the corolla, the anthers more or less united about the stigma; between the corolla and the stamens is a crown of 5 cornucopia-like horns or appendages; pollen cohering into a waxy mass (pollinium) which is removed bodily by insects that visit the fl.: fr. 2 warty, or echinate or smooth follicles.

The pollination of an asclepias fl. is shown in Fig. 398. The pollen-masses are usually twin (as at *b*), and the handle or caudicle lies in a chink on the side of the stigma. The pollen-masses become attached to the legs or mouth parts of the insect, and are thereby transferred to another fl.—The milkweeds are common in waste places in N. Amer., and are rarely cult. About 80 species are known, mostly North American, but others in Cent. and S. Amer. and Afr. Several species (described below) have been offered by dealers in native plants. The butterfly-weed and some others are very showy and worthy of more general attention. The large-lvd. kinds are desirable when heavy foliage effects are wanted. They are all perennials of the easiest cult. Prop. by division, rarely by seeds.

A. *Fls. (corolla and crown) orange.*

**tuberösa**, Linn. BUTTERFLY-WEED. PLEURISY ROOT. Fig. 399. Hairy, 2–3 ft. high, from long, horizontal roots, with more or less alternate, lance-oblong or lance-linear lvs.: umbels several, short-peduncled: pods pubescent, erect. Dry banks and fields; widespread, and not infrequent. B.R. 76.—A handsome plant.

AA. *Fls. in shades of red or purple.*

**Curassávica**, Linn. Plant glabrous, 2 ft. or less: lvs. opposite and short-petioled, thin, oblong-lanceolate: corolla scarlet: pods glabrous, erect. Fla. and La. B.R. 81.

**incarnata**, Linn. Glabrous or nearly so, leafy and branching, 3 ft.: lvs. opposite, oblong-lanceolate: corolla rose-purple to flesh-color, with oblong lobes: pods glabrous, erect. B.R. 250. Var. **púlchra**, Pers. Hirsute, and lvs. broader. Swamps.—Common.

AAA. *Fls. greenish, yellowish or white (sometimes purple-tinged, especially in A. quadrifolia).*

B. *Pods tomentose and soft-spiny.*

**speciosa**, Torr. (*A. Douglasii*, Hook.). St. stout and simple, 3 ft. or less, fine-tomentose or becoming glabrous: lvs. large and broad, ovate, transversely veined, short-petioled: fls. purplish and large, the peduncle of the umbel shorter than the lvs. Neb. W. and S. B.M. 4413.

**Cornùtii**, Decne. (*A. syriaca*, Linn.). Differs from last in having obtuse and short hoods to the crown, taller, less pubescent: lvs. oblong or oval: fls. dull purple, in large, more or less nodding umbels. Mn. 7:221.—The common milkweed of the eastern states.

BB. *Pods glabrous and unarmed.*

c. *Fruiting pedicels decurved or deflexed, the pods erect or ascending.*

**amplexicaulis**, Michx. Plant glabrous and glaucous: st. decumbent, 1–2 ft. long: lvs. numerous, cordate-ovate and clasping, obtuse, succulent: corolla green-purple. Barrens, N. C. and S.

**phytolaccoides**, Pursh (*A. nivea*, Sims). Plant glabrous and green, 3–4 ft., erect: lvs. thin, oval to lance-oval, acuminate and short-petioled: fls. greenish, in large, loose umbels. Moist ground; frequent. B.M. 1181.

**Hállii**, Gray. Stout, puberulent: lvs. thickish, ovate-lanceolate or oblong (3–5 in. long), short-petioled: fls. greenish white and purple, in few many-fl. umbels. Colo. G.C. III. 28:183.



398. Milkweed flower, showing pollination.

397.  
Plume of *Arundo*  
*Donax*. ( $\times \frac{1}{8}$ )



*variegata*, Linn. Two ft. or less high: lvs. 3-7 pairs, oval, ovate or oblong, thinnish, green and glabrous above and pale beneath: fls. white and pink, in 1-3 umbels. Dry, shady places, central and southern states. B.M. 1182.

*ericiarpa*, Benth. Densely woolly all over: lvs. alternate or in 3's, long-oblong or lanceolate, short-petioled: fls. dull white, in few or several umbels. Calif.

cc. *Fruiting pedicels erect, and the pods erect.*

*quadrifolia*, Linn. About 2 ft., not branched, with lvs. towards the top of the st. in whorls of 4: lvs. ovate or lance-ovate, acuminate, thin, nearly or quite glabrous: fls. pink to white in 2-4 loose umbels. Dry soil; frequent. L.B.C. 13:1258.

*verticillata*, Linn. About 2 ft., slender, very leafy: lvs. in whorls of 3-6, very narrow-linear and revolute: fls. greenish white, in many small umbels. Dry soil; frequent. L.B.C. 11:1067.

Var. *pumila*, Gray. A few inches high from a fascicled root: lvs. filiform, crowded. Plains, W.

*mexicana*, Cav. Height 5 ft. or less: lvs. in whorls of 3-6, or sometimes opposite or fascicled, linear or narrow-lanceolate: fls. greenish white or purplish in dense, many-fl. umbels. Ore., W. and S. L. H. B.



399. *Asclepias tuberosa*. ( $\times \frac{1}{4}$ )

G.F. 5:257 (adapted in Fig. 400). Mn. 3:65.

*stans*, Michx. ST. PETER'S-WORT. Tailer, scarcely branched: st. 2-edged, stout: lvs. thicker, broad-oblong or oval and clasping: petals obovate; styles 3-4.

L. H. B.

ASH: *Frazinus*.

ASÍMINA, (from *Assiminier*, a French-and-Indian name). *Annonaceæ*. PAPAW (the papaw of literature is *Carica*, which see). Small trees or shrubs, grown chiefly for their handsome large foliage and for their attractive flowers; also sometimes for their edible fruit.

Low shrubs, and 1 species a small tree: lvs. alternate, usually deciduous, entire: fls. axillary, solitary or few, nodding, short-stalked; sepals 3, smaller than petals,



400. *Ascyrum hypericoides*. ( $\times \frac{1}{2}$ )

deciduous; petals 6, the inner ones smaller, usually upright; stamens numerous, crowded, with short filaments; pistils 3-15, separate, 1-celled with many ovules: fr. consisting of 1 or few oval to oblong berries with rather large compressed seeds in 1 or 2 ranks.—Eight species in E. N. Amer. Description of all species is given in Gray, Syn. Fl. N. Amer. I, pt. 1, pp. 62 and 464.

Asiminas are ornamental trees or shrubs with handsome large foliage, of disagreeable odor when bruised, conspicuous white or purplish flowers in early spring and large edible fruits in autumn. Only two species are cultivated, of which the arborescent one is the hardier and the handsomer in foliage, while the more tender *A. grandiflora* has larger and showier flowers.

They grow best in rich and moist soil. They transplant with difficulty. Propagation is by seeds sown in autumn, or stratified and sown in spring, or by layers in autumn; also by root-cuttings. In the North, the seeds should be sown in pots or pans.

*triloba*, Dunal (*Annona triloba*, Linn.). Fig. 401. Small tree, 10-40 ft.: lvs. cuneate, obovate-oblong, acute,  $\frac{1}{2}$ -1 ft. long, glabrous: fls. with the lvs. from branches of the previous year, green when expanding, changing to purplish red, with yellow in the middle, 2 in. broad: fr.



401. *Asimina triloba*. ( $\times \frac{1}{4}$ )

oblong, 2-6 in. long, dark brown. *S. states*, north to N. Y., west to Mich. and Kan. S.S. 1:15, 16. B.M. 5854. Gn. 33, p. 321. G.F. 8:495. A.G. 44:713. R.H. 1911, pp. 134, 135.—This is the only arborescent species of the genus. It is well worth a place in the garden, for its large foliage is very handsome and the fls., appearing in the early spring, are attractive. The large fr. is edible, and may be still improved by cult. and careful selection of the best varieties. Many persons do not relish the highly aromatic flavor; and the large seeds are a disadvantage. The tree has proved hardy in Mass. and Ont. One or 2 named forms have been offered.

*grandiflora*, Dunal. Shrub, 2-6 ft.: lvs. cuneate, obovate or oblong, obtuse, 2-4 in. long, rufous-pubescent when young, at length glabrous and chartaceous: fls. large, appearing with the lvs.; outer petals cream-colored, over 2 in. long, much larger than the inner ones: the large fr. is said to be very delicious. *S. Ga.*, Fla.

ALFRED REHDER.

**ASPARÁGUS** (the Greek name). *Liliaceæ*. ASPARAGUS. SMILAX (greenhouse). ASPARAGUS FERN. A large genus of herbaceous perennials and tender woody shrubs and vines, grown mostly for ornamental habit and foliage, but one of them (*A. officinalis*) for food.

Plants provided with short underground rhizomes from which the aerial sts. arise in serial order: roots often tuberous, sometimes fleshy but long-cylindric as in *A. officinalis*: sts. varying from low herbs to stout woody vines 50 ft. or more long: lvs. reduced to scale-like bracts usually with a basal spur, often spiny; lf.-function performed by special sterile twigs, cladodes (phyllodia, cladophylls, i.e., lf.-like branchlets) of determinate growth and of characteristic shape with each species (see Fig. 411): fls. usually axillary, or terminal, in 1-4's, sometimes umbellate, often racemose on special branches lacking the cladodes, small; perianth 6-parted; stamens 6, free, filament attached to base of perianth lobes; ovary 3-celled, stigma 3-parted (except in Section *Kodiastigma*), ovules 2-6 in locule: fr. a berry 1-, 3-, 6- or more seeded; seed globose or flat on one side, testa usually black, embryo straight, surrounded by a hard endosperm.—About 150 species, all native of the Old World, ranging from Siberia to Cape of Good Hope, usually from dry regions. Monogr. by Baker, Journ. Linn. Soc. 14 (1875); account of cult. species by Watson, G.C. III. 23:122, 147, 178.

This large genus is remarkable for its lack of functional leaves, whose place is taken by the leaf-like cladodes which are usually considered as leaves. The cladodes are usually borne in fascicles of three to forty in the axils of the leaf-scale; in *A. asparagoides* the leaf-like cladode is solitary in the axils. The woody members of the genus often have the base of the leaf-scale developed into a strong spine. In some groups the cladodes are spiny tipped. *A. stipulaceus* and its relatives (apparently not in cult.) have the side branches developed into thorns.

Most of the ornamentals of the genus will not stand frost, but some of the Asiatic forms are perfectly hardy except in the North. Members of this genus furnish the most satisfactory "green" for decorative purposes known to the trade, some of the forms rivaling the finest ferns in their delicate beauty. Their ability to hold up for several days without wilting makes the cut sprays of some of the species necessary in some forms of decorative work.

Nearly all the species are of easy cul-

ture and can be propagated readily by seed which is usually produced in abundance; also propagated by division and in some woody forms by cuttings.

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#### KEY TO THE SPECIES.

- A. *Lf.-scales with a basal spur or scale: cladodes fascicled in axils of lf.-scales and, when flat, with stomata on both sides.*
  - B. *Fls. diæcioous: fl.-buds axillary and present on young shoots, developing with the cladodes.*.....Section **EUASPARAGUS**
    - C. *Cladodes filiform.*
      - D. *Plant an erect herb: cladodes terete.*.....1. *officinalis*
      - DD. *Plant a semi-woody vine: cladodes angled.*.....2. *verticillatus*
    - CC. *Cladodes flat, linear or linear-lanceolate.*
      - D. *Berry black: cladodes falcate, ¼-½ in.; branches with twigs and cladodes in a horizontal plane: fls. opening widely: an erect herb*.....3. *filicinus*
      - DD. *Berry white or pink: cladodes nearly straight, 1-2 in., not in a definite plane: a vine.*.....4. *lucidus*
  - BB. *Fls. perfect, usually appearing after the cladodes or on special branches on the old wood.*
    - C. *Base of lf.-scale a spur, often a sharp spine: fls., when solitary, in axils with cladodes.*.....Section **ASPARAGOPSIS**
      - D. *Position of fls. axillary or terminal, with cladodes.*
        - E. *Cladodes filiform or 3-angled.*
          - F. *The fls. not umbelled, 4 or less.*
            - G. *Shape of cladodes 3-angled, in 3's: fls. axillary: an herbaceous vine, tuberous-rooted.*.....5. *crispus*
            - GG. *Shape of cladodes terete, numerous: fls. terminal: woody vines, not tuberous-rooted: branches with twigs pinnate in a horizontal plane.*
              - H. *Lf.-scales white or whitish, spine deltoid: sts. slender, smooth.*.....6. *plumosus*
              - HH. *Lf.-scales red-brown, spine terete, strong and sharp: sts. thick, with short pubescence.*.....7. *Cooperi*
          - FF. *The fls. in umbels.*
            - G. *Plant a slender green-stemmed vine: cladodes 3-8.*.....8. *umbellatus*
            - GG. *Plant stiff gray-stemmed shrubby climber: cladodes 10-20.*.....9. *retrofractus*
        - EE. *Cladodes flat.*
          - F. *Berry 3-lobed: cladodes lanceolate: fls. terminal: erect shrub, 1 ft.*.....10. *madagascariensis*
          - FF. *Berry globose: cladodes linear-falcate: fls. axillary: a delicate vine*.....11. *scandens*
          - DD. *Position of fls. in racemes on old wood.*
            - E. *Cladodes 3- or 4-angled, flattened.*.....12. *tetragonus*



402. Male flower of *Asparagus officinalis*. Typical of *Euasparagus*. The rudimentary ovary is shown.



403. Female flower of *Asparagus officinalis*, showing rudiment of stamen.



EE. *Cladodes flat, linear or linear-lanceolate.*

F. *The cladodes arranged in horizontal plane on twigs:*

a long vine.....13. *drepanophyllus*

FF. *The cladodes not in one plane.*

G. *Length of cladodes about 1 in.: st. 6 ft. or less:*

spines small.....14. *Sprengeri*

GG. *Length of cladodes 2-3 in.: a rank-growing vine, 20-40 ft.....*

.....15. *falcatus*

CC. *Base of lf.-scale appressed, bract-like: stigma capitate: fls. solitary in axils without cladodes.*

Section **KODIASTIGMA**.....16. *virgatus*

AA. *Lf.-scales not spurred: fls. axillary: cladodes solitary in axils, flat, lf.-like, stomata only on lower side.*

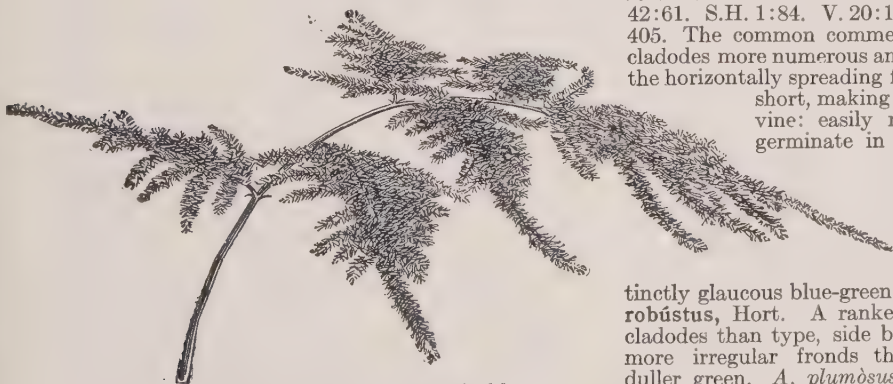
Section **MYRSIPHYLLUM**.....17. *asparagoides*

1. *officinalis*, Linn. **ASPARAGUS**. Figs. 402, 403. An erect herb from a woody crown with long fleshy roots: sts. smooth, much branched above, 4-12 ft. high: cladodes 3-8 in a fascicle,  $\frac{1}{4}$ -1 in. long, terete: lf.-scale with a short soft spur at base: fls. 1-4, in axils with cladodes or branches, campanulate, yellowish green: berries red,  $\frac{1}{4}$ - $\frac{3}{8}$  in., 1-9-seeded; seed germinate in 12-14 days in warmhouse, often taking a month when planted outdoors in spring. Eu.—The esculent asparagus of the garden, the fruiting sprays with the bright red berries used for decorating. The young seedlings developed from a large number of seed planted in a small pot or pan make a very handsome table decoration. See *Asparagus*, *Esculent*.

2. *verticillatus*, Linn. A semi-woody climbing vine from a woody rootstock: roots long-cylindric, fleshy: sts. stout ( $\frac{1}{2}$  in.), 10-15 ft. long, edible when young: branches green, angled, flexuose: cladodes 3-8,  $\frac{3}{4}$ -2 in. long, angled, filiform, not stiff: lf.-scales of main st. developed below into spines: fls. funnel-shaped in 1-4's in axils of lf.-scales: berries red,  $\frac{1}{4}$  in. diam., 1-3-seeded. Persia to Siberia. R.B. 20:154. G.W. 14:648. G.Z. 24:505.—A hardy ornamental climber; grows readily from seed, which germinates in about 3 weeks in a warmhouse; plants slow-growing at first.



404. Flower of *A. plumosus*. Typical of *Asparagopsis*.



405. *Asparagus plumosus* var. *nanus*. (X $\frac{1}{4}$ )

3. *filicinus*, Ham. An erect herb with densely clustered fusiform tuberous roots 2-4 in. long: sts. erect, branching: branches with twigs and cladodes in a horizontal plane like *A. plumosus*: cladodes flat, lanceolate strongly falcate, 3-5, of varying lengths,  $\frac{1}{4}$ - $\frac{5}{8}$  in.: fls. axillary on long slender pedicels, green; stamens and pistils white; perianth-lobes wide-spreading: berry black,  $\frac{3}{8}$  in., 1-3-seeded. India and China. G.C. III.

44:122, 123.—Hardy herbaceous perennial, very ornamental, suggesting a delicate fern in appearance; several wild varieties.

4. *lucidus*, Lindl. Semi-woody climber, 6-10 ft., few main branches: roots tuberous, 2-6 in. long: cladodes 3-5, flat curved linear about 1 in. long: lf.-scale on main st. with a short spine: fls. small, white, 1-4, in axils with cladodes: berries pink or white,  $\frac{1}{4}$  in. diam. China, Japan and Formosa. A.G. 13:78.—Probably hardy in most of U. S. Tubers edible.

5. *crispus*, Lam. (*A. decumbens*, Jacq., and Hort.). Roots tuberous, short, densely clustered about crown: sts. herbaceous, green, weak, climbing or drooping, 3-6 ft., much branched: branches deflexed, and zigzag: lf.-scale developed below into a weak spur: cladodes 3, 3-angled, reflexed, about  $\frac{1}{4}$ - $\frac{3}{8}$  in. long: fls. on slender drooping pedicels, axillary, solitary, or in pairs, white, sweet-scented, resembling the fls. of *A. asparagoides*: berry white or pink,  $\frac{1}{2}$  in., several-seeded, seeds small, black. S. Afr. A.F. 16:825.—Easily grown from seed or prop. by division; a beautiful plant for hanging-baskets. This species is often sold under the name of *A. scandens deflexus*, Baker, which has flat cladodes and 1-3-seeded, red berries.

6. *plumosus*, Baker. **ASPARAGUS FERN**. Fig. 404. Woody, tall climbing vine: roots not tuberous, long, slightly fleshy: st. terete, green, glabrous: branches with twigs and cladodes arranged in a horizontal plane, making a compound pinnate frond, triangular in outline: cladodes numerous, 8-20 in a fascicle,  $\frac{1}{4}$  in. or less long, slender, terete, bright green: lf.-scale white or gray, on main st. developed below into a woody deltoid spine: fls. 1-4 at ends of twigs, white; perianth-lobes spreading obovate, blooming in autumn: berry 1-3-seeded, purple-black. S. Afr. F. 1882:101. F.R. 4:93. F.S. 2413-14. G. 25:110. G.C. II. 13:749; III. 23:146. G.Z. 25:2. A.F. 11:1178.—A popular decorative plant now almost superseded by some of its varieties. The cut sprays and strings of *A. plumosus* and its varieties are used in large quantities by florists on account of their beauty and keeping qualities. Most of the forms are prop. by seed or division but some are readily increased by means of cuttings. Var. *comorensis*, Hort. (*A. comorensis*, Hort.). Similar to *A. plumosus* but more robust: cladodes lighter green, more open and delicate in their arrangement: frond widely triangular, very regular. A.F. 18:684. F.E. 14:462. F.R. 9:877. G.C. III. 23:181. Gng. 10:295. I.H. 42:61. S.H. 1:84. V. 20:101. Var. *nanus*, Hort. Fig. 405. The common commercial variety of the species: cladodes more numerous and shorter than type, making the horizontally spreading fronds more dense: sts. often short, making a short spray rather than a vine: easily reproduced by seed, which germinate in three weeks. Var. *tenuissimus*, Hort. (*A. tenuissimus*, Hort.). Fig. 406. A wiry stemmed variety with fewer cladodes longer than in type and not so much in a horizontal plane, distinctly glaucous blue-green; not a strong climber. Var. *robustus*, Hort. A ranker-growing vine with shorter cladodes than type, side branches making longer and more irregular fronds than *A. plumosus nanus*, a duller green. *A. plumosus superbus*, Hort., *A. Blampiedii*, Hort., and *A. Hatcheri*, Hort. (F.E. 31:935), are all botanically closely related if not identical with *A. plumosus robustus* and with it are separated from the other forms of the species by their stronger growth and by the much less regular arrangement of the cladodes and twigs into a horizontal plane. Var. *compactus*, Hort. A dwarf form, said to be a hybrid between *A. plumosus nanus* and *A. plumosus tenuissimus*, suitable for pot-plants. F.E. 16:637 See Fern, *Asparagus*.

7. *Coëperi*, Baker. Roots long, cylindric, more or less fleshy: sts. large, up to  $\frac{3}{4}$  in. diam. and 60 or more ft. long, branching above; main sts. and branches very dark green, with a soft, very short pubescence: cladodes very dark green,  $\frac{1}{4}$ – $\frac{1}{2}$  in. long, 5–12 in a cluster, much stouter than in *A. plumosus*: final branches with twigs and cladodes making beautiful pinnate fern-like sprays  $\frac{1}{2}$ –3 ft. long: lf.-scale swollen at base, red-brown,



406. *Asparagus plumosus* var. *tenuissimus*. ( $\times \frac{1}{4}$ )

with a strong spine: fls. small, white, bell-shaped, sweet-scented; berry about  $\frac{1}{4}$  in. diam., red. S. Afr. G.Z. 21: 568, 569.—This species is probably the largest one in the genus, its long vines covered with beautiful dark green sprays making a very desirable cover for pillars. The side sprays are valuable for cut-green for florists' use and, when removed, a second crop will appear shortly on the old vines.

8. *umbellatus*, Link. A spreading climber or undershrub: sts. terete, slender, scabrous, dark green, woody below, branching: branches and twigs often reflexed and pendulous: cladodes 3–10, terete,  $\frac{3}{4}$ –1 in. long, very dark green: fls. in axillary or terminal umbels; pedicels  $\frac{1}{2}$  in. long, perianth largest of genus,  $\frac{1}{8}$ – $\frac{1}{2}$  in. spreading, white; segms. elliptic-obtuse; stamens dark yellow: berry globose, yellow to dark red. Canary Is. and Madeira. B.M. 7733. G.C. III. 28:379.—The large, sweet-scented fls. produced abundantly in midsummer; a good plant for pillar decoration; grows well from seed.

9. *retrofractus*, Linn. (*A. retrofractus arboreus*, Hort.). Sts. slender (6 or more ft.), becoming woody and gray, scarcely climbing, zigzag, the branches wiry: cladodes in close clusters, green, filiform, about 1 in. long: lf.-scale bases spiny: fls. in umbels, small, white: berry small, nearly globose, 1-seeded. S. Afr. Gn. 59:111.

10. *madagascariensis*, Baker. Erect, much-branched shrub, 1 ft. or more, suggesting *Ruscus aculeatus*: sts. green, angled: cladodes 3, lanceolate, pointed, glabrous, dark olive-green, often arranged on the twig in one plane making a pinnately compound lf. in appearance,  $\frac{3}{8}$ – $\frac{5}{8}$  in. long: base of lf.-scale not spiny: fls. creamy white, normally in 4's at end of twigs,  $\frac{1}{4}$  in. diam.: berry scarlet, 3-lobed, 1–3-seeded. Madagascar. B.M. 8046.—A good pot-plant, especially in winter when it is well set with scarlet berries. Thrives in either a hot or temperate greenhouse, easily prop. from seed, which are freely produced.

11. *scandens*, Thunb. A slender climbing vine up to 6 ft.: sts. green, branching freely above; branches with twigs and cladodes in one plane, suggesting *A. filicinus* somewhat: cladodes flat, long, lanceolate-falcate, 3–5 in.: fascicle  $\frac{1}{4}$ – $\frac{1}{2}$  in. long, central one longest, glabrous, light green: lf.-scale minute, base not spined: fls. pendulous, solitary or paired in axils, greenish white,  $\frac{1}{2}$  in. diam., perianth spreading, segms. elliptic-oblong: berry

globose,  $\frac{1}{8}$  in. diam., red, 1-seeded. S. Afr. B.M. 7675. G.C. III. 33:339.—One of the weaker-growing kinds of ornamental asparagus, thriving well in an intermediate house. A good decorative plant when grown in strings for table decoration; also good as a pot-plant. Var. *deflexus*. Similar to type but with branches deflexed: cladodes stiffer and smaller: fls. smaller: seed often white. G.W. 5:446; 13:301. *A. crispus* is often sold under this name, but is easily distinguished by its 3-angled cladodes (see discussion under No. 5).

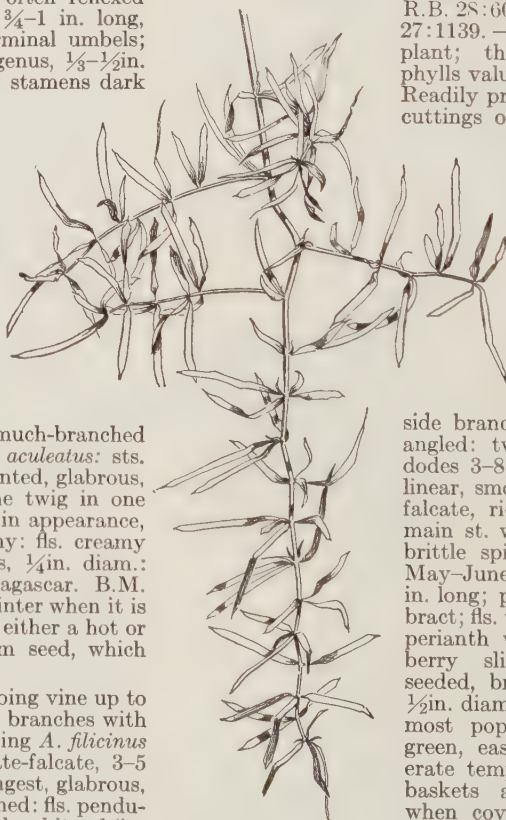
12. *tetragonus*, Bresler (*A. racemosus tetragonus*, Baker). A climbing vine, 15–20 ft. high: roots tuberous, elliptic, 1–2 in. long: sts. gray to brown, branching above: cladodes 3–8, usually 5, 3–4-angled,  $\frac{1}{8}$ – $\frac{5}{8}$  in. long, dense; more or less falcate: lf.-scale on main st. with a strong recurved basal spine up to  $\frac{1}{2}$  in. long: fls. in racemes 2–3 in. long, on old wood; perianth white or pink,  $\frac{1}{4}$  in. diam., segms. obovate-obtuse; fls. fragrant. S. Afr. B.M. 8288. G.C. III. 23:147.

13. *drepanophyllus*, Welw. (*A. Duchénei*, Linden). A tall climbing woody vine with tuberous roots 2–3 ft. long: sts. 20–30 ft. long, terete, without main branches: axillary twigs and cladodes making a compound cladophyll from upper axils: twigs  $\frac{1}{2}$ –2 ft. long, thick-set with cladodes in fascicles of 3–5: lf.-scales on twigs 5-ranked but cladodes turned into a horizontal plane: central cladode 2–3 in. long, lateral  $1\frac{1}{2}$  in., the compound cladophyll suggesting a frond of *Asplenium*: lf.-base with a strong spine: fls. in dense erect racemes, 3–8 in. long; pedicels deflexed in fascicles of 3–8; perianth greenish, bell-shaped, not opening widely: berry rare, 3-lobed, usually 1-seeded,  $\frac{1}{2}$  in. diam., bright scarlet, ripe in 90–120 days after the bloom. Oct.–Jan. S. Cent., Afr., Congo region. G.C. III. 28:305. R.B. 28:60. Gng. 15:131. A.F. 27:1139.—A highly decorative plant; the compound cladophylls valuable in florists' work. Readily prop. by division or by cuttings of the twigs taken off

with a heel, or piece of the main st. attached and put in a sandy soil in a close case with bottom heat.

14. *Sprengeri*, Regel. Figs. 407, 408. Roots tuberous, white, elliptic, not densely clustered: sts. numerous, scarcely climbing, 6 ft. or less:

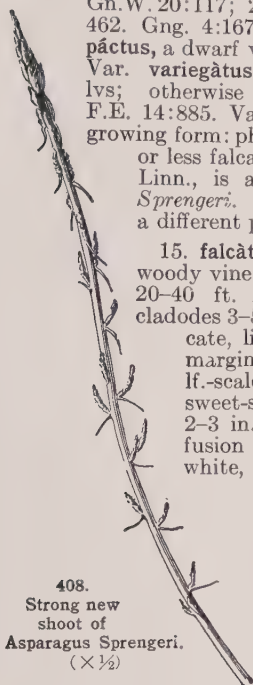
side branches numerous, small, angled: twigs 1–3 in. long: cladodes 3–8,  $\frac{1}{2}$ – $1\frac{1}{2}$  in. long, flat, linear, smooth, pointed, slightly falcate, rich green: lf.-scale on main st. with a slender brown brittle spine  $\frac{3}{8}$  in. long: fls. in May–June, in open racemes 1–3 in. long; pedicels 1–2 from each bract; fls. whitish pink, fragrant, perianth wide-spreading,  $\frac{1}{8}$  in.: berry slightly 3-lobed, 1–3-seeded, bright coral-red, up to  $\frac{1}{2}$  in. diam. Natal.—One of the most popular plants for cut-green, easily grown in a moderate temp. Plants in tubs or baskets are very ornamental when covered with the bright red berries which ripen about Christmas-time. Easily grown



407. *Asparagus Sprengeri*. ( $\times \frac{1}{2}$ )



from seed, which germinates in a temperate house in about 4 weeks. The best asparagus for a house plant. A.G. 18:86, 883; 19:101. B.M. 7728 (as *A. ternifolius*), 8052. F.E. 9:11. F.R. 4:95. G. 21:123. Gn. 54, p. 88; 58, p. 109. G.L. 17:175. Mn. 8, p. 151. Gn.W. 20:117; 23:607. G.W. 4, p. 109; 13, p. 462. Gng. 4:167. G.C. III. 37:10. Var. **compactus**, a dwarf variety seldom over 18 in. long. Var. **variegatus**, a form having variegated lvs; otherwise like the type. Gn. 59:145. F.E. 14:885. Var. **falcatus**, a large strong-growing form: phylloclades solitary to 5-6 more or less falcate. *A. sarmentosus*, Hort., not Linn., is a short compact form of *A. Sprengeri*. The true *A. sarmentosus* is quite a different plant and not in cult.



408. Strong new shoot of *Asparagus Sprengeri*. ( $\times \frac{1}{2}$ )

15. **falcatus**, Linn. A large spreading woody vine with stout gray or brown sts. 20-40 ft. long, much branched above: cladodes 3-5, or more at ends of twigs, falcate, linear-lanceolate, with undulate margins, rich dark green, 2-3 in. long: lf.-scales with stout basal spines: sweet-scented fls. in loose racemes 2-3 in. long, produced in great profusion in midsummer; perianth pure white,  $\frac{1}{4}$  in. diam., segms. lanceolate; stamens yellow: fr. dull brown. Trop. Asia and Afr.—One of the largest and finest species of the genus; thrives under temperate conditions, growing outdoors in the absence of frost. G.C. III. 23:123; 41:82. Ref. Bot. 261. G.W. 5:334.

16. **virgatus**, Baker (*A. elongatus*, Hort.). Fig. 409. Roots fibrous, crown with long semi-woody rhizomes: sts. erect (3-6 ft.), much branched above, branches long, straight or drooping: cladodes in 3's, stiff,  $\frac{1}{4}$ - $\frac{3}{4}$  in. long, angled, not very abundant; cladodes and sts. dark green: lf.-scale white, developed basally into an appressed bract-like extension similar to upper part: fls. solitary at nodes on drooping pedicels, no cladodes in axils with fls.; perianth greenish white, wide-spreading,  $\frac{1}{8}$  in. diam.; stigma capitate: berry 1-2-seeded, dull orange-red,  $\frac{1}{4}$  in. in diam. S. Afr. F.E. 27:114.—Easily grown from seed, which germinates in 3 weeks, or from cuttings of rhizomes. Not highly ornamental, but of value in decorative work on account of its erect habit.



409. Flower of *Asparagus virgatus*. Typical of *Kodiastigma*.

17. **asparagoides**, Wight (*Myrsiphyllum asparagoides*, Willd. *A. medeoloides*, Thunb.). **SMILAX** of florists. Fig. 410. Tall slender glabrous twiner: sts. slender, much branched: cladodes single in axils of lf.-scales, ovate, about 1 in. long, usually spreading horizontally: lf.-scale small, not developed into a spur at base: fls. solitary or paired in axils on slender pedicels, greenish white; perianth-lobes spreading or recurved from beyond middle: berries dark purple, 1-3-seeded. S. Afr. B.M. 5584. R.H. 1895: 177. S.H. 1:417; 2:160. Gn. 42, p. 536. G.W. I, p. 206.—Much grown for florists' use in decorations. Seed small, germinating in about 3 weeks (see cultural notes under *Smilax* in a succeeding volume). Var. **myrtifolius**, Hort. "BABY" **SMILAX**, an extremely light and elegant variety with much smaller lvs. than the type, becoming popular.

*A. acutifolius*, Linn. Semi-hardy, becoming a woody shrub in the S., zigzag, branching, 5 ft.: cladodes short, stiff, terete, spiny-tipped in fascicles of 5-12,  $\frac{1}{4}$  in. long: fls. dioecious, yellow; berry waxy olive-green.—A dark green cedar-like ornamental. *Medit. region.*—*A. ethiopicus*, Linn. Tropical vine: cladodes 3-5 ft., linear falcate, 1-2 in. long: lf.-base spiny: fls. in racemes, near *A. Sprengeri*. S. Afr.—*A. africanus*, Lam. Woody semi-climber, spiny: cladodes filiform-terete, stiff, dark green, up to 20 in a cluster 1 in. long: fls. in umbels. S. Afr.—*A. albus*, Linn. (*A. Pastorianus*, Webb & Berth.). A white-stemmed branching woody shrub, semi-hardy, 3-4 ft. high: cladodes densely fasciated, 1 in. long: lf.-scale with a long sharp spine: fls. in umbels. *Medit. region.*—Very susceptible to attacks of red-spider. G.Z. 1907:31.—*A. asiaticus*, Linn. A tall branching woody vine: cladodes numerous in clusters, soft-filiform,  $\frac{1}{2}$  in. long: fls. in umbels. S. Afr.—*A. declinatus*, Linn. Allied to *A. plumosus* but with cladodes about  $\frac{1}{2}$  in. long: branches slender, drooping: fls. axillary, small, white: berries 1-seeded. S. Afr.—*A. larinicus*, Burch. A woody shrub suggesting *A. retrofractus* but with cladodes 1 in. long. S. Afr. G.C. III. 23:122.—*A. longipes*, Baker. A copiously branched undershrub with subterete slender green cladodes  $\frac{1}{2}$ -1 in. long in whorls of 9-12: fls. axillary, solitary or paired. S. Cent. Afr.—*A. myriocladus*, Hort. (*A. Greenfieldii*, Hort.). An erect, much-branched shrub, 6 ft., with tuberous roots: st. gray: branches zigzag with dense clusters of light green filiform cladodes  $\frac{1}{2}$  in. long, becoming dark green with age.—Very ornamental: fls. unknown, but it is closely related in type to *A. retrofractus*. *Natal. G.* 25:293; 33:435. Gng. 12:547. F.E. 16:637. The true *A. myriocladus*, Baker, is related to *A. Sprengeri* and has flat cladodes and racemose fls. This species is apparently not in cultivation.—*A. oligoclados*, Maxim. Erect, hardy herbaceous perennial suggesting *A. officinalis*: cladodes more dense, slender and graceful: 1-2 ft.: fls. dioecious, campanulate. N. Asia.—*A. schobertoides*, Kunth. Erect, hardy herbaceous perennial, 1-3 ft.: roots tuberous: cladodes long, 3-angled, flat, ascending: fls. nearly sessile, dioecious: berries red. Japan and China.—*A. Sieberianus*, Hort. A supposed hybrid



410. *Asparagus asparagoides*, or *Smilax* of florists. (Natural size.)

between *A. crispus* and *A. plumosus tenuissimus*: sts. slender, rigid, with slightly curved cladodes. Distinct and valuable as a market plant.—*A. tenuifolius*, Lam. Herbaceous perennial: like *A. officinalis*, with very slender, numerous cladodes and large bright red berries. S. Eu.—*A. trichophyllus*, Bunge. Hardy herbaceous perennial, somewhat twining, 3-6 ft.: cladodes like *A. officinalis*,  $\frac{1}{4}$ -1 in. long: fls. dioecious (long-campanulate) on drooping pedicels. N. Asia.

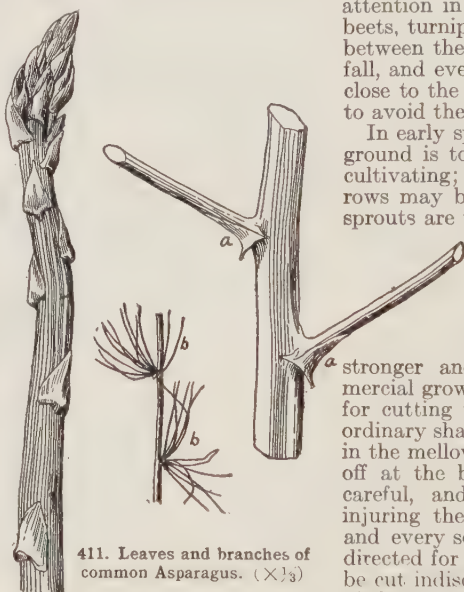
J. B. NORTON.

**ASPÁRAGUS, ESCULENT** (*Asparagus officinalis*, Linn.). *Liliaceæ*. A perennial herb, cult. for the succulent young shoots that arise from the crown in spring.

Asparagus is native to Europe. It has been cultivated 2,000 years and more. It was known to the Greeks and Romans. The so-called lvs. of asparagus are really leaf-like branches. The lvs. are the scales, which are well shown on the shoot at the left in Fig. 411. From the axils of these scales, branches may arise, *a a*. At *b b* are shown clusters of branchlets, or "leaves," issuing from the axils of scales or lvs.

Being a rugged plant, asparagus will live and in a measure thrive on almost any kind of soil, even under adverse circumstances and when entirely neglected. Occasionally one may find apparently thrifty plants in fence rows, or strong stalks pushing up through stone heaps or other rubbish piled foot-thick upon an old abandoned asparagus bed. Plants on good soil will get so large, and the immense network of roots so well anchored in the soil, that all the strength of a good team may be insufficient to pull them out, and sometimes several years' persistent efforts may be required to clear them out of a piece of ground once used as an asparagus patch. The stalks that the discriminating growers and fastidious consumers want are those an

inch in diameter and deliciously tender and succulent, and these can be grown only on good plants set far enough apart on well-drained, well-manured and well-tilled soil. To secure the choice early stalks that bring the high prices, the land selected for an asparagus patch should be a warm rich loam, preferably exposed to east or south. Manures and fertilizers, also, must be used most lavishly. In this respect, many growers fail to obtain best results, such as are within their reach by greater liberality. Unless the soil is already well supplied with vegetable matter and for that reason very loose and mellow, bulky manures, such as fairly well-rotted stable manure or rich compost, are almost or quite indispensable at the start. A heavy dressing is to be plowed under, and should be well and deeply mixed with the soil by reploting and reworking the land. Afterwards concentrated manures, rich especially in nitrogen and potash, will do very well for loose soils, and may be used broadcast on top, as the crop appears to need them from year to year, at least for a while. Even then an occasional, or better, yearly, application of good stable manure or compost placed in furrows plowed (with a one-horse plow) on each side of the rows after the cutting season or in early fall, will be of benefit or become necessary to keep the yield up to a high mark. To start a plantation in the right way, the selection of good strong one-year-old plants is of much importance. They are usually preferable to the ordinary two-year plants. To grow one's own supply for starting a plantation a year later is usually a safer plan than to depend on purchased plants. The male, or pollen-bearing, plants are often more vigorous and more productive of good stalks than the female or seed-bearing plants; but one cannot very well tell the one from the other unless they bloom, until long after they are already established in the plantation, when it would be impracticable to tear out the less desirable female plants and replace them with the male plants.—The seed, obtainable from any regular seed house, is rather hard-shelled and so netimes slow to germinate. It is important to give the seedling plants the longest possible period of growth so as to secure the strongest possible plants. It is advisable, therefore, to soak the seed, or give it special treatment or seed stimulation, before sowing it, and to sow it just as soon in spring as a rich mellow seed-bed can be prepared. The rows or drills may be made a foot apart, and seed sown rather thinly. Plants are to be thinned to 3 inches apart at an early age, and weeds should be carefully kept down from the very start. In short, nothing should be neglected to prevent any interference with the rapid and healthy growth of the seedlings, for the future outcome hinges, to a great measure, on a favorable early start.—When getting ready to set the plants, and after the land has been carefully and deeply plowed and harrowed, plow out furrows 4 or even 6 feet apart. It may look like a sinful waste of good land to set asparagus so far apart, but even at 6 feet the roots will fill the soil and reach across



the rows, and the fat stalks obtainable by wide planting are worth more in our markets than the inferior ones usually found there. Some markets demand or prefer green stalks which are mainly grown above ground. In that case, make the furrows 5 to 9 inches deep. In other markets blanched shoots are wanted, and these are of superior flavor and tenderness, provided they are grown in mellow soil and under high and skillful culture. In that case, make the furrows a few inches deeper than for plants set for green stalks. Set the plants in the furrows about 2 feet apart, each on a little mound of soil, spreading the roots in the same way as they grew in the seed-bed. Cover with mellow soil to the depth of a few inches, and afterwards, in the course of some weeks and by means of some suitable tools (cultivators, harrows, and the like), gradually fill the furrows even with the ground-level. A still better plan when the material can be had, especially for the home-gardener, is to fill the furrows with fine old compost, wood's earth, leaf-mold, or any other loose and rich material, as the covering above the crowns of the plants cannot be made too loose. It is advisable and will insure closer attention in cultivation, to grow some hoed crop, like beets, turnips, radishes, cabbage, beets, beans or peas, between the rows of asparagus the first year. In the fall, and every fall thereafter, cut the asparagus stalks close to the ground and remove them from the patch, to avoid the scattering of the seed.

In early spring of the second year, the surface of the ground is to be loosened by shallow plowing or deep cultivating; and when the first sprouts appear, the rows may be hilled up to some extent if any of the sprouts are to be cut for use. Under especially favorable conditions a few may be cut the second year. It is better for the plantation and its future value, however, if no cutting is done that year. Plants left intact until the third year, and kept in a high state of cultivation, will grow much stronger and be more productive afterward. Commercial growers use specially devised asparagus knives for cutting the stalks. In the absence of such, any ordinary sharp table or kitchen knife may be used, or in the mellow soil the blanched shoots may be broken off at the base with the finger. In cutting, be very careful, and try to avoid cutting later shoots or injuring the crown of the plants. The third season and every season thereafter, loosen up the ground as directed for the second season. The shoots are now to be cut indiscriminately and clean, up to the beginning of the green-pea season. After that, allow them to grow undisturbed, but continue cultivation, to keep the ground-surface mellow and free from weeds. For market, wash the freshly-cut stalks and tie them in neat, compact bunches of the size demanded in the particular market, using some bright-colored ribbon, or perhaps rubber bands. If to be shipped, especially for longer distances, pack the bunches in moist moss or other material that will keep the stalks fresh.

The varietal differences in the asparagus plant do not appear to be very pronounced except in the color of the young shoots, and most of the variations seem to be due to differences in culture and environment rather than to those characteristic of the variety. American seedsmen offer the following as distinct varieties: Colossal (Conover's), Palmetto, Mammoth (Barr's), Columbian (Mammoth Columbian White), Argenteuil (Giant Argenteuil), Bonvallet Giant, Reading Giant.

To save the seed, strip the ripe berries off the stalks by hand, or thresh them off with a flail, put them in a sound barrel or tank, and mash them with a wooden pounder, to separate the hard, black seeds from the pulp. Clean them by washing in plenty of water, pouring off the pulp and skins; then dry and store.

To any person who has even a little land to use for a home-garden, no better advice could be given than to



plant in a corner or at one side of it 50 or 100 asparagus roots for his family, as no other use of that spot, ordinarily, may be expected to give more real benefit, enjoyment and value. The number of roots named will under average conditions give all the stalks that a large family could use, and several times the quantity that a person of ordinary means would feel able to purchase for the family table in the open market. For the market-gardener, especially one with a regular retail trade, few if any vegetables offer equal chances of profit and regular returns and a sure income at a most opportune time (spring).

**Enemies.**—The asparagus rust (*Puccinia asparagi*) has often done considerable damage. Planting rust-resistant varieties is the best procedure. Argenteuil and Reading Giant afford the best relief. Dusting completely with flowers of sulfur when the dew is on, and after the cutting season, is the best remedy; two applications, three or four weeks intervening, are usually sufficient.

Of insect enemies, two have become well known on asparagus plants in America, namely, the common asparagus beetle (*Crioceris asparagi*) and the twelve-spotted asparagus beetle (*C. 12-punctata*). The following remedies are recommended: chickens and ducks; close cutting of the young shoots in the early season, and the use of arsenate of lead or of dry arsenites dusted on the dew-wet plants after the cutting period.

The subject of asparagus and asparagus-growing is treated in the following books and bulletins: Asparagus, by F. M. Hexamer, Orange Judd Company. Farmers' Bulletin No. 61 (Asparagus Culture), issued by the Department of Agriculture, Washington, D. C. Bulletin No. 151 of the Maryland Station (Fertilizers for Asparagus). Bulletin No. 34 of the Missouri Station (Asparagus and Rhubarb Culture). Bulletins Nos. 165 and 172 of the California Station (Asparagus and Asparagus Rust in California). T. GREINER.

**ASPÀSIA** (Greek personal name). *Orchidaceæ*. Epiphytic hothouse orchids.

Stems thickened into pseudobulbs, 1- or 2-lvd.: racemes lateral; sepals and petals nearly alike, spreading; lip with the claw adnate to the column, the blade spreading; lateral lobes distinct or confluent with the middle lobe; pollinia 2.—Species about 8, ranging from Cent. Amer. to Brazil.

**epidendroides**, Lindl. Pseudobulbs, oblong, 2-edged: lvs. linear-lanceolate: racemes of 2-4 fls.; sepals and petals whitish yellow, streaked with brown; lip white, dotted with purple. Panama. B.M. 3962.

**lunata**, Lindl. Pseudobulbs, 2-edged, oblong: lvs. oblong-ligulate, up to 6 in. long: fls. single, or rarely 2; sepals and petals linear-lanceolate, acuminate, green or yellowish, marked with violet-purple; lip white, marked with purple. S. Brazil.

**variegata**, Lindl. Pseudobulbs ovate or oblong, 2-edged: lvs. lanceolate-ligulate, up to 8 in. long: raceme of 2 or 3 fls.; sepals oblong-lanceolate, acute, greenish or yellowish, marked with interrupted longitudinal black-purple lines; petals obovate-oblong, acute, yellowish veined with purple; lip white, yellowish at the base, spotted with purple. S. Amer. B.M. 3679. B.R. 1907.

GEORGE V. NASH.

**ASPEN:** *Populus*.

**ASPERÉLLA:** *Hystrix*.

**ASPERULA** (roughish; referring to lvs.). *Rubiaceæ*. WOODRUFF. Mostly dwarf hardy herbs, for borders, rock gardens and shady places.

Annual or perennial: sts. square: lvs. whorled (some of the lvs. are really stipules): fls. many, small, mostly 4-parted, produced freely from May to July; corolla funnelform, which distinguishes it from the closely related *Galium* in which the corolla is rotate.—About 80 species in Eu., Asia and Austral.

The commonest species is *A. odorata*, the Waldmeister of the Germans, which is used in their Mai-trunk, or May wine, and in summer drinks. The dried leaves have a hay-like fragrance, lasting for years, and are often kept with clothes. The plant occasionally escapes from gardens. *A. hexaphylla*, with its delicate, misty spray, is used with sweet peas and other cut-flowers that are inclined to look lumpy. Other plants for this purpose are *Gypsophila paniculata*, *Statice latifolia*, and several galiums, all of which have small, abundant flowers in loose panicles on long, slender stems.

In half-shaded and moist soil, asperulas grow very luxuriantly until late fall. In dry and sunny places they soon become stunted, and die down before the season is over.

Propagation is by division and by seeds.

*A. Plants perennial: fls. white or pink.*

*B. Corollas 4-lobed.*

**odorata**, Linn. SWEET WOODRUFF. Fig. 412. Habit erect or ascending: height 6-8 in.: lvs. usually in whorls of 8, lanceolate, finely toothed or roughish at the margin: corollas campanulate: seeds rough. Eu. and Orient. Eng. Bot. 2:775. Baxter Brit. Bot. 1:46.—Increases rapidly, and is used for carpeting shady places, and for edgings.

**Gussònei**, Boiss.

(*A. suberosa*, Guss.).

A glaucous, smooth, usually caespitose perennial suitable only for the rock-garden: lvs. small, in pairs, some ovate-oblong, the rest lanceolate-linear: fls. at the ends of the branches, the corolla smooth and pinkish, not showy. Sicily.—A graceful little alpine.

**hexaphýlla**, All. Plant-st. glabrous: habit ascending, slender: height 1-2 ft.: lvs. in whorls of 6, linear, acute, rough: corollas tubular-funnel-shaped: panicles very loose; fls. larger than the bracts: seeds smooth. Italy, Hungary, Pyrenees on high passes and dry mountainsides.—Well-grown specimens may be 3 ft. in diam. and nearly as high.

**hírta**, Ramond. A many-stemmed hairy perennial, suitable for the alpine garden: sts. 4-sided, with verticillate lvs. in 6's: lvs. linear, 1-nerved: fls. small, pinkish. Rocky situations in the Pyrenees. July, Aug.

*BB. Corollas often 3-lobed.*

**tinctória**, Linn. DYER'S WOODRUFF. Habit procumbent unless supported: height 1-2 ft., the st. purplish: lvs. linear; lower ones in 6's, middle ones in 4's, uppermost ones in 2's: bracts ovate: fls. reddish on outside: roots large, creeping widely, reddish. Dry hills and rocks of Eu.

*AA. Plants annual: fls. blue.*

**orientális**, Boiss. & Hohen. (*A. azurea* and *A. setosa*, Jaub. & Spach. *A. azurea-setosa* and *A. setosa-azurea*, Hort.). Height 1 ft.: lvs. in whorls of 8, lanceolate, bristly: fls. longer than the bracts. Eu. and Orient.

*A. cymánchina*, Linn. 9-12 in., glabrous: fls. corymbose on erect peduncles: lvs. 4 to a whorl. Eu. and Asia.—*A. longiflora*, Waldst. 6-8 in., weak, glabrous: fls. white, yellowish inside: lvs. 4 to a whorl, linear-lanceolate. Eu.—*A. taurina*, Linn. 1 ft., erect, smooth: fls. in fasciculate umbelled corymbs, white: lvs. 3-nerved, ciliate, 4 to a whorl. Perhaps not hardy N. S. Eu.

WILHELM MILLER. N. TAYLOR.]

**ASPHODEL:** *Asphodeline* and *Asphodelus*.



412. *Asperula odorata*. (×1)

**ASPHODELINE** (name modified from *Asphodelus*). *Liliaceæ*. Hardy herbaceous plants, distinguished from *Asphodelus* by the erect and leafy stems.

*Asphodelines* have long racemes of yellow or white fls. in June and July. All the older species were described under *Asphodelus*. In 1830, Reichenbach made the new genus *Asphodeline* for *A. lutea* and others. The only species advertised in Amer. is *A. lutea*, but all those described below are likely to be in cult. Monogr. by J. G. Baker in Journ. Linn. Soc. 15:273-278 (1877). There are some 145 species in the Medit. region and the Caucasus.

The culture of *Asphodeline lutea* is simple. Any soil will suit. Partial shade is allowable, but flowers are often better in the sun. Propagated readily by division, in spring or the fall.

A. *Sts. leafy up to the raceme*

B. *Fls. yellow.*

**lûtea**, Reichb. (*Asphodelus luteus*, Linn.). TRUE ASPHODEL of the ancients, or KING'S SPEAR. Height 2-4 ft.: roots thick, fleshy, stoloniferous: lvs. 3-12 in. long; margins rough: racemes 6-18 in. long, 3 in. wide: bracts large, membranaceous, persistent. Italy, Mauritania and Algeria to Tauria and Arabia. B.M. 773. L.B.C. 12:1102 as *A. tauricus*.—The best species. A double-fl. var. *flöre-plêno* has been advertised.

BB. *Fls. white.*

**taûrica**, Kunth. Height 1-2 ft.: roots slender: lvs. 3-9 in. long; margins membranaceous: racemes 6-12 in. long, 1½-2 in. wide: bracts 9-12 lines long, 1½-2 in. wide. Caucasus, Tauria, Syria, Asia Minor, Greece. G.C. III. 21:175.

AA. *Sts. leafy only a third or half the way to the raceme.*

B. *Fls. white: raceme dense.*

**globîfera**, J. Gay. Height 2-3 ft.: lvs. numerous, subulate 5-6 in. long, 1-1½ lines broad: racemes dense-fl. caps. globose. Cappadocia.

BB. *Fls. yellow: raceme lax.*

C. *Bracts large, 6-12 lines long, long-cuspidate.*

**tendîor**, Ledeb. Height 1 ft.: smaller than *A. lutea*, with finer lvs. and smaller, fewer and paler fls. Caucasus, Armenia, N. Persia. B.M. 2626.—Especially distinguished by the stalk being naked at the upper part, below the raceme of fls., and the bracts as short as or shorter than the peduncle.

CC. *Bracts small, 1½-3 lines long, short-cuspidate.*

**libûrnica**, Reichb. (*A. crêtica*, Vis., not Boiss.). Height 1-2 ft.: lvs. 3-4 in. long: racemes weak, 6-9 in. long, when expanded 2½-3 in. wide; stamens unequal. Greece, Crete, Dalmatia, Austria, Italy, not Asia Minor. L.B.C. 10:915 (as *A. crêtica*).

**brevicaûlis**, J. Gay (*A. crêtica*, Boiss., not Vis.). St. often flexuose, that of all the others here described being erect and strict. Asia Minor, Syria, Palestine, Egypt.

AAA. *Sts. leafy only at the base: fls. white: racemes dense.*

B. *Racemes usually simple.*

C. *Height 8 ft.: sts. having lf.-scales.*

**imperîâlis**, Siehe. Tallest species of the genus: fls. large, reddish white: lvs. numerous, forming a large rosette, and also clothing part of the st. Cappadocia. G.C. III. 22:397.

CC. *Height 1½-3 ft.: sts. not having lf.-scales.*

**damascêna**, Baker. Height 1½-2 ft.: bracts membranaceous, lanceolate, the lowest 9-12 lines long: racemes simple, rarely branched. Mt. Lebanon.

**Balansæ**, J. Gay. Height 2 ft.: bracts scarious, 6-9 lines long. Cilicia. Gt. 46, p. 521. G.C. III. 23:111.

BB. *Racemes much panicked.*

**isthmocârpa**, J. Gay. Height 2 ft. Cilicia. G.C. III. 23:117. WILHELM MILLER. N. TAYLOR.†

**ASPHÔDELUS** (Greek name of unknown origin). *Liliaceæ*. ASPHODEL. Hardy herbaceous stemless plants, with white, lily-like fls. in long racemes, fleshy fascicled roots, and firm, linear, radical, tufted lvs.: perianth funnel-shaped; segms. 6, oblong-ligulate, obtuse, equal, with a distinct nerve on the back, and always ascending.—Probably a half-dozen species in Medit. region and India.

The asphodel of the ancients, or king's spear, is *Asphodeline lutea*, which see. Homer mentions the asphodel meadows of the dead, where the shades of heroes congregated in Hades. The asphodel in Greek mythology was the peculiar flower of the dead. It has always been a common weed in Greece, and its pallid yellow flowers are associated with desert places and tombs. The word daffodil is a corruption of asphodel. The asphodel of the early English and French poets is *Narcissus Pseudo-Narcissus*. J. G. Baker, in his revision of the genus in Jour. Linn. Soc. 15:268-272 (1877), refers forty species of other botanists to *A. ramosus*, the dominant type, of which he makes three subspecies. These subspecies are here kept distinct, for horticultural purposes, as good species. They are the ones first described below. *A. ramosus* and *A. albus* are among the few current trade names in America.

Culture simple; see *Asphodeline*.

A. *Plant perennial: lvs. 3-angled.*

B. *Scape long.*

C. *Racemes simple or sparingly branched.*

**âlbûs**, Mill., not Willd. BRANCHING ASPHODEL. Bracts buff-colored when young: filaments deltoid at the base: caps. medium-sized, 5-6 lines long, subglobose or ellipsoid. S. Eu.

**cerasîferus**, J. Gay. Bracts pale yellow: filaments wedge-shaped at the base, but rapidly becoming awl-shaped: caps. large, 8-10 lines thick, flattish globular, umbilicate. W. Medit. region.

CC. *Racemes much branched or panicked.*

**comôdsus**, Ford. Radical lvs. sword-shaped, 1-1½ ft. long, acutish, sharply keeled on the back: panicle branched, the terminal racemose cluster 2-3 in. diam.; petals white, 5⁄8-¾ in. long. Himalayan region.

**tenuifôlius**, Cav. (*A. microcârpûs*, and *A. æstîvus*, Reichb.). Bracts pale yellow at first: filaments 4-angled at the base: caps. small, 3-4 lines long; obovoid-globose. Medit., Canary Isls.

BB. *Scape short, almost wanting.*

**acaûlis**, Desf. Lvs. 6-20, in a dense rosette, 3-4 in. long, minutely pubescent: fls. 6-20, in a crowded corymb; segms. of perianth 2-3 lines wide. Algiers. B.M. 7004.

AA. *Plant annual: lvs. cylindrical, hollow.*

**fistulôsus**, Linn. Height 16-20 in.: lvs. 12-30, in a dense rosette, 6-12 in. long, striate, awl-like, glabrous: segms. of perianth 1-2 lines wide, lined with pink: buds pink: fls. pinkish. France and Portugal to Syria, Arabia and Afghanistan. B.M. 984. L.B.C. 12:1124. —Needs protection under glass in winter. If removed early in autumn to a greenhouse, it may be induced to seed freely.

*A. crêticus* = *Asphodeline liburnica*. — *A. luteus* = *Asphodeline lutea*. — *A. Villarsii*, Verl., is a form of *A. ramosus*, from E. France, with long, dense racemes and dark brown bracts.

WILHELM MILLER. N. TAYLOR.†





XII. Asparagus, variety Colossal.





**ASPIDISTRA** (Greek, *a small, round shield*; referring, probably, to the shape of the stigma). *Liliaceæ*. A popular florists' plant, grown for its stiff, shining, beautiful foliage, which is sometimes striped.

Leaves all radical, many, long, gradually narrowed into petiole, the rhizome thick and sometimes creeping; fls. inconspicuous and borne close to the ground; perianth wide-campanulate, 8-lobed; stamens 8, attached on the tube, the filaments very short; ovary 4-celled: fr. a globose indehiscent 1-seeded berry.—Three or 4 species in Himalaya, China and Japan. The casual observer never suspects that *Aspidistra* is a liliaceous plant. The parts of the fl. in monocotyledons are typically in 3's. The genus *Aspidistra* is considered abnormal, as usually having its parts in 4's. This tetramerous state (which is here considered the normal one, and described below) is pictured in B.M. 2499, but the species was first described upon a trimerous state, and pictured in B.R. 628. In *A. lurida*, the trimerous state must be regarded as an exceptional reversion: in *A. typica*, B.M. 7484, the trimerous state is thought to be constant.

*Aspidistra* is invaluable to the florist in decorative work, owing to its ability to withstand rough usage, dust, heat, cold and drought. The foliage is very useful when cut for mixing with amaryllises when they are used as cut-flowers, lasting for weeks in good condition; for such purposes the *aspidistra* may be planted under greenhouse benches in waste places for the production of leaves alone. The variegated variety is often seen, but a poor soil must be used or the variegation will speedily disappear. To increase the plants, divide in early spring when repotting, shaking out the old soil from the roots and separating the leaves, putting several in a pot of a useful size, a 6-inch being large enough to hold a number of leaves and their roots. (E. O. Orpet.)

*lurida*, Ker-Gawl (*A. elatior*, Hort. *A. punctata*, Lindl.). Fig. 413. Lvs. 15–20 in. long, stiff, evergreen, oblong-lanceolate, sharp-pointed, radical; blade narrowed into a channeled petiole a third of its length: fls. lurid purple, on short 1-fl. scapes; perianth segms. 8; stamens 8; stigma broadly shield-shaped, like a small mushroom. China. B.R. 977. Var. *variegata*, Hort., has alternation of green and white stripes, no 2 lvs. being exactly alike.—In Fla., the *aspidistra* makes beautiful dense specimens in unheated plant-sheds. It thrives in sunshine when growing along the edges of ditches and flowing water.

*A. typica*, Baill. Rootstock creeping: lvs. elliptic-lanceolate, long-petioled, about 7-nerved: fls. greenish or whitish, speckled with red, purple inside, trimerous. China. L. H. B.†

**ASPIDIUM:** *Dryopteris* and *Polystichum*.

**ASPLENÉNDRIUM:** *Thamnopteris*.

**ASPLENIUM** (Greek, *not the spleen*; referring to supposed medicinal properties). *Polypodiaceæ*. A large, widely distributed genus of ferns, containing some 200 species. Some of them hardy, and many others grown in the greenhouse.

Aspleniums are distinguished by the free veins, and by the elongated sori covered by an indusium, which normally is attached to one side of a vein. The species here included under *Asplenium*, which have some of the sori curved across the subtending veinlets and certain differences in the internal structure of the st. are placed by many botanists in a separate genus, *Athyrium*; in the list below, Nos. 10, 25, 26, and 27 belong in this group.

Aspleniums enjoy an abundance of moisture at the roots, but they will turn brown in the winter months in

an excessively moist atmosphere. They should be kept in a very lightly shaded position. A good potting material consists of equal parts of rich soil and leaf-mold or peat. The following are some of the most useful commercial kinds: *A. Bélangeri*, height 2½ feet; *A. bulbiferum* (including *A. laxum*), which grows quickly into a handsome specimen about 20 inches high, and seems to stand the hot, dry American summers better than other species; *A. salicifolium*; and *A. viviparum*, which is dwarf, compact, with lace-like fronds, and easily propagated. For hanging-baskets, *A. flaccidum* is best. The foregoing species and others of like habit develop small plantlets on the surface and edge of pinnae. As soon as these are sufficiently strong, they may be detached, with a small piece of old pinnae, and pricked into shallow pans, the older part being placed below ground to hold the young plant firmly in position until roots have



413. *Aspidistra lurida* var. *variegata*.

formed. The best soil for this purpose is composed of equal parts of fresh garden soil, leaf-mold or fine peat, and sand. Plant very firmly, and place in a shady, moderately moist and close position, where in ten or fifteen days they will make roots. The foregoing ones do best in a temperature of 50° F. *A. cristatum* is easily grown from spores, and is very useful for fern-dishes. (Nichol N. Bruckner.)

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A. Sori linear or oblong, straight, borne on the back of the lf. (Nos. 1–26.)

B. Lf. simple, with a serrate margin.

1. *serratum*, Linn. Lf. 1–3 ft. long, on a very short stalk, 2–4 in. wide, gradually narrowed below: sori 1 in. or more long. Fla. to Brazil.

2. *Nidus*, Linn. (*Thamnopteris Nidus*, Presl. A. and T. *Nidus-avis*, Hort.). BIRD'S-NEST FERN. Fig. 414. Much like the preceding in size and habit of growth, but with entire margined lvs. and with the veins partly united to form a net.

BB. Lf. lobed or pinnatifid.

3. *Hemionitis*, Linn. (*A. palmatum*, Lam.). Lf. 4-6 in. each way, hastate, with a triangular terminal lobe and 2 lateral ones, and a large, rounded sinus at the base: sori often over 1 in. in length. Spain, Canary Isls. S. 1:586.

4. *pinnatifidum*, Nutt. Lvs. clustered, from a short rootstock, 3-9 in. long, with mostly rounded lobes at the base and terminating in a slender point; texture thick, herbaceous; occasionally rooting at the tip. Pa. to Ala. S. 1:628.

5. *ebenoides*, R. R. Scott. Texture thin: lvs. 5-10 in. long, with a few irregular divisions near the base, and a long, slender, much-incised apical portion, occasionally rooting at the apex. A very rare native fern.—One of the very few definitely proved fern hybrids, its hybrid name being *A. platyneuron* × *Camplosorus rhizophyllus*.



414. *Asplenium Nidus*. (× $\frac{1}{10}$ )

6. *alatum*, HBK. Lvs. 1½-2 ft. long, the stalks 4-6 in. long, winged above, the blades 1-1½ ft. long, 3-4 in. broad, deeply pinnatifid, the rachis winged throughout, the lobes 1-1¼ in. long, ½-¾ in. broad, herbaceous.—W. Indies and S. Amer.

BBB. Lf. once pinnate.

c. Pinnæ less than ¾ in. long, blunt.

d. Rachises greenish.

7. *viride*, Hudson. Lvs. 3-8 in. long, scarcely more than ½ in. wide, with numerous rather distant lfts., which are ovate and deeply crenate: sori abundant, oblique. A subalpine species of N. Eu. and N. Amer. S. 1:661.

DD. Rachises purplish or blackish.

8. *Trichomanes*, Linn. Lvs. densely clustered, 3-8 in. long, ½ in. wide, with densely crowded oval lfts., which are slightly crenate on the upper side and suddenly narrowed at the base. Northern hemisphere generally. A.G. 13:653. S. 1:653. Gn. 59:318 (as *A. incisum*).

9. *resiliens*, Kunze (*A. parvulum*, Mart. & Galeotti). Lf. 5-9 in. long, with 20-30 pairs of mostly opposite lfts.,

which are ¼-¾ in. long, rounded at the outer margin and squarely truncate at the base. Southern states and Mex.

cc. Pinnæ ¾-1 in. long, with a strong auricle at the upper side of the base or deeply incised on the upper margin.

10. *platyneuron*, Oakes (*A. ebenum*, Ait.). Lvs. 6-15 in. long, with 30-35 pairs of lfts. which have an enlarged auricle at the upper side at the base, the lower lfts. reduced to mere triangular auricles: sori, when mature, covering the entire surface. Canada to S. Amer. A.G. 13:654. S. 1:535.

11. *formosum*, Willd. Lvs. 12-16 in. long, with numerous alternate pinnæ which are mostly deflexed, with the upper margin deeply incised and the lower margin toothed: sori 3-5 to each lft. Trop. Amer. S. 1:576.

12. *tenerum*, Forst. (*A. Veitchianum*, Hort.). Lvs. 1-1¼ ft. long, the stalks 4-6 in. long, grayish, the blades 8-15 in. long, 3-4 in. broad, 1-pinnate with 10-20 pairs of stalked pinnæ, the pinnæ 1-1½ in. long, ¼-¾ in. broad, rounded, toothed, inequilateral, usually auricled. Asia, Malaya.

13. *Colensoi*, Col. Stalks 3-4 in. long, with small scales: lf.-blades 4-5 in. long, 2 in. broad; pinnæ numerous, spreading, the lower pinnatifid auricled, on stalks ¼-½ in. long. New Zeal.

ccc. Pinnæ 3-6 in. long, linear or lanceolate.

14. *angustifolium*, Michx. Lvs. 18-24 in. long on stout stalks, 4-6 in. wide, with 20-30 pairs of nearly sessile pinnæ, which are truncate at the base and extend to a tapering point; fertile pinnæ narrower and more distant. Moist woods northward. S. 1:496.

15. *salicifolium*, Linn. Lvs. 12-18 in. long, with about 20 distinctly stalked horizontal pinnæ, which are wedge-shaped at the base, and curve upward to a long point: sori strongly oblique to the midrib, wide apart, not reaching either margin or midrib. W. Indies to Brazil.

16. *caudatum*, Forst. Stalks 4-6 in. long, densely clothed with fine fibrillose scales: blades 12-18 in. long, 4-8 in. broad, with 20-30 pairs of pinnæ, the pinnæ 3-4 in. long, ½-1 in. broad, acuminate, deeply toothed, auriculate above. Polynesia, Malaya.

17. *lucidum*, Forst. Stalks 3-6 in. long, grayish, densely clothed with large gray scales, the blades 1-2 ft. long, 4-8 in. broad, oblong, or ovate-deltoid, with a terminal pinna and 15-20 pairs of lateral pinnæ; pinnæ 4-6 in. long, 1-1½ in. broad, acuminate, toothed. New Zeal.

BBBB. Lf. 2-4 pinnate.

c. Ultimate divisions linear or cuneate; venation somewhat fan-shaped; texture thick.

18. *Báptistii*, Moore. Lf. bipinnate, with broadly ovate pinnæ 5 in. or more long, each with about 4 stipitate linear toothed pinnules; sori nearly parallel with the midvein and close to it; rachises scaly, with purplish lined scales. South Sea Isls.

19. *affine*, Swartz. Lf. 9-18 in. long, with numerous pinnæ on either side, the lower ovate deltoid, the upper lanceolate; pinnules incised: sori linear. Mauritius and Ceylon to E. Indies.

20. *Adiantum-nigrum*, Linn. Stalks brownish, lvs. 3-pinnatifid from winged rachises, triangular, 5-9 in. long; ultimate divisions ovate, sharply incised and serrate on both sides. Old World generally. S. 1:486.

21. *cuneatum*, Lam. Lvs. 12-16 in. long, 4-6 in. wide, tripinnate below, the ultimate divisions broadly obtuse above and strongly cuneate below: sori linear, usually long for the size of the segms. Tropical regions generally.

22. *frágans*, Swartz (*A. fœniculaceum*, Kunth). Lvs. 2-3-pinnate; ultimate segms. lanceolate, sharp-serrate above; veins simple or the lowest forked: sori



oblong, extending from midrib to near base of the lobes: petiole brownish, rachis flattened. W. Indies. S. 1:577.

cc. *Ultimate divisions rhombic, sharply spinulose: texture herbaceous.*

23. **fontanum**, Bernh. Growing in dense clusters: lvs. 3-6 in. long, 1 in. or more wide, 2-pinnate; segms. with 2-5 spinulose teeth which are widely divergent: sori at maturity covering nearly the entire surface of the segms. England and Spain to the Himalayas. S. 1:574.

ccc. *Ultimate divisions longer, not spinulose: texture membranous or herbaceous.*

24. **bulbiferum**, Forst. (*A. laxum*, Hort.). Lvs. 1-1½ ft. long, 6-8 in. wide, 3-pinnatifid; pinnæ tapering to a slender toothed point: often bearing bulbs from which new plants originate while still attached to the lf. Afr. and Australasia. S. 1:508. Gn. 72:156.

25. **myriophyllum**, Presl. (*A. rhizophyllum*, Kunze). Fig. 415. Growing in extensive tufts, with grayish brown stalks and rachises: lvs. 6-15 in. long, 3-pinnate or 4-pinnatifid, the ultimate segms. frequently deeply 2-lobed with a single sorus to each division. Fla. to S. Amer.

26. **cristatum**, Lam. (*A. cicutarium*, Swartz). Lvs. 3-pinnatifid with a winged rachis, 8-18 in. long; pinnules ovate, with 5-7 narrow divisions, each bearing a single sorus; texture thin, membranous. Trop. Amer., rare in Fla.

AA. *Sori linear, marginal or submarginal, on narrow, linear, ultimate divisions of the lf. (Darea.)*

B. *Lvs. bipinnatifid, less than a foot long.*

27. **oceanicum**, C. Chr. (*A. obtusilobum*, Hook., not Desv.). Lvs. 4-7 in. long, 2 in. wide or less, with about 10 pinnæ, which are made up of 5-7 narrow segms. bearing occasional sori in the outer margin of the segms. New Hebrides and Fiji Isls. S. 1:625.

BB. *Lvs. 2-pinnate or 3-pinnatifid, over a foot long.*

C. *Pinnæ short, with close segms.*

28. **rutæfolium**, Kunze. Lvs. 13-15 in. long, with 12-20 pinnæ on each side, each with 7-11 narrow segms., 2 or 3 of the lower ones 2-fid. or rarely 3-fid. S. Afr., India and Japan.

29. **Belangeri**, Kunze. Fig. 416. Lvs. 15-18 in. long, 3 in. wide, with numerous horizontal pinnæ on each side, cut into about 12 slender linear segms. on either side, which are set nearly at right angles to the rachis; the lower basal segms. often forked. Each segm. has a single sorus, and 1 vein. This species is thought by some fern students to be merely a divided variety of *A. tenerum*, Forst. (No. 12). In general the two species are much alike. E. Indies.

30. **dimorphum**, Kunze. Stalks 6-12 in. long, naked: blades 2-3 ft. long, 12-15 in. broad, ovate-deltoid, 2-3 pinnate; sterile lvs. 2-pinnate, segms. ovate 1 in. long, ½ in. broad, bluntly toothed; fertile lvs. 3-pinnate, segms. linear, each with a single sorus. Norfolk Isl.

cc. *Pinnæ longer, with scattered narrowly linear segms.*

31. **viviparum**, Presl. Lvs. 15-24 in. long, 6-8 in. wide, on rather short stalks with pinnatifid pinnules and ultimate segms., which are narrowly linear and often forked: plant often bulb-bearing, like *A. bulbiferum*. Mauritius and Bourbon. Cult. under various names. S. 1:662. *A. nobilis*, Hort., is a more vigorous variety, originally from New Guinea.

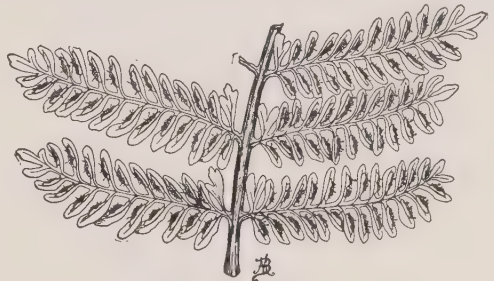
AAA. *Sori more or less curved, sometimes horseshoe-shaped: lvs. ample, 2-4-pinnatifid.*

32. **Filix-fœmina**, Bernh. Lvs. 1½-3 ft., broadly ovate-oblong, bipinnate; pinnæ 4-8 in. long, lanceolate, with numerous more or less pinnately incised or serrate segms. Eu. and N. Amer.—Very variable, especially in cult. Schneider describes 56 varieties.

33. **acrostichoides**, Swartz (*A. thelypteroides*, Michx.). Lvs. 1-2 ft. long, on long, straw-colored stalks, 6-12 in. wide, 2-pinnatifid, with linear-lanceolate pinnæ; segms. crowded, oblong, minutely toothed: sori 10-12 to each segm. Rich soil in the E. U. S. S. 1:651.

34. **spinulosum**, Baker. Lvs. 9-12 in. each way, deltoid, 3-4-pinnatifid, with 9-12 pinnæ on either side, the lowest much the largest; segms. short and sharply toothed. China and Japan.

Supplementary list of less common trade names: *A. aculeatum*, Hort. Hab. (?).—*A. arboreum*. See Diplazium.—*A. bifidum* = *A. lineatum*.—*A. decorum*, a sport from *A. bulbiferum*.—*A. decussatum*. See Callipteris.—*A. ellipticum*, Hort., a trade name.—*A. flaccidum*, Forst. Coolhouse basket fern from Austral., Tasmania and New Zeal. Lvs. 2-3 ft. long, 4-8 in. broad; stipes stout, flexible, greenish, naked; pinnæ numerous, close or distant, lanceolate, leathery, 4-8 in. long, ½-¾ in. broad. Very variable.—*A. Goringianum* var. *pictum*, Mett (*Athyrium Goringianum* var. *pictum*, Hort.). Distinguished from all other members of the genus by the bright color of its entirely deciduous lvs., which are 10-15 in. long, spear-shaped, and pendulous. Possibly the only hardy variegated fern. It, however, needs glass protection for best results. Stalks purple or claret-colored: lvs. green with a central band of gray; lfts. divided into sharply toothed pinnules on which the oblong or kidney-shaped sori are arranged in 2 rows parallel to the midvein. Japan.—*A. laceratum*, Desv. Allied to *A. Nidus* and possibly a variety of that species. Lvs. narrower, cut into irregular lobes, each lobe having black stripe about 3 in. long. Brazil.—*A. lanceum*. See Diplazium.—*A. Lauréntii*, Christ. var. *denticulatum*. Allied to *A. macrophyllum* but smaller. Congo.—*A. lineatum*, Swartz. Warmhouse species from Mauritius and Bourbon, is very variable, running into forms with lfts. again pinnate, which have either small, linear pinnules or these again twice cut: lvs. 1-2 ft. long, 4-6 in. wide; stalks erect, 6-9 in. long, more or less scaly.—*A. longissimum*, Blume. The best of all the genus for large baskets. Lvs. 2-3 ft. long, 4-6 in. broad; stalks blackish, 3-12 in.



416. *Asplenium Belangeri*. (×¾)

long: lfts. sessile, auricled. E. Indies. S. 1:602.—*A. macrophyllum*, Swartz. Coolhouse species from Polynesia, Malaya, China, and Himalayas. Lvs. 6-18 in. long, 6-12 in. wide; stalks brownish: lfts. 6-12 pairs, stalked, 3-6 in. long, 1-3 in. wide, sharp-pointed, serrate.—*A. Shepherdii*, Spreng. See Diplazium.

L. M. UNDERWOOD.  
R. C. BENEDICT.†

ASPRÉLLA: *Hystrix*.

**ASTÈLIA** (name alluding to epiphytic character of some species). *Liliaceæ*. Greenhouse plants with racemes or panicles of small flowers.

Astelias are perennial herbs of about a dozen species in New Zeal., Austral. and the Pacific Isls., with lvs. all radical or crowded at the base of the st., belonging to the Dracæna tribe: fls. small and diœcious; perianth

6-parted, persistent, the parts spreading or reflexed; stamens 6, attached to base of corolla-parts; staminodia present in pistillate fls., the ovary sessile, 1-3-celled: fr. an indehiscent somewhat fleshy and globose berry. In New Zeal., the astelias form a prominent part of the vegetation. The species are confused. Two or 3 New Zeal. species have been sparingly intro. to cult. abroad, as: *A. Cunninghamii*, Hook. f., with 1-celled fr.: fls. numerous and small, greenish yellow or reddish yellow or maroon: a densely tufted species, epiphytic or terrestrial, with lvs. 2-5 ft. long and scape 1-3 ft. B.M. 5175. *A. Banksii*, Cunn., with 3-celled fr.: fls. larger (about  $\frac{1}{4}$  in. long), many, greenish: densely tufted, large, the lvs. 2-6 ft. *A. Solandri*, Cunn., with 3-celled fr.: fls. very numerous and lemon-yellow,  $\frac{1}{2}$  in. long: densely tufted, often making large clumps on trees and rocks, the lvs. 2-5 ft. B.M. 5503. L. H. B.

**ÁSTER** (a star). Including *Diplopappus*. *Compósitæ*. **ASTER. STARWORT. MICHAELMAS DAISY.** A large temperate-zone genus of attractive but botanically-confused, mostly perennial leafy herbs, particularly abundant in North America; very useful for border planting.

The genus is characterized by numerous flattish rays (white, blue, red, or purple), slender subulate or lanceolate style appendages, compressed several-nerved achenes, and an involucre with unequal bracts in few or several rows, the pappus simple, soft, and abundant (Fig. 417); leafy stemmed, mostly blooming in the autumn: lvs. always alternate. It differs from *Erigeron* in having 2 to several rows of involucre bracts; in *Erigeron* there is only 1 series of bracts.

Some of the species are annual, but those in cult. are perennial (or rarely biennial). Calimeris and *Linosyris*, which have yellow fls., a color unknown in aster, are kept distinct in this book.

In North America, where the asters are such abundant plants in the autumn flora, the species are not much known as cultivated plants, most of the specimens seen in gardens being the wild species transplanted. In Europe, however, there are numbers of named garden kinds, some of them derived from American species that have been long cultivated there. *A. novi-belgii* has been particularly productive of garden forms. Many of the garden forms are undoubtedly confused hybrids. The Michaelmas daisies are mostly from this species and perhaps also from *A. novæ-angliæ*. Many of the Latin-form garden names are very difficult to place.

The native asters are amongst the very best plants for borders and roadsides. They should be better known. *A. acuminatus* grows well in shade in ordinary soil, not necessarily moist; increases in vigor under cultivation. *A. cordifolius* prefers open or partial shade; improves much under cultivation with good soil. *A. corymbosus* prefers at least partial shade, and will grow even in very deep shade; seeds very freely; does well on dry ledges and in small crevices in rock; very tenacious of life. *A. dumosus* prefers full sunlight and dry situation. *A. ericoides* wants full sunlight and dry situation; will grow in very poor or shallow soil, but does best where roots can penetrate deep. *A. laevis* grows in either full sunlight or partial shade and good soil. *A. novæ-angliæ* will not endure much shade; prefers moist soil, but grows well in ordinary garden situations. Fall-sown seedlings of *A. novæ-angliæ* var. *roseus* come practically true to varietal name, though varying in shade of color, and these seedlings bloom later than

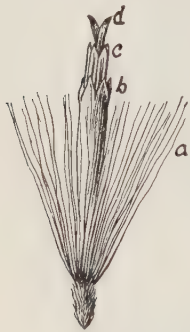
older plants and at a height of 18 inches, making the plant of value as a late bedding plant treated as an annual. *A. novi-belgii* prefers moist soil; will not endure heavy shade. *A. paniculatus* prefers moist soil, but will do well in rather dry situations; will endure more shade than either of the two above species. *A. patens* wants open or half-shaded places, and good soil; one of the weaker species, often proving short-lived. *A. puniceus* will not endure shade; prefers moist



418. *Aster macrophyllus*. ( $\times \frac{1}{2}$ )

places, but will grow in good soil not over-moist; in dry situations it loses its vigor; spreads rapidly in favored locations. *A. spectabilis* prefers open or partly shaded places; one of the weaker species in wild state; rather short-lived. *A. undulatus* wants open or half shade; late-flowering, handsome plant, forming large clumps when allowed to develop. (F. W. Barclay.)

The garden or modified asters undoubtedly deserve more attention in American collections. The beautiful low-growing, vernal alpine asters are little known at present, but are valuable for rock-garden and for bordering purposes. The earliest asters to flower are the Alpine varieties. These are well adapted for floral mass effects, and transplant well, even in an advanced state. There are many garden varieties of asters, among which are Schoene von Ronsdorf, Ultramarin, Beauty of Colwall, Beauté Parfaite, Rosalind and Boule de Neige. Alpine asters can be easily raised from seed sown in spring. Seedlings do not flower until the second year. In the garden they require a light rich soil, open exposure and moderate amount of moisture. Plants retain their foliage over winter and for this reason need a more careful covering than the tall-growing classes require. Garden varieties of the latter, as a rule do better in low and rather moist locations. Here a minimum of care is sufficient. To bring out their full beauty, however, it is necessary to plant them in well-prepared richly manured ground and properly to cultivate, stake and irrigate them. Stock of named varieties must be purchased as plants. Propagation can be effected by division of old clumps, or, if larger quantities are



417. Disk floret of Aster. ( $\times 3$ )

a, pappus; b, corolla; c, stamens; d, styles.



desired, by cuttings. If distinctness of variety and color is no object, seeding may be employed; sow early in spring, thinly in rows; transplant seedlings in August or early in September and await their coming into flower the following season. (R. Rothe.)

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A. Old World asters, some of them old garden plants, and somewhat modified by cult. Nos. 1-12.

B. Sts. simple and scape-like, bearing a single fl., sometimes branched in A. Thomsonii.

c. Rays purplish or violet.

1. *alpinus*, Linn. Lvs. entire and spatulate, forming a cluster on the ground, those on the st. small and linear: st. 3-10 in., bearing a large violet-rayed, handsome head. B.M. 199. Gn. 76, p. 122.—In its wild state, the plant also occurs in the Rocky Mts. Valuable alpine or rockwork plant, with fls. varying to pink and white. Var. *speciosus*, Hort., is taller and stronger, with heads 3-4 in. across. Var. *superbus*, Hort. (Gn. 54:328. G. 32:591), is a large and showy form. Var. *albus* is a beautiful pure white-fl. form of the type. G.M. 50:617.

2. *Thomsonii*, Clarke. An erect, sometimes laxly branched herb, with slender, flexuous, hairy branches: lvs. 2-4 in. long, almost clasping at the base: fls. solitary, 1½-2½ in. wide, the rays reddish purple, about 20-30 in each head. Himalaya region. Gn.W. 23:27. Gn. 42, p. 295.—To be treated as an alpine near N. Y. Perhaps better referred to *Calimeris*.

cc. Rays predominantly blue or lilac.

d. Plants low, not over 1 ft. in height.

3. *himalaicus*, C. B. Clarke (A. *himalayensis*, Hort.). Similar to A. *alpinus*, but dwarfer: rays lilac-blue, slightly recurved at the tip: sts. 4-12 in., slightly villous: lvs. oblong or elliptic, nearly entire. Himalayas, 13,000-15,000 ft.—Little known in Amer.

4. *subcæruleus*, S. Moore. Erect herb from a tufted mat of foliage with sessile, nearly oblong lvs., all a little hairy: lvs. entire or sometimes slightly denticulate: fls. large, solitary on long stalks, at least 2 in. wide, the rays a beautiful pale blue, the disk yellow; involueral lvs. broadly oblong, ciliate. N. W. India. June. G. 32:449.

G.C. III. 38:23. G.M. 48:411. Gn. 68, p. 11.—Needs protection N. June.

5. *pyrenæus*, DC. St. erect, simple, 10-18 in. high: lvs. sessile, roughly pubescent, oblong-lanceolate and prominently 3-nerved: fls. solitary or 2 or 3 together, at least 2½ in. wide, the numerous rays lilac, the disk fls. yellow. S. Eu. Aug., Sept.

DD. Plants 2-3 ft. high.

6. *diplostephioides*, Benth. Two to 3 ft., soft-pubescent or hairy, the st. simple and solitary: lvs. obovate or oblanceolate, entire but ciliate: solitary head large, inclined, 2-3 in. across, blue or pale purple, very showy. Himalayas. B.M. 6718. J.H. III. 33:262. G.C. III. 48:56. G.M. 35:445.—In the American trade has been misspelled A. *Deptostaphides*. Var. *Falconeri*, Clarke (A. *Falconeri*, Hort.), from Cashmir, has very large sky-blue heads.

BB. Sts. usually branched and several- to many-fl.

7. *Amellus*, Linn. St. simple or nearly so, few-fl. or sometimes only 1-fl.: lvs. oblong-lanceolate, obtuse, somewhat serrate, more or less 3-nerved, roughish, pubescent: involucre scales oblong, obtuse or nearly so, spreading, in 4-5 rows; heads large, purple. Eu. and



419. *Aster cordifolius*. A handsome blue-flowered native aster. (X½)

420. *Aster novæ-angliæ*. One of the best and most showy of native asters. (X¼)

Asia. Gn. 27, p. 202; 35:172.—Variable, and several well-marked garden forms.

8. Var. *bessarabicus*, DC. (A. *bessarabicus*, Bernh.). Lvs. oblong and attenuated at base: plant taller and larger-fl., deep purple. G. 21, p. 167. Gn. 35, p. 173; 75, p. 511.—Showy and desirable.

9. *sibiricus*, Linn. A foot or sometimes nearly 2 ft. high, somewhat pubescent, each branch terminating in a single head: lvs. oblong-spatulate to broad-lanceolate, serrate, almost clasping the st.: heads violet or lilac.

Arctic Eu. and Amer., and Rocky Mts.—Excellent rockwork plant.

10. *àcris*, Linn. About 2-3 ft., slender-branched: lvs. linear, or lance-linear: heads large and blue, with long, distinct, handsome rays. S. Eu. Gn. 37:240. G.M. 34:615.—Excellent showy garden plants. A dwarf form is *A. canus*. Var. *nānus* is a very dwarf form, not exceeding 15 in.

11. *trinerviū*, Roxbg. About 3 ft., stout, corymbose at summit: lvs. lance-ovate, 1-4 in. long, usually rough on both sides and strongly toothed: heads large, blue or purple (a pale variety) with narrow, spreading rays. Himalayas. R.H. 1892:396.—Hardy, handsome, variable.

12. *tataricus*, Linn. f. St. erect and striate, hispid, corymbose at the summit, often 7 ft. high: lvs. large (the radical 2 ft. long), lanceolate or oval lanceolate, attenuate at base, entire: involucre scales purplish at



421. *Aster Herveyi*.  
( $\times \frac{1}{2}$ )

tip; heads blue or purple, late. Siberia. G.F. 4:197.—Excellent for the hardy border, particularly for its very late blooming. Var. *Petersianus*, Hort., has narrower lvs. and pale blue rays and yellow disk. China.

AA. *Native Asters*. These plants are one of the charms of the American autumn, and are amongst the best of all hardy border plants. They usually improve greatly in habit when transferred to cultivated grounds. Any of these wild asters are likely to come into cultivation at any time. The number of kinds is large. The student will find them all described in Gray's *Synoptical Flora of North America*, 1, pt. 2. Those of the northeastern states and adjacent Canada will be found in Britton and Brown's *Illustrated Flora of the United States* and Gray's *Manual*. Those of the South are described in Small's *Flora of the Southeastern States*, and those of the Rocky Mountains in Nelson's *Manual of Rocky Mountain Botany*. The following comprises those known to be in cultivation. Of these, *A. novæ-angliæ* is the best known in domestication. The species are much confused.

B. *Basal and lower lvs. cordate and slender petioled*.  
c. *Plant glandular: rays violet*.

13. *macrophyllus*, Linn. Fig. 418. Perennial about  $2\frac{1}{2}$  ft. tall with reddish angular st.: lvs. cordate and petioled below, on the upper part of st. sessile and acute: rays about 16, violet-lavender, the involucre bracts prominently green-tipped. E. N. Amer. G.F. 4: 89 (adapted in Fig. 418).—Suitable for dry shady places.

cc. *Plants not glandular: rays blue or purple*.

14. *Shörtii*, Hook. Perennial, 3-4 ft., with a rough, usually slender paniculately branched st.: lvs. thick, usually quite smooth, the lower cordate, the upper lanceolate and quite entire and those of the small branches bract-like: heads very numerous, the 10-15 violet-blue rays showy and linear. S. E. U. S. G.F. 4:473. G.C. III. 32:269.—Cult. easy, even in dry rocky places.

15. *cordifolius*, Linn. Fig. 419. Perennial, much-branched herb, 3-4½ ft., with a smooth st. and thin, rough, usually hairy lvs., the lower cordate, the upper ovate or lanceolate: heads very numerous, not over ½ in. diam., the pale blue rays usually 10-20 in number. Cent. N. Amer. Gn.M. 3:211.—Can be grown almost anywhere. There are many varieties, the best being var. *polycéphalus* with more heads than the type. Gn. 40, p. 337.—In cult. it has varied much and is prized abroad. *A. elegans* is probably a form of it. Var. *magnificus* is large with many small fls.

BB. *No cordate and petioled lvs.: those of the st. with clasping bases*.

c. *St. rough or hirsute, pubescent*.

16. *novæ-angliæ*, Linn. NEW ENGLAND ASTER. Fig. 420. A stout-st. corymbosely branched perennial, 3-5 ft.: lvs. oblong-lanceolate, clasping the st., hairy, 2½-4 in. long: fls. numerous, showy, the 40-50 violet-purple rays about ½-¾ in. long. E. N. Amer. A.F. 9:283.—The best and most widely known native aster suitable for open places but partial to moisture. Var. *roseus*, Hort., an excellent rose-colored form, is offered by some dealers. Many cult. forms in European collections.

cc. *St. quite smooth*.

17. *lævis*, Linn. (*A. decurrens*, Hort.). Perennial, with stout often glaucous st., 2-3 ft.: lvs. thick, sharply toothed, often rough-margined, the upper strongly st.-clasping: heads numerous, about 1 in. wide, the 15-30 blue or violet rays acutish. N. E. N. Amer.—There are several varieties, but apparently not known to the trade.

18. *novi-bélgii*, Linn. NEW YORK ASTER. Widely variable, slender-st. perennial, 2-3 ft.: lvs. lanceolate, or oblong-lanceolate, entire, smooth, 2½-5 in. long: heads many, in a corymbose-paniculate infl., the 15-25 rays a rich violet. Atlantic coast from Maine to Ga.—Suitable for moist places. Many garden varieties and hybrids are known, but they are mostly confined to the European trade. *A. éminens* and *A. cæspitosus* probably belong here.

BBB. *Lvs. neither cordate nor st.-clasping*.

19. *Herveyi*, Gray. Fig. 421. A rough-st. perennial, 2-3 ft., with firm lvs. that are rough above, hairy on the veins beneath, 2½-5 in. long, and toothed: heads numerous, about 2 in. broad, with 15-25 violet rays, very showy. New England. G.F. 2:473 (adapted in Fig. 421). Good for dry sandy soil.

20. *ericoides*, Linn. WHITE HEATH ASTER. FROST-WEED ASTER. A smooth-st. perennial with paniculately, much-branched facies, 2-3 ft.: lvs. slender, those of the st. narrowly linear and acute, not over 2½ in. long, usually shorter: fls. very numerous, the heads not over ¾ in. wide, and composed of 15-25 white rays.



Not very showy. E. N. Amer. J.H. III. 49:465. Gn. 32, p. 318.—Useful for naturalizing in open dry situations.

Besides these, many other native species are from time to time found in the catalogues of dealers in native plants. The most common are:

*A. acuminatus*, Michx.; *A. amethystinus*, Nutt. (G.F. 5:378); *A. Andersonii*, Gray; *A. Bigelovii*, Gray (B.M. 6430); *A. canescens*, Pursh; *A. carnosus*, Gray; *A. carolinianus*, Walt.; *A. Chamissonis*, Gray; *A. Chapmanii*, Torr. & Gray; *A. commutatus*, Gray; *A. concolor*, Linn. (Mn. 10:161); *A. conspicuus*, Lindl.; *A. corymbosus*, Ait.; *A. Cusickii*, Gray; *A. diffusus*, Ait., and var. *horizontalis*; *A. Douglasii*, Lindl.; *A. Drummondii*, Lindl.; *A. dumosus*, Linn.; *A. falcatus*, Lindl.; *A. Fendleri*, Gray; *A. foliaceus*, Lindl. (*A. foliosus*, Hort.?). *A. Frémontii*, Gray; *A. grandiflorus*, Linn. (G.C. III. 45:36); *A. Hallii*, Gray; *A. integrifolius*, Nutt.; *A. linearifolius*, Linn.; *A. Lindleyanus*, Torr. & Gray (Fig. 422), (G.F. 2:449, adapted in Fig. 422; G.M. 34:615); *A. longifolius*, Lam. (G.F. 9:507); *A. Menziesii*, Lindl.; *A. multiflorus*, Ait.; *A. nemoralis*, Ait.; *A. oblongifolius*, Nutt.; *A. paniculatus*, Lam.; *A. patens*, Ait., and var. *Meehanii*; *A. polyphyllus*, Willd.; *A. Porteri*, Gray; *A. prenanthoides*, Muhl.; *A. ptarmicoides*, Torr. & Gray (G.F. 3:153); *A. pulchellus*, Eaton; *A. puniceus*, Linn. (G.M. 34:615), (Fig. 423), and var. *laevicaulis* and var. *lucidulus*; *A. radulinus*, Gray; *A. sagittifolius*, Willd.; *A. salicifolius*, Ait.; *A. sericeus*, Vent. (G.F. 5:473); *A. spectabilis*, Ait. (Mn. 5:41); *A. surculosus*, Michx. (G.F. 5:521); *A. tanacetifolius*, HBK.; *A. Tradescantii*, Linn. (B.M. 7825); *A. turbinellus*, Lindl. (G.F. 6:17; Gn. 32, p. 319); *A. undulatus*, Linn.; *A. versicolor*, Willd. (J.H. III. 49:309).

In the following list, those marked \* are offered by dealers: *A. brachytrichus*, Franch. Dwarf; disk-fls. yellow, ray-fls. blue.

Yunnan, part of China. R.H. 1900:369.—*A. coccineus nevadensis* = (?).—*A. Didschii* = (?).—*A. hybridus nanus* = (?). "Rosy color, only 6 in. high."—*A. lanceifolius californicus* = (?).—*A. decima*, Hort., white to pink = (?).—*A. delicata*, Hort., pale flesh-color = (?).—*A. gracilimus*, Hort., white changing to rosy pink = (?).—*A. Iberis*, of gardens: 20 in. high, of compact even growth: fls. rich blue. Probably a form of *Amellus*.—*A. lilacinus nevadensis* = (?).—*A. Linosyris*, Bernh. = *Lynosyris vulgaris*, Cass., which see.—*A. mesa grande speciosa grandiflora*, dark purplish blue = (?). R. B. 36:117.—*A. Meehanii*, Hort., is a well-marked form of *A. patens*, found by Joseph Meehan at Antietam.—*A. nova-caruleus* = (?).—*A. pyramidalis* = (?).—*A. Reevesii*, Hort., is *A. ericoides* var. *Reevesii*, Gray, a "rigid form, comparatively stout, glabrous, except that the lvs. are often hispidulous-ciliate toward the base, the heads and rays as large and the latter about as numerous as in *A. polyphyllus*." N. Amer.—*A. rotundifolius*, Hook. Three to 4 ft., stout and erect; lvs. lanceolate-acuminate, spinulose-serrate; heads purple, in large corymbs. Himalayas. B.M. 4557. J.F. I, pl. 91.—*A. Stracheyi*, Hook. Stemless and sarmentose, with 1-fl. bracted scapes: radical lvs. spatulate, hairy; heads lilac-blue, 1 in. across. Pretty. Himalayas. B.M. 6912. G. M. 31:358.—*A. terminalis* = (?).—*A. Townsendii*, Hook. = *A. Bigelovii*, Gray. N. Amer.

N. TAYLOR.†

#### ASTER, CHINA

(*Callistephus hortensis*). One of the most popular of all garden annuals, being particularly valuable for its fall blooming.

The evolution of the China aster suggests that of the chrysanthemum at almost every point, and it is, therefore, a history of remarkable variations. The plant is native to China. It was introduced into Europe about 1731 by R. P. d'Incarville, a Jesuit missionary in China, for whom the genus *Incarvillea* of the Bignonia family was named. At that time it was a single flower; that is, the rays or ligulate florets were of only two to four rows. These rays were blue, violet or white. The center of the flower (or head) was comprised of very numerous tubular, yellowish florets. Philip Miller, the famous gardener-botanist of Chelsea, England, received seeds of the single white and red asters in 1731, evidently from France; and he received the single blue in 1736. In 1752 he secured seeds of the double red and blue, and in 1753 of the double white. At that time there appears to have been no dwarf forms, for Miller says that the plants grew 18 inches or 2 feet high. Martyn, in 1807, says that, in addition to these varieties mentioned by Miller, there had then appeared a "variegated blue and white" variety. The species was well known to American gardeners at the opening of the last century. In 1806 M' Mahon, of Philadelphia, mentioned the "China aster (in sorts)" as one of the desirable garden annuals.



422. *Aster Lindleyanus*. (× 1/2)



423. *Aster puniceus*. (× 1/2)

Bridgeman, a New York seedsman, offered the China and German asters in 1837 "in numerous and splendid varieties," specifying varieties "alba, rubra, cerulea striata purpurea, etc." In 1845, Eley said that "China and German asters" "are very numerous" in New England. This name German aster records the fact that the first great advances in the garden evolution of the plant were made in Germany, and the seed then used came largely from that country. The first marked departure from the type appears to have been the prolongation or great development of the central florets of the head, and the production of the "quilled" flower. This type of aster was very popular fifty and sixty years ago. Breck, in the first edition of his "Flower Garden," 1851, speaks of the great improvement of the aster "within a few years" "by the German florists, and others," and adds that "the full-quilled varieties are the most highly esteemed, having a hemispherical shape, either a pure white, clear blue, purple, rose, or deep red; or beautifully mottled, striped, or edged with those colors, or having a red or blue center." About sixty years ago the habit of the plant had begun to vary considerably, and the progenitors of our modern dwarf races began to attract attention. The quilled, high-centered flower of a generation or more ago is too stiff to satisfy the tastes of these later days, and the many flat-rayed, loose and fluffy races are now most in demand, and their popularity is usually greater the nearer they approach the form of the uncombed chrysanthemums.

The China aster has long since varied into a wide range of colors of the cyanic series—shades of blue, red, pink and purple. The modern evolution of the plant is in the direction of habit and form of flower. There are various well-marked races or types, each of which has its full and independent range of colors. The Comet type (with very flat rays), now one of the most deserving of the China asters, illustrates these statements admirably. This Comet form—the loose, open flower with long, strap-like rays—appeared on the market about 1886 or 1887, with a flower of a dull white overlaid with pink. The pink tended to fade out after the flower opened, leaving the color an unwashed white.

The rose-colored Comet next appeared, and the blue was introduced in 1890. The first clear white was introduced in America in 1892, coming from Vilmorin, of Paris. The Branching types marked a departure. The introduction of the "New White Branching" by James Vick's Sons, in 1893, gave the main impetus to the commercial development of the aster in America.

It is probable that more than one-half of all the asters now grown in

the United States are of the various Branching varieties. The named garden forms of China aster are several hundred. As early as 1895, American seedsmen offered 250 varieties. Some of the forms are shown in Figs. 424-427. For botanical account of the China aster, see *Callistephus*.

It is impossible to construct a satisfactory classification of the China asters. It is no longer practicable to classify the varieties by color. Neither is it feasible to classify them upon habit or stature of plant, for several of the best marked types run into both tall and dwarf forms. Vilmorin, however, divides the varieties into two main groups, the pyramidal growers, and the non-pyramidal growers. The most elaborate classification is that proposed by Barron, from a study of extensive tests made at Chiswick, England. Barron has 17 sections, but they are not coördinate, and they are really little more than an enumeration of the various types or classes. After considerable study of the varieties in the field and herbarium, the following scheme seems to be serviceable:



425. China aster, the Branching type.

- A. Flat-rayed asters, in which all, or at least more than 5 or 6 rows of rays, are more or less prominently flat and the florets open.
- B. Incurved or ball-shaped.
- BB. Spreading or reflexed.
- AA. Tubular or quilled asters, in which all, or all but the 2 or 3 outer rows of florets, have prominently tubular corollas.
- B. Inner florets short, outer ones longer and flat. Represented by the German Quilled.
- BB. All the florets elongated and quilled.

A grower's classification (Arnold) would be approximately as follows:

*Upright*.—All the branches erect; plants compact: e. g., Victoria, Truffaut, Giant Comet.

*Semi-upright*.—Branches few; strong; ascending from base: e. g., "non-lateral" type of Branching.

*Branching*.—Strong pyramidal habit. Original type much branched.

*Spreading*.—More open and spreading form than Branching: e. g., Queen of the Market, Early Wonder and Early Hohenzollern.

For growing in borders, one of the best types is the Comet (Fig. 424), in various colors. Other excellent races are the Branching (Vick's Branching is shown in Fig. 425); Truffaut, known also as Perfection and Peony-flowered; Chrysanthemum-flowered; Washington; Victoria, Mignon, and Queen of the Market. The last is commended for earliness and graceful, open habit, and it is one of the best for cut-flowers. Many other types are valuable for special purposes. The Crown or Cocardeau is odd and attractive. Amongst the quilled asters, the various strains of German Quilled (Fig. 426), Victoria Needle (Fig. 427), and Lilliput are excellent. The very dwarf tufted asters are well represented in Dwarf Bouquet or Dwarf German, and Shakespeare. All these are easily grown in any good garden soil. For early bloom, seeds may be started under glass; but good fall bloom may be had, even in the North, by sowing seeds in the open as late as the 1st of June. Asters make very showy bedding plants when grown in large masses, and are also valuable for filling up vacancies in the mixed herbaceous border, where they ought to be planted in clumps, the dwarfier kinds put in front and the taller behind. The colors of asters are not so strong or heavy as to introduce violent contrasts, and for this reason, as well as because of their simple requirements, they are useful and popular.

L. H. B.



424. China aster, the Comet type. ( $\times \frac{1}{2}$ )



The China aster is now grown largely for cut-flowers, rather than merely for garden decoration. Commercially, it is the most important of the cut-flowers that are grown out-of-doors. In the garden of the amateur, it divides honors with the sweet pea. The commercial value of aster seed sold by American seedsmen exceeds that of any other flower. In addition to the large amount of aster seed grown in southern California, New York now produces annually twenty hundredweight of seed, mostly in varieties used by the commercial florist. The principal reasons for the popularity of the aster with florists, aside from its range of useful colors, are its excellent keeping qualities as a cut-flower, its ability to stand rough handling in shipping, and the ease with which it may be grown.

The past ten years have been marked by a decided increase in the use of the artistic Comet type of flower. Many asters of American origin, adapted to American market conditions, have been widely disseminated. "Non-lateral" strains of Branching asters, devoid of side buds, have been produced to meet a need of the florists, and as a result of careful seed-growing, the semi-double aster has nearly disappeared from field and garden. The frequent accidental crossing and re-crossing of widely differing types and a natural tendency toward variation are constantly furnishing material for improvement when asters are grown in quantity and variety. Recent introductions of types of asters show increased size and vigor of plant commonly attributed to a more or less remote Branching cross. Some of the most valuable introductions, like the Rochester and the Crego Pink, appear to be a combination of a Branching plant and a Comet flower.

The Comet aster group has not taken the place, commercially, to which its great beauty would entitle it, because its very long slender petals make it less lasting as a cut-flower than flowers with broader, shorter petals. The slender stems usually correlated with this type of flower, although attractive in cut-flowers, are undesirable in the field. Beautiful single asters have been introduced from Europe, but so far have made little headway against the American prejudice in favor of double flowers.

#### Classes of asters.

The typical Branching aster is pyramidal in form, large and vigorous, with many lateral branches. It blooms at the close of the season. The abundant leaves are broad and large. The flower is large and deep with the long, rather broad petals irregularly arranged, giving it a soft appearance. The flowers bear well the rough handling incident to ordinary shipping, and if cut before fully mature will last for two weeks. The size and vigor of plant enable the amateur to get fair results with indifferent culture. Modifications of the original type may now be had with flowers having petals variously folded, incurved or whorled and with plants varying to upright in growth and entirely devoid of the many branches that gave the type its name.

The Comet flower is characterized by having petals that are long and narrow and strongly recurved. This gives it a charming light feathery appearance. Originally it was of medium size and bloomed in midseason on upright plants. Comet flowers may now be had on every sort of aster plant. The season includes the earliest and the latest, and the largest aster flowers now grown are of the Comet type.



426. China aster of the Quilled type. ( $\times \frac{1}{2}$ )

Queen of the Market was the first of the distinctively early varieties and is still the most largely grown. The plants are open and spreading and the flowers, while smaller and flatter than those of the Branching, have the same general character.

Victoria and Truffaut (or Pæony-flowered Perfection) were for many years the standard varieties and are still grown to some extent. The plants are upright and bloom in midseason. The petals of the Victoria aster are reflexed at the ends; those of the Truffaut aster strongly incurve, making a ball-shaped flower. Both varieties comprise every shade of color known in asters, and these are duplicated in Giant and Dwarf classes.

#### Cultivation.

Asters thrive in any soil that can be kept in a good mechanical condition. The large late asters are usually the most satisfactory to the amateur. They may easily be grown from seed sown as early as possible in the open ground. Asters transplant readily.

If the plants are started in boxes in the house, the soil should be allowed to dry off on the surface as much as possible between waterings to prevent damping off. Midseason varieties may be grown successfully in this way; but the very earliest varieties need to be started in a greenhouse or an early hotbed.

For market, the extra-early kinds should be sown eight to ten weeks before the soil will permit planting out. They should be kept growing thriftily with a night temperature of about 50° and afterward be thoroughly hardened off in coldframes so that they will not be injured by late frosts after planting out. The soil should be quite as rich as that used for profitable crops of onions or celery; otherwise the flowers will be too short-stemmed. Midseason varieties for market succeed well when started in a mild hotbed. Give plenty of air and avoid overwatering. The last sowing of late varieties is made in the open ground.

When growing in large quantities, the seed is sown with a garden drill in rows a foot apart. A transplanting machine, drawn by horses, is used for setting the plants in the field.

The most destructive diseases in the commercial cultivation of asters are various forms of stem-rot. They are of fungous origin and are induced by allowing the plants to remain moist too long at a time. The infection usually takes place in the seed-row, but often no effect is noticed until the plants are nearly full-grown, when they suddenly wilt and die. Covering the soil in the seed-boxes with clean sand, which can be kept dry between waterings, is an effective aid in the prevention of damping-off and stem-rot. The "yellow disease" causes the plants to have a bleached appearance and to make a spindling growth. It is a derangement of the functions of plant-growth caused, so far as known, by irregularity in the moisture-supply. Thorough cultivation of the soil is the best preventive. The presence of "orange rust" is shown by conspicuous orange-colored pus-



427. China aster, Victoria Needle type. ( $\times \frac{1}{2}$ )

tules on the under side of the leaves. The disease can be held in check by thorough spraying with a fungicide. The Pennsylvania blister beetle is so destructive to asters south of the latitude of New York that it is now commonly known as "the aster beetle." It is a large, soft-bodied, black beetle. It feeds on the flower. Spraying with an arsenical poison will control the beetles in the field. Frequent hand-picking can be practised in the garden. The season of this insect is short. The "tarnished plant-bug" causes extensive damage to asters, most of which is commonly attributed to other causes. The inconspicuous yellowish brown insect, smaller than a house-fly, easily escapes notice. The terminal buds that are punctured by the bug, usually die. Frequently the branch becomes diseased and sometimes the entire plant is dwarfed and sickened. The insects cannot be poisoned, but kerosene emulsion and whale-oil soap are effectual deterrents. Asters growing in partial shade are seldom injured by plant-bugs.

GEO. ARNOLD.

**ASTEROLINOSYRIS** (name derived from *Aster* and *Linosyris*). *Compositæ*. A plant with "rosy-mauve petals, mixed yellow," reputed to be a hybrid between *Aster acris* and *A. Linosyris* (*Linosyris vulgaris*). Apparently a bi-generic hybrid. *Asterolinosyris Willmottiae* is the only species offered, and apparently not by American dealers.

N. TAYLOR.

**ASTILBE** (Greek, meaning *not shining*). *Saxifragaceæ*. Includes *Holèia*. Ornamental perennial herbs grown chiefly for their showy panicles of white or pink flowers.

Leaves ternately 2-3-pinnate; fls. perfect or dioecious; calyx 5-, rarely 4-lobed; petals as many, rarely wanting; stamens 10 or 8, rarely 5; pistils 2 or 3, distinct or partly connate; fr. 2 or 3 dehiscent follicles with many minute seeds.—About 14 species in Cent. and E. Asia, Java and E. N. Amer. They look much like *Aruncus* (which see), and are often called *Spiræa*. *Aruncus* and *Spiræa* are rosaceous genera, and are characterized by many stamens and usually by several to many separate pistils, whereas *Astilbe* has 10, 8 or 5 stamens (twice the number, or of the same number, as the petals), and a 2-3-lobed pistil (which finally separates into more or less distinct follicles). *Astilbe* and *Aruncus* are so much alike that they are often confounded by horticulturists.

The *astilbes* are perennial herbs, mostly rather tall with handsome compound bright green foliage and small white, pink or almost purple flowers in slender or dense spikes forming large terminal feathery panicles.

They are hardy plants of great merit. They are easily grown in any well-made border and like rich good soil and plenty of water during the growing period. They give conspicuous masses of bloom in summer.

Propagation is mostly by division; also by seeds sown early in spring in the greenhouse; they germinate after two or three weeks; the young seedlings must be pricked off several times and later planted out in

frames or in the open ground. The young plants will flower the second year.

*Forcing of astilbe*.—Few herbaceous plants force with greater ease than *Astilbe japonica*, and its var. *compacta*; but three weeks longer time should be given the latter fully to develop its feathery spikes. *Astilbes* are so easily and cheaply imported that for the commercial florist it is cheaper to buy than to divide and grow his own plants. When first received, the clumps of roots should be stored, with a little earth or moss between the roots and a little soil over the crown, until the florist is ready to pot them. No amount of freezing does them the slightest harm; but the boxes or flats in which they are stored are best covered with a little straw or litter, and should have the full benefit of rain or snow to keep the roots from drying. From potting or bringing into the greenhouse, it requires from ten to fourteen weeks to bring them into flower, according to the earliness of the season at which they are wanted in flower. The quality of soil is of no consequence, provided it is light and easily handled. They need water in great abundance. Temperature is also of little consequence. Anything above 50° at night will do; but it is best not to flower them in a higher temperature than 60°, or they will quickly wilt when cut or used for decorations. From the time the sprays begin to show white color until they are fully developed, every *astilbe* should stand in a saucer in which there should be constantly an inch of liquid manure. When sold for window plants or for decoration, *astilbes* are often disappointing. It is merely want of water. Before the full development of the shoots and leaves, they are easily hurt by tobacco smoke, and should be covered with paper or well wetted when fumigation is necessary. Aphis, spider or thrips never trouble *astilbe*. As a border plant, *astilbe* is one of the best of our hardy herbaceous plants; but the feathery plume obtained in the greenhouse is much shorter, more compact, and lacks the pure whiteness of the outdoor-grown specimens. (Wm. Scott.)

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428. *Astilbe japonica*.

A. Color of petals white or yellowish white (or changing to pinkish in *A. Thunbergii*), rarely petals wanting.

B. Petals wanting; stamens 5.

1. *rivularis*, Ham. Rhizome creeping; st. 3-5 ft.: lvs. 2-ternate, the lfts. ovate, dentate 1-3 in. long; the petioles tawny-hairy like the sts. at the base; fls. yellowish white, in large spikes, which are disposed in panicles; stamens 5, pure white. Nepal, W. China. Gn. 48, p. 355.—Attractive, border species, blooming late. Probably needs protection.

BB. Petals present at least in the staminate fls.; stamens 10.

c. Stamens exceeding the petals; tall, 3-6 ft. high.

2. *bitemata*, Brit. (*A. decandra*, Don. *Tiarèlla bitemata*, Vent.). Somewhat pubescent, 3-6 ft.: lvs. 2-3-ternate, the lfts. ovate and cordate or abrupt at base, sharp-serrate, 2-5 in. long; fls. yellowish white, in a large (10-12 in. long) racemose panicle; petals linear, spatulate in the staminate fls., small or wanting in the perfect ones. June. Woods, Va. and S. B.B. 2:170.—Often confounded with *Aruncus sylvestris*, which has numerous stamens not exceeding the broad petals.



3. *grándis*, Stapf. St. 4-6 ft.: lvs. ternately pinnate or 3-pinnate; lfts. ovate to oblong-ovate, doubly serrate, 2-4 in. long, slightly hairy, petiole hairy; panicle 2-3 ft. long with spreading branches; fls. crowded, petals 3 times as long as calyx, stamens longer than petals. July. Cent. China. G.C. III. 38:426. R.B. 33:232.

cc. Stamens shorter than petals: st. 1-4 ft.

d. Lfts. distinctly cuneate at the base: petals about twice as long as calyx.

4. *japónica*, Gray (*Hotëia japónica*, Morr. & Decne. *H. barbata*, Morr. & Decne. *Spiræa japónica*, Hort.). Fig. 428. Erect, 1-3 ft., hairy on the petioles and nodes; lvs. 3-2-ternate, petiole reddish; lfts. ovate-acute, tapering to the base, serrate; fls. white, in a pubescent racemose panicle with somewhat recurved branches; sepals obtusish, as long or slightly longer than pistils. Japan. B.M. 3821. Gn. 48, p. 366. Mn. 5:174.—Commonly known as a spring glasshouse plant in this country, but hardy in the open. There are various cult. forms, as var. *grandiflora*, Hort., with larger and denser panicle; var. *compácta*, Hort., the panicle more compact; var. *multiflora*, Hort.; var. *variegata*, Hort., with variegated lvs.; var. *purpurea*, Hort., with purple-shaded foliage.

dd. Lfts. rounded at the base or occasionally broadly cuneate: petals  $2\frac{1}{2}$ -4 times as long as calyx.

5. *Lemoinei*, Lemoine. Foliage graceful, standing  $1\frac{1}{2}$  ft. high, with lfts. broad-oval, dentate and crimped, satiny green, hairy; fls. with white petals and 10 pink stamens, very numerous, in plume-like clusters, disposed in panicles  $1\frac{1}{2}$  ft. long. Gn. 48, p. 355. R.H. 1895, p. 567. A.F. 11:459.—Garden plant, a hybrid of *A. Thunbergii* and *A. astilboides*. Hardy, and forces well.

6. *astilboides*, Lemoine (*Spiræa astilboides*, Moore. *Spiræa Aruncus* var. *astilboides*, Hort., not Maxim. *A. aruncoides*, Lemoine). Fig. 429. St. 2-3 ft.: lvs. 2-3-pinnate; lfts. ovate to ovate-oblong, 1-2 $\frac{1}{2}$  in. long, doubly and sharply serrate, hairy; fls. white, crowded in dense spikes, forming a panicle, with straight spreading branches; sepals acutish, shorter than pistils; petals linear-oblong, at least  $2\frac{1}{2}$  times as long as sepals. Intro. from Japan. G.C. II. 14:113.—Var. *floribunda*, is supposed to be a cross of this species and *A. japonica*.

7. *Thunbergii*, Miq. St. 1-2 ft.: lvs. 2-3-pinnate, the lfts. slender-stalked, ovate,  $1\frac{1}{2}$ -3 $\frac{1}{2}$  in. long, serrate, yellowish green, hairy; fls. white, on reddish stalks, often changing to pink, in clusters on rather slender spikes forming a spreading panicle; petals  $2\frac{1}{2}$  times as long as the calyx. Japan. F.M. 1881:457. R.H. 1895, p. 565.—A graceful plant. Forces well.

8. *chinensis*, Franch. & Sav. (*Hotëia chinensis*, Maxim.). Plant  $1\frac{1}{2}$ -2 ft., graceful: lvs. ternately 2-3-pinnate; lfts. ovate-lanceolate, doubly serrate, 2-3 $\frac{1}{2}$  in. long, hairy; fls. in a branchy, rather narrow panicle; petals linear-spatulate, white, 3 or 4 times as long as the yellowish white or pink calyx; stamens lilac; anthers blue. July. China. M.D.G. 1907:547.—Possibly a form of the preceding.

9. *rosea*, Van Waveren & Kruijft (*A. hybrida rosea*, Arends). A hybrid between *A. chinensis* and *A. japonica*. Similar to *A. japonica* in habit, but fls. pinkish. The two best known forms are var. Peach Blossom, with lighter pink fls., R.H. 1908, p. 341, and var. Queen Alexandra, with deeper pink fls. M.D.G. 1911:53.

AA. Color of petals pink.

10. *Davidii*, Henry (*A. chinensis* var. *Davidii*, Franch.). St. 4-6 ft.: lvs. ternately pinnate or bipinnate; lfts. ovate to ovate-oblong, 1-1 $\frac{1}{2}$  in. long, coarsely

and unequally serrate; panicle about 2 ft. long, narrow, with ascending, spike-like slender branches, the lower 4-5 in. long; fls. nearly sessile, crowded, fascicled, bright rose-pink; petals linear; stamens 10, shorter than petals with violet filaments and dark blue anthers. July. N. and Cent. China. B.M. 7880. G.C. III. 32:103. R.H. 1907:40. Gn. 72, p. 179. M. D.G. 1907:545.

11. *rubéila*, Lemoine. A hybrid between *A. Lemoinei* and *A. Davidii* (or *A. Lemoinei* × *A. chinensis* × *A. Davidii*). Similar to *A. Lemoinei*, but fls. rose-colored; panicle more compact than in *A. Davidii*. R.B. 34:28.

—Other forms

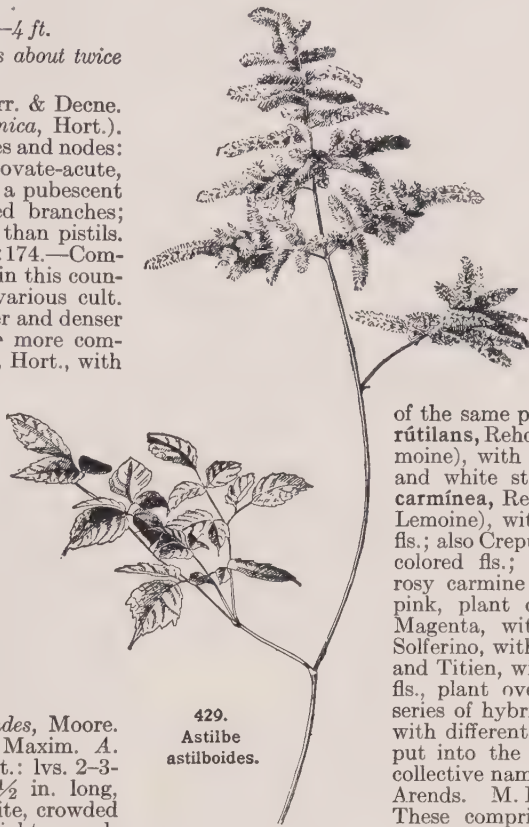
of the same parentage are var. *rutilans*, Rehd. (*A. rutilans*, Lemoine), with rosy-carmine fls. and white stamens, and var. *carminea*, Rehd. (*A. carminea*, Lemoine), with violet-carmine fls.; also *Crepusculæ*, with flesh-colored fls.; *Lumineux*, with rosy carmine fls. changing to pink, plant over 3 ft. high; *Magenta*, with carmine fls.; *Solferino*, with violet-pink fls.; and *Titien*, with delicate pink fls., plant over 3 ft. high. A series of hybrids of *A. Davidii* with different species has been put into the trade under the collective name of *A. Arendsii*, Arends. M.D.G. 1907:546.

These comprise the following crosses: *A. Davidii* × *A. astilboides*, with rosy-lilac fls. in loose and graceful feathery panicles; stamens and petals much exceeding the sepals; here belong the varieties *Juno*, with purplish pink fls., plant over 3 ft. high; *Venus*, also with purplish pink fls.; *Vesta*, with rosy lilac fls.; and *Ceres*, with lilac-pink fls. *A. Davidii* × *A. japonica*, with creamy white to pale pink or salmon fls. in dense spikes; petals and the pink stamens not much exceeding the sepals; here belongs *Rose Perle*. *A. Davidii* × *A. rosea*, similar to *A. japonica* in habit, with purplish pink to salmon or nearly white fls.; this cross may be classed with *A. rubella*. *A. Davidii* × *A. Thunbergii*, taller, 4-5 ft. high with large feathery panicles, their branches nodding at the tips; fls. pale pink to white.

12. *rubra*, Hook. & Thoms. St. simple, 4-6 ft., long-hairy; lvs. 2-ternate; lfts. oblique-ovate, more or less cordate, 1-3 in. long, sharp-serrate; fls. numerous, rose-red, in compact, robust panicles, with the main branches erect and numerous short lateral branchlets about 1 in. long; stamens 10, shorter than petals. India. B.M. 4959.—Needs protection. Little known in Amer.

*A. crenatilobata*, Small (*A. decandra crenatilobata*, Brit.). Allied to *A. decandra*. Lfts. crenately toothed, the terminal one usually 3-lobed. N. C.—*A. simplicifolia*, Makino. Low, not exceeding 1 ft.: lvs. simple, ovate, deeply lobed or incised, about 3 in. long; panicle slender and narrow, the branches short, with star-like white fls. Japan. G.C. III. 48:294; 52:101.—*A. virescens*, Hutchins. Allied to *A. rivularis*. Lfts. obliquely cordate-ovate, 3-4 in. long, denticulate; panicles much branched with small greenish white fragrant fls.; petals wanting; stamens 10. China.

ALFRED REHDER.†



**ASTRÁGALUS** (ancient Greek name of some shrub). *Leguminosæ*. MILK VETCH. Hardy herbs or subshrubs, now and then seen in plantings.

Leaves mostly odd-pinnate, sometimes simple: fls. in spikes or racemes, yellow, purple or white; calyx tubular, its teeth nearly equal; petals clawed, the standard erect; stamens in 2 clusters, the anthers similar: pods fleshy, leathery or papery, not much swollen, as they are in the membranous-legged *Phaca*, the nearest relative.



430. *Astragalus hypoglottis*.  
( $\times \frac{1}{2}$ )

—About 1,500 species. Many kinds are cult. in the Old World, but those described below are the only kinds commonly sold in Amer. The loco-weed of the prairies, which is said to poison cattle, is *A. mollissimus*. For those below and many others, the student is referred to Britton and Brown's Illustrated Flora, Nelson's Manual of Rocky Mountain Botany, and Rydberg's Flora of Colorado. The botanical characters are mostly found in the pods.

*Astragalus*es prefer a light, porous soil and no shade. The dwarfier kinds may be placed in the front of the border or in the rockery.

Propagation is chiefly by seeds, which germinate slowly, or by careful division in early spring. Many kinds are likely to die if divided or transplanted, as they are mycorrhizal plants, much dependent on a semi-parasitic organism, which is better left undisturbed.

*A. Fls. yellow.*

**alopecuroides**, Linn. St. erect, strict; height 2–5 ft.: fls. ovate-lanceolate, pubescent: fls. in thick ovate-oblong spikes, on short, axillary peduncles. Siberia. B.M. 3193.

**carolinianus**, Linn. (*A. canadensis*, Linn.). One to  $3\frac{1}{2}$  ft.: fls. 15–31, glabrous or slightly pubescent,

elliptic or oval, obtuse or slightly emarginate at apex: fls. yellowish,  $\frac{3}{4}$ –1 in. long, in a dense spike: pods 2-celled, coriaceous, sessile, terete and glabrous. July, Aug. E. N. Amer. L.B.C. 4:372.

**Drummondii**, Douglas. Erect, 10–20 in.: fls. 19–33, glabrous, oblong or sometimes oblanceolate, and obtuse: fls. yellowish white, the keel rarely tinged with purple, 1–1½ in. long, in a loose spike: pods 1-celled, distinctly stalked, glabrous and grooved. June, July. Plains of Cent. N. Amer. Hook. Fl. Bor. Amer. 57.

*AA. Fls. not yellow.*

*B. Sts. trailing.*

**monspessulanus**, Linn. St. trailing; height 9 in.: fls. purple, purplish or white, in smaller and looser heads than the above. Eu. B.M. 375.

*BB. Sts. erect or merely decumbent, not trailing.*

*c. Plants not spiny.*

*d. Pods 1-celled.*

**flexuosus**, Hook. Four to 15 in., leafy-std. and finely hairy: fls. 9–21, linear, oblong or oblanceolate, obtuse or emarginate: fls. purplish,  $\frac{1}{2}$ –¾ in. long, the peduncles exceeding the lvs.: pods 1-celled, sessile, cylindric, linear or linear-oblong. June–Aug. Plains of Cent. N. Amer.

**alpinus**, Linn. Height 6–15 in.: fls. 13–25: fls. violet, keel darker: pods 1-celled, black-pubescent. Northern and Arctic regions around the world.

*DD. Pods more than 1-celled.*

**hypoglottis**, Linn. Fig. 430. Height 3–24 in.: fls. 17–25: fls. violet-purple, 6–10 lines long, in dense heads: pods 4–5 lines long, 2-celled, densely villous with white hairs. Eu., Asia, and from Kan. west to Nev. and north to Alaska.—Also a white variety excellent for pots.

**caryocarpus**, Ker-Gawl. Perennial, the whole plant tomentulose: sts. decumbent, ultimately ascending: lvs. alternate, distant, with 17–25 fls.: fls. pale violet-purple, the calyx about half as long as the corolla: seeds several in each cell. La. B.R. 176.

**adsurgens**, Pall. (*A. Laxmanii*, Jacq.). Fig. 431. Small, erect or mostly decumbent plant, with 15–25 fls., which are oval to linear-oblong, obtuse and rarely emarginate: fls. purplish,  $\frac{1}{2}$ –1 in. long, the peduncles exceeding the lvs., the spikes dense: pods 2-celled, sessile, oblong and pointed. June, July. Plains of Cent. N. Amer. Jacq. Hort. Vind. 3:37 (as *A. Laxmanii*).

*CC. Plant spiny: fls. white.*

**hórrida**, Boiss. A low bristly perennial with spiny lvs. composed of 7–8 pairs of broad fls.: fls. white in a dense, long-stalked, spike-like cluster. Persia.—Curious and rare, rather than attractive.

*A. racemósus*, Pursh. Zigzag, erect st.: fls. 17–21: fls. yellowish in loose racemes. July. Plains of Cent. U. S.—*A. Robbinsii*, Oakes. Erect and glabrous: fls. 9–25: fls. in loose racemes, white or purple: pods 1-celled, flattened. Suitable for rocky places. June, July. N. E. U. S.—*A. Shortianus*, Nutt. Silvery canescent: fls. 9–15: fls. blue or violet: pods sessile, 1-celled, strongly curved upward. May, June. Plains of Cent. U. S.

N. TAYLOR.

**ASTRÁNTIA** (name in allusion to star-like appearance of umbels). *Umbelliferae*. MASTERWORT. Perennial garden plants, grown for the odd and ornamental umbels and attractive habit.

Glabrous and erect low herbs with dark-colored aromatic roots: lvs. palmately lobed or dissected, petioled, the st.-lvs. often sessile and more simple: fls. polygamous, the sterile long-pedicelled and the fertile short-pedicelled; calyx with 5 foliaceous lobes, more or less tuberculate; petals oblong-ovate, connivent: fr. compressed.—Perhaps a half-dozen species, in Eu. and W. Asia, bearing fls. in leafy-involved umbels and umbellules, the fls. being white, rose-colored or bluish. The astrantias grow a foot or more high, making



interesting branching plants for the border, particularly in moist places. Prop. by seeds, and easily by divisions in autumn or spring.

**carriõlica**, Wulf. About 1 ft.: radical lvs. 5-7-lobed, the lobes oblong-acuminate, serrate; fls. white or blush; involucre of about 12 entire whitish parts with green red-tinged line. Eu. Attractive. June, July.

**màjor**, Linn. The commonest species in cult.: 1-3 ft.: radical lvs. 5-lobed, the lobes ovate-lanceolate and more or less parted and toothed, acute; fls. pinkish, or rose, or white; involucre of 20 or less linear-lanceolate entire leafy parts; calyx-lobes lanceolate and spinulose, exceeding the petals. Eu.—Thrives by running water and in partial shade. May, June.

**Biebersteinii**, Traut. Small: radical lvs. 3-parted, the middle lobe oblong or obovate and more or less 3-lobed, sharp-serrate; involucre parts oblong, entire or nearly so, equaling the umbel; calyx-lobes lanceolate-acute, equaling the petals. Caucasus.

*A. helleborifolia*, Salisb. (*A. heterophylla*, Willd., *A. maxima*, Pall.). 2 ft. or less: radical lvs. 3-lobed, serrate; fls. pink; involucre of about 12 ovate-lanceolate bristly parts. Caucasus.—*A. minor*, Linn. 8-10 in.: radical lvs. 7-9-lobed, toothed; fls. white; involucre white. Eu.

L. H. B.

**ASTRAPÆA**: *Dombeya*.

**ASTROCARYUM** (Greek, *astron*, star, and *karyon*, nut; referring to star-like arrangement of the fruits). *Palmaceæ*, tribe *Bactridæ*. Spiny palms, stemless or with a short, or tall, ringed caudex.

Leaves terminal, pinnately parted; segms. approximate, equidistant or fasciculate, lanceolate-acuminate or attenuate to the obliquely truncate apex, plicate, whitish beneath, the terminal ones free or confluent, the spiny margins recurved at the base; petiole very short; sheath short, open, the spines of nearly all parts of the plant, in some cases, nearly a foot long; spadices short or long, the finely divided branches pendulous, thickened at the base, thence very slender, long, naked, the floriferous naked basal portion, as it were, pedunculate; spathes 2, the lower one membranous, deciduous, the upper fusiform, coriaceous or woody, open on the ventral side, persistent; bracts of the female fls. broad, imbricated like the bractlets; pistillate fls. with a stipitate male one on either side: fr. rather large, ovoid or subglobose, beaked, smooth or spiny, red or orange.—Species 30. Trop. Amer.



431. *Astragalus adsurgens*. ( $\times \frac{1}{2}$ )

*Astrocaryums* are elegant palms of medium height, very suitable for moderate-sized conservatories. *A. Murumuru*, *A. mexicanum* and *A. argenteum* are the kinds most commonly met with in collections. The leaves are pinnate, spiny on both sides, even in very young plants, and in small plants, at least in some of the species, the segments are narrow, four or five pairs of these alternating with two very broad ones. *A. argenteum* has the under surfaces of the leaves of a much lighter color than the others.

In a young state, the plants require the temperature of the stove, and after attaining the height of a few feet they may be best grown in a warmhouse, and given plenty of water; also a humid atmosphere. Specimens 8 to 10 feet high fruit freely.

Propagation is by seeds, which are slow in germinating. The soil in which they are sown should be changed occasionally, to prevent it from becoming sour. Be careful not to overpot, or the fleshy roots will decay. G.C. II. 22:522. See *Palms*.

*A. Lvs. scurfy, at least beneath or on the petioles.*

**Mûrumuru**, Mart. Lvs. 9-12 ft. long; segms. lanceolate, somewhat falcate, rich green above, silvery beneath; sts. 12-15 ft. high, densely covered with stout, black spines 6 in. long. Brazil. I.H. 22:213.

**argenteum**, Hort. Petioles and under surface of the lvs. covered with silvery white scurf: lvs. arching, wedge-shaped, 2-lobed, distinctly plicate, bright green above; petioles with numerous dark, spreading spines 1 in. long. Colombia. F.R. 3:569.—Perhaps more correctly named *A. Malybo*, Karsten.

**filulære**, Hort. Small, slender: lvs. erect, narrowly cuneate, with 2 divergent lobes, inversely sagittate; petioles densely scurfy; rachis scurfy on both sides; spines numerous on the petioles and rachis, and on the principal nerves above; brown. Country unknown.

*AA. Lvs. not scurfy.*

**Àyri**, Mart. Trunks 18-30 ft. high, 8-12 in. diam., usually cespitose: lvs. 15 ft. long, equally pinnatisect to the apex; petiole plano-compressed, membranaceous on the margins, densely scaly and with scattered spines; lower segms. over 3 ft. long,  $1\frac{3}{4}$ -2 in. wide, 2 in. apart, the upper ones 2-2 $\frac{1}{2}$  ft. long, 1 in. wide,  $1\frac{1}{4}$  in. apart, conduplicate at the base, linear, long, attenuate, pointed, minutely and remotely spiny along the margins, white-tomentose below. Brazil.

**mexicanum**, Liebm. St. 4-6 ft. high, cylindrical, thickly covered with rings of black, straight, 2-edged spines: petiole 2 ft. long, 4-sided, the 2 upper sides concave, clothed (as is the rachis) with straight black spines; blade 6 ft.; segms. 15-18 in. long, 1 in. wide, alternate, broadly linear, acute, straight, white beneath, with deciduous black spines along the margins. Mex.

*A. granatense*, Hort., is an unidentified trade name.

J. G. SMITH and G. W. OLIVER.

N. TAYLOR.†

**ASYSTÀSIA** (obscure name). Including *Henfrèya*, *Dicentranthèra* and *Mackàya*. *Acanthaceæ*. Hothouse or greenhouse evergreen herbs and shrubs.

Plants erect or scandent: lvs. membranaceous, entire: corolla-tube straight or curved, the spreading limb 5-lobed and nearly or quite regular; stamens 4, unequal; stigma blunt or minutely 2-lobed; fls. white, blue or purple, in axillary or terminal clusters, often very showy.—About 20 species in the Old World tropics. Require the general treatment of *Justicia*, in intermediate or warmhouses.

**bèlla**, Benth. & Hook. (*Mackàya bèlla*, Harv.). Glabrous, upright sub-shrub: lvs. ovate-oblong, acuminate, spreading, short-stalked, sinuate-toothed: fls. lilac, 2 in. long, with a long tube below the flaring throat, the spreading segms. ovate-obtuse, disposed on one side of a raceme 5-8 in. long. S. Afr. B.M

5797.—A beautiful plant, rarely seen, and thought to be difficult to manage; but it seems to flower readily in fall in our climate, if rested during the previous winter and brought on in the summer. Prop. by cuttings of firm wood in spring or summer. Young plants in small pots often bloom well.

*A. coromandeliana*, Nees (*A. comorensis*, Bojer. *A. violacea*, Dalz. *Justicia gangetica*, Linn.). Zigzag sub-shrub: lvs. ovate-cordate, wavy: fls. purple, nearly sessile, in 6-10-fl. raceme. India. B.M. 4248. P.M. 14:125. F.S. 2:179.—*A. scandens*, Lindl. (Henfrey *scandens*, Lindl.). Climbing: lvs. obovate to ovate, thick, entire: fls. large, yellow, white and bluish, in a thyrs. Afr. B.M. 4449. B.R. 33:31. F.S. 3:231. L. H. B.

ATACCIA: *Tacca*.

**ATALANTIA** (*Atalantia*, one of the Hesperides). *Rutaceæ*, tribe *Citrææ*. Woody plants, now receiving

attention in America as stocks for citrus fruits, and as possible parents in breeding new forms of such fruits.

Small trees or shrubs, usually spiny, with persistent coriaceous simple lvs. having prominent netted veins and wingless or very narrowly winged petioles jointed at base of lf.: fls. usually pentamerous, with the stamens free or united into a tube, twice as numerous as the petals; ovary 3-5-celled, with 1 or 2 ovules in each cell: fr. like a small orange with a lemon-like skin. In the typical species, the pulp-vesicles fill the segms., but in some dry-fruited species they are rudimentary; these species constitute the subgenus *Rissoa*.—Twelve or 15 species are known, ranging from India through the Malayan peninsula to Austral.



432.

Leaf of *Atalantia citrioides*. ( $\times \frac{5}{8}$ )

*A. Subgenus Euatalantia. Cells of fr. lined with pulp-vesicles.*

**monophylla**, DC. (*Limonia monophylla*, Roxbg., not Linn.). A large shrub or small tree, native to India, Ceylon, Burma, Siam and Indo-China, usually spiny: lvs. glabrous, or sometimes pubescent, 1-3 in. long; petioles short, slightly or not at all winged: fls. borne in axillary panicles; calyx irregularly lobed, split to the base on one side; petals usually 4, stamens 8, the filaments connate and forming a completely closed tube; ovary 3-5-celled: fr. from  $\frac{1}{2}$ – $\frac{3}{4}$  in. diam., with a skin like a lime, globose, with several cells (generally 4), each usually containing 1 seed and filled with pulp-vesicles, making the fr. much like a miniature orange. India, Ceylon, farther India. Ill. Roxbg. Pl. Corom., pl. 83. Wight, Icones, pl. 1611. Engl. in Engl. and Prantl. Nat. Planzenf. III. 4:191; fig. 111, C.D.—This tree, still little known outside of India and Ceylon, is the



433.

Cross-section of ovary of *Atalantia citrioides*. ( $\times 1$ )

type of the genus *Atalantia*, and one of the promising species for trial as a stock on which to graft other citrus frs., and also for use in breeding new types of citrus frs. The frs. yield an oil which in India is considered a valuable application in chronic rheumatism.

**macrophylla**, Kurz. (*A. monophylla* var. *macrophylla*, Oliver). A small or medium-sized tree, native to the Andaman Is. and Burma, having ovate-

elliptical emarginate lvs.  $1\frac{1}{2}$ –4 in. long and  $1-2\frac{1}{2}$  in. broad: fls. on short axillary racemes; calyx irregularly lobed, split to the base on one side as in *A. monophylla*; stamens connate and forming a tube: fr. large, said to reach  $1\frac{1}{2}$ –2 in. diam. Andaman Is., Burma, Malay Peninsula, Bangka Isl.—Little known and is chiefly interesting because of the large size of its frs. Kurz, in his "Forest Flora of British Burma," says of this species:

"Berries globose, the size of a wood-apple, glabrous," and gives the size of the wood-apple as  $1\frac{1}{2}$ –2 in. diam. A tree brought from the island of Bangka, east of Sumatra, and now growing at the Botanical Gardens at Buitenzorg, Java, is considered by Hochreutner to belong to this species. It is of remarkable size, being a beautiful round-topped tree 40 ft. high with a deeply furrowed trunk 6 ft. in circumference, forking at 3 ft. from the ground and branching profusely at  $6\frac{1}{2}$ –10 ft. No other species of *Atalantia* is known to reach this size or to bear frs. so large. This species is of unusual interest for trial as a stock and also for hybridizing with other citrus frs.

**citrioides**, Pierre. A small tree native to Indo-China, usually spiny, having glabrous emarginate oval lvs.  $2-3\frac{1}{2}$  in. long (Fig. 432): calyx cup-shaped, not split to the base; stamens connate, forming a tube; ovary usually 3- or 4-celled: fr. resembles a small orange about  $\frac{3}{4}$  in. diam., with a roughened glandular skin; cells filled with pulp-vesicles and contain usually a single seed about  $\frac{3}{4}$  in. long (Fig. 433). Ill. H. Lecomte Fl. gén. de l'Indo-Chine, Vol. I, pl. 24, fig. C. 5, 6.—This interesting species is native to Cochinchina and Cambodia and has recently been intro. into this country, where it will be tested as a stock and for breeding purposes. Its close relationship to *Citrus* is shown by the fact that it grows well when grafted on grapefruit.

**racemosa**, Wight. A shrub or small tree, differing from *A. monophylla* chiefly in having a regular calyx not split down one side. S. India, Ceylon. Ill. Hook. J. bot. Vol. I, pl. 122: Wight, Icones, pl. 71.

**AA. Subgenus, Rissoa**, n. subg., named for A. Risso, b. Nice, 1777, d. 1845, a well-known writer on citrus frs. *Rissoa*, Arnott, 1836 as a genus. Like *Euatalantia*, but with dry frs., the cells being nearly filled with 1 or 2 large seeds; pulp-vesicles rudimentary and greatly reduced in number.

**ceylónica**, Oliver (*Rissoa ceylónica*, Arn.). Fig. 434. A much-branched spiny shrub or small tree native to Ceylon and India: lvs. lanceolate emarginate,  $1\frac{1}{4}$ –3 in. long: fls. borne in crowded cymes; calyx not split on one side; stamens free, alternate ones longer; ovary usually 2-celled with 2 ovules in each cell: frs. about  $\frac{1}{2}$ – $\frac{3}{4}$  in. diam., dry, having only rudimentary pulp-vesicles; containing from 2-4 very large rounded seeds. Ceylon.—This species is of interest chiefly for trial as a stock, since its large seeds would be likely to produce very vigorous seedlings. The dry fr. renders it unpromising for breeding purposes. The figure is from a specimen grown at the Hope Garden, Jamaica.

**Guillauminii**, Swingle. A small spiny tree, 10-13 ft. high: young branches angular and pubescent: lvs. oval, more or less pointed at both ends, 2-4 in. long: fls. unknown: frs.  $\frac{3}{4}$ –1 in. diam., 3-celled, 2 large seeds in each cell, pulp-vesicles rudimentary. Tonkin. Ill. Notulae systematica. H. Lecomte, Vol. II, p. 162, fig. 1.—A little-known species, interesting on account of its large frs. Because of its large seeds, it should yield vigorous seedlings.



434. *Atalantia ceylonica*. ( $\times \frac{1}{2}$ )



**simplicifolia**, Engl. (*Amyris simplicifolia*, Roxbg. *Atalantia Roxburghiana*, Hook. f.). A spineless shrub or small tree: lvs. very large, 4-6 in. long,  $1\frac{1}{2}$ -2 $\frac{1}{2}$  in. wide, elliptic, pointed at both ends: stamens free; ovary 2-celled: fr. spherical, rough-skinned,  $\frac{1}{2}$ -1 in. diam., with large seeds. Malay Peninsula. Ill. Wight, *Icones*, pl. 72. —An interesting species because of its unusually large lvs.

Imperfectly known species: *A. caudata*, Hook. f. Lvs. caudate-acuminate, narrowed at base: ovary 2-celled. India.—*A. puberula*, Miq. Lvs. narrowly oblong-emarginate: twigs, petioles, lf.-bases and midrib puberulous; perhaps a form of *A. monophylla*.

WALTER T. SWINGLE.

**ATAMASCO LILY:** *Zephyranthes*.

**ATHANÁSIA:** *Lonas*.

**ATHROTÁXIS** (name alludes to the crowded cone-scales). Sometimes spelled *Arthrotaxis*. *Pinaceæ*. Evergreens, allied to *Cryptomeria*, *Sequoia* and *Sciadopitys*, suitable for planting South, or for use as tub specimens in coolhouses.

Trees, densely branched, monœcious: lvs. small, either short, blunt, scale-like and appressed, or lanceolate and somewhat loosely disposed: staminate fls. in imbricated spiral aments, the anthers 2-celled; pistillate fls. in spirally imbricated aments, 3-6 ovules under each scale, these aments becoming small globular cones with woody scales which are contracted at base and at apex incurved or acuminate or pointed.—Three species in Tasmania; by some considered to be inseparable from the genus *Cunninghamia*. These plants are little known in cult. Aside from seeds, cuttings may be used for prop.

**selaginoides**, Don (*A. alpina*, Van Houtte. *Cunninghamia selaginoides*, Zucc.). Stout, to 45 ft.: lvs. loose, lanceolate, incurved, acute,  $\frac{1}{2}$  in. or less long, those of young seedlings narrower: cones  $\frac{1}{2}$ - $\frac{3}{4}$  in. diam., the scales lanceolate-pointed. Mts.

**cupressoides**, Don (*A. imbricata*, Maule. *Cunninghamia cupressoides*, Zucc.). Tree, reaching 40 ft., with ascending branches: lvs. broad and obtuse, less than  $\frac{1}{6}$  in. long, thick and keeled, closely appressed to the branches: cones  $\frac{1}{2}$  in. or less diam., the scales rounded at top and bearing a short point.

**laxifolia**, Hook. (*A. Doniana*, Henk. & Hochst.). Tree, 25-30 ft., closely allied to *A. cupressoides*: lvs. imbricate but less appressed, acute, about  $\frac{1}{6}$  in. long: cones larger and scales more acuminate. Mts.

L. H. B.

**ATHÏRIUM**. A generic name recognized as valid by many well-known fern students. As usually delimited, it includes species of *Asplenium* (which see) which have some of the sori curved across the subtending veinlets. There are also differences in the stem structure. The species are mostly larger and more herbaceous than those of true *Asplenium*.

R. C. BENEDICT.

**ATRÁGENE:** *Clematis*.

**ATRAPHÁXIS** (ancient Greek name). *Polygonaceæ*. Ornamental shrubs grown chiefly for the white or pinkish flowers produced during the summer.

Low shrubs with spiny or unarmed branches: lvs. deciduous, short-petioled, alternate or fasciculate: fls. small, apetalous in few-fl. axillary clusters forming terminal racemes; sepals usually 5, sometimes 4, the 2 outer ones smaller and usually reflexed; stamens 8, sometimes 6; ovary superior with 2-3 styles free or connate at the base: fr. a small 2- or 3-angled achene enveloped by the enlarged inner sepals. Summer.—About 18 species in Cent. and W. Asia, Greece, and N. Afr.

These plants are of spreading habit, with usually small leaves, attractive with their numerous racemes of white or rose-colored flowers, which remain unchanged for a long time, owing to the persistent calyx.

They grow best in well-drained soil and sunny situations, but do not stand transplanting well when older. They are well adapted for planting in rockeries or on rocky slopes and are hardy North. The handsomest of the species is *A. Muschketovii*. Propagation is by seeds sown in spring; the seedlings are liable to rot if kept too moist, or in damp air. Increased also by greenwood cuttings under glass in early summer, and by layers. None of the species is in the American trade.

*A. buxifolia*, Jaub. & Spach (*Polygonum crispulum*, Sims). Height 1-2 ft., spineless: lvs. obovate, crenate, dark green,  $\frac{1}{2}$ -1 in. long: racemes short. Transcaucasia, Turkestan. B.M. 1065.—*A. frutescens*, Koch (*A. lanceolata*, Meisn.). Height 1-2 ft., spineless: lvs. ovate-lanceolate, glaucescent,  $\frac{1}{4}$ -1 in. long: racemes loose. Caucasus, Turkestan, Siberia. L.B.C. 5:489. B.R. 3:254.—*A. Muschketovii*, Krassn. (*A. latifolia*, Koehne. *Tragopyrum lanceolatum* var. *latifolium*, Regel). Erect, 2-3 ft., spineless: lvs. lanceolate, crenate,  $\frac{3}{4}$ -2 in. long: fls. white with the anthers and ovary red,  $\frac{1}{4}$  in. across in dense racemes. Turkestan. B.M. 7435. Gt. 40:1344.—*A. spinosa*, Linn. Height 1-2 ft., spiny: lvs. elliptic, entire, glaucescent,  $\frac{1}{4}$ - $\frac{1}{2}$  in. long: racemes short; sepals usually 4 and stamens 6. S. Russia, Orient, Siberia. ALFRED REHDER.

**ÁTRIPLEX** (from a Greek name of orache). *Chenopodiaceæ*. Herbs with inconspicuous flowers, some of which are used for forage under the name of salt-bushes, some for hedges or lawn specimens, and one as a garden vegetable, and many succulent weeds of desert regions.

Flowers diœcious or monœcious, in spicate or paniculate clusters, sometimes bunched in the axils: lvs. usually alternate or some opposite: fr. half or wholly inclosed by the persistent bractlets.—About 125 widely distributed species, often weeds. *A. patula*, in many forms, is a common weedy plant throughout the country.

*Atriplex hortensis* is a garden vegetable used like spinach; for culture, see *Orach*. *A. leptocarpa*, *A. semibaccata* and others have been introduced as supplementary forage plants for arid regions. *A. Breweri* is a popular low hedge plant in southern California.

A. Garden vegetable (with ornamental-lvd. variety).

**hortensis**, Linn. ORACH. SEA PURSLANE. Annual: st. herbaceous, erect: lvs. hastate, cordate, or triangular-oblong, acute, 4-5 in. long,  $2\frac{1}{2}$ -3 in. wide; petioles 12-18 lines long: fruiting bracts 4-8 lines long, short-pedicel. Var. *âtre-sanguinea*, Hort., is a crimson-lvd. ornamental about 4 ft. high, sometimes grown with amarantus-like plants. Old World. See *Orach*.

AA. Ornamental shrubs.

B. Shrubs 1-3 feet.

**canescens**, James. A pale, densely scurvy shrub, 1-3 ft. high: lvs. oblanceolate, entire: fruiting bractlets with 4 vertical, reticulated wings. July-Sept. New Mex. to S. Dak. and west to Calif.

**Hálimus**, Linn. Low-spreading shrub with gray foliage, cult. in Calif. for hedges and for seaside planting: lvs. 1-1 $\frac{1}{2}$  in. long; petioles 3-4 lines long: fls. purplish: fruiting bracts 1 $\frac{1}{2}$  lines long, 2 lines wide, sessile, reniform, obtuse, entire: seed compressed, yellowish. Medit. region and S. Afr.



435. *Atriplex Breweri*. Used for hedges in California. ( $\times \frac{1}{3}$ )

BB. Shrubs 4-10 feet.

**Bréweri**, S. Wats. Fig. 435. Stout woody shrub, 4-6 ft.: lvs. ovate-oblong, silvery gray, somewhat rhombic-cuneate at the base, obtuse and acute at apex, 1-3 in. long; fls. dioecious, the calyx deeply 4-cleft. At home in sandy, wind-swept places. S. Calif.

**lentifórmis**, S. Wats. (*Obidne lentifórmis*, Torr.). Diffusely branched, 4-10 ft., the branches terete, with rigid often spinescent branchlets: lvs. oblong-rhombic,  $\frac{1}{2}$ -1 $\frac{1}{2}$  in. long; fl.-clusters small, golden or silvery, the calyx 5-parted. S.W.U.S.—Silvery and tall, growing as the preceding but standing more cold.

N. TAYLOR.†



436. *Atropa Belladonna*  
or Deadly Nightshade.  
( $\times \frac{3}{8}$ )

**ÁTROPA** (after *Atropos*, that one of the three Fates who cut the thread of life). *Solanaceæ*. **BELLADONNA**. A genus of 2 species of Old World herbs of great economic importance. Calyx with 5 ovate leafy divisions, enlarging in fr.; corolla bell-shaped or funnellform. The purple berries are poisonous. The plant is used in medicine and is the source of atropine and other drugs. Not in cult. in U. S. except in botanic gardens.

**Belladónna**, Linn. Fig. 436. Plant erect, branching, leafy; lvs. ovate, entire, pointed; fls. single or in pairs, nodding on lateral peduncles; corolla blue-purple or often greenish purple. Eu. to India.

N. TAYLOR.†

**ATTALEA** (*attalus*, magnificent). *Palmaceæ*, tribe *Cocoinæ*. A large genus of horticulturally little-known palms, well worth more attention.

Stems spineless, single, usually ringed, sometimes lacking: lvs. usually many in a large erect tuft, pinnate, the numerous lfts. rather regularly placed, but at right

angles to the rachis, those above standing erect, those beneath falling below the rachis; young lvs. very attractive but rather stiff in their perfect erectness; petiole concave above, often very fibrous at the base: fls. monœcious or polygamo-dioecious, on a branched spadix inclosed in a rather woody spathe, at least at first, which appears among the lowest lvs.; spadix ultimately recurving, sessile, bracted, usually yellow: fr. a drupe, sometimes quite large, frequently fibrous-coated.—Because of their slow growth the 20-25 species are not very favorably known to the dealers. All are natives of Trop. Amer. See G.C. II. 22:523.

At least two of the species are of economic importance. *A. Cohune* is the source of a finer oil than that of the coconut, and is also used in making an intoxicating beverage. *A. funifera* is the source of a fine fiber much used in the making of brooms, and in rope-making.

Attaleas must be grown in a tropical greenhouse, with a night temperature not less than 60°. They will do best in a mixture of loam three parts, cow- or horse-manure, one part, and one part of sand.

Propagation is by seeds, which may be placed 2 inches deep in a box to be plunged out-of-doors in summer, covered with moss and watered freely.

A. Trunks becoming tall, or at least not stemless.

B. Bases of the petiole prominently fibrous: old lvs. persistent in *A. funifera*: trunks 18-30 ft.

**funifera**, Mart. **PISSABA PALM**. **COQUILLA**. St. 18-30 ft., 8-13 in. diam., smooth: lvs. as long as the caudex, green both sides; petioles with very long hanging fibers; segms. broadly linear-acuminate, in clusters of 3-5, divaricate, very numerous: drupe 4 in. long. Brazil.

**gomphococca**, Mart. St. 20-30 ft. crowned by a magnificent cluster of large (6-9 ft.) lvs.: lfts. very numerous, linear or linear-lanceolate, bright green above, paler beneath; petiole relatively short, very fibrous at the base: spathe slender and woody, the spadix reflexed, but short-stalked and half hidden by the lvs.: fr. fibrous-coated. Costa Rica.—Intro. by Reasoner Bros. in 1911.

BB. Bases of the petiole not prominently fibrous: trunks 50-100 ft.

**excelsa**, Mart. St. 90-100 ft. high in the wild, 16-20 in. diam.: lvs. erect-spreading; pistillate fls. solitary on the branches of the spadix: drupe oblong-cylindric, acute at both ends. Brazil.—A little-known palm among the dealers, but not uncommon in fanciers' collections. Stately in habit and with splendid large lvs.

**Cohune**, Mart. **COHUNE PALM**. Fig. 437. St. 50-60 ft.: lvs. erect, pinnate, the dark green pinnæ 30-50 and 18 in. or less long; petiole flat above and rounded below: drupe broadly ovate, nearly 3 in. long, with a very short beak. Honduras.—Fruit used for soap-making, and exported from Cent. Amer. for that purpose. Used for thatching.

AA. Without trunks.

**spectabilis**, Mart. Stemless, or with a very short caudex: lvs. 18-21 ft. long, erect or spreading, the lower segms. 3-4 ft., the upper 12-16 in.,  $\frac{1}{2}$  in. wide, linear-acuminate: spathe erect: fr. about as large as a hen's egg. Brazil.—Requires plenty of water, as its home is on the banks of the Amazon.

**amygdalina**, HBK. (*A. nucifera*, Karsten). Stemless: lvs. 15-18 ft. long, crowded, pinnatisect; segms. 90-100 on each side, ensiform, glabrous above, with hairs along the outer margins beneath,  $2\frac{1}{3}$ -2 $\frac{2}{3}$  ft. long, about  $1\frac{1}{4}$  in. wide; petiole with rusty scales beneath: spadix of male fls. about 18 in. long, with a flattened stalk, inclosed by a thick woody spathe. Brazil.

*A. Guichire* is a trade name; "extremely long-leaved."—*A. Maripa*, Mart. (*A. Mariposa*, Hort.). See Maximiliana.

N. TAYLOR.†



**AUBRIETIA** (Claude Aubriet, French natural history painter of last century). *Cruciferae*. **PURPLE ROCK-CRESS**. Showy perennial more or less evergreen trailers, excellent for rockwork or edgings.

Allied to *Alyssum* and *Vesicaria*: distinguished chiefly by the outer sepals being saccate at base, the shorter filaments toothed, and the valves of the oblong or globose silique convex and not ribbed: lvs. entire or angular-toothed: fls. in shades of violet or purple, in few-fl'd. bractless racemes: plant canescent or tomentose.—About a half-dozen species, Italy to Persia. The aubrietias are of simple cult. Prop. by seeds, layers or cuttings. They make excellent mats of foliage and bloom.

**deltoides**, DC. Fig. 438. Lvs. oblong-spatulate, deltoid or rhomboid, with 1 or 2 teeth on either side, grayish, narrowed into a very short petiole: fls. in few-fl'd. lax clusters, the violet or purple petals twice the length of the calyx.—Grows 2–12 in. high. Pretty spring and summer bloomer. Hardy in the N. Very variable, some of the forms being named as if of specific rank. Var. *Bougainvillei*, Hort. Fls. light violet: dwarf and compact. Var. *Campbellii*, Hort. Fls. large, purple: plant large. Var. *Eyrei*, Hort. Fls. large and long, deep violet. Var. *græca*, Hort. (var. *superba*). Dwarf and compact, large-fl'd. One of the best. Var. *Hendersonii*, Hort., probably the same as *Campbellii*. Var. *Leichtlinii*, Hort. Profuse bloomer, pink fls. Var. *olympica*, Hort. Fls. large, violet, like var. *Eyrei*. Var. *violacea*, Hort. One of the largest forms. Var. *Mooreana*, Hort. Compact: fls. blue. Var. *Perkinsii*, Hort. Fls. deep purple with tiny white eye, the petals rounded: plant strong, 10 in., making a large mat. Gn. 67, p. 344. Raised by F. Perkins, Stratford-on-Avon. Var. *Moerheimii*, Lemoine. Fls. large, rosy pink or mauve, blooming all summer. Var. *purpurea*, Hort. Erect in habit: fls. large, purple. Var. *variegata*, Hort. Lvs. variegated.

L. H. B.

**AUCUBA** (Latinized for *Aokiba*, its Japanese name). *Cornaceæ*. Ornamental plants grown for their large evergreen foliage, often handsomely variegated, and also for the bright scarlet fruits.

Shrubs with stout forked branches: lvs. opposite, remotely serrate or nearly entire: fls. dioecious, small; calyx minute, 4-toothed; petals 4; staminate fls. with 4 stamens, filaments short, with a large disk in the middle; pistillate with an inferior 1-celled ovary, style short with an oblique stigma: fr. a 1-seeded berry-like drupe.—Three species in E. Asia extending west to W. China and E. Himalayas, often considered varieties of one polymorphous species.

The aucubas are evergreens with large, lustrous, and often handsomely variegated leaves, small purple flowers in terminal panicles, elongated in the staminate, short and rather dense in the pistillate plant and with bright scarlet oblong berries forming terminal clusters. Hardy in the southern states about as far north as Washington, D. C., and in sheltered localities even farther north; they are well adapted for city gar-

dens as they withstand dust and smoke to a considerable degree.

In the northern states, aucubas are grown in cool-houses—those adapted to azaleas are excellent—and they are kept evergreen by keeping them in a pit during winter, or by holding them cool and partially dry

in the house. They will stand five or six degrees of frost in a pit. From cuttings of half-ripened wood, good specimen plants may be had in two or three years. Fruiting plants, with their numerous bright scarlet berries, are exceedingly attractive, but as the plant is dioecious, there must be male plants with the female ones. If grown in pots and under glass, the plant must be fertilized by shaking the flowering male plant over the female, or by applying the pollen with a camel's-hair pencil. If the male plant flowers earlier, the pollen may be collected and kept dry until the female plant is in flower; it remains effective for some weeks. In the open, aucuba

grows well in any good, somewhat moist though well-drained soil, in a half-shaded position. In pots, it will thrive in a sandy loam with sufficient drainage, and requires plenty of water during its growing period. Fruiting plants should not have too large pots.

They are propagated very easily by half-ripened greenwood cuttings at nearly any time of the year, under glass, and by seeds sown soon after maturity; the varieties are sometimes grafted on the common form in early spring, under glass.

**japonica**, Thunb. A stout shrub, 4–15 ft.: lvs. usually ovate, 3–8 in. long, remotely and coarsely dentate, obtusely acuminate, shining: petals obtusely acuminate: berries scarlet, rarely white or yellow, usually oblong. From Himalayas to Japan. B.M. 5512. I.H. 11:399. S.I.F. 2:59. F.S. 16:1609. F. 1865:65.—There are a great number of garden forms in cultivation, mostly with variegated leaves; the latter are more often cult. than the green forms. Handsome variegated forms are: Var. *latimaculata*, Kirchn. (var. *aureo-maculata*, Dombrain). Lvs. ovate-oblong with a large irregular yellow blotch in the middle and smaller yellow dots around it. F.M. 10:527. F.W. 1876:353. Var. *variegata*, Dombrain, not Regel (var. *maculata*, Regel, var. *picata*, Hort., var. *punctata*, Hort.). **GOLD DUST TREE**. Fig. 439. Lvs. with numerous yellow spots.—The most commonly cult. form. B.M. 1197. F.M. 5:277. R.H. 1866:292. Var. *limbata*, Bull. Lvs. large, coarsely dentate, with a greenish yellow margin. Var. *bicolor*, Regel. Lvs. with a large yellow blotch in the middle, ovate to ovate-oblong, remotely dentate. The following forms have green lvs.: Var. *angustifolia*, Regel (var. *salicifolia*, Hort.). Lvs. narrowly oblong-lanceolate. Var. *concolor*, Regel (var. *viridis*, Hort.). Lvs. ovate-lanceolate or elliptic-ovate, remotely and coarsely serrate. Gt. 25:859.

Var. *dentata*, Carr. (var. *macrodonata*, Hort.). Lvs. elliptic, coarsely and long-dentate. Var. *macrophylla*, Bull. Lvs. large and broad, remotely and slightly dentate. Var. *ovata*, Regel. Lvs. ovate, coarsely sinuately dentate, dark green, lustrous. Var. *pygmaea*, Regel. Low: lvs. ovate-oblong, remotely and sharply



438. *Aubrietia deltoidea*. (plant  $\times \frac{1}{2}$ )



437. *Attalea Coghne*.

dentate, bright green, dull. Differently colored frs. distinguish the following forms: Var. *luteocarpa*, Rehd. (*A. luteo-carpa*, Dombrain) with yellow fr. F.M. 1872: 12. Var. *leucocarpa*, Matsum. & Nakai, with white fr.—*A. cranifolia*, once offered in American trade, is probably a form of *A. japonica*. To indicate whether a certain form is a staminate or a fruit-bearing plant, mascula or femina (fœmina) is often added to the varietal name.

*A. chinensis*, Benth. Lvs. lanceolate to nearly obovate, entire or toward the apex sharply dentate, sharply acuminate; petals finely and long-acuminate; panicle with scattered short and stiff hairs. China.—*A. himalaica*, Hook. f. & Thoms. (*A. japonica* var. *himalaica*, Dipp.). Lvs. usually lanceolate to ovate-lanceolate, entire or dentate, sharply and long-acuminate; panicles densely hairy; petals long and finely acuminate; fr. orange to scarlet. E. Himalayas. F.S. 12:1271. L.H. 6:197. ALFRED REHDER.

**AUDIBÉRTIA** (*M. Audibert*, of Provence). *Labiatae*. Including *Ramona*. Perennial herbs or sub-shrubs, sometimes grown for bees and in ornamental plantings.

Ten species all from W. U. S. mostly from Calif., related to *Salvia*, but differing in the calyx being more deeply cleft in front, and in being almost spathaceous: lvs. opposite, usually rugose, sage-like: fls. axillary or terminal, not unlike those of *Salvia officinalis*; corolla with upper lip spreading, 2-lobed or emarginate.

**grandiflora**, Benth. St. villous, glandular, 1-3 ft. high: lvs. woolly beneath; lower lvs. hastate, obtuse, 3-8 in. long, coarse; bracts crowded, conspicuous: fls. 1-1½ in. long, red or crimson-purple, in dense, showy clusters. Calif.—Prized for bees.

**incana**, Benth. St. woody, tomentose-canescens, leafy: lvs. spatulate or obovate, obtuse or retuse, not rugose, scarcely 1 in. long; bracts obovate, ciliate, purple-tinged; corolla ½ in. long, rarely slightly longer, pale blue. Wash. to Ariz. B.R. 1469. N. TAYLOR.

**AURÍCULA** (*Primula Auricula*, Linn.). Fig. 440. A European perennial, sending up short scapes, bearing flowers of many colors. It is one of the most famous of florists' flowers, but it has never received the attention in this country that it has in Europe. Our summers are generally too hot for it. In this country generally treated as a greenhouse plant; but it is hardy, and in the Old World is grown largely in frames. See *Primula*.

Auriculas grow wild in the mountainous districts of Switzerland, Austria, Syria, and the Caucasus; therefore they are generally regarded as alpine plants, but like many other alpine, they have proved to be excellent subjects for cool greenhouse culture as well as for rock- or alpine-garden culture. In their native habitats, some plants are heavily powdered with a fine mealy substance called "farina," while others are perfectly destitute of it. Under cultivation, also, they show this same characteristic. This has caused fanciers to divide them into two sections; those covered with farina, called show auriculas, and those destitute of it, termed alpine auriculas. The show auriculas have received the most attention at the hands of fanciers. Their flowers are large, and present more combinations in variety of color than the alpine section, and since rains mar their beautiful farina-covered leaves and flowers, they are by far best adapted to greenhouse culture. Like all primulas, the flowers are tubular and borne in erect trusses well above the foliage. Well-grown plants will produce strong trusses with often as many as twenty "pips" or individual flowers. Such a number cannot fully develop, consequently they should be thinned out

and only eight or nine flowers allowed to develop on each truss. The tube of the flowers of show auriculas is usually white, with a circle of maroon, violet, plum or chocolate-color above and a margin of green, gray, white, or yellow. In what are called "selfs," the circle of chocolate-maroon, or violet, extends to the edges of the flowers. They are usually very sweet-scented. Alpine auriculas are best adapted for growing in the rock- or alpine-garden since the leaves and flowers are destitute of farina. This section does not exhibit as large a variety of color in the flowers. The tube of the corolla is usually

yellow or cream-color with a margin of maroon or purple which shades off toward the edges. The culture given below is the same for both sections except that the alpine section should be planted on the north side of the rock-garden in October, where they will flower the following spring.

Auriculas may be propagated by seed for general purposes and for the production of new varieties, but to perpetuate very choice varieties it is necessary to propagate either by offsets or division of the plants. Seed should be sown in shallow pans or 4-inch pots early in March, so

that the seedlings will be well developed before very warm weather sets in. The soil used in the seed-pans should be very light and sandy, the surface should be made smooth, and the seeds then pressed lightly

into the soil, after which a light covering of sand should be given, and the pans placed in a temperature of 60° until they have germinated, which usually takes from three to four weeks; pans should then be removed to a light position, shaded from direct sunlight, in a rather lower temperature, to induce a stocky growth. As soon as the seedlings are large enough to handle conveniently, they should be pricked off into other pans or shallow boxes containing a mixture of three parts leaf-mold and one part sifted loam and clean silver-sand. Watering should be carefully attended to, and everything done to promote active growth, so that, if possible, the plants may be large enough to require a second shift into other boxes, similarly prepared, by the end of June. Auricula seedlings go through the hottest months much better in boxes than in pots, as they can be kept more evenly moist. For their summer quarters, a wooden frame placed on sifted coal-ashes on the north side of a building or wall, or almost any position in which they will be sheltered from the sun and still receive plenty of light, should be given them. The frame should be provided with sash, which should be kept over the plants most of the time, giving air in abundance in favorable weather, and during the warmest weather the whole frame should be raised by placing a brick under each corner, so as to allow a good circulation of air among the plants. About the second week in September the young plants should be potted, using a compost of two parts good fibrous loam, one part leaf-mold, and one part well decayed cow- or sheep-manure, with a little sand added. The frame should be kept a little close for a few days after potting, and from this time care must be taken not to wet the foliage in watering. The plants may remain in the frame until danger of freezing, when they should be transferred to a cool



439. *Aucuba japonica* var. *variegata*. (×½)



greenhouse for the winter. All decaying leaves should be carefully removed, and but little water will be required during the dull winter months. Toward the end of February the plants will show signs of flowering, when they should be given a top-dressing of pulverized sheep-manure and placed in a light, airy position, in a temperature of 55°. The flowering season lasts about two months, after which the plants should receive their annual potting. All diseased or decayed roots should be cut away, and most of the old soil carefully removed. The propagation of very choice varieties by offsets or division is best done at this time. The pots used in potting should be well drained, and no larger than will just accommodate the plants. The soil best suited is the same as before recommended. After potting, they may be placed in their summer quarters. Offsets should be inserted around the edge of 4-inch pots, using very sandy soil, and kept in a moist, shaded position until rooted. By annually repotting and giving a little extra care during the summer months, a batch of show auriculas will return very satisfactory results, and may be kept in a good, healthy condition for several years.

EDWARD J. CANNING.

#### AUTUMN COLORS, PHYSIOLOGY OF.

When the conditions in almost any locality are favorable for the rapid growth of plants, the prevailing color of the vegetation is green. The leaf-green, or chlorophyll, is a conspicuous part of vegetative organs. Green is normal, so that one does not regard a green plant as "colored." It is true that in some species of plants, chlorophyll is partially or completely veiled by the presence of other pigments, and in the blossoms it may practically fail; but in the latter case the life of the brilliant structures is fleeting, and green is promptly predominant. "Color" is more or less restricted to blossoms, to particular species, or to seasons. The great seasonal change is here the center of interest.

In the autumn the vegetation of the usual temperate landscape loses gradually its distinctive green, while striking yellows and reds are substituted. With favorable conditions, the climax of this transformation is such a riot of color as is not seen at any other time. It is noteworthy that this change is an immediate forerunner of leaf-fall and death. The vegetation that is suddenly cut off by severe frost seldom exhibits true autumnal colors, but instead the dry brown or blackened effects of rapid death, characteristic of any season. On the other hand, autumn tints of leaves may appear in the summer, as when limbs of the hard maple or peach are ringed. This suggests that the production of color is susceptible of experimental study. On the whole, the layman may regard the autumn colors as a necessity to the wholesome rounding out, and a fitting terminus, of a season of usefulness. Coloration is, however, an evidence of fundamental physiological changes; and it is appropriate to ask regarding the climatic or other conditions which bring this about, as well as concerning the nature of these internal changes which also make for the development of color in the autumn.

For the most part, the autumn leaf-colors fall into two groups—yellows and reds. These colors are pro-

duced by two groups of pigments essentially different in chemical and physical properties; yet these pigments are frequently blended in the same leaf, yielding such gorgeous effects as may be seen in the sumach.

The yellow pigment (more correctly pigments) of leaves occurs in the chlorophyll bodies of the cell. It is present in conjunction with the leaf-green in the healthy leaf, but not infrequently it seems to increase in quantity as the chlorophyll disappears. It belongs to a group of substances often called xanthophylls. These are carotin-like compounds, that is, related to carotin, the orange or orange-red pigment of the carrot root. Carotin-like bodies are widely distributed in plants and are also responsible for the yellow, orange, and orange-red colors of a large number of blossoms. These pigments do not occur in solution in the cell-sap, but may be present either in the healthy chlorophyll bodies (plastids) or outside of them. In the latter case, they form crystals, or are in solution in droplets of fatty oils. Carotin-like compounds are more permanent than chlorophyll, so that any green plant may exhibit a yellowish color upon the gradual disappearance of the chlorophyll.

The red pigments of autumn leaves are cell-sap colors, substances soluble in the aqueous solution constituting plant juices. They are supposed to be tannoid compounds, and are generally referred to as anthocyanin. The pigments of red beets and dark grapes are similar compounds. It is significant that those plants exhibiting conspicuous red coloration in the autumn are usually those which give some indication of red during the growing season, as in the possession of red petioles or twigs; and, more especially, they are those in which red is more or less conspicuous as the buds open and the leaves unfold in the spring. The attractive tints of unfolding hard maple buds are therefore an indication that the maple has the capacity to develop a coloration of the cell-sap in the autumn. Some plants develop no anthocyanin under normal conditions of growth.

It is then evident that the yellow colors of autumn leaves may be due to both a greater visibility of the yellow in the chlorophyll body when the chlorophyll disappears, and also to actual increased development of carotin-like compounds. The reds and purples in autumn leaves are a result of the formation or increased formation of tannoid compounds. The question then is: What are the conditions which make the autumn season particularly favorable for the development of these substances?

Some careful studies have been made that bear upon this question. It appears that the production of autumnal reds in many species is related to the sugar-content, and color may be induced or heightened in the shoots of many plants by growing them for a time in strong solutions. Moreover, cold weather has been found to be generally favorable to the accumulation of sugar in the tissues. Observation indicates that after a season favorable for growth, a cold, protracted autumn results in exquisite autumn coloration. It is certain that nothing is more disastrous to brilliance of color than severe early frosts. In addition to enhancing pigmentation, sugar-content seems to be most important as one factor in cold-resistance. It requires a very light frost in the late summer to kill outright the leaves and young shoots of many trees, but the same shoots may be unaffected by an equal degree of cold when the conditions have been such as to bring about the normal autumn coloration.

B. M. DUGGAR.

**AUTUMN-GARDENING.** There is wealth of material for spring- and summer-gardening; but to secure good garden effects in autumn requires mostly other material and a different intellectual conception of the problem. The common problems of the gardener in autumn grow out of two facts: First, the frost kills tender plants sooner than he desires; therefore he tries



440. Auricula. ( $\times \frac{1}{2}$ )



to save vegetables and flowers as long as possible by protection and by choosing hardy kinds. Second, gardens tend to look unattractive and seedy in September, because this is nature's time for ripening fruits; therefore he desires fresh flowers. The popular demand is for fresh vegetables as long as possible, color in the garden right into the teeth of winter, cut-flowers after frost, home grounds that will be attractive even after a summer's absence, and a note of welcome to the children in every school-yard. Also, there are enthusiasts who wish gardens devoted exclusively to autumn beauties.

#### *Prolonging the vegetable-garden.*

The ideal way to prolong the yield of fresh vegetables in late autumn is by means of greenhouse, hotbeds and coldframes. In frames, which are the cheapest, it is



441. A good autumn landscape for color effects.

easy to have in November lettuce, spinach and radishes. The next best plan is to shelter the garden from cutting winds and frost by a windbreak, e.g., wall, fence, hedge, natural wood, or group of evergreens. Sheltered gardens often yield fresh vegetables two to six weeks after adjacent unsheltered gardens have been devastated by frost. It is also possible to prolong the season by raising late-growing varieties and by starting the ordinary kinds later in the year.

#### *Freshening the flower-garden.*

Parks and the grounds of wealthy people often rely chiefly on tender or temporary bedding plants, e.g., cannas, dahlias, scarlet sage, gladioli, geraniums and Pfitzer's torch-lily, for their largest masses of autumn color. This method gives the greatest show the first year, but is costly in the long run. Moreover, these plants are killed by frost, leaving gaps too large to fill.

A grade higher is hardy bedding, which has become popular since 1900. The favorite plants are long-blooming shrubs and perennials, e.g., Baby Rambler rose, garden and tree hydrangeas, Miss Lingard phlox, gaillardias, stokesia, Napoleon III pink, double ragged

robin, *Veronica longifolia* var. *subsessilis*, *Conoclinium* (*Eupatorium*) *celestinum*.

Unfortunately, the flowers of the two preceding lists do not really freshen the garden, because they are summer flowers or are being made so by the irresistible tendency to exploit earlier varieties of everything. As taste improves, there is a reaction against excessive use of long-blooming plants, and a desire has arisen for "season markers." Among the finer plants of this real autumn sort are *Colchicum Parkinsonii*, *Crocus zonatus*, *C. speciosus*, *C. sativus*, *Crinum Powellii*, *Sternbergia lutea*, *Chrysanthemum uliginosum*, gordonia, and the rarer plants to be mentioned hereafter. They are, however, plants of the skilled amateur.

For beginners, the favorite hardy autumn flowers include the following annuals or plants treated as such, —China asters, pansies (sown outdoors about May 10 in latitude of New York City), snapdragons, and cosmos; bulbs, —*Colchicum autumnale*; perennials, —sneezeweed, *Helianthus orgyalis* and *H. Maximilianii*, and pompon chrysanthemums.

Another way of providing fresh color in autumn is to make a second or June sowing of favorite annual flowers, e.g., sweet alyssum, candytuft, love-in-a-mist, common and pot-marigold, mignonette, nasturtium, phlox, California poppy, portulaca and zinnia. These usually fail in September from the April sowing. The June sowing will carry them beyond a hard frost, except nasturtium and portulaca.

#### *Flowers after frost.*

In early November, after frost had devastated the gardens in the neighborhood of Philadelphia, the following flowers were in condition at one of the largest nurseries of perennials. Only those are mentioned that gave decided masses, not mere dots or remnants of color: *Aconitum columbianum*, *A. Fischeri*, alyssum, antirrhinum, *Aster grandiflorus*, *A. tataricus*, *Cimicifuga simplex*, Napoleon III dianthus, *Erigeron glabellus*, gaillardias, gladioli, *Helianthus Maximilianii*, huneemannia, kniphofias, pansies (sown in May), Miss Lingard phlox.

Nearly all the flowers in the two preceding lists are available for home decoration, although the quality may not be equal to that of early September. If long-stemmed, long-lasting flowers are needed in quantity, the most satisfactory, perhaps, are chrysanthemums, snapdragons, Miss Lingard phlox, gaillardias. To this list may be added delphiniums, Baby Rambler rose and *Catananche cærulea*.

#### *Gardens based on the dominant color.*

It is feasible to make a garden that changes its color every three or four weeks, based upon the idea that a garden may well reflect the dominant color in the landscape produced by the wild flowers of each season. Since yellow is the dominant color of autumn (witness the goldenrods, sunflowers and other composites) such gardens may be rich in sneezeweed and perennial sunflowers (especially *Helianthus Maximilianii*, *H. orgyalis*, and *H. multiflorus* var. *plenus*) since these are particularly appropriate to season and country. The following yellow flowers of summer may be prolonged into autumn by seed-picking, cutting back, fertilizing, and watering: Tufted pansies, snapdragons, Golden Glow rudbeckia, gaillardia, Iceland and horned poppies, *Anthemis tinctoria* and *Lepachys columnaris*.

#### *Gardens of perennial asters.*

The English make an exceedingly showy, yet artistic, garden based upon what they call "Michælmass daisies" (asters), of which 137 species and varieties are catalogued by a single dealer. It consists of a double border devoted to the early kinds that bloom during the first three weeks of September; and a separate border for the October- and November-blooming species.



The pictorial effect is improved by a definite color scheme, planting in drifts, and an ingenious system of training on hidden branches. This type of garden is of peculiar interest to Americans because the perennial asters are mostly American wild flowers, and it meets the general desire to grow a class of flowers which is too prolific for the ordinary garden. Owing to the notorious difficulties of identifying species of this genus, Americans find it more practicable to import collections than to assemble species from the wild. The true asters are generally supplemented by yellow flowers of other genera (e.g., *Chrysopsis*) in order to make the early garden a pink and yellow composition, while the later garden is devoted to purple, lavender and blue.

#### Woody plants for autumn bloom.

In larger gardens and on home grounds it is desirable to secure flowers by using more permanent materials, as woody plants. Unfortunately, the only tree that blooms in autumn (*gordonia*) has to be wrapped during winter in the North. The list of vines also is small, being confined to left-over blooms of trumpet creeper, Hall's honeysuckle, and panicked clematis.

The autumn-blooming shrubs, however, are excellent. Unluckily, the showiest of them all, *Hydrangea paniculata* var. *grandiflora*, is commonly used in such ways as to bring upon American yards the reproach of gaudiness and vulgarity. It looks gross and overfed compared with the slender grace of its prototype, *H. paniculata*, and its double flowers are artificial compared with the single ones. True, they last longer and give more for the money than any other flower of autumn, but such plants from their irresistible appeal to beginners, are planted in every yard and tend to make home grounds look too much alike and too common. The situation is aggravated by inartistic ways of using it, e.g., hedges from sidewalk to porch, great masses across the front of the house, borders of curving drives, and beds in the middle of the lawn. Again, it is pruned severely to make the largest trusses, which results in loss of height and dignity, and in top-heavy masses ill-concealed by supports. A better system of yard-decoration, is the use of informal shrubby borders, since they give year-round interest and greater variety to yards.

To supplement the ubiquitous double hydrangea, the following may be recommended, subject to the limitations noted: *Abelia chinensis*, white, begins blooming in Georgia in June and is well covered in New England as late as September 30; *Abelia grandiflora*, pink, needs a winter covering of boughs North; *Baccharis halimifolia*, has tufts of showy pappus, like camel's-hair brushes, that look like white flowers; *Buddleia variabilis*, pink, is killed to the ground at New York but recovers and blooms freely; *Caryopteris Mastacanthus*, blue, behaves like buddleia; *Hamamelis virginiana*, yellow, not showy, but the last shrub to bloom; *Hibiscus syriacus* or althæa (only the single white variety here recommended); *Hydrangea paniculata* var. *laxa*, which gives a fresh white after the double hydrangea has begun to assume its metallic colors; roses, hybrid teas, which are at their best on Long Island in early September; *Vitex Agnus-Castus*, lilac, hardy to New York.

#### A more artistic way of securing color.

Although the popular interest is in flowers, there is a far more important method of securing color,—by means of trees, shrubs and vines with brilliant autumn colors in foliage and fruit. This method is more artistic because more appropriate to the season, more permanent, and cheaper in the end. It is also more American, because we have more native shrubs than autumn flowers; because shrubbery is the only class of material (except water-lilies) in which we enjoy a climatic advantage over England; and because autumnal colors in America are more brilliant than those in western Europe.

For home decoration, cut sprays of multiflora rose, common barberry, bittersweet, and the like, are longer-stemmed and last longer than flowers. Those just named remain attractive all winter, even when shriveled.

Our climate naturally suggests flowers in spring, attractive foliage in summer, natural colors in autumn, and in winter the shrubs with brightly colored berries and twigs. The late season situation can be met by making 90 per cent of the planting consist of combinations of trees and shrubs with triple or quadruple attractions of flowers, foliage, autumn colors and fruit, e.g., *Cornus alba* and var. *sibirica*, *C. Amomum*, *C. florida*, and *C. mas*; *Viburnum cassinoides*, *V. Lentago*, *V. prunifolium*, *V. Lantana*, *V. tomentosum*, and *V. americanum*; *Magnolia stellata*, *M. Soulangeana*, *M. glauca*, *M. acuminata*, and *M. tripetala*; *Berberis vulgaris* and *B. Thunbergii*; Regel's privet and the best form of the Amoor River privet; Morrow's bush honeysuckle; prairie, multiflora, rugosa, and Wichuraiana roses and their sturdiest descendants; and the following vines: *Euonymus radicans* var. *vegetus*, trumpet creeper, wistaria, bittersweet, and the wild and panicked clematis.



442. An autumn-blooming bulb.—*Colchicum autumnale*.

#### Color harmony in autumn.

Sentimentalists aver that nature never produces discordant colors, although the famous poinciana of the tropics and the nemesias of the garden furnish a combination of magenta and scarlet in the same flower. A walk through a good arboretum in September will convince the unprejudiced observer that discords exist in flowers, fruit, and foliage. In practice, nine-tenths of the troublesome discords are produced by the magenta group of colors, including the strongest purples, crimson, lilac, and crimson-pink. The artistic way to handle these colors is to isolate them in nooks surrounded by green, or to put them in deep shade, where they are purified and softened, instead of allowing them in the open garden, where full sun makes them too strong and where they conflict with all other colors, except white and green. The list of "dangerous colors" includes the flowers of Japanese anemone, crimson-pink chrysanthemums and China asters (in all of which safer colors are available), the Anthony Waterer spirea, the subsease veronica, *Lespedeza Sieboldii* and *Clerodendron fatidum*. Examples among fruits are Indian currant, callicarpa, burning-bush, strawberry-bush and several of the species of euonymus during the period when their highly colored capsules conflict with their scarlet arils. The purplish-twigged shrubs, e. g., *Cornus alba*, *C. Amomum*, *C. stolonifera*, and *C. Purpusii* (the last a species commonly but unwittingly distributed as *C. Amomum*), constitute an exception, since they are brilliant only in sunlight, and their color being dis-



sipated, instead of massed, is less liable to produce discords.

In foliage, the colors bordering on magenta are so rare that they may be ignored in planning the home-grounds, although careful designers always consider autumnal colors. When discords occur they may be resolved usually by planting between the discordant trees or shrubs some plants that retain green foliage until late autumn. Wine- or claret-colored foliage, like that of the maple-leaved arrow-wood, or crimson, like that of *Itea virginica*, occasionally makes discords with nearby foliage of yellow or scarlet, but in the case of such small plants it is usually easier to remove one of the trouble-makers. The sweet-gum, however, often makes a large mass of very dark purple, which may seriously disagree with yellow-foliaged specimens, or with buildings of yellow or red, especially since it has come to be used as a street tree. In practice, however, flowers make less trouble than shrubs, and shrubs than trees, and discords may generally be abolished by moving the smaller plants. The commonest and greatest color difficulty in autumn foliage comes from over-planting the following class.



443. Hardy chrysanthemum, one of the best of the autumn-blooming herbaceous plants.

Scarlet foliage in autumn theoretically may be no more vivid than other colors, but it is popularly regarded as the climax of all the autumn colors. For example, persons who give little thought to planting for autumn effect buy the scarlet and Tartarian maples, the red variety of silver maple, and ask the nurserymen for "a sugar maple that is guaranteed to turn red." The aromatic, scarlet, smooth, and staghorn sumachs are in considerable demand.

And, above all, the Japanese and common barberry are planted. At the entrance to public parks are often seen several hundred Japanese barberries planted in a bed for a blaze of autumn color. If disproportionately large, such masses of scarlet are perhaps only one grade higher than tender foliage plants. The brilliant reds commonly conflict with brick buildings and partico-colored houses of wood.

Deep red foliage in autumn is quieter, but rich enough. It is seen in the scarlet, pin, and red oaks, flowering dogwood, black choke-cherry, wild gooseberry (*Ribes cynosbati*), and several native huckleberries and roses.

Bronze foliage is seen in most of the plants that become red, for they attain to it from green through many bronzy colors. But the richest bronzes generally are associated with thick, lustrous, persistent leaves. The most highly esteemed, because most costly, are the broad-leaved evergreens, e.g., the Hinodigiri and amœna azaleas, mahonias, leucothœs, *Pieris floribunda* and *P. japonica*, and galax. These assume their brightest colors in full sunshine and, at the northern limits of their cultivation, sometimes suffer a loss of foliage. In the higher latitudes it is often best to sacrifice color to hardiness, by sheltering the plants from winter winds and sunshine, in which case they usually retain a lively green. A cheaper list, because composed of semi-evergreen plants, comprises California privet, Hall's honeysuckle, Wichuraiana rose, sweet fern, and bayberry. These color poorly in some localities, but they are of special value in the latter half of Novem-

ber, when the landscape first becomes bare, except for evergreen and nearly evergreen plants.

Yellow and orange foliage in autumn is midway between the vividder and the quieter autumn colors, the former having an exciting, while the latter have a soothing, effect upon the mind. The yellow and orange group rises in vividness from pale yellow, through gold to orange, the three stages being exemplified by larch, witch-hazel, and persimmon. Here belong the striped maple, yellow-wood, Kentucky coffee tree, ironwood, *Prunus pennsylvanica* and *P. serotina*, cucumber tree, large-leaved magnolia, *Crataegus punctata*, yellow-root and sugar maple. The duller yellows merge with the next group.

Brown and neutral autumn foliage tones down the most brilliant colors and resolves nature's discords. Examples are the American and slippery elms, and perhaps even the brighter red and chestnut oaks.

Green foliage in autumn is even more valuable in harmonizing colors. It is well expressed in the evergreens and nearly evergreen plants. The sudden devastation of the landscape occasioned by the fall of the leaves (whence the Americanism "fall" as a synonym of autumn) excites fresh interest in all the plants that remain green. These are of three classes: (1) The broad-leaved evergreens constitute the most sumptuous class of hardy plants, because they often possess showy flowers or fruits in addition to broader and more lustrous leaves than the conifers. Of the fifty kinds that are hardy in the latitude of New York, the following have special autumn attractions: *Osmanthus Aquifolium* (flowers), mountain laurel (red twigs), American holly, climbing euonymus, fire thorn, *Cotoneaster buxifolia* and *C. microphylla*, partridge berry, and wintergreen. In the South, the following have special attractions in autumn: English holly, *Euonymus japonicus*, ardisia, and nandina, all of which have red fruits, and pernettyas having fruits of various colors. Unfortunately, no plant of this class much exceeds 15 feet in height in the northeastern United States, and it is idle to hope for a 50-foot tree of this group, such as England possesses in the holm oak or ilex. (2) The narrow-leaved evergreens, or conifers, may lack showy flowers but they furnish more tall hardy plants than the broad-leaved evergreens. Their year-round uses are too numerous for mention here, but their autumnal functions are four,—(a) to harmonize discords; (b) to rest the eye from color; (c) to furnish contrast, which intensifies color; (d) to give greater dignity than showy colors possess. This dignity is due to the year-round beauty, longer life, and costliness of white and red pine, northern and Carolina hemlock, Nordmann and concolor fir, white and Douglas spruce, red cedar and arborvitæ, as compared with cheap, showy and temporary deciduous trees like willows, poplars, silver maples, and the like. Even the Vermont sugar-bush which, in October, is one of the most gorgeous spectacles, presents a finer appearance in the landscape when skirted by occasional white pines, which add greatly to the dignity and "paintable quality" without obscuring its farm value or purposeful character. (3) The nearly evergreen or half-evergreen plants may be bare from one to three months, depending largely on latitude and season. The plants that remain green until their leaves fall are mostly natives to western Europe, or to the warmer parts of China, Japan or Korea, and are usually associated with a moist and cloudy autumn. European examples are buckthorn, common privet, sea buckthorn, *Cytisus capitatus* and *C. nigricans*, *Genista tinctoria*, *G. elata*, *G. pilosa* and *G. germanica*. Far-eastern examples are California privet, matrimony vine, panicle clematis, *Akebia quinata* and *A. lobata*, *Lonicera fragrantissima* and *L. Standishii*, and *Euonymus Hamiltonianus* var. *semipersistens*. American examples are few, and *Lonicera Ledebourti* comes from California (climate like Europe), but the overcup oak and *Leucothœ racemosa*



are eastern and southern plants. All these species were reported as being green at the Arnold Arboretum as late as November 8. The peculiar value of this class is as a substitute for broad-leaved evergreens. Unfortunately, the climate of the northeastern United States is not favorable to broad-leaved evergreens, compared with the South or Europe, and the lavish use of them requires a princely income. Consequently, some of these cheaper plants, e.g., California privet, Hall's honeysuckle, and Wichuraiana roses, are available even to the poor, while the whole list is of special interest to people who have summer homes.

#### Ornamental fruits of autumn.

The extraordinary beauty of shrubs with brightly colored berries was first publicly and sufficiently demonstrated in this country by the Arnold Arboretum. Compared with autumnal colors of foliage, the fruits present fewer, smaller, and more jewel-like masses. Amid the bewildering variety one may discern three groups.

First are the short-lived fruits, which drop soon after the killing frost, or present an unattractive appearance owing to decay. Here belong the vast majority of ornamental fruits, including crab apples, dozens of hawthorns, *Viburnum*, *Lantana*, *V. alnifolium*, *V. cassinoides*, *V. Sieboldii*. The chief function of this class is to suggest the fecundity and variety of nature in autumn, but attractive thorneries have been designed, and the ornamental fruits of the Rosaceae are now used to connect the battle-scarred remnants of old orchards with modern ornamental planting, especially boundaries.

The second group comprises all the fruits that remain attractive until Christmas, e.g., the rugosa rose.

The third and most valuable group comprises those that remain attractive all winter, like the barberries. This and the second group are classified by color under *Winter Gardening* (Vol. VI.)

Most persons are willing to sacrifice some degree of ornament in order to attract the birds. The following furnish food in autumn, when it is especially desirable to attract the migrants to the South: the flowering dogwood, red osier, and alternate-leaved dogwood, choke-cherry, black and sweet elder, arrow-wood, sassafras, kinnikinnick, crab-apple, hawthorn, fire-thorn, cotoneaster, buffalo berry, tupelo, and mountain ash.

#### Landscape forestry in autumn.

Private and public woodlands in the East are more beautiful than a decade ago, in spite of the destruction of magnificent chestnut trees, and this is true, although probably to a lesser extent, in other parts of the country. The sudden spread of the chestnut disease has brought certain compensations. For example, the flowering dogwood, which was formerly kept down, has prospered mightily, making the woods showier both in May and September; and other vegetation changes are following.

There is arising a general interest in pleasure woods, as witness the term "landscape forestry," which was unknown ten years ago. We are beginning to make personal use of woods. Judged by English standards, American woods are too crowded by crooked and spindling trees for comfort, and the general lack of evergreens robs them of mystery and charm. Our most urgent needs, therefore, are thinning, drives, paths, and the restoration of evergreens, all of which are especially enjoyable during the autumn and nutting season. Mistaken zeal has denuded many woods of undergrowth, which should quickly be restored along drives and paths. To glorify the woods on dark autumnal days, it is well to use masses of witch hazel, the foliage of which furnishes one of the cheapest and quickest ways of getting great sheets of sunny color.

Unfortunately the eastern mountains have been devastated so often by fires and lumbermen that there is comparatively little variety, the chief masses of color being furnished by quick, short-lived species, like poplars, birch and balsam, which are mere weeds compared with the more enduring and valuable oaks and pines. Our greatest problems are the restoration of variety and of long-lived species. In such work the fashionable colonies in the Berkshires ought to take the lead, since the social season reaches its height at Lenox in September. The Arnold Arboretum presents one of the most artistic, and probably the most varied, autumn landscapes made by man.

WILHELM MILLER.

**AVÈNA** (the old Latin name). *Gramineæ*. OATS. Mostly annuals with open panicle and large spikelets.

Spikelets 2-6-fl.; rachilla bearded below the florets; glumes about equal, large and membranaceous, many-nerved, usually as long as the spikelet; lemmas indurated, bidentate at apex, bearing a stout twisted awn on the back (this often straight or wanting in the cultivated oat).—Species about 50, of the temperate or cooler regions of the world. Scarcely grown as ornamental subjects.

**fátua**, Linn. WILD OATS. Resembles the cultivated oat, but differs in having long, brown hairs on the lemmas: spikelets usually 3-fl.; glumes 1 in. long; awns of lemmas about an inch long. Dept. Agric., Div. of Agrost. 20:94.—Intro. from Eu., especially on the Pacific coast, where it is a troublesome weed. In the latter region the spontaneous growth is frequently used for hay.

**sativa**, Linn. CULTIVATED OATS. Spikelets usually 2-fl.; lemmas glabrous, awns usually straight or wanting. See Cyclo. Agric. I.

**stérilis**, Linn. ANIMATED OATS. Resembles *A. fatua* but the spikelets larger, the glumes about 1½ in.; awns 2-3 in.—Occasionally cult. as a curiosity, the florets when moistened presenting spontaneous movements due to the twisting and untwisting of the awns as they absorb or give off moisture.

*A. elatior* = Arrhenatherum elatius.

A. S. HITCHCOCK.



444. Averrhoa Carambola. (× 1/2)

**AVERRHŌA** (after Averrhoes, the Arabian physician). *Oxalidaceæ*. Tropical fruit trees, cultivated in India and China, and sometimes grown under glass for ornament.

Leaves alternate, odd-pinnate; lfts. alternate, ovate-acuminate, entire, stalked, sensitive: fls. borne on the naked sts. and branches, minute, fragrant, rose-colored to reddish purple in axillary or lateral cymes which are often panicle-like; calyx red; corolla campanulate; petals 5. See N. Amer. Fl. 25:57 (1907).

**Carambôla**, Linn. CARAMBOLA. Fig. 444. Height 15-30 ft.: lfts. 5-10; fls. rosy purple borne in the lf.-axils: fr. varying in size from a hen's egg to a large orange, ovate, acutely 5-angled, yellow, fragrant, the pulp acid. P.M. 15, p. 231. Rheede, Hort. Ural. 3, pl. 43, 44. Cav. Diss. pl. 202.—Cult. sparingly in S. Calif., and frequent in W. Indies. The half-grown fr. used as pickles; the ripe fr. for preserves. There are said to be two varieties, the sweet and sour, the former being eaten. Said to produce 3 crops a year. Leaves responding to the touch.

*A. Bilimbi*, Linn. CUCUMBER TREE. BILIMBI. Height 20-60 ft.: lfts. usually 31-45 pairs: fls. red, in longer clusters than the above and borne on branchlets from the hard wood: fr. smaller than the carambola, cucumber-shaped, smooth, green rind, and acid pulp. Extensively cult. in S. Amer. P.M. 15, p. 231. Rheede, Hort. Mal. 3, pl. 45:46. Lam. Encyc. pl. 385.

N. TAYLOR.†



**AVICENNIA** (from *Avicenna*, the Latin name of an illustrious physician of the Orient, 980-1036). *Verbenaceae*. **BLACK MANGROVE**. **WHITE MANGROVE**. Trees or shrubs usually growing in mangrove swamps and on the shores of tropical estuaries, remarkable for the vertical leafless breathing-stems that rise above the soil from their long spreading horizontal roots.

Leaves opposite, entire, coriaceous, persistent: fls. small and inconspicuous in axillary cymes; calyx cup-shaped, deeply 5-lobed; corolla bell-shaped, whitish, 4-lobed; stamens 4, inserted on the corolla-tube, exserted, bearing ovate, 2-celled anthers; ovary sessile, 1-celled, ovate, tapering upward into a slender 2-lobed style, and containing 4 ovules suspended from a central placenta: fr. ovate, oblique, opening by the ventral suture and exposing the expanding embryo, before dropping off; embryo with broad, fleshy conduplicate cotyledons.—Three species now recognized: *A. nitida* which reaches S. Fla. and La., *A. officinalis* of Polynesia and the E. Indies, and *A. africana* of the west coast of Afr. Planted on the shores of estuaries to prevent washing by tidal currents, they collect floating debris by means of their erect breathing-sts., and by this means aid in extending the shoreline seaward.

*nitida*, Jacq. **BLACK MANGROVE**. **WHITE MANGROVE**. **HONEY MANGROVE**. **SALT-BUSH**. A tree, usually of moderate size but sometimes 60 to 70 ft. high, with a short trunk, and spreading crooked branches: inner bark bright orange-red, outer bark scaly, deciduous, dark reddish brown: young branches hoary-pubescent, at length glabrous and marked with interpetiolar lines and conspicuous lf.-scars: lvs. opposite, oblong or lanceolate-elliptical, gradually narrowed at the base, coriaceous, deep green and glossy above, whitish or grayish beneath, 2 or 3 in. long and about 1-1½ in. broad: fls. inconspicuous, fragrant, borne in few-fl. spikes on angled canescent peduncles, closely invested with small bracts; corolla whitish, about ½ in. diam. when expanded, the lobes slightly tomentose on both surfaces, and the 4 anthers together with the style protruding from the nearly closed throat: fr. oblong or elliptic 1-2 in. long and about 1 in. broad. Mangrove swamps and shores of estuaries, Fla., Miss., and Texas; also Trop. Amer.—The fls. are very rich in honey, on which account bee-keepers in certain parts of Fla. transport their entire apiaries to the coast, along the Indian River during the season of blooming, which occurs in June and July. The honey produced is white and clear, and of excellent flavor, and always commands the highest market-price. The embryo begins to germinate while the fr. is still on the tree. When it drops off, the two cotyledons unfold into a miniature boat, floating on the tide, which distributes the fr. along the shores of bays and lagoons and carries it to the outlying keys. Crystals of salt are often deposited on the lvs., on which account this species is sometimes called *palo de sal*, or salt-bush. W. E. SAFFORD.

**AVOCADO**. (*Persea gratissima*, Gaertn.). Figs. 445, 446. One of the most highly valued of tropical fruits. It is commonly grown in Mexico, Central America, parts of South America, the West Indies, and Hawaii; to a limited extent in India, Madagascar, Reunion, Madeira, Samoa, Tahiti, Algeria, Queensland, and other tropical and subtropical countries. In Florida and California, its cultivation is conducted commercially. See *Persea*.

The avocado is considered by most authorities to be indigenous to Mexico, Central America, and South America to Peru and Brazil. From the Aztec *ahuacatl* has been derived the Spanish adaptation *ahuacate* or *aguacate*, the name in general use in Spanish-speaking countries. *Avocado* is an adaptation in use in the United States and other English-speaking countries; *avocat* in the French colonies. *Alligator pear* is a misleading corruption that should be dropped.

Seedling avocados grow to a height of 50 or 60 feet; when budded the tree is considerably dwarfed. The leaves are elliptical to oblong-lanceolate, varying from 4 to 8 inches in length, persistent, deep green, the new growth frequently wine-colored. The tree is worthy of a place in every dooryard for shade and ornament. The small, greenish flowers are produced in great abundance on loose axillary racemes.

The fruit is variable in form, color, and size, as well as in quality and minor characters. The form ranges from oblate or spherical to slender pyriform, including a great variety of shapes, one of the commonest being broad pyriform. The color may be light or dark green, purple, crimson, or maroon. The fruit varies from 1 to 6 inches in diameter, and in weight from a few ounces to three or four pounds. The skin is sometimes soft and pliable, and no thicker than that of an apple;



445. Avocado tree.

in other forms it is coarsely granular, woody, and ⅛ inch thick,—in reality almost a shell. Inclosed by it is a mass of yellowish pulp, of the consistency of firm butter, and of delicious nutty flavor. The avocado is unlike most other cultivated fruits in the fact that it contains a large amount of vegetable oil, sometimes as much as 18 per cent; hence it can be considered more as a food than as a dessert. It is used in numerous ways, the commonest being as a salad, with the addition of salt, pepper and an acid. Sometimes it is cut in half, the seed removed, and the flesh eaten with a spoon, as muskmelons are eaten, salt or other condiment being added. The single, spherical or conical seed is frequently as large as a hen's egg. It is provided with two more or less distinct coats, which sometimes adhere to the seed, and in other instances to the flesh.

In recent years the avocado has been given systematic attention in the United States, both in regard to cultivation and varieties. Previous to 1900, propagation was exclusively by seed, and as the species is variable when grown in this way, many trees produced inferior



fruit and commercial cultivation on a sound and profitable basis was not possible. The choicest varieties are now propagated by budding and are grown on a large scale.

The diverse climatic conditions under which the avocado is found enable varieties to be obtained which are suited to regions with cool climates as well as those which are strictly tropical. In Mexico the fruit has been grown for centuries at altitudes of 6,000 or 7,000 feet, where severe frosts are experienced each winter; varieties from such regions, as opposed to those from hot and humid lowlands, are suitable for cultivation in those parts of California and Florida in which slight frosts are the usual winter occurrence. When mature, some types will stand temperatures as low as 20° F. without injury, if in proper condition at the time of the freeze; others will not withstand lower than 27° or 28° without serious damage.

The subject of races or types has not been given systematic attention outside of the United States, and no attempt at classification has been made, other than brief descriptions of types found in limited areas in Mexico and Central America. In California two very distinct types are grown, commonly referred to as the Mexican and the Guatemalan; the former (*Persea drymifolia* of some botanists) is ordinarily a small fruit, four to eight ounces in weight, oval or pyriform, and thin-skinned. It is one of the hardest types in cultivation and very productive, as a rule. The Guatemalan type is characterized by its thick, woody skin, frequently rough or tuberculate on the exterior; the fruits are medium-sized. It is considered one of the best for commercial use, as it can be shipped without difficulty. The type grown in Florida is usually referred to as the West Indian-South American. It has a skin sometimes as thick as the Guatemalan, but of softer texture; some varieties are of large size and attractive appearance, but the type is rather susceptible to frost.

The avocado has been subjected to systematic cultivation for so brief a period that a large number of named varieties has not been established. In Florida the Trapp is the most widely planted and is, in fact, the standard commercial variety, Pollock occupying the place of next importance. Several others are grown to a limited extent, including Family, Rico, Blackman, and Wester. In California some of the most promising varieties are Taft, Lyon, Meserve and Murrieta; a number of others have been disseminated. Several named varieties have been established in Hawaii.

For commercial cultivation, winter-fruited varieties have been found to be the most valuable, since northern markets are almost destitute of fresh fruit during that season. It is desirable, however, to have a supply, for local consumption at least, during other seasons of the year. Fortunately varieties are obtainable which ripen at widely different times,—in California fruit is in the markets fully ten out of the twelve months, although the season in Florida, at the present time, is not so long. A variety running uniformly about a pound in weight appears to be the most desirable, and if the fruit is round or oval, it can be more advantageously packed and shipped than if pear-shaped or "bottle-necked." The skin should be sufficiently thick and tough to withstand shipment without undue care in packing, and the seed should be as small as possible. It is also important that the seed be tight in its cavity, for in the loose-seeded varieties, the flesh is often seriously damaged by the seed shaking around while the fruit is in transit. Flavor and quality must of course be up to the standard, there being a wide difference among the varieties in these respects.

Large seedling trees of the small-fruited Mexican type sometimes produce as many as 2,000 or 3,000 fruits in a season, while a large-fruited variety may not produce more than a few dozen. Two or three hundred

fruits may be considered a good crop for a tree of a medium-sized variety.

In Florida, budded trees are planted in orchard form 20 feet apart; in California the distance is increased to 24 or 25 feet. Seedlings must be given more room,—30 feet at least. A well-drained, sandy loam is the soil best suited to the avocado, drainage being the most important requirement. For this reason it is best, where possible, to select a sloping piece of ground as a site for the orchard. Heavy soils, such as clay and adobe, will grow the tree successfully if the drainage is good.

Transplanting is best done in early spring, after danger of frost is over, but before the tree has started into new growth. In climates such as those of California and Florida, the tree is in a semi-dormant state after the cool weather of winter, and can be moved with little difficulty. A ball of soil should be taken with the roots, and the top pruned moderately. In light soils which cannot be balled, the trees should be transferred to pots or boxes and allowed to establish themselves, after which they may be set out in the orchard without disturbing the roots. When the budded trees have been grown in pots, the possibility of injuring the delicate roots is eliminated.

The cultural requirements of the avocado are similar to those of the citrus fruits. In dry climates the trees must be irrigated regularly and frequently, particularly during the first two or three years. For bearing trees a fertilizer containing 3 per cent nitrogen, 5 per cent phosphoric acid, and 12 per cent potash has been recommended, the quantity required each season varying from three to ten pounds per tree, according to the character of the soil. This should be applied in several doses during the growing season. The growth of young trees is greatly encouraged by organic nitrogen. Leguminous cover-crops are very desirable, for the humus they will furnish as well as the nitrogen.

Often there is a tendency, especially in seedlings, to shoot upward and not spread out; this must be checked by heading back. All weak or unshapely growths should be trimmed out, and all wounds made when pruning should be covered with grafting wax or paint to prevent the entrance of any fungus into the wood. It is well to keep the trees headed low to prevent damage from winds as much as possible; this also brings the fruit within easy reach for picking.

In regions subject to severe frosts, the trees should be protected during the first two or three winters with a shelter of palm leaves, corn stalks, burlap, or some such material. Where irrigation is practised, it is well to harden the trees by withholding water in late fall.

In Florida the avocado is attacked by the wither-tip fungus (*Colletotrichum gleosporioides*), which can be controlled with bordeaux mixture. Two or three scale insects have been noted on trees in California, but up to the present time they are not of serious importance, with the exception of the black scale (*Saissetia oleæ*), which sometimes requires combative measures. The avocado mealy bug (*Pseudococcus nipæ*) is troublesome in Hawaii.

For market purposes, the fruit should be graded according to size, color and form, and carefully packed; it is essential, if the fruit is to be shipped any distance, to select varieties having good carrying qualities. Light wooden crates are used for shipping, containing one layer of fruits, and provided with good ventilation. The fruits must be separately wrapped in pieces of strong paper, and packed closely together to prevent their shaking about and becoming bruised. If they are to be shipped long distances, refrigeration is essential, experiments having shown that the temperature should be 40° to 45° F. Prolonged storage in temperature lower than 40° results in decomposition of the flesh.

Seedlings do not usually bear as early as budded trees, and on account of the variation which they are

likely to show in productiveness, as well as in form, size and quality of fruit, they are unsuitable for commercial cultivation. For the home grounds, on account of their ornamental value, they are worth planting; it is imperative, however, to select seeds from the most desirable fruits, of known quality and productiveness.

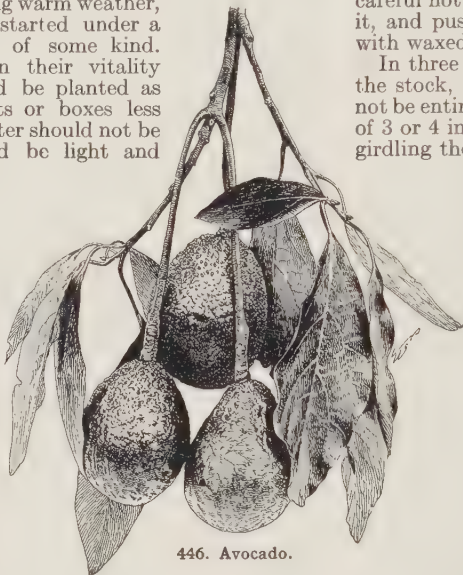
The avocado is budded on seedlings of the same species. For nursery purposes the seeds are usually planted singly in pots or in rows in the open ground. They may also be planted in flats, and potted off as soon as they have germinated; as the roots are delicate and easily injured, however, this is not a desirable method. A glasshouse is unnecessary, provided the seeds are planted during warm weather, but they are usually started under a lath or slat covering of some kind. Seeds will not retain their vitality very long, and should be planted as fresh as possible. Pots or boxes less than 4 inches in diameter should not be used. The soil should be light and porous, preferably rich in humus. Most avocado seeds are somewhat conical; they should be planted with the pointed end up, leaving the tip projecting above the surface of the soil. The pots should then be plunged in a frame, covered with straw or litter, and kept continually moist, but not soggy. Germination will take place in two or three weeks if conditions are favorable. If planted in the open ground, the seeds should be placed in rows 3 or 4 feet apart, and 14 inches apart in the row, covering them with an inch or two of soil. It is well to cover the ground with a mulch of straw to prevent evaporation as much as possible.

The avocado is a rapid grower, and young plants require frequent repotting. It is also a gross feeder, so that a rich soil should be used. The plants may be budded either in pots or in the open ground; if in the former, they must be given very careful attention so as to keep them growing vigorously, and should be in 6- or 8-inch pots. They may be budded when  $\frac{3}{8}$  inch in diameter, or even slightly less.

For avocados, shield budding, essentially the same as practised with the citrus fruits, is most successful and advantageous. The amateur may have some trouble in performing the work successfully, but after a little experience, few difficulties will be encountered.

The season at which budding is most successful naturally depends somewhat upon the locality. In Florida, late autumn and winter budding is favored; in California, May and June seem to be the best, although good success is often obtained in the fall; in Hawaii winter and early spring are preferred. Probably the work can be done at any season when the bark will slip readily, but all seasons are not equally advantageous.

Selection of budwood is one of the most important matters, and one likely to give the novice most trouble. If the wood is too old or too far advanced, the buds are almost certain to drop, leaving a "blind" shield; this may happen even when good budwood is used, if the stock is not in vigorous condition. The ideal wood is of recent growth, but hardened up sufficiently so that it does not snap on bending, and having plump, well-developed buds.



446. Avocado.

It is essential that the buds be cut large,—not less than  $1\frac{1}{4}$  inches in length, and thick enough so that a small quantity of wood will be taken. In budding large stocks,  $\frac{3}{4}$  inch in diameter, 2 inches is not too long for the bud, provided the budstick is, as it always should be, not less than  $\frac{3}{8}$  inch in diameter. The budding-knife must be as keen as a razor, and kept in as nearly that condition as possible by frequent stropping or whetting the knife after cutting each thirty or forty buds. The incision in the stock may be made either in the form of a T or an inverted T, preferably the latter, which has the recommendation of the most successful avocado budders. In lifting the bark be careful not to injure the delicate tissues which lie under it, and push the bud in very gently. Tie it in firmly with waxed tape, leaving the eye exposed.

In three to five weeks the bud will have united with the stock, and the wrap should be loosened; it should not be entirely removed until the bud has made a growth of 3 or 4 inches. Force the bud into growth by partly girdling the stock 3 or 4 inches above it, or by cutting

off the stock about a foot above it. Lopping is difficult, as the wood is brittle and will frequently break off rather than be lopped. The stock must be gone over every week and all adventitious buds rubbed off. When the bud is 8 or 10 inches high, the stock may be trimmed off close above it, and the stump covered with paint or grafting-wax.

Both inarching and grafting are practised to a limited extent, the latter usually under glass. Neither of these methods is so desirable as budding. Cuttings can be grown if bottom heat is available but trees produced in this way do not seem to have the vigor of budded trees.

Large, unproductive or undesirable seedlings should be worked over to a good variety. This is not difficult to do by budding; grafting is also possible. Cut the tree back severely in spring, leaving only the stumps of the largest branches, 3 or 4 inches in diameter, and painting the cut ends with white lead. Numerous sprouts will soon make their appearance; all but three or four of these on each branch must be rubbed off, and when these have attained a diameter of  $\frac{3}{4}$  inch they can be budded in the same manner as seedlings. It is necessary to loosen the wraps oftener, however, as the sprouts naturally make a very rapid growth. Old trees worked over in this way will often produce fruit in two years.

F. W. POPENO.

**AZÀLEA** (from Greek *azaleos*, dry: Linnæus believed them to grow in dry locations). *Ericacæ*. See *Rhododendron*.

The genus *Azalea* seems botanically inseparable from *Rhododendron*; there are no characters by which the two genera can be clearly separated, though if one looks only at the American species and those generally in cultivation, the differences seem to be clear enough, but if one takes into consideration the whole genus, particularly as it is represented in Asia, where it reaches its greatest development, one finds many species that have the characters of these two groups combined in various ways and render a natural and clear separation impossible.

Most of the species retain the same specific or varietal name under *Rhododendron*, except the following:

*A. álba*, Sweet=*Rhododendron rosmarinifolium*.—*A. balsaminiflora*, Carr.=*R. indicum* var. *rosiflorum*.—*A. californica*, Buckl.=*R. occidentale*.—*A. Danielsiana* Paxt.=*R. indicum* var. *macranthum*.—*A. ledifolia*, Hook.=*R. rosmarinifolium*.—*A. liliiflora*, Poir.=*R. rosmarinifolium*.—*A. lutea*, Linn.=*R. calendulaceum*.—*A. mollis*, Blume=*R. sinense*.—*A. mollis*, Miq.=*R. japonicum*.—*A. mucronata*, Blume=*R. rosmarinifolium*.—*A. pontica*, Linn.=*R. luteum*.—*A. procumbens*, Linn.=*Loiseleuria procumbens*.—*A. punctata*, Sweet=*R. rosmarinifolium*.—*A. reticulata*, Koch=



*R. rhombicum*.—*A. Rollisonii*, Hort.=*R. indicum* var. *rosiflorum*.—*A. Sieboldii*, Miq.=*R. indicum*.—*A. speciosa*, Willd.=*R. calendulaceum*.—*A. squamata*, Lindl.=*R. Farrerae*.

ALFRED REHDER.

**AZÀRA** (I. N. Azara, a Spanish promoter of science, especially of botany). *Flacourtiaceæ*. Ornamental shrubs or small trees grown for their handsome evergreen foliage and also for their fragrant flowers.

Leaves evergreen, alternate, short-petioled, entire or serrate, with usually one of the stipules enlarged and lf.-like; fls. small, in axillary peduncled racemes or clusters, apetalous; sepals 4-5; with glands between the stamens and the sepals opposite the latter; stamens numerous, rarely 5; ovary superior, 1-celled, with numerous ovules; style simple, elongated; fr. a many-seeded berry.—About 20 species in S. Amer., especially in Chile.

They are handsome evergreen shrubs, with small or medium-sized foliage, inconspicuous but fragrant flowers, and therefore called "aromo" in Chile.

They can be grown only in warmer temperate regions; the hardiest species is *A. microphylla*. They are sometimes cultivated as greenhouse plants and potted in a sandy compost of loam and leaf soil. Propagation is by seeds or by cuttings of mature wood in autumn under glass with slight bottom heat.

*microphylla*, Hook. f. From 3-12 ft.: lvs. obovate, serrate, or nearly entire,  $\frac{1}{2}$ - $\frac{3}{4}$  in. long, shining, glabrous, the stipules similar, but half the size; fls. greenish in few-fl. clusters; stamens 5; berries orange. Feb., March. Chile. G.C. II. 1:81. Gn. 18, p. 403. Gt. 23, p. 340. F. 1874, p. 221.—Graceful evergreen shrub, regularly pinnately branched, excellent for covering

walls; the hardiest of all the cult. species; hardy as far north as Washington, D. C.

*Gilliesii*, Hook. & Arn. Height 10-15 ft.: lvs.  $2\frac{1}{2}$ -3 in. long, broad-ovate, with coarse, spiny teeth, glabrous; stipules orbicular, much smaller; fls. in dense, elliptic, nodding heads, yellow. Feb., March. Chile. B.M. 5178. F.S. 23:2+45. G.C. II. 15:401.—The handsomest of all azaras.

*A. crassifolia*, Hort.=*A. Gilliesii*.—*A. dentata*, Ruiz. Height 12 ft.: lvs. obovate or elliptic, crenate-serrate; fls. yellow, in small corymbs. Chile. B.R. 1788.—*A. integrifolia*, Ruiz. Height 10-20 ft.: lvs. entire; fls. yellow, in oblong heads. Chile. Has a variegated form.

ALFRED REHDER.

**AZÓLLA** (Greek, *to destroy by drying*). *Salviniaceæ*. A small genus of floating aquatics with small, pinnately branched sts. and minute fleshy 2-lobed lvs., producing 2 sorts of spores in globular sporocarps. The plants multiply rapidly by self-division, and will grow readily in water containing a little nutriment. The species are distinguishable only by microscopic examination. In natural conditions, the plants grow so closely together and multiply so rapidly as to cover very completely any quiet water surface. For this reason, they have been found useful in preventing the propagation of mosquitos in Germany and Panama.

*caroliniana*, Willd. Plant  $\frac{3}{4}$ -1 in. long; anchor-like processes of spores with septa. N. Y. to the Gulf of Mex.

*fiiculoides*, Lam. Plants 1-2 in. long; anchor-like processes without septa. Calif. to Chile.

L. M. UNDERWOOD.  
R. C. BENEDICT.†

# B

**BABIÀNA** (said to come from Dutch for *baboon*, because those animals eat the bulbs). *Iridaceæ*. About fifty cormous plants of South Africa (and one Socotran), sometimes grown for spring bloom under glass, or in the open in the South.

Usually less than 1 ft. tall: fls. showy, red or purplish, in a short spike-like cluster or raceme, tubular at the base, the segms. with claws or narrow bases, and the limb erect-spreading, in marked colors and shades, often fragrant; ovary 3-loculed: lvs. narrow, hairy, plaited, standing edgewise to the st.

Low plants, of easy culture if treated like freesias or hyacinths. Three or four corms placed in a 4-inch pot, in autumn, give attractive bloom in March or later. Grown only indoors or under frames in the North. Outdoors in mild climates they may remain continuously in the ground, although it is better to take up and replant every year or two. Propagation is by cormels and seeds. They are showy and useful plants. Monograph by Baker in Handbook of the Iridæ, 1892.

A. *Perianth-limb regular or nearly so, and wide-spreading.*

**stricta**, Ker (*B. villôsa* and *B. purpurea*, Ker). Fig. 447. Plant 1 ft. or less high: lvs. broad, oblong-lanceolate or sword-shaped, barely reaching the spikes: fls. scattered, showy, usually red or purple, with a prominent tube, the segms. oblong-lanceolate. B.M. 583, 621.—Babianas are not sold under species-names in this country, but as mixed varieties. These varieties are chiefly, if not wholly, of this species. There are many forms and colors. Var. **angustifolia**, Sweet. Lvs. linear: fls. blue, pinkish inside. B.M. 637. Var. **rubro-cyanea**, Ker. Limb lilac, throat red. B.M. 410 (as *lxia*). Var. **sulphurea**, Ker. Yellow or whitish. B.M. 1053. Two other long-cult. types are described below.

AA. *Perianth-limb distinctly ringent or gaping.*

**plicata**, Ker. Low: lvs. lanceolate, hairy, usually overlapping the spikes: fls. lilac or red, long-tubed, the segms. oblong and unequal; odor pink-like. B.M. 576.

**dística**, Ker. Differs from the last in having the perianth-tube distinctly exerted from the spathe; odor hyacinth-like. B.M. 626.

*B. flabellifolia*, Harv. Fls. 2-5, in erect spike, long-tubed, lower lobes blotched: lvs.  $\frac{3}{4}$  in. broad, toothed at apex.—*B. ringens*, Ker. 6-10 in.: fls. gaping and ringent, scarlet: lvs. narrow and pointed.—*B. sambucina*, Ker. 6-10 in.: fls. purplish, with spreading divisions, elder-scented. B.M. 1019.—*B. socotrana*, Hook. f. 3-4 in.: fl. single, the tube very slender, pale blue, 2-lipped: lvs. narrow-lanceolate. Isl. of Socotra. B.M. 6585.

L. H. B.

**BABY'S BREATH**: *Gypsophila*; also *Galium* and *Androstaphium*.

**BACCAÛREA** (Greek, *bacca*, berry, and *aureus*, golden, from the yellow fruit). *Euphorbiaceæ*. Trees, rarely

cult., some with edible fr.: lvs. large, alternate, simple: infl. racemose; calyx imbricate; petals absent; 2 ovules in each of the 2-5 cells.—About 50 species in the Old World tropics: related to *Antidesma*. **B. bracteata**, Muell. Arg. (*Pierardia dulcis*, Wall.), is mentioned as once intro. to England. Malaya. Seed of **B. Motleyana**, Muell. Arg., of Malaya where the fr. is used, has been intro. by the U. S. Dept. Agric.

J. B. S. NORTON.

**BÁCCHARIS** (*bakkharis*, an ancient Greek name for different shrubs). *Compósitæ*. **GROUNDSEL TREE**. Ornamental plants, chiefly grown for the showy white pappus of the fruit; some species also for their evergreen foliage.

Shrubby or suffruticose: lvs. alternate, usually serrate, glabrous, deciduous or evergreen: heads of fls. small, white or yellowish, dioecious, in panicles or corymbs; involucre with many imbricate scales; receptacle flat, naked; pistillate fls. with filiform corolla: achenes compressed, ribbed, with pappus.—More than 250 species in Amer., chiefly in S. Amer.

*Baccharis halimifolia* and *B. salicina* are hardy North, while the evergreen species are more tender. They grow in almost any well-drained soil in a sunny position, and are well adapted for dry and rocky slopes, and valuable for seashore planting. Propagation is by seeds, or by cuttings under glass.

**halimifolia**, Linn. Shrub, 3-12 ft.: branches angular: lvs. cuneate, oblong or obovate, coarsely toothed, the uppermost entire, glabrous, 1-2 in. long: fls. in large panicles: pappus white, about  $\frac{1}{2}$  in. long. Sept. Seacoast, from New England southward. Gng. 7:113.—The hardiest species; in fr. resembling a shrub with abundant snow-white fls.

*B. glomeruliflora*, Pers. Allied to *B. halimifolia*: heads axillary, solitary or clustered, sessile or nearly so: pappus somewhat shorter. N. C. to Fla.—*B. patagonica*, Hook. & Arn. Low evergreen shrub: lvs.  $\frac{1}{4}$ - $\frac{1}{2}$  in. long: heads mostly axillary. Patagonia.—*B. pilularis*, DC. Height 6 ft.: evergreen: lvs. 1 in. long: heads in racemose panicles. Pacific coast.—*B. salicina*, Torr. & Gray (*B. salicifolia*, Nutt.). Allied to *B. halimifolia*. Lvs. narrow-oblong, or linear-lanceolate. Colo. to W. Texas.

ALFRED REIDER.

**BACHELOR'S BUTTONS**: *Centaurea Cyanus*, *Gomphrena globosa*, *Ranunculus acris* and *Ageratum conyzoides*.

**BACKHOÛSIA** (James Backhouse, botanical traveler). *Myrtiææ*. Evergreen greenhouse plants, blooming in spring.

Shrubs or trees, with opposite lvs. and blossoms in cymes or umbels: calyx-tube turbinate, or broadly campanulate, adhering to base of ovary, with 4 persistent segms.; petals 4, short; stamens many; ovary 2-celled, bearing a filiform style: fr. a caps., more or less inclosed in calyx, indehiscent or separating into 2 parts.—Five species in Austral. Requires the general treatment of myrtaceous coolhouse plants. Prop. by hardening cuttings under glass.

**myrtifolia**, Hook. & Harv. Large slender-branched shrub, or small tree: lvs. ovate-acuminate, stiff, pelucid-punctate: fls. white, in pedunculate corymbs, the younger ones partly concealed by the petaloid bracts; petals small, round-ovate, concave, acute; calyx hairy. Queensland and New S. Wales. B.M. 4133.

L. H. B.

**BÁCTRIS** (Greek, *baktron*, cane; the young stems used for walking-sticks). *Palmææ*, tribe *Bactrideæ*. Usually low palms, very rarely entirely spineless.

Stems solitary or fasciculate ringed, spiny or smooth, sprouting from the roots: lvs. terminal or scattering,



447. *Babiana stricta*. ( $\times \frac{1}{4}$ )



equally or unequally pinnatisect, glabrous or pubescent; segms. sparse or aggregated, or more or less imperfectly connate, forming a bifid blade, acute or rarely obtuse at the apex, the ciliate margins recurved at the base; petiole short or long; sheath long, spiny: spadices sessile or pedunculate, perforating the lf.-sheaths; spathes 2, the lower short, open at the apex, the upper coriaceous or woody, exceeding the spadix, or fusiform, ventrally dehiscent, smooth, bristly or spiny; bracts persistent: fls. small or medium, pale yellow or greenish: fr. small, green, ovoid or globose.—Species 90. Trop. Amer. G.C. II. 22:595.

These are ornamental palms, but little grown on account of the spines. The fruits of *B. major* are used extensively in South America for food.

The cultivation of *bactris* is easy if it is grown in a warmhouse, with a range of temperature from 60° to 80°, and given plenty of water. Frequent syringing is advisable. It thrives best in a mixture of loam, two parts; leaf-mold, one part; well-rotted cow-manure, one part. The young plants are very decorative, but in age most of the species become spindly.

Propagation is by suckers which grow freely; rarely by seeds, which are hard to get.

A. *Spines yellow, tipped black.*

*pallidispina*, Mart. (*B. flavispina*, Hort.). St. 10–18 ft. high, 1–2 in. diam., the internodes spiny: lvs. showy, 5–9 ft. long, equally interruptedly pinnatisect; petiole 4–6 ft., brown-scaly, thickly covered with very long ( $\frac{3}{4}$ – $2\frac{1}{4}$  in.), black-tipped yellow spines, either solitary or in groups of 2–4; segms. linear-lanceolate, caudate-acuminate, prickly on the margins, the basal ones 2–8 in. long,  $1\frac{1}{2}$  in. wide, the upper,  $12 \times 1\frac{1}{4}$  in.: fr. 3–4 times exceeding the persistent calyx, about  $1\frac{1}{2}$  in. long. Brazil.

AA. *Spines black.*

B. *Lf.-segms. acute at both ends.*

*major*, Jacq. BEACH PALM. St. 9–15 ft. high,  $1-1\frac{1}{2}$  in. diam., armed with rows of black spines 2 in. long: petiole armed with very long black, terete spines; lvs. 4–6 ft. long, equally pinnatisect nearly to the rachis; sheath and rachis spiny and white or brown tomentose; segms. linear, acute at both ends, 25–35 on each side, 1-nerved, 8–12 in. long,  $\frac{1}{2}$ – $\frac{1}{2}$  in. wide, glabrous on both sides, densely setose, with black hairs along the margin.: frs. about the size of an apricot, edible. Brazil.

*minor*, Jacq. Fig. 448. A tall, slender-stemmed palm, often 40 ft. in height, armed with many dark-colored spines: lvs. roundish in outline, about 3 ft. long and composed of numerous narrow, sharp-pointed lfts. that are spiny on the veins beneath: spathe axillary, solitary, spreading, very spiny; corolla in both sexes gamopetalous: fr. rotund, purplish black.—A rare but showy palm grown sometimes in tropics.

BB. *Lf.-segms. acute at tip.*

*Gasipañes*, HBK. (*Guilielma speciosa*, Mart.). St. about 60 ft. high, single or cespitose, with rings of subulate-compressed black spines, 1 in. long, the rings about as far apart as the diam. of the st.: lvs. 6 ft. long, curving; segms. dark green above, pale green below, very numerous, approximate,  $1\frac{1}{2}$  ft. long,  $1\frac{1}{4}$  in. wide, linear-lanceolate, long-acuminate, bristly or minutely prickly along the margins: fr. orange or reddish, nearly 2 in. long, ovoid. Lower Amazon.

*hórrida*, Oerst. Cespitose sts. 6–8 ft. high, 8–9 in. diam., very spiny, sheathed for most of its length with bases of dead lvs.; spines 3–4 in. long, 4-sided, whitish tomentose, at length glabrous: lvs.  $2\frac{1}{2}$ –3 ft. long; sheath 8 in., brown-tomentose; petiole  $1\frac{1}{2}$  ft., densely spiny, subtetragonal, densely brown-tomentose beneath; segms. 7 in. long,  $\frac{1}{2}$  in. wide, lanceolate, rigid, glaucous. Unlike all the above in having a hairy but not spiny spathe. Nicaragua

*B. aurantiaca*, Hort., is a "pinnate palm from Mex., dwarf and spiny but beautiful." The name is unknown in botanical literature.—*B. caryotaxifolia*, Mart., from Brazil, with wedge-shaped 3-lobed pinnae, has been catalogued; also *B. utilis*, Benth. & Hook. (*Guilielma utilis*, (Erst.), from Costa Rica, with spiny petioles and young lvs.

N. TAYLOR.†

**BACULÀRIA** (Latin, *baculum*, a small walking-stick) *Palmaceæ*, tribe *Arècæ*. Two or three small palms, completely spineless. By some, included in *Linospadix*.

Stems very thin, either solitary or in bunches, which are prominently ringed: lvs. usually numerous, terminal, unequally pinnate, and with relatively short petioles: lfts. coriaceous, usually alternate, from 4–6 pairs, strap-shaped, and with incised or much-laciniated apices, attached by a broad, almost decurrent base; nerves prominent, numerous on older lfts., on small ones solitary: spathes in pairs; spadix consisting of a long spike-like cluster, as long as or longer than the lvs.; fls. in 3's, a female with 2 males in each cluster on the green spadix: fr. small, obovate or ovoid, green, from  $\frac{1}{4}$ – $\frac{3}{4}$  in.



448. *Bactris minor*.

long. The genus is confined to temperate and tropical Austral. G.C. II. 22:595.

For general culture, see *Areca*, to which they are allied. The only species known in cultivation seem to do better in a temperate rather than a tropical house, but shifting will probably be found advantageous. One of the smallest palms in cultivation, *B. monostachya* is very popular, particularly in England.

*monostachya*, F. Muell. (*Arèca monostachya*, Mart. *Kéntia monostachya*, F. Muell.). WALKING-STICK PALM. Trunk 6–12 ft. high, scarcely 1 in. thick: lvs.  $1\frac{1}{2}$ –4 ft. long; the sheath broad, coriaceous, about 6 in. long, produced into 2 stipular lobes; segms. very irregular, acuminate, very variable in breadth and distance, adnate to the rachis, or tapering at the base, the longest about 1 ft. long; infl. very long, often exceeding the lvs.; stamens usually 10: fr. ovoid, about  $\frac{1}{2}$  in. thick. Queensland, New S. Wales. B.M. 6644.

*minor*, F. Muell. Sts. several from the same rhizome, 2–5 ft. high, about  $\frac{1}{2}$  in. thick: lvs. about  $3\frac{1}{2}$  ft. long, with from 12–14 lfts.: spadix about as long as the lvs. or a little shorter, scarcely  $\frac{1}{2}$  in. thick; stamens 12; seed about  $\frac{1}{2}$  in. diam. Queensland.—A delicate palm, not so well known as the preceding, but attractive.

N. TAYLOR.†

**BAERIA** (after the Russian zoölogist, Karl Ernst von Baer). *Compósitæ*. Small plants, one of which is sometimes grown as a garden annual.

Heads usually many-fl'd., radiate, the rays 5-15; bracts of the involucre as many as rays; pappus often wanting.—Twenty species of Californian annuals (or one or two perennial species), with numerous showy, inch-wide yellow fls. in early summer.

*gracilis*, Gray (*Burrielia gracilis*, DC.). Easily distinguished from *Actinolepis coronaria* by its hairy sts. and foliage and undivided lvs.: plant much branched: height 4-12 in.: lvs. opposite, connate, linear-lanceolate; fls. solitary, on slender terminal peduncles; involucre leafier than in *Actinolepis coronaria*, the scales longer, downy, in 2 series; rays 8-12. B.M. 3758.—This is likely to be cult. as *Lasthenia californica*, which, however, is not hairy and has much longer lvs.

*B. chrysostoma*, Fisch. & Mey. Lvs. narrowly linear, 1 line or less wide; fls. larger than in *B. gracilis*, the heads 3-4 lines high; ligules 3-4 lines long; habit more erect.—*B. coronaria* = *Actinolepis coronaria*.



N. TAYLOR.†

**BAHIA** (probably from the port of Bahia, or San Salvador, South America). *Compósitæ*. A little-known group of herbaceous perennials or sometimes subshrubs grown for their yellow flowers and canescent leaves.

Leaves mostly opposite, rarely alternate, the rather small pedunculate heads terminating the branches; involucre hemispheric or obovate; receptacle mostly flat; achenes narrow, 4-sided; pappus of several scarios scales.—There are 12 species, all American. They thrive on borders of light and well-drained soil, and may be increased by seeds or by division in spring.

*lanata*, DC. One to 2 ft. high, slender: lvs. pinnately cleft or divided into 3-7 linear or linear-lanceolate lobes: rays mostly 8-9, oblong, showy: achenes glabrous or minutely hairy. Calif. B.R. 1167 (as *Eriophyllum*).—Perhaps not hardy in the N. E. Summer. N. TAYLOR.

**BAIKIÆA** (Wm. B. Baikie, African traveler). *Leguminosæ*. Great-flowered Trop. African trees of 2 species, one of which has been cult. in Eu. Trees unarmed: lvs. abruptly pinnate, coriaceous: fls. few in each raceme, not papilionaceous; petals 5, much exceeding the turbinate calyx, broadly oblanceolate or obovate, long-clawed; stamens 10. *B. insignis*, Benth., is an erect evergreen, to 40 ft., with short-lined fls. 10 in. across, snow-white with lower petal or lip lemon-yellow. Upper Guinea.—Said to be the largest flower in the Leguminosæ.



450. Pod of garden balsam

**BALÅKA** (the Fijian vernacular name). *Palmææ*, tribe *Arëææ*. Palms, differing, if at all, from *Ptychosperma*, to which they are with equal propriety referred, in having the seed not sulcate, and in the half-rhomboid segms. of the lvs.; and from *Drymophloeus* in the form of the lf. and the caducous spathes.—Species 2. Fiji Isls.

**Seemannii**, Becc. (*Ptychosperma Seemannii*, H. Wendl.). **BALÅKA**. Fig. 449. Caudex slender, 8-12 ft. high, straight, ringed, about 1 in. diam.: lvs. pinnatisect, 4 ft. long; segms. erose-dentate at the apex, alternate, 9 on each side, semi-rhomboid, obliquely truncate, the upper margin longer, cuspidate at the apex, the terminal one deeply bifid. Growing as underwood in dense forests. Fiji.—Sts. used for spears by natives, because of their strength and straightness. Fig. 449 is adapted from Seeman's *Flora Vitiensis*. N. TAYLOR.†

**BALLOON VINE**: *Cardiospermum*.

**BALM** (*Melissa officinalis*, Linn.). *Labiatæ*. **LEMON BALM** and **BEE BALM**. Sweet herb, the lvs. being used for seasoning, particularly in liquors, and also in medicine. It has a lemon-like flavor. It is a hardy perennial from S. Eu. The plant grows 1-2 ft. high, somewhat hairy, loosely branched, with ovate-petioled, sometimes cordate, lvs. and yellowish or whitish fls. in loose axillary clusters. Thrives in any warm position, and is easy to grow. Prop. by seeds; also by division. Becoming wild in E. U. S.

**BALSAM**, *Impatiens Balsamina*, Linn. (*Balsamina hortensis*, DC. *Balsamina Impatiens*, Hort. *Impatiens coccinea*, Sims, B.M. 1256). *Balsaminææ*. An erect, much-branched, half-succulent annual, long ago introduced from India, and now widely cultivated for its showy flowers.

Plant 1½-2½ ft.: lvs. lanceolate, toothed, the lower ones being mostly in pairs: fls. clustered in the axils of the lvs., on very short stalks; sepals and petals similarly colored and not easily distinguished, one of the sepals (of which there seem to be 3) long-spurred; petals apparently 3, but 2 of them probably represent 2 united petals, thus making 5; stamens 5. The pod, shown in Figs. 450 and 451, is explosive. It has 5 carpels and very thin partitions, and seeds borne on axile placentæ. When the caps. are ripe, a pinch or concussion will cause the valves to separate and contract, the seeds being thrown with considerable force. The balsam has varied immensely in the doubling, size and color of its fls. and in the stature of the plant. It was known to Gerarde in 1596. The balsam is sometimes called "lady slipper," although this name is properly confined to *Cypripedium*, and used for *Calceolaria*.

Practically all the garden balsams are now double or semi-double. The full-double forms are known as the camellia-flowered varieties. Fig. 452. In well-selected stock, the greater part of the flowers from any batch of seedlings should come very double. The colors range from white to dark blood-red, yellowish and spotted. Balsams are of very easy culture. They are tender, and should be started in thumb-pots or boxes indoors, or in the open when danger of frost is past. The seeds are large, and germinate quickly. The plants prefer a rich, sandy loam, and must not suffer for moisture. Transplanting, and



451. Explosion of balsam pod.



pinching-in the strong shoots, tend to make the plants dwarf and compact; two or three transplantings are often made. It is well to remove the first flower-buds,



452. Camellia-flowered balsam. (×1)

especially if the plants are not thoroughly established. Better results are secured when only a few main branches are allowed to grow, all the secondary and weak ones being pinched out. Sometimes they are pruned to a single stem, and if much room is given very large blooms are secured. The lower leaves may be removed if they obscure the flowers.

Well-grown bushy plants should stand 2 feet apart each way, and the tall kinds will reach a height of 2 to 2½ feet. Good bloom is impossible if plants are crowded. For this reason, balsams do well in rows on the border of a garden where they may have room. Seed of the finest double strains is expensive, but inferior or common seed gives little satisfaction. Plants started early in May should give flowers in July, and should bloom until frost. A full-grown plant is shown in Fig. 453. At present, balsams are grown chiefly as flower-garden plants; but some years ago the flowers were largely used as "groundwork" in florists' designs, particularly the double white varieties. The flowers were wired to toothpicks, and were then thrust into the moss that formed the body of the design. L. H. B.

**BALSAMOCÍTRUS** (Latin, *balsamum*, balsam, and *citrus*). *Rutaceæ*, tribe *Citrææ*. Trees; usually spiny, suggested as stocks for citrous fruits; as yet scarcely known in this country.

Fruits hard-shelled and persistent: lvs. trifoliate, or rarely simple: fls. 4-5-parted; stamens 10-20; ovary 8-9-celled; ovules numerous in each cell; seeds large, smooth; hypocotyl very short, the cotyledons remaining near or just above the surface of the ground. The first



453. The garden balsam.

foliage lvs. are opposite, lanceolate or ovate.—Three species are known, all occurring in Trop. Afr. *B. Dawei* is the type species.

The subgenus *Afrægle* (Latin, *Africa* and *Ægle*) differs from *Balsamocitrus* proper in having more than twice as many (usually 4 times as many) stamens as petals and in having a larger, more deeply lobed disk. *B. paniculata* is the type of this subgenus.

*Dawei*, Stapf. Fig. 454. A large tree, 50-60 ft. or more in height: first few foliage lvs. on young plants simple but next succeeding ones 3-foliolate; lateral lfts. three-fifths to three-fourths as long as the terminal lft., having a cylindrical petiolule  $\frac{3}{8}$ - $\frac{1}{2}$  in. long; terminal lft. with a much shorter petiolule,  $\frac{1}{8}$ - $\frac{1}{4}$  in. long, but usually borne on a section of the rachis  $\frac{1}{2}$ -1½ in. long, jointed both at the insertion of the lateral lfts. and also where the petiolule of the terminal lft. is inserted (such imperfectly pinnate lvs. are not uncommon in some pinnate-lvd. plants but are rare in trifoliate species): fls. 5-merous with 10 free stamens (twice as many as the petals): frs. globose or oval, 4-6 in. diam., with a very thick, hard woody rind and 8 oval cells surrounded by the more or less fibrous mesocarp tissue; cells contain numerous seeds imbedded in amber-colored, fragrant gum. The ripe frs. drop off the pedicel, leaving a hole through the shell where they were attached. The seeds are large,  $\frac{1}{2}$ - $\frac{3}{4}$  x  $\frac{1}{8}$ - $\frac{3}{16}$  in., smooth, and germinate with a very short hypocotyl, often bringing the cotyledons to the surface of the ground or just above it. Occurring in the Budongo forest east of Lake Albert Nyanza in Uganda, E. Cent. Afr., at an altitude of 2,000-3,000 ft.

—The seedlings grow very rapidly. Experiments indicate that this is a very promising stock on which to graft the bael fruit (*Ægle Marmelos*), which it is difficult to grow on its own roots. Ill. Journ. Linn. Soc. Bot. 37, pl. 22.



454. Fruit of *Balsamocitrus Dawei*. (×½)

*paniculata*, Swingle (*Citrus paniculata*, Schum. *Ægle Bārteri*, Hook. f. *Limonia Warnéckii*, Engler). Fig. 455. A handsome tree, 20-45 ft. high and much branched: lvs. on old trees trifoliate, the lateral lfts. about two-thirds as long as the terminal one and narrowed into a slender petiolule  $\frac{1}{8}$ - $\frac{1}{4}$  in. long; terminal lft. has a long slender petiolule  $\frac{1}{2}$ - $\frac{3}{4}$  in. long but there seems to be no articulation where it joins the lamina as in case of *B. Dawei*; spines are said to be solitary, from 1-4 in. long but are wanting on fruiting branches: fls. usually 4-merous, sometimes 5-merous; stamens 13-20, normally 4 times as many as the petals; ovary 8- or 9-celled; disk large, lobed: frs. spherical or obovoid, 3-5 in. diam., with a thick woody rind, green until maturity, then taking on a gray color; cells of fr. contain numerous smooth seeds; germination unknown.—Commonly planted in the villages of Nigeria and the Gold Coast in Trop. W. Afr. This species has not yet been intro. into cult., but it is to be hoped that seeds will be secured from Afr. to permit its being tested as a stock for citrous frs. Ill. Hooker, Ic. 37, pl. 2285. Bull. Soc. Bot. Fr. v. 58, Mem. 8d., pl. 1-2.

*gabonensis*, Swingle. A little-known tree or shrub: lvs. narrowly lanceolate, simple, with short petioles: vigorous young trees, when they have reached a height of 8 or 10 ft., begin to show trifoliate lvs. with relatively small lateral lfts. from one-third to one-half as long as the terminal lft. and like it acute at both ends; terminal lft. sessile: fls. unknown: fr. nearly globular, slightly pear-shaped, with a thick woody rind.—The natives remove the contents through an opening at the stem end and use

the empty fr. as a powder-flask. Native to the M'fan or Pahouin country in N. French Congo and S. Kamerun where the fr. is known to the French residents as "poire à poudre" (powder-flask). This species grows very rapidly under greenhouse conditions. It has been grafted successfully on the tabog (*Chætospermum glutinosa*), a related tree native to the Philippines, and may prove of value as a stock for citrous fruits on account of its vigor and healthiness. Ill. Bull. Soc. Bot. Fr. v. 58, Mém. 8d, pl. 3, and Fig. B., p. 235.

WALTER T. SWINGLE.

**BALSAMORRHIZA** (Greek, *balsam* root). *Compósitæ*. Low perennials with thick, deep, resinous, frequently tuberous roots, tufts of radical lvs., and large yellow fls.: lvs. usually long-petiolate, when cauline usually opposite, mostly radical: scapes few-lvd. or naked; fls. usually solitary. The root was an aboriginal food, when the rind was peeled.—About 10 species, mostly from Cent. and W. N. Amer.

**Hodkeri**, Nutt. Canescent: height 4–12 in.: lvs. lanceolate, 1–2-pinnately parted: fls. solitary, on naked scapes.—Intro. 1881 by E. Gillett, but scarcely known to horticulturists. Useful in dry situations.

N. TAYLOR.



455. *Balsamocitrus paniculata*. ( $\times \frac{1}{2}$ )

**BAMBOO**. Various perennial ornamental grasses embracing the genera and species of the tribe *Bambuseæ*, order *Gramineæ*, cultivated for the surpassing beauty of their foliage and habit; some of them are hardy even in parts of the northern states, but they are warm-country plants.

Usually large, sometimes tree-like, woody, rarely herbaceous or climbing plants, of wide geographical range. The species are irregularly distributed throughout the tropical zone, a few occurring in subtropical and temperate zones, attaining their maximum development in the monsoon regions of Asia.—About twenty-three genera, only two being common to both hemispheres. Something more than 200 species are recognized, of which upwards of 160 occur in Asia, about seventy in America, and five in Africa. They extend from sea-level to altitudes of more than 10,000 feet in the Himalayas and 15,000 feet in the Andes, and under the most favorable conditions some species may attain a height of 100 to 120 feet, with a diameter of culm of 8 to 12 inches.

An attempt to enumerate the numerous and varied economic uses of the giant-grasses would greatly overreach the field of this article; but as objects of grace and beauty in the garden, conservatory, and under special conditions of landscape, bamboos are matchless. Not only are they adapted to sections favored with a

gentle climate, but it is possible to grow certain species where the cold of winter may reach zero Fahrenheit, or even occasional depressions of greater severity.

Bamboos delight in a deep, rich loam, and generously respond to good treatment. A warm, slightly shady nook, protected from the prevailing cold winds of winter, and in which moist but well-drained soil is plentiful, is an ideal location. A top-dressing of manure and leaves is not only beneficial in winter, by preventing the frost from penetrating the ground too deeply, but it also preserves the moisture that is so essential to the welfare of the plants during the growing season. Some species produce rampant subterranean stems, and spread rapidly when once established. These should not be planted for ornamental purposes, but only those forming tufts or clumps. It is best to plant each group of but a single species, and to restrict the wide-spreading sorts to isolated positions. The most effective results to be obtained by planting bamboos are secured on gentle banks above clear water, and against a background of the deepest green. In such situations the graceful stems and dainty branches, bending with their wealth of soft green leaves, and the careless lines of symmetry of each individual, lend a bold contrast of the richest beauty. Ordinarily it will require two or three years thoroughly to establish a clump of bamboos in the open air, and, until this is accomplished, the vigor, hardiness and beauty that characterize some noble kinds will be lacking. During the first few years, a new plantation should receive generous protection in localities in which the winters are trying, and even with this precaution it is likely the plants will suffer to some extent in cold weather. Planted out in conservatories or confined in tubs or large pots, the bamboos present many admirable qualities, and, as decorative plants, several species offer many inducements to their cultivation, especially as they may be grown and used out-of-doors in the summer and cheaply wintered in a coolhouse.

Propagation is best effected by careful division of the clumps before the annual growth has started. The difficulty of procuring seeds in some instances is very great; indeed, the fruiting of a number of species has never been observed. Some species flower annually, but the majority reach this stage only at intervals of indefinite and frequently widely separated periods. In some species the flowers appear on leafy branches; in others the leaves fall from the culms before the flowers appear, or the inflorescence is produced on leafless, radical stems. Fructification does not exhaust the vitality of some species; but others, on the other hand, perish even to the portions underground, leaving their places to be filled by their seedling offspring. Owing largely to the difficulty in obtaining flowering specimens, the systematic arrangement or nomenclature of the bamboos is in a sad plight. As it is sometimes even impossible to determine accurately the genus without flowers, the correct positions of some forms are not known.

Four sub-tribes of *Bambuseæ* are accepted by Hackel, namely: *Arundinarieæ*.—Stamens 3: palea 2-keeled: fr. with the seed grown fast to the seed-wall. To this belong *Arundinaria* and *Phyllostachys*. *Eubambuseæ*.—Stamens 6: fr. with the seed fused to a delicate seed-wall. *Bambusa* is the only garden genus. *Dendrocalameæ*.—Stamens 6 (rarely more): palea 2-keeled: fr. a nut or berry. Here belongs *Dendrocalamus*. *Melocanneæ*.—Characters of the last, but palea not keeled. *Melocanna* is an example, an extra-tropical genus, probably not in cult. in the U. S.

The genera *Arundinaria*, *Phyllostachys*, *Bambusa* and *Dendrocalamus* contain the most important species in cultivation. Roughly, the species of *Arundinaria* may be separated from *Phyllostachys* by the persistent sheaths and cylindrical stems. In *Phyllostachys* the sheaths are early deciduous, and the internodes, at



least those above the base, are flattened on one side. Generally, *Arundinaria* and *Bambusa* cannot be separated by horticultural characters, and *Dendrocalamus* is hardly separable except by its great size. It is probable that many of the forms now classed as species of *Bambusa* will eventually be found to belong to other genera, especially to *Arundinaria*. Extended information regarding the *Bambuseæ* may be found in the following publications: Munro's Monograph, in Transactions of the Linnean Society, Vol. XXVI (1868); Hackel, in *Die Natürlichen Pflanzenfamilien*, Vol. II, part 2, p. 89 (1887), English Translation by Lamson-Scribner & Southworth, as *The True Grasses*, New York, 1890; papers by Bean in *Gardeners' Chronicle* III, 15:167, et seq. (1894); Freeman-Mitford, *The Bamboo Garden*, 1896, New York, The Macmillan Company, pp. 224; A. & C. Rivière, *Les Bambous*, Paris, 1879; Gamble, *The Bambuseæ of British India*, Calcutta and London, 1896; Houzeau, *Le Bambou*, Mons., 1906; Fairchild, *Japanese Bamboos*, 1903; Franceschi, *Bamboos in California*, Santa Barbara, 1908. Among the hardest of the bamboos are the following: *Phyllostachys Henonis*, *P. nigra*, *P. viridi-glaucescens*; *Arundinaria macrosperma*, *A. japonica*, *A. nitida*; *Bambusa palmata*, *B. tessellata* and *B. pygmæa*.

The list of descriptions contains the important kinds of bamboos in cultivation in America, and following the classified descriptions will be found a list of species, showing those that are more or less rare in gardens, but procurable from time to time through horticultural catalogues or prominent growers. An attempt has been made to separate the harder forms of bamboos from the tenderer kinds by the character of the venation of the leaves, a distinction that has been enthusiastically entertained by Freeman-Mitford in his most estimable work, a book that has done much to create a popular appreciation of bamboos, and also to clear up the complete confusion into which the trade names have fallen.

Bamboos have slowly but persistently increased in popular esteem, especially in the southern and Pacific states, where they have proved their great beauty and usefulness as garden ornamentals. A new impetus has been given the cultivation of these plants by the dissemination of suitable species and varieties, and by the introduction of new and desirable kinds by commercial horticulturists and the U. S. Department of Agriculture.

In the following taxonomy, A.=*Arundinaria*; B.=*Bambusa*; D.=*Dendrocalamus*; P.=*Phyllostachys*; T.=*Thamnocalamus*, which is here considered a subgenus of *Arundinaria*. No Japanese native names are indicated, although bamboos are sometimes offered under such names. The prevailing tendency is to discard vernacular names, when unassociated with the Latin binomials, as they breed hopeless confusion.

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| <i>A. Falconeri</i> , 33.       | <i>B. Narthura</i> , 13.     | <i>B. virescens</i> , 22.          |
| <i>T. Falconeri</i> , 33.       | <i>B. nigra</i> , 21.        | <i>P. virescens</i> , 22.          |
| <i>B. fastuosa</i> , 9.         | <i>P. nigra</i> , 21.        | <i>B. viridi-glaucescens</i> , 28. |
| <i>A. Fortunei</i> , 7, 17, 18. | <i>A. nitida</i> , 8.        | <i>P. viridi-glaucescens</i> , 28. |
| <i>B. Fortunei</i> , 17, 18.    | <i>A. nobilis</i> , 31.      | <i>B. viridi-striata</i> , 13.     |
| <i>B. gracilis</i> , 33.        | <i>B. palmata</i> , 2.       | <i>A. viridis</i> , 17.            |
| <i>D. Hamiltonii</i> , 37.      | <i>B. plicata</i> , 13.      | <i>B. vulgaris</i> , 36.           |
| <i>B. Henonis</i> , 27.         | <i>A. pumila</i> , 6.        |                                    |
| <i>P. Henonis</i> , 27.         |                              |                                    |

SECTION I.—Venation conspicuously tessellate, i.e., the veins crossing one another like the meshes of a net, visible to the naked eye by holding a lf. up to the light, or more clearly seen by the use of a lens. (Embraces the hardier types of bamboos, 1-30.)

A. Internodes not flattened: sheaths persistent.

B. Lvs. relatively very broad, usually 2 in. wide, or more.

1. *A. Veitchii*, N. E. Br. (*Bambusa Veitchii*, Carr.). Fig. 487. Height usually 3 ft. or less: sts. purple, white-waxy below the nodes: lvs. 5-8 in. long, about 2 in. wide, bright green above, below pale and minutely pubescent, serrate. Japan. M. 77, but not G.C. III. 15:169, or R.B. 23, p. 270, which are pictures of *B. palmata*, as explained in G.C. III. 15:209.—This is also liable to confusion with *B. tessellata*, but may be separated by lf. characters. Quite hardy, but the edges of the lvs. wither in late autumn, giving a variegated but injured appearance.

2. *B. palmata*, Burbidge. Fig. 488. Height 2-5 ft.: lvs. 10-15 in. long, 2-3½ in. wide, bright green, serrate, smooth and shining above, below pale and minutely pubescent; longitudinal veins very prominent. Japan. M. 79. Gn. 49, p. 59, shows a clump 36 ft. in circum.—A beautiful, broad-lvd. ornamental.



456. *Bambusa tessellata*. ( $\times \frac{1}{10}$ )

3. *B. tessellata*, Munro (*B. Ragamowskii*, Hort.). Fig. 456. Height 3-4 ft.: lvs. 12-18 in. long, 2-4 in. wide, smooth and shining above, whitened beneath, sharply serrate; midrib prominent and bearing a tomentose line on one side. China and Japan. G.C. III. 15:167; 18:189. R.B. 23, p. 269.—Produces the largest lvs. of any of the hardy bamboos in cult., which is especially remarkable on account of its dwarf habit. Much confused in gardens, but unnecessarily, with *A. Veitchii*, as the tomentose line on one side of the midrib is unique in *B. tessellata*. The lvs. are used by the Chinese for wrapping tea.

BB. Lvs. distinctly narrower.

c. Foliage green.

D. Plants low, usually 1-3 ft. in height.

E. Arrangement of lvs. distichous.

4. *B. disticha*, Mitford (*B. nana*, Hort., not Roxbg.). Height 2-3 ft.: sts. zigzag, slender, green or tinged with purple: branches borne singly: lvs. 2-2½ in. long, ½ in. wide, or less, green, serrate on both edges, produced in 2 vertical ranks. Origin uncertain.—An interesting and beautiful species, the distichous arrangement of the lvs. lending a distinct and unusual character.

EE. Arrangement of lvs. not distichous.

5. *B. pygmæa*, Miq. Height ½-1 ft.: sts. very slender, purple, much branched; nodes prominent, with a waxy glaucous band: lvs. 3-4 in. long, about ½ in. wide, serrate, pubescent, bright green above, glaucous beneath. Japan.—The smallest of the bamboos, and remarkably hardy. It is especially valuable as an undergrowth, quickly making a carpet in wild places; but its rampant growth will quickly outgrow close quarters.

6. *A. pumila*, Mitford (*B. pumila*, Hort.). Height 1–2 ft.: sts. very slender, purplish, white-waxy below the nodes: lvs. 4–5 in. long,  $\frac{3}{4}$  in. or less wide, minutely pubescent, bright green.—Much rarer than *B. Veitchii*, dwarfier, the sts. merely purplish, the lvs. shorter and narrower. The lvs. are a darker green than in *A. humilis*, shorter, narrower, and taper less gradually; nodes less well defined, but having a waxy bloom; internodes about  $2\frac{1}{2}$  in. long.



457. *Arundinaria nitida*. ( $\times \frac{1}{2}$ )

7. *A. humilis*, Mitford (*A. Fortunei* var. *viridis*, Hort.). Height 2–3 ft.: branches in 2's and 3's, long in proportion to the sts.: lvs. 4–6 in. long, the largest about  $\frac{7}{8}$  in. wide, pale green: internodes 2–5 in. long. Japan.—A rare and pretty plant, liable to confusion with *A. pumila*, but the sts. lack the waxy bloom of that species.

DD. Plants taller than in D, usually in excess of 3 ft.

E. Sts. hollow, cylindrical, or nearly so.

F. Culms purple, or purplish.

8. *A. nifida*, Mitford. Fig. 457. Height 6–10 ft.:

sts. slender, seldom exceeding a lead-pencil in thickness, black-purple in color: lvs. 2–3 in. long,  $\frac{1}{2}$  in. wide, shining green above, pale beneath; sheaths purplish, the ligule without hairs. China. M. 73. G.C. III. 18:179; 24:211. Gn. 49, p. 388.—One of the daintiest and most attractive of the arundinarias, and exceptionally hardy. Some shade is desirable, as the lvs. are often injured by strong sun. Easily distinguished from *A. Veitchii* and *A. pumila* by the deeper color of the sts., which are almost black.

9. *B. fastuosa*, Latour-Marliac. Height 15–20 ft.: culms marked with purple-brown: the internodes with an unusually large cavity: branches numerous, erect, giving a columnar outline to each st.: sheaths shaded with purple: lvs. 5–7 in. long, an inch or less wide, bright green above, glaucous beneath. Japan.

FF. Culms green or golden.

G. Species native.

10. *A. macrospérma*, Michx. LARGE CANE. Height 15–25 ft., with numerous, short, divergent branches: lvs. 4–8 in. or more long,  $\frac{3}{4}$ – $1\frac{1}{2}$  in. broad, smoothish or pubescent; sheaths very persistent: sts. erect, rigid, simple or sparingly branched the first year, becoming dense and leafy the second, afterwards fruiting at indefinite periods, and soon after decaying. Chiefly along river banks, Va. and Ky. southward.—Forming canebrakes, sometimes of great size and density. This and the next are the only bamboos native to the U. S. Sometimes cult. as an ornamental.

11. *A. técta*, Muhl. (*A. macrospérma* var. *suffruticosa*, Munro). SMALL CANE. SWITCH CANE. SCUTCH CANE. Height 2–12 ft.: sts. slender: lvs. 3–6 in. long, 4–12 lines wide, roughish; sheath bearded at the throat. Swamps and moist soil, Md. and S. Ind. southward.—A form, perhaps specifically distinct, which may be known as var. *decidua*, common in W. N. C., has the peculiarity of dropping its lvs. every autumn, and passing the winter in a leafless state. The foliage of this deciduous cane turns yellow in autumn, drops, and in early spring the culms resume their verdure.

GA. Species not native to the U. S.

H. Branches borne singly in the axils.

12. *A. japonica*, Sieb. & Zucc. (*B. Metake*, Sieb.). Fig. 458. Height 5–10 ft.: lvs. 4–8 in. or more in length, 1–2 in. wide, smooth and shining on the upper surface, below whitened and finely pubescent; sheaths conspicuous. Japan. M. 1. G.C. III. 15:239; 18:185.—The commonest of the hardy bamboos, and readily distinguished from other tall-growing kinds of arundinarias by the large, broad lvs. and by the broad, persistent sheaths which almost permanently unwrap the canes. From *A. Simonii* it differs by the bud being a simple flattish scale, instead of a complex scaly one, and also by the less amount of waxy bloom on the sts. Particularly recommended for cities.

HH. Branches borne in dense, semi-verticillate clusters.

13. *A. Simonii*, A. & C. Rivière (*B. Simonii*, Carr. *B. viridi-striata*, Hort. *A.* and *B. Narihira*, Hort.). Height 10–20 ft.: lvs. 6–10 in. or more in length, usually less than an inch wide, sometimes striped with white, tapering to a long, fine point; mid-vein glaucous on one side toward the apex, green on the other. Himalayas, China and Japan. G.C. III. 15:301; 18:181.—A silver-variegated form is sometimes known as *B. Maximowiczii*, Hort., and *B. plicata*, Hort. B.M. 7146.—One of the tallest of the arundinarias. Very late in starting into growth. It flowers quite frequently, and does not die down entirely after blooming, as some kinds do. Resistant to drought, hardy and ultimately very vigorous and handsome.

14. *A. Hindsii*, Munro (*B. erecta*, Hort.). Height 6–10 ft.: culms straight, the branches appearing as if whorled: lvs. upright at first, varying in length up to 9 in., and about  $\frac{5}{8}$  in. wide; the veins conspicuously tessellated: internodes 3–7 in. long, waxy-white; sheaths with a few hairs, long persistent. Japan.—The erect habit of



458. *Arundinaria japonica*. ( $\times \frac{1}{5}$ )



growth is very pronounced, and it spreads with marked rapidity.

EE. *Sts. either solid or quadrangular.*

15. *B. quadrangulâris*, Fenzl. *Sts.* square, especially in older plants, 20–30 ft. tall; lvs. deep green, serrate, 6–7 in. long, about 1 in. wide, the tessellation minute. China and Japan.—A wide-spreading species, when established, and one possessing considerable hardness. New growth is produced mostly in late summer and autumn.

16. *A. marmorea*, Franceschi (*B. marmorea*, Mitford). Height 3–5 ft.: *sts.* slender, cylindrical, without a cavity; sheaths purple, marbled with gray; nodes unusually prominent, purple, with the under side bright green; internodes short, usually 1–2 in. long; lvs. 3–5 in. long, about  $\frac{1}{2}$  in. wide, abruptly and sharply pointed at the apex. Japan.—In cult. for several years in Calif.

CC. *Foliage variegated.*

D. *Plants low, usually 1–3 ft. in height.*

17. *A. Fôrtunei*, A. & C. Rivière (*B. Fôrtunei*, Van Houtte, and var. *variegata*, Hort.). Fig. 459. Height 1–3 ft.: lvs. 4–5 in. long,  $\frac{1}{2}$ – $\frac{3}{4}$  in. wide, beautifully striped with white. Japan. F.S. 15:1535.—Sometimes loses its lvs. in severe winters, but quickly recovers in spring. The internodes are rarely more than an inch long. Var. *aurea*, Hort., with yellow variegation, is *A. auricoma*. Var. *viridis*, Hort.=*A. humilis*. An old favorite. Rhizomes very active, requiring considerable space.

18. *A. auricoma*, Mitford (*A.* and *B. Fôrtunei* var. *aurea*, Hort.). Height 2–3 ft.: lvs. 4–6 in. long, about an inch wide, brilliantly variegated with yellow, velvety pubescent on the lower surface, serrate, with the teeth more pronounced on one side; *sts.* purple; nodes 3–5 in. apart. Japan.—An exceedingly beautiful and meritorious ornamental of striking character.

19. *B. angustifolia*, Mitford (*B. Vilmorinii*, Hort.). Height about 1 ft.: *sts.* slender, purplish or light green, with prominent nodes; lvs. 2–4 in. long, about  $\frac{1}{4}$  in. wide, serrate, frequently variegated with white. Japan.—A dainty species, soon forming attractive clumps.

DD. *Plants taller than in D, usually in excess of 3 ft. (See also under No. 13 for A. Simonii.)*

20. *A. chrysantha*, Mitford (*B. chrysantha*, Hort.). Height 3–5 ft.: lvs. 5–7 in. long, 1 in. or less wide, nearly smooth, more or less variegated with yellow. Japan.—Not so brilliantly colored as *A. auricoma*, from which it may be readily distinguished by the prominent ribs and absence of the soft velvety pubescence from the lower surface of the lvs.

AA. *Internodes flattened on one side: sheaths early deciduous.*

B. *Sts. black or brown.*

21. *P. nigra*, Munro (*B. nigra*, Lodd.). BLACK BAMBOO. Height 10–20 ft.: *sts.* green at first, but changing to black the second year; nodes conspicuous, the upper rim nearly black, the lower edged with white; lvs. very thin, 2–6 in. long, 6–10 lines broad. China and Japan. M. 142, and frontispiece. G.C. III. 15:369; 18:185. R.B. 23, p. 268. B.M. 7994.—One of the most popular of the bamboos, markedly hardy and distinct. Var. *punctata*, Hort., has yellowish *sts.* spotted with brownish black.

22. *P. violascens*, A. & C. Rivière (*B. violascens*, Carr.). Height 10–20 ft.: *sts.* violet, almost black the first few months, changing the second year to a dingy yellow or brown; lvs. variable in size, 2–6 in. long,  $\frac{1}{2}$ – $1\frac{1}{2}$  in. wide, the larger lvs. borne on young shoots or lower branches; they are sharply serrate, and have a well-defined purplish petiole. China and Japan.

BB. *Sts. striped with yellow and green.*

23. *P. Castillônis*, Hort. (*B. Castillônis*, Hort.). Height 10–20 ft. or more: *sts.* zigzag, striped golden yellow and green, the colors alternating at the nodes; lvs. sparingly striped with yellowish white, variable in size, usually 3–6 in. long,  $\frac{3}{4}$ – $1\frac{1}{2}$  in. wide, serrate, the teeth being especially prominent on one edge; lf.-sheaths topped by a whorl of dark brown or purple hairs. Japan.—Both beautiful and uncommon.

BBB. *Sts. green, yellow, or yellowish.*

C. *Plants tall, i.e., more than 5 ft. high.*

D. *The internodes very short at the base of the culms.*

24. *P. aurea*, A. & C. Rivière (*B. aurea*, Hort.). Height 10–15 ft.: *sts.* yellowish, often brilliant in color, the internodes at the base remarkably short; lvs. narrowed from near the base to the apex, minutely and regularly serrate on only one border, usually 2–4 in. long and  $\frac{3}{4}$  in. wide, but variable, light green, glaucous beneath; sheaths deciduous, marked with purple. China and Japan. Gn. 8:206. A.F. 5:41.—Easily recognized by the very short nodes at the base of the culms.

DD. *The internodes at the base of the culms not congested.*

E. *Outline of sts. not conspicuously zigzag.*

25. *P. mitis*, A. & C. Rivière (*B. mitis*, Hort., not Poir.). Height 20 or more ft., and said to attain 60 ft.

in its native soil: *sts.* deep green at first, eventually yellow; internodes at the base not conspicuously short; lvs. variable, usually 2–4 in. long and  $\frac{3}{4}$  in. wide, light green, serrate on only one border; sheaths deciduous, marked with purple. China and Japan. Gn. 17:44.—Readily distinguished from *P. aurea* by the long internodes at the base of the culms.

26. *P. Quiloi*, A. & C. Rivière (*B. Quiloi*, Hort. *B. Mazélie*, Hort.). Height 20 or more ft., and under favorable conditions up

to 70 ft.: *sts.* arched, green or yellowish, bearing unusually long branches; lvs. remarkably large and broad, the largest 8 in. long,  $1\frac{1}{4}$  in. wide, conspicuously serrate on one edge, dark green, often spotted with brown, very glaucous beneath; lf.-sheaths pinkish brown, deeply mottled with purple spots. China and Japan.—Rare and unusually attractive.

27. *P. Henônis*, Mitford (*B. Henônis*, Hort.). Height 10–15 ft.: *sts.* arched, bright green, eventually yellowish, the surface slightly roughened; sheaths yellow-brown, early deciduous; lvs. 2–3 in. long, a little under  $\frac{1}{2}$  in. broad, narrowed below the middle to the base, long-attenuate at the apex, bright green; lf.-sheaths often purplish, the ligule fringed with purple hairs; internodes 5–6 in. long near the base and middle of the culm, grooved with a double furrow. Japan.—Wonderfully graceful and eminently hardy.

EE. *Outline of sts. conspicuously zigzag.*

28. *P. viridi-glaucescens*, A. & C. Rivière (*B. viridi-glaucescens*, Carr.). Height 20 or more ft., and under favorable conditions up to 60 ft.: *sts.* zigzag, arched,



459. *Arundinaria Fortunei*. ( $\times \frac{1}{2}$ )

bright green at first, fading as they ripen to a dingy yellow: sheaths early deciduous, the ligule extended into fringed auricles: lvs. 3-4 in. long, about  $\frac{1}{2}$  in. wide or a little more, bright green above, whitened below. China and Japan. Gn. 7:279. G.C. III. 15:433; 18:183.—Frequent in cult. and very hardy.

29. *P. bambusoides*, Sieb. & Zucc. Height 6-10 ft.: sts. slender, zigzag, green at first, eventually yellowish: sheaths purplish, early deciduous: branches in 3's, the longest in the middle, little longer than the internodes: lvs. variable, 5-7 in. long, 1 in. or less wide, serrate, the teeth especially sharp on one edge, bright green, pale beneath. China and Japan. Gamble, Bamb. Brit. Ind. 27, t. 27.—The true plant very rare in cult.

cc. Plants low, 1-3 ft. high.

30. *P. ruscifolia*, Hort. Kew (*P. Kumasáca*, Mitford. *P. Kumasáca*, Munro. *B. ruscifolia*, Sieb. *B. viminális*, Hort.). Fig. 460. Height 1-3 ft.: sts. zigzag, dark to pale green: sheaths purple, much fringed: branches very short, not more than 1 or 2 in. long, in 3's and 4's: lvs. 2-3 in. long, about 1 in. wide, ovate in outline. Japan. G.C. III. 15:369; 18:189.—The sts. are almost solid, the tube being exceedingly small. Dwarfest species of *Phyllostachys*.

460. *Phyllostachys ruscifolia*. ( $\times \frac{1}{3}$ )

SECTION II. Venation essentially striate, i.e., the veins running in parallel lines from the base to the apex, cross veins obsolete or obscure, but usually with a number of interposed pellucid dots. (Embraces the less hardy types of bamboos, 31-41.)

A. Sts. hollow, not spiny.

B. Lvs. averaging not more than 3 in. long.

31. *A. nobilis*, Mitford. Height 15-25 ft.: lvs. 2-3 in. long, usually less than  $\frac{1}{2}$  in. wide, bright green, borne on short, purple petioles, striate-veined: sts. yellow-green, with purple-brown nodes. Probably a native of China.—A large and graceful species intro. into Calif. by Franceschi in 1896. One of the hardest of the arundinarias with striated lvs.

32. *A. debilis*, Thwaites. Height probably 5-10 ft.: sts. clustered, much branched, the nodes 2-6 in. apart, yellowish: lvs. 1-3 in. long,  $\frac{1}{2}$  in. or less wide, striate-veined. High mts. of Ceylon and the Philippines. Gamble, Bamb. Brit. Ind. 7, t. 6.—Intro. in Calif. and offered in 1910 by the Montarioso Nursery. The character of the venation would seem to imply only moderate hardness.

BB. Lvs. averaging not more than 6 in. long.

33. *A. falcateri*, Benth. (*T. falcateri*, Hook. f. *B. gracilis*, Hort., not Wall.). Height 10-15 ft.: sts. slender, bright green when young, yellow when old, the internodes sometimes white-waxy: lvs. thin, 3-4 in. long, about  $\frac{1}{2}$  in. wide, striate-veined. Himalayas. Gamble, Bamb. Brit. Ind. 20, t. 18. B.M. 7947.—Not very hardy. The lf.-sheaths are smooth, cut short at the top, without a fringe, and with an elongated ligule; while *A. falcata* has very downy lf.-sheaths, fringed with long hairs at the intersection with the lf. The serrations of the lf.-edges are more pronounced in *A. falcateri*, especially on one side.

34. *A. falcata*, Nees (*B. falcata*, Hort.). Height 10-20 ft.: lvs. 4-6 in. long, about  $\frac{1}{2}$  in. wide, light green, striate-veined: sts. slender, not exceeding  $\frac{1}{2}$  in. diam., covered with a bluish white-waxy coating when young, eventually yellow-green: sheaths downy, ciliate at the ligule. Himalayas. Gamble, Bamb. Brit. Ind. 12, t. 11 and 12.—A great many plants cult. under this name are really *A. falcateri*, a species with smooth sheaths and fringed ligules. Requires a mild climate.

BBB. Lvs. averaging more than 6 in. long.

C. Culms 15-25 ft. tall, reddish brown at maturity.

35. *A. Hookeriána*, Munro. Height 15-25 ft.: culms glaucous green when young, turning reddish brown with age: nodes prominent, with a bluish ring: lvs. 6-10 in. long,  $\frac{1}{2}$ -1  $\frac{1}{2}$  in. wide, the venation striate. Himalayas. Gamble, Bamb. Brit. Ind. 17, t. 15.—The tallest and largest species of arundinaria in cult. Intro. in Calif. by Franceschi. Not very hardy.

cc. Culms taller; giant species: sts. green or yellowish.

36. *B. vulgaris*, Schrad. FEATHERY BAMBOO. Height 20-80 ft.: sts. bright green, 4 in. diam., or more, straight at first, eventually much arched by the weight of the dense foliage: branches numerous, striate: lvs. usually 6-10 in. long, 8-15 lines wide, rough on and near the margins and on the lower surface. India. G.C. III. 25:390. Gamble, Bamb. Brit. Ind. 44, t. 49. Var. *aureo-variegata*, Hort., GOLDEN BAMBOO, has canes of a rich golden yellow color, penciled with green. —Will stand but slight frost.

37. *D. Hamiltonii*, Nees & Arn. Height up to 80 ft.: sts. 4-7 in. diam., much branched above, pubescent with white hairs when young: internodes 12-20 in. long: lvs. variable, sometimes 15 in. long, 2  $\frac{1}{2}$  in. wide, finely serrate; midrib narrow, with 6-17 nerves on either side, the nervules chiefly of pellucid glands. Himalayas. Gamble, Bamb. Brit. Ind. 85, t. 74.—The lower branches usually seated on woody knobs. Promises to become an important member of the tall bamboos in S. Calif.

38. *D. latiflorus*, Munro. Height 60-70 ft.: sts. erect and remarkably straight, 4-5 in. diam., with a large cavity: lvs. 7-10 in. long, 1-2 in. broad, long-acuminate, deep green, borne on short petioles; midrib prominent, with about 9 nerves on either side, the transverse nervules lacking or obscure. Formosa, Burma, Cochin China. Gamble, Bamb. Brit. Ind. 131, t. 117. Munro, Trans. Linn. Soc. 26:152, t. 6.—Considered one of the best of the giant bamboos in S. Calif.

39. *D. membranaceus*, Munro. Height 60-70 ft.: sts. white-



461. *Bambusa arundinacea*. ( $\times \frac{1}{6}$ )



powdery when young, smooth and bright green when older, 1-5 in. diam.: nodes prominent: internodes 9-20 in. long: sheaths with waved, hairy auricles: lvs. 5-10 in. long,  $\frac{1}{2}$ - $\frac{3}{4}$  in. wide, deep green above, pale beneath, slightly hispid. Burma, India. Gamble, Bamb. Brit. Ind. 81, t. 71.—Requires a warm, protected situation to attain full development. Intro. into Calif. in 1895 by Franceschi.

AA. *Sts. either solid or spiny.*

40. *B. arundinacea*, Retz. Fig. 461. A majestic species, often attaining a height of more than 40-60 ft.: sts. produced in dense clumps, at first green and shining, zigzag in outline, eventually straight and golden in color: branches, especially the lower, more or less spiny: lvs. 4-8 in. long,  $\frac{1}{2}$  in. or a little more wide, nearly glabrous; sheaths persistent: fls. produced at long intervals, and after perfecting seeds, the plants die. India. Gamble, Bamb. Brit. Ind. 51, t. 48.

41. *D. strictus*, Nees. Called MALE BAMBOO, on account of the solid character of the culms. Height 20-50 ft.: sts. 1-3 in. diam., solid or nearly so, glaucous green when young, yellowish when mature: nodes swollen: internodes 10-15 in.: branches long and slender, leafy: lvs. 4-10 in. long, up to  $1\frac{1}{4}$  in. wide, soft-hairy, at least when young, narrowed from near the base to the tip, the apex usually twisted; midrib prominent, with 3-6 nerves on either side, the nervules chiefly of interposed pellucid glands. India, Burma. Gamble, Bamb. Brit. Ind. 78, t. 68 and 69.

*B. agræstis*, Poir. India, Cochinchina. Adv. by Yokohama Nurs. Co.—*B. Alphonse Kérri*, Hort. A variegated form of *B. nana*, Roxbg. Young sts. striped with white and pink, older sts. yellow with broad green stripes. Tender.—*A. anceps*, Mitford. Similar to *A. nitida*, but mature sts. yellow-green or brown, and lf.-sheaths fringed with white hairs. Native of the Himalayas, at elevations between 9,000-10,000 ft.—*B. argentea*. Grows 25-35 ft. high; the dense masses of beautiful green foliage, glaucous underneath, and the hundreds of slender culms growing close together, the exterior ones bending over to all sides, combine to make this bamboo indescribably beautiful." H. Nehrling, Fla.—*B. argentea* var. *vitata*, the variegated bamboo or the blue bamboo of gardens, the taiho-chiku of the Japanese, who have grown this from time immemorial in pots, is one of the most satisfactory in Fla.; it attains the size of *B. argentea*, but its lvs. are still more blue on the under side and altogether smaller and more delicate; they are striped and edged with white." Nehrling.—*A. aristata*, Gamble. Sts. 5 ft., purplish brown: lvs. 4 in. long,  $\frac{1}{2}$  in. or less wide, narrowed to an acute apex, venation tessellate. Himalayas, where it thrives at elevations of 11,000 ft.—*B. aureo-striata*, Regel. Japan.—*P. Boryana*, Hort. By some authorities considered to be a form of *P. nigra*, but the culms are of a dull yellow color when mature, splashed here and there with purple-brown blotches, and the branches are much longer in proportion to the culms. China and Japan.—*P. flexuosa*, A. & C. Rivière. Culms 6-10 ft., dull greenish yellow when mature: lvs. similar to those of *P. viridiglaucescens*: ligules of the culm-sheaths without auricles. A comparatively small and compact ornamental. China.—*A. foliis variegatis*, Hort., is presumably A. Fortunei, the commonest low-growing, variegated arundinaria.—*"B. gracilis"*. This most beautiful small species used to be grown in gardens under the name of *A. falcata*: the lvs. are very small, arranged in a distichous way on both sides of the twigs; they have a fine emerald-green color: sts. thin and slender, the whole plant not growing taller than 10-12 ft." Nehrling.—*P. heterocycla*, Carr. A curious plant, the lower internodes of which are obliquely and alternately arranged like the scales of a tortoise, and for this reason called the "tortoise-shell bamboo." At about 1-3 ft. from the ground the nodes lose this peculiar character, and assume a regularity as in other species. In other respects this interesting bamboo does not differ much from *P. mitis*, or *P. aurea*. Japan.—*A. Khasiana*, Munro. A Himalayan species with black sts., allied to *A. falcata*. The name, however, has been misapplied to *A. nitida* and *A. nobilis*, and the true species is probably not in cult. in the U. S.—*B. Laydékerti*, Hort. Height 3-8 ft.: sts. green with a tinge of purple, verticillately branched above, the branches relatively long: lvs. 4-6 in. long,  $\frac{1}{2}$  in. or less wide, dark green, somewhat mottled in appearance. China and Japan.—*"B. macroculmis"*. Received about 15 years ago directly from Japan under the name of taisan-chiku. It is a veritable giant, growing 50-75 ft. high with large dark green lvs. and thick culms, first green, then black; old culms have a gray color: in stature this is one of the noblest of all the bamboos, and it is perfectly hardy: the sts. spring straight out of the soil like spears and when they have fully developed they bend over to all sides at their tops, so that the entire plant from a distance looks like a gigantic sheaf." Nehrling.—*P. marliacea*, Mitford. Wrinkled Bamboo. Similar to *P. Quiloi*, but the internodes at the base are very close together, not more than 1-2 in. apart, much wrinkled. Japan.—*P. nigro-punctata*, Hort. Probably a variety of *P. nigra*, under which it appears in the classified descriptions above.—*"B. nütans"*. A most exquisite bamboo grown for many years under the name of *Dendrocalamus strictus*.

which is a very different plant; grows 35-40 ft. high with a very dense growth of small green lvs, the green having a shade of blue in it; the sts. hang over to all sides, forming beautiful arches; tender; a most exquisite plant to grow on lawns or on the edge of lakes, or in the foreground of deep green magnolias." Nehrling.—*B. orientalis*, Nees. Adv. by Franceschi, Santa Barbara, Calif., who regards it as a form of *B. arundinacea*, with lvs. larger and velvety to the touch. It forms clumps quickly. E. India.—*A. racemosa*, Munro. A native of the Himalayas, growing at high altitudes: height up to 15 ft., the culms brown, very thick in proportion to height; the long and narrow lvs. are conspicuously tessellate.—*"B. scriptoria"*. A small species not growing over 6-8 ft. high, forming fine dense clumps: lvs. small, green, underneath glaucous; particularly valuable for small gardens." Nehrling.—*A. spathiflora*, Trin. Height 10-20 ft., the culms yellowish or nearly brown, slender and much branched: lvs. tessellate, 2-3 in. long, about  $\frac{1}{4}$  in. wide, acutely pointed, thin in texture. Himalayas, at altitudes of 7,000-10,000 ft.—*B. striata*, Lodd. Height 4-5 ft.: sts. striped yellow and green, as thick as the thumb; internodes 4-6 in. long: lvs. 6-8 in. long,  $\frac{1}{4}$ -1 in. broad. China. B.M. 6079, which shows a flowering specimen with conspicuous anthers, red-purple at first, and fading to lilac. Not described by Mitford. Formerly sold by Yokohama Nurs. Co.—*B. striatifolia* var. *aurea*, Hort., an abandoned trade name never recognized by botanists.—*B. stricta*, Hort., an old trade name probably not *B. stricta*, Roxbg.—*P. sulphurea*, A. & C. Rivière. Height 10-15 ft., seemingly intermediate between *P. mitis* and *P. aurea*. It is less tall than the former, and the sts. are more brightly colored than in the latter species. Japan.—*B. Thoudarsii*, Kunth. A doubtful species, considered by some botanists to be only a form of the widespread *B. vulgaris*; but, according to Franceschi, at least horticulturally distinct. Height 50-60 ft., with a diam. of culm of 4-5 in. Intermediate in outline between the erect-growing *D. latiflorus*, and the spreading or horizontally inclined *B. vulgaris*. Intro. into Calif. some 25 years ago, and in recent years reintro. by the U. S. Dept. of Agric. from S. France, where it had come from Algiers 40-45 years ago.—*B. Tulda*, Roxbg. Height up to 70 ft., the culms 4-5 in. diam., and of a remarkable gray-green color: lvs. very glaucous or the lower surface. Recently intro. by the U. S. Dept. of Agric. Bengal and Burma. Gamble, Bamb. Brit. Ind. 30, t. 29.—*B. variegata*, Sieb.—A. Fortunei.—*B. verticillata*, Hort., Franceschi. Height 15-20 ft.: sts. orange-yellow: lvs. in whorls, striped white.

Among the recent introductions of bamboos by the United States Department of Agriculture, representing two genera of much interest and rarity to the United States, are the following:

**CHUSQUËA.** A genus belonging to the subtribe Arundinarieæ, of tall, shrubby or climbing plants with the flowering branches in clusters at the joints, and comparatively small lvs. and spikelets. W. Indies and S. Amer., chiefly in the Andes.—*C. bambusoides*, Hack. A large species with small panicles exceeded by the crowded blades, 1 in. wide and about 6 in. long. Native of Brazil.—*C. quila*, Kunth. A freely branching arborescent species with numerous open panicles and distant lvs. scarcely  $\frac{1}{2}$  in. wide. Native of Chile.—*C. valdivensis*, Desv., of Chile, is a slender climbing species with naked sts. and numerous fasciated leafy flowering branches, the lvs. 3-4 in. long.—*C. abietifolia*, Griseb. A climbing species with dense tufts of short branches with lvs. less than 2 in. long and about  $\frac{1}{2}$  in. wide. Native of the W. Indies.

**OXYTENANTHERA.** A genus of the subtribe Eubambuseæ, of tall, shrubby plants from the E. Indies and Afr., characterized by long, cylindrical or conical spikelets in compact fascicles; the anthers enclosed in a bristle.—*O. abyssinica*, Munro (*Bambusa abyssinica*, Rich.). Infl. capitate, large and spiny: lvs. about 6 in. long, 6-8 lines broad. Native of Trop. Afr.

C. D. BEADLE.

**BAMBURÁNTA** (*Bambusa* and *Maranta*). *Zingiberaceæ*. A name applied to an undetermined plant with maranta-like leaves and bamboo-like habit, from the Congo Free State. *B. Arnoldiana*, Lind. Lvs. broadly ovate, acuminate, distinctly petioled, on long, spreading, graceful stems; attractive as a pot-plant. G.C. III. 28: 313 (1900).

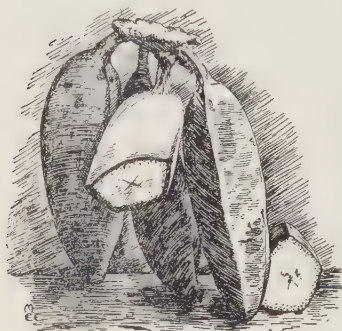
**BANANA**, a name applied to certain species of *Musa*, particularly to those that produce edible fruits, although it is sometimes used for species grown for ornament, as for *Musa Ensete*. There are three groups of edible bananas. The common banana, eaten raw, *Musa sapientum*; the plantain, fruits to be cooked, *M. paradisiaca*; dwarf, with edible fruits, *M. Cavendishii*. The first two are probably forms of



462. Tip of flower-cluster of banana.

one species, and the botanical nomenclature is confused. Some species produce fiber. Consult *Abaca* and *Musa*.

The banana plant is a great perennial herb. It grows 10 to even 30 feet tall, and produces a bunch of fruit, and the stalk then dies or becomes weak; in the



463. Plantain banana. ( $\times \frac{1}{5}$ )

meantime, suckers have arisen from the rootstock to take its place. The peculiar flower-bearing of the banana is shown in Fig. 462, which illustrates the tip of a flower-cluster. This cluster may be likened to a giant elongating bud, with large, tightly overlapping scales or bracts. Three of these bracts are shown at *a a a*, in different stages of the flowering. As they rise or open, the

flowers below them expand. The bracts soon fall. The flowers soon shed their envelopes, but the styles, *b*, persist for a time. The ovaries soon swell into bananas, *c*. The bracts are royal purple and showy.

The banana has come to be one of the most popular fruits in North America, due to the cheapness of its cultivation and transportation, ease of handling, long-keeping qualities, and adaptability to many uses. The source of supply is mostly Jamaica, Costa Rica, Cuba, Honduras, and latterly the northern shores of Colombia. In the tropics, the ordinary bananas are cooked and used as a vegetable rather more than as a fruit to be eaten from the hand. The plantains, which are coarser and harder fruits and thicker, are always cooked. A form of cooking banana used in parts of tropical America is shown in Fig. 463. Of the banana itself there are many varieties. The common large fruit in northern markets is the Martinique, Jamaica, Gros Michel or Bluefields. A red variety, the Baraço or Red Jamaica, is sometimes seen. In the tropics, various very small forms are grown for local consumption. These are fragile and do not keep long, and are rarely seen in the markets North. One of them, known as the "fig" in Trinidad, is shown in Fig. 464; the fruits are about 3 inches long. The dwarf or Cavendish banana is grown extensively in the Canary Islands, and apparently also in Bermuda; and it is not uncommon as an ornamental plant in conservatories.

It is said that the banana was first imported into the United States in 1804 by Captain John N. Chester of the schooner *Reynard*, the lot consisting of thirty bunches. The first full cargo is said to have been 1,500 bunches brought to New York in 1830 on the schooner *Harriet Smith*, chartered by John Pearsall of the firm of J. & T. Pearsall. Two or three cargoes would appear each year, until about 1857 William C. Bliss entered the

banana-importing business, securing his supply from Baraço, Cuba, and taking the trade to Boston. In 1869, he secured a small cargo from Jamaica. In recent years, the Jamaica-United States banana trade has assumed very large proportions.



464. A hand of the "fig" banana. ( $\times \frac{1}{10}$ )

In the United States, there is little commercial cultivation of bananas, since the frostless zone is narrow and the fruit can be grown so much more cheaply in Central America and the West Indies. Small banana plantations are common in southern Florida, however, and even as far north as Jacksonville. They are also grown in extreme southern Louisiana, and southwestward to the Pacific coast. The plants will endure a slight frost without injury. A frost of five or six degrees will kill the leaves, but if the plants are nearly full grown at the time, new foliage may appear and fruit may form. If the entire top is killed, new suckers will spring up and bear fruit the following year. A stalk, or trunk, bears but once; but the new sprouts which arise from the roots of the same plant continue the fruit-bearing. A strong sprout should bear when twelve to eighteen months old (from two to three years in hothouses).



465. A bearing banana plant.

The plantation will, therefore, continue to bear for many years. A bearing stalk, as grown in southern California, is shown in Fig. 465.

The species mostly in demand for fruiting seldom or never produce seeds, and naturally increase by suckers. The suckers are most readily separated from the parent rootstock by a spade. This is a slow process of increase, but the suckers so produced make large and vigorous plants. A quicker method of propagation is to cut the entire rootstock into small, wedge-shaped pieces, leaving the outer surface of the root about 1 by 2 inches in size, planting in light, moist soil, with the point of the wedge down and the outer surface but slightly covered. The best material for covering these small pieces is fine peat, old leaf-mold, mixed moss and sand, or other light material that is easily kept moist. The beds so planted should be in full open sunshine if in a tropical climate, or given bottom heat and plenty of light if in the plant-house. The small plants from root-cuttings should not be allowed to remain in the original bed longer than is necessary to mature one or two leaves, as that treatment would stunt them.



The textile and ornamental species, also, may be increased by the above process, but as these species usually produce seeds freely, seedlings can be more quickly grown, and with less trouble. The seeds of bananas should be sown as fresh as possible, treating them the same as recommended for root-cuttings. As soon as the seedlings show their first leaves, they should be transplanted into well-prepared beds of rich, moist soil, or potted off and plunged into slight bottom heat, as the needs of the grower or his location may demand. Both seedlings and root-cuttings should have proper transplanting, sufficient room and rich soil, as a rapid, unchecked growth gives the best and quickest results.

In the West Indies, Central America and Mexico, bananas are raised for export to the United States and Canada. The site chosen is usually a level plain in the lowlands, near the coast, or in valleys among the hills, where the rainfall or artificial moisture is sufficient. For distant shipping, bunches of fruit are cut with "machetes" or knives, after they reach their full size and are almost mature, but quite green in color. Ripening is effected during shipment in warm weather, and by storing in dark, artificially heated rooms during cold weather. Banana flour is a valuable product of ripe bananas prepared among the plantations in the tropics. It is nutritious, and has an increasing demand and use as human food. A recently invented process of drying ripe bananas has been found very successful, and the industry promises to be of vast importance as the marketable article finds ready sale. Further details of the growing of the commercial crop in the tropics may be found in *Cyclo. Amer. Agric.*, Vol. II, p. 199.

E. N. REASONER.  
L. H. B.

**BANEBERRY:** *Actæa*.

**BANKS.** The means of holding and planting banks and steep surfaces is one of the perplexities of the horticulturist and landscape designer. The banks to be considered may be defined as very steep earth slopes with a bare, shifting surface, requiring protection and planting, or a surface covered with natural vegetation. Figs. 466-469.

Low banks, either curved or rigidly formal, usually enter into symmetrical designs of the elaborately finished surroundings of a fine home. Usually they are



466. A bank before planting.

placed to outline or to inclose parts of a design, or to decrease or increase the apparent height of a building or other structure, or of a garden compartment.

#### Protection.

One problem to be solved is the protection of sea, lake, river, and small stream banks and bluffs against the sliding of the soil, due to waves or along-shore currents in sea or lakes and to running water, especially

floods, in stream beds. Such water-action, cutting under the base of a bank, causes the soil above to slide down. On lake and sea shores, jetties built from the bluff-base into the water will check an eroding marginal current, make it drop its load of silt, and extend the shore. In many positions willows, planted close together in a wide band on the beach or at the bluff-base, will accumulate and fill with roots the soil that



467. Same bank after planting.

is washed down and blown in, and thus create a water-resisting barrier. Along salt water, plantations of the sea-beach grass, *Ammophila arenaria*, and the shrubby *Baccharis halimifolia* and *Iva frutescens* are serviceable; and far South, the mangrove may be planted on outermost sea-edges.

Another bank trouble is soil-seepage water coming to the surface part way up the slope and making mud patches that slide down and cause the soil above to cave away. Usually this sloughing is at an impervious soil layer at some feet below the surface, to which the water passes, then finds its way out to the bank-face. If this water is at fixed spring-like points, a tile drain laid in porous material about 3 or 4 feet deep and directly down the bank to a concrete anchor at the outlet opening will usually take off the water that causes sliding. If the seepage is all along the face of the bank, it may be necessary to carry a drain some feet back from and parallel to the edge of the bluff-top down to and a little into the impervious soil, with tile outlets down the bank.

The surface of banks is often gullied by water running from the top down the face at frequent intervals. This may be prevented by forming a ridge or barrier at the edge of the bluff to carry the water along sodded channels to paved or piped outlets down the slope.

Sand-bluff surfaces that drift with the wind need thick plantations of plants that will grow well in sand, with a mulching of hay, leaves or litter to keep the sand in place until vegetation is established.

The erosion of large streams at the base of bluffs is often beyond the means of individuals to control, although persistent willow-planting along shore and planting on the slope, will often suffice. In bad banks, a riprap of stone with plants having matted roots between the stones will hold. On smaller streams, ripraps of stones or stumps, while unattractive until covered with vines, will hold banks at critical places. A continuous stone wall is not a good barrier unless it is high enough on both sides to include flood-water, and the cost of such walls is too high for most individuals.

On sliding slopes there is usually an overhanging upper edge with a short perpendicular edge just under it to be graded back. The material thus secured may be used at the foot of the bluff. When more ideal conditions are desired, the grading may be extended to give angular raw banks the graceful contours that nature's gradual rounding-down of angles will give

### Planting.

On low banks and terraces, where soil may be thoroughly prepared and well cared for, turf or any vigorous plant can be established. In elaborate garden designs, such planting is often trimmed or trained to a uniform surface or arranged to make a part of a formal pattern.

On high banks, landscape beauty of distinction may be created by the selection, arrangement and manage-



468. Banks held by moderate planting, the scenic features not being obscured.

ment of artificial plantations or the natural growth. High banks uniformly drained and graded to prevent slipping, such as railroad and reservoir slopes, may be turfed. Such treatment is not recommended in large operations in which an interesting and varied surface-cover, or a low maintenance cost, is desired. When large bluffs require many thousand plants and limitations of cost require that they be planted with little soil preparation, varieties must be selected that will grow well in the soil presented. They must be plants that can be procured in large quantities at low cost, for the bulk of the planting, and it is desirable that they have such special characteristics as underground or surface stolons or trailing stems that root strongly at frequent intervals, or stems that root at the tips. There are also varieties with very densely matted fibrous roots that hold soil well.

The following plants meet these requirements for the soils indicated:

Low evergreen plants for the sandy or gravelly soil of the North: Bearberry (*Arctostaphylos Uva-Ursi*) an ideal evergreen trailing ground-cover for sand or gravel, of which collected plants must be used that are not easily transplanted. Trailing juniper (*Juniperus communis*). Savin juniper (*Juniperus Sabina*). These three species are not procurable in large quantities at low cost, and collected plants do not transplant readily.

Low evergreen plants for good soil in shade: Evergreen spurge (*Pachysandra terminalis*), excellent for shade and hardy over a wide territory. Myrtle or large periwinkle (*Vinca major*), from Virginia south. Periwinkle (*Vinca minor*), from Pennsylvania north. The last three plants are offered by nurseries in large quantities, the latter at low cost by collectors, and collected plants transplant well. Japanese evergreen honeysuckle (*Lonicera japonica*). This climber and trailer is one of the best bank-covers in states south of New York, and it can be obtained in nurseries or from collectors in large quantities. Spring planting should be done very early.

For low deciduous trailers or medium high shrubs for nearly all soils, the tip-rooting species of blackberry, such as *Rubus canadensis*, *R. dumetorum*, *R. occidentalis*, and the species with underground stolons, such as the cultivated high-bush blackberries, and red raspberries, are serviceable and can be obtained in large quantities at low cost. Plants having a similar habit may also be thus secured, as the matrimony vine, the Indian

currant, the weeping golden bell (*Forsythia suspensa*), the wild roses, (*Rosa lucida* or *R. nitida*), the staghorn sumac (*Rhus typhina*). Of low-cost trees, the common locust, soft maple, box elder, and Russian mulberry, are all suitable.

Of matted-root plants, the Japanese barberry, the hop-tree (*Ptelea trifoliata*), the European euonymus, the common buckthorn, can usually be readily procured.

Of small trees for shade, the flowering dogwood and red-bud are especially suitable and attractive from Massachusetts and New York south.

Of tall evergreen trees, the white pine is more serviceable for light soils and more easily procured; the arborvitæ and red cedar are the most available medium-height trees for average soils.

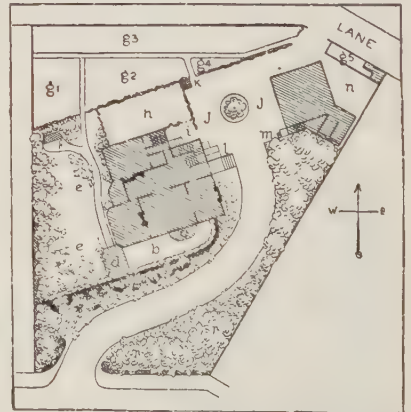
In California, the mesembryanthemums are largely used for bank-covers.

It is very desirable to establish a ground-cover of low shrubs and especially herbs under trees on banks as soon as practicable. By using hay containing wild asters, thoroughworts, blazing star, goldenrod, perennial sunflowers, and the like, for mulching young plantations, many of these plants will be introduced from seed, especially when seeds are mature. These will gradually be superseded by such shade-loving plants as ferns, violets, woodland asters, and goldenrods, especially if colonies of these plants are introduced as soon as the plantations are high enough to give shade.

### Arrangement.

If it is important to retain an extended open view from the top of high banks, then high trees must be confined to the lower edge, medium-sized trees and large shrubs to the central zone, and trailing plants or low shrubs to the upper zone. If the bank is a low one, then low trees or large shrubs must be substituted for the large trees at the bottom of the bank. It is often more interesting, however, to allow the bank to be covered with tall trees and then open vistas and views through these trees

by cutting branches and thinning out as they develop. Banks offer rather an unusual opportunity for the development of interesting detail in the development of the planting, because of varying conditions of moisture and soil. Such interesting details should be made accessible by trails following along the slope on easy grades that can be made at the time the bank is first graded or at later periods as the growth develops.



469. Flat plan of a bank treatment on the right of the plan; and good planting against the residence, and up a bank at the rear.

WARREN H. MANNING.

**BANKSIA** (Sir Joseph Banks, 1743-1820, famous English scientist). *Proteaceæ*. Australian evergreen shrubs or trees with handsome foliage, but not widely known in cultivation here.

Leaves variable, often deeply incised, usually dark green above, white or brown downy beneath; fls. showy, sessile, usually in pairs, spicate; spike terminal or axillary, mostly crowded within the bracts and floral lvs.,



the pistillate ones ultimately forming thick woody strobiles.—Species 46, more than 23 of which have been more or less cult. in England, but only 2 or 3 so far known here.

Propagation is difficult, and by seeds is usually an unsatisfactory method, although *B. serrata* has been grown satisfactorily from seeds. Cuttings under a bell-jar, without too much heat, root fairly well.

The following have been recently catalogued in North America; none of them has "gained a permanent foothold" in California. Several species are known in American botanic gardens.

**integrifolia**, Linn. Ten to 12 ft.: lvs. 6 in. long, 1-1½ in. wide, entire, or rarely a little dentate, the upper side dark green, silvery white beneath, scattered or sometimes irregularly verticillate; spikes 3-6 in. long; perianth about 1 in. long, greenish yellow. Cav. Ic. 546. B. M. 2770. Lam. Encyc. 54.

**serrata**, Linn. Tree, 10-20 ft., the young branches tomentose: lvs. oblong-lanceolate, 3-6 in. long, coriaceous and deeply and regularly serrate: fls. similar to the preceding, but red. B. R. 1316 (as *B. undulata*). Cav. Ic. 539, 540.—Almost perfectly hardy in Cent. Fla.

**ericifolia**, Linn. Fig. 470. Shrub or small tree, 12-14 ft.: lvs. scarcely longer than ¾ in., heath-like: spikes 6-10 in. long, the yellow perianth about ¾ in. long. B. M. 738. Andr. Bot. Rep., pl. 156. Cav. Ic. 538.

*B. latifolia*, R. Br. Stout shrub: lvs. irregularly almost spiny serrate, 4-8 in. long, 1½-3 in. wide: spikes 3-5 in. long; perianth slender, scarcely 1 in. long, greenish. B. M. 2406.—*B. prionotes*, Lindl. Tree, 15-25 ft.: lvs. 8-11 in. long, ½-1 in. wide, pinnatifid: spikes 3-5 in. long; perianth scarcely an inch long, villous; style rigid, incurved at the base.

N. TAYLOR.

**BANUCALAG**: *Aleurites trisperma*.

**BANYAN TREE**: *Ficus indica*, and other species.

**BAOBAB**: *Adansonia*.

**BÁPHIA** (name meaning *dye*). *Leguminosæ*. CAMWOOD. BARWOOD. Shrubs or small trees, sparingly planted far south.

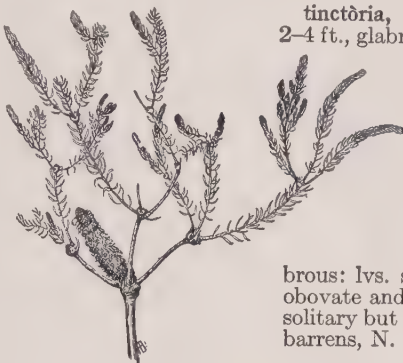
Erect or climbing: lvs. 1-foliate, exstipellate, the stipules small: fls. white or yellow, papilionaceous, fascicled or racemose; calyx short-toothed but becoming slit as the fl. opens; standard orbicular, and wings oblong or obovate, keel obtuse and slightly incurved; stamens not united: pod linear-lanceolate, acuminate, flattened.—A dozen species in Trop. Afr. and Madagascar. Sometimes grown in hothouses. Prop. by cuttings bearing lvs.

**racemosa**, Hochst. Erect, 8 ft., branches glabrous: lvs. leathery, 3 in. long, oblong or nearly so, acute: fls. large in a leafy panicle; corolla much exceeding the calyx, white with purple veins on the standard: pod 2 in. long, about 2-seeded. S. Cent. Afr. and Natal.—Offered in S. Fla.

L. H. B.

**EAPTÍSIA** (Greek, *to dye*, alluding to the coloring matter in some species). *Leguminosæ*. FALSE INDIGO. About twenty-five erect perennial herbs of eastern North America, sometimes planted in borders and collections.

Branching herbs: lvs. alternate, mostly 3-foliate: corolla papilionaceous, the standard not larger than the wings: calyx campanulate, the 5 teeth separate and equal or the 2 upper ones united: stamens 10, distinct:



470. *Banksia ericifolia*.  
(× ½)

pod stalked in the calyx.—Plants usually turn black in drying.

Baptisia thrive in any ordinary soil and under common treatment, preferring free exposure to sun. Propagation is by division or seeds.

A. *Lf.-blades simple: fls. yellow.*

**simplicifolia**, Croom. Branchy, 2-3 ft.: lvs. 2-4 in. long, sessile, broadly ovate and obtuse: fls. in numerous terminal racemes. Fla., in dry pine- or oak-lands.—Intro. 1891.

**perfoliata**, R. Br., with small axillary fls. and broad perfoliate lvs., is occasionally planted, and is hardy as far north as Washington, but is evidently not in the trade. S. C. and Ga., on sand-hills. B. M. 3121.

AA. *Lf.-blades compound, 3-foliate.*

B. *Fls. yellow.*

**tinctoria**, R. Br. WILD INDIGO. Bushy-branched 2-4 ft., glabrous: lvs. stalked, the lfts. small, obovate or oblanceolate, and nearly or quite sessile and entire: fls. ½ in. long, bright yellow, in numerous few-fl. racemes. Common in eastern states and to La. B. M. 1099. Mn. 5:81.—A kind of indigo may be extracted from this plant, and it has been used by dyers. The root and sometimes the herb are employed medicinally.

**lanceolata**, Ell. About 2 ft., pubescent when young, but becoming nearly glabrous: lvs. short-stalked, the lfts. thick, lanceolate to obovate and obtuse: fls. large, dull yellow, axillary and solitary but close together near ends of branches. Pine barrens, N. C. to Fla.

BB. *Fls. blue.*

**australis**, R. Br. (*B. cærulea*, Eaton & Wright. *B. exaltata*, Sweet). Stout, 4-6 ft., glabrous: lvs. short-stalked; lfts. oblanceolate to oval, entire, obtuse: fls. lupine-like, indigo-blue, nearly or quite an inch long, in loose-fl. long terminal racemes. Pa., W. and S. J. H. III. 29:64; 34:511.—Handsome. Probably the best species for cult.

BBB. *Fls. white or whitish.*

**alba**, R. Br. Wide-branching, 1-3 ft., smooth: lvs. stalked; lfts. oblong or lanceolate, obtuse, thin, drying green: fls. white, ½ in. long, in long-peduncled, elongated lateral racemes. N. C., W. and S., and extending northward. B. M. 1177.

**leucantha**, Torr. & Gray. Branching, more or less succulent, 2-4 ft., glabrous: lvs. stalked; lfts. obovate to oblanceolate to cuneate, very obtuse, drying black: fls. white, nearly an inch long, in loose-fl., lateral racemes. Ont. to Texas.

**leucophæa**, Nutt. St. stout and angled, but low and wide-branched, 1-2½ ft., hairy or nearly glabrous: lvs. short petioled; lfts. oblanceolate to obovate, stiff, drying black: fls. large and cream-colored, on slender erect pedicels, borne in 1-sided declined racemes. Mich. to Texas. B. M. 5900. Mn. 3:177. F. S. 23:2449.

L. H. B.

**BARBACÈNIA** (Barbacena, a Brazilian governor). *Amaryllidacæ*. About 30 Brazilian plants, with scape bearing a single purple fl. Grown mostly in baskets, after the manner of many orchids. *B. purpurea*, Hook., is occasionally seen in fine collections, but does not appear to be in the American trade. Grown in a warm, moist house. It has many scapes which are much longer than the long, grass-like, toothed, prominently keeled lvs; 1½ ft. Summer. B. M. 2777.—The genus is anomalous. It has been placed in the *Hæmodoracæ* as well as in *Amaryllidacæ*; and Engler & Prantl place it in the small family *Velloziacæ*.

**BARBADOS LILY**: *Hippeastrum*.

**BARBARÈA** (from the old name, Herb of Saint Barbara). *Cruciferae*. Hardy biennials, with yellow flowers, sometimes cultivated; allied to water-cress and horse-radish.

Branching leafy herbs: fls. small, yellow, clustered: fr. a linear cylindrical and 4-angled pod, the valves keeled.

*vulgaris*, R. Br. COMMON WINTER CRESS. UPLAND CRESS. YELLOW ROCKET. Fig. 471. Height 10-18 in.: lower lvs. lyrate, the terminal lobe round, the lateral usually 1-4 pairs; upper lvs. obovate, cut-toothed at the base. Eu. Asia.—Cult. for salad, and also a common weed, making fields sulfur-yellow in early spring. Native far N., but apparently a settler in central states. Var. *variegata*, Hort., lvs. splashed and mottled with yellow, is cult. as a border plant, and grows freely in rich soil. If the fls. are picked off, st. and all, before they open, the plant will be practically perennial.

*præcox*, R. Br. (*B. verna*, Asch.). EARLY WINTER, or BELL ISLE CRESS. Distinguished by the more numerous divisions of the lvs. (4-8 pairs) and thickened pedicels. Slightly cult. as a winter salad, and known S. as scurvy grass. Naturalized from Eu.

**BARBE DE CAPUCIN:** *Chicory*.

**BARBERRY:** *Berberis*.

**BARBIÈRIA** (after J. B. G. Barbier, French physician). *Leguminosæ*. Hothouse evergreen; 1 species, from Trop. Amer. Its nearest allies familiar to the horticulturist are *Indigofera* and *Petalostemon*. It is distinguished from these allied genera by the calyx- and corolla-tubes, which are much longer than in either of them. Tender evergreen shrubs, with odd-pinnate lvs., numerous entire lfts., and awl-shaped stipules: fls. large racemose, red. Prop. by seed and by cuttings of half-ripened wood under a bell-jar, with bottom heat.

*pinnata*, Baill. (*B. polyphylla*, DC. *Galactia pinnata*, Pers. *Clitorea polyphylla*, Poir.). Lfts. 9-11 pairs, elliptic-oblong, mucronate, pubescent with age: racemes few-flld., shorter than the lvs.; fls. 2 in. long. Trop. Amer.—*B. glabellula*, Hort., is probably a variety. N. TAYLOR.†

**BARKÈRIA:** *Epidendrum*.

**BARLÈRIA** (J. Barrelier, died 1673, French botanist). *Acanthaceæ*. Hothouse evergreen shrubs.

Fls. axillary or terminal, the calyx with 4 sepals, the 2 outer larger than the inner; corolla-tube long, its limb of 5 rounded, ovate lobes.—A genus of 150 species of tropical shrubs, mostly African, sometimes seen in fine col-

lections of stove plants, but not offered in the American trade. Prop. by cuttings of young wood, under a bell-jar with bottom heat. *B. cristata*, Linn., with purplish blue fls., or rarely white, in dense spikes, is sometimes used as a bedding plant. *B. strigosa*, Willd., with subcoriaceous lvs., somewhat strigose, and large blue fls. in terminal spikes, is not uncommon in botanic garden collections.—Worthy of greater notice.

N. TAYLOR.

**BARLEY.** Various kinds of *Hordeum* of the *Gramineæ*. Common barley is *H. sativum*, Jess. According to Hackel, it "undoubtedly originated from *H. spontaneum*, C. Koch, which grows wild from Asia Minor and Caucasian countries to Persia and Beloochistan, as well as in Syria, Palestine, and Arabia Petraea." The common barley has a 4-rowed ear or head. There are also 2-rowed and 6-rowed races, and other well-marked forms. They are probably all domestic forms of one parent stock. For fuller treatment, see *Cyclo. Amer. Agric.*, Vol. II, p. 202.

**BARÓSMA** (*heavy scent*). *Rutaceæ*. A group of 15 species of S. African heath-like shrubs. Fls. on axillary twigs; calyx 5-cleft or 5-parted; petals 5, oblong, usually subsessile; stamens 5, alternating with 5 staminoidea: lvs. mostly opposite, rarely in 3's. Some of the species furnish the buchu lvs. of commerce, which are used in medicine for their diuretic, diaphoretic, stimulant, and tonic properties. They are evergreens, and in the N. must be grown under glass. Prop. by mature-wood cuttings.

*pulchella*, Bartl. & Wendl. Fig. 472. Shrubby, 3-4 ft.: lvs. scattered, ovate, with a revolute margin: fls. axillary, solitary or in pairs longer than the lf.; petals 3 times longer than the calyx. B.M. 1357 (as *Diosma*).—Sold by some dealers, but rare in this country.

*B. fatidissima*, Bartl. & Wendl. (*Agathosma fetidissima*, Hort.). A low shrub, 2-3 ft.: lvs. ternate, a little longer than the internodes: fls. umbellate at the ends of the branches, the petals one-half to one-third longer than the calyx, white or pinkish white.—Attractive little shrub, grown in the temperate house, but evil-smelling. It often scents a whole greenhouse.

N. TAYLOR.

**BARRINGTONIA** (Daines Barrington, English naturalist and antiquary, died 1800). Including *Stravidium*. *Myrtaceæ*; placed in *Lecythydaceæ* by those who keep this group as a distinct family. Evergreen broad-leaved trees, some of which are planted in the tropics for the striking foliage and flowers.

Leaves mostly large and crowded at the ends of the branches, entire or somewhat crenate: fls. large in the cult. species and striking because of the numerous long and protruding stamens which are united in a ring; calyx-tube ovoid or turbinate, lobed; petals 4 or 5; ovary inferior, 2-4-celled: fr. a fibrous berry-like or box-like structure, crowned by the calyx-limb, 1-seeded by abortion of other ovules.—About 30 species in tropical parts of Asia, Afr., and Polynesia, bearing the white or reddish fls. in spikes or racemes.

*speciosa*, Forst (Figs. 473, 474), is apparently most planted in parts of the American tropics: tree wide-spread-



471. *Barbarea vulgaris*.

L. H. B.†



472. *Barosma pulchella*.



473. *Barringtonia speciosa*.  
( $\times \frac{1}{2}$ )



ing, large-boled, to 50 ft. in height: lvs. entire, obovate, sessile, shining, 12-15 in. long: fls. few in the raceme, large and showy, petals white and stamens tinted purple, the style long and prominent: fr. 4-sided (almost square in cross-section at the middle or below), 3 in. diam. at base, box-like in looks, with a single large seed and crowned by calyxlobes and style. India, near the sea. L. H. B.

**BARTONIA** of Sims is *Mentzelia*; this is in cult. Bartonia of Muhlenberg is one of the Gentianaceæ, but is not cult.

**BASÉLLA** (native Malabar name). *Basellacæ*. MALABAR NIGHTSHADE. Annual or biennial herbs, cult. in the tropics as a pot-herb, like spinach. They have bisexual, white, red or violet fls. Rarely cult. N. as an ornamental warmhouse climber. It may also be started indoors, and set out in May for use as a garden vegetable, to follow spinach. Prop. by seeds. Only 1 species, which is, however, remarkably variable.

*rùbra*, Linn. Lvs. succulent, alternate, rarely opposite, almost entire, of various forms: fls. not pedicelled, in simple spikes or racemes; spikes short or long, lax, few-fl'd. Lam. Ill., pl. 215, fig. 1. Rheede, Hort. Mal. 7, pl. 24.—The following species are now considered only forms of the above: *B. alba*, a white-fl'd. form rarely cult. as a trailer from roofs of warmhouses, or as a basket plant; *B. caninifolia*; *B. cordifolia*, with heart-shaped lvs. 4-5 in. long and 2-2½ in. wide; *B. crassifolia*; *B. japonica*; *B. lucida*, from India; *B. nigra*, a Chinese form; *B. ramôsa* and *B. volubilis*. Under the name of sweet malabar vine, a form with tiny yellow and red fls., and lvs. variegated with white, pink, and green has been advertised. It is said that "with age it assumes a drooping habit. When cut, keeps fresh for weeks."

**BASIL.** Species of *Öcimum* (sometimes, but incorrectly written *Ocymum*), of the *Labiata*. They are Indian annuals, and are cult. as pot-herbs, the clove-flavored foliage being used as seasoning in soups, meats and salads. They are of easiest cult., the seed being sown in the open as soon as the weather is settled. Common basil is *Öcimum basilicum*, Linn., a foot high, branching, with ovate toothed lvs., and white, bluish white, or purplish fls. in leafy terminal racemes or spikes. *O. minimum*, Linn., the dwarf basil, is lower, and smaller in all its parts; rarely seen and perhaps only a mere form of *O. basilicum*, Linn. When basil is in bloom, it can be cut and dried for winter use.

**BASILIMA:** *Sorbaria*.

**BASKET PLANTS.** Under this term are included all those plants which, from their habit of growth and blooming and adaptabilities as to cultivation, have been found especially suitable for use in hanging-baskets. Figs. 475, 476.

Most of the basket plants are dwarfish subjects of indeterminate growth, of gracefully drooping or vine-like habit, and are valued either for their grace, or for freedom and daintiness of bloom. Some of the plants used in baskets are of upright habit. These are either plants of naturally small stature, or are practically such for a season from a slow habit of growth. The suitability of these erect-growing plants for the purpose is determined, aside from their stature, by their freedom of bloom, beauty of foliage, striking form, or grace of habit. Such plants are used principally for filling the central part of the basket; whereas, plants of trailing habit are inserted near the sides—some to droop, others to twine upward on the cords or handle by which the

basket is suspended. In addition to the long drooping or climbing plants, there are a number of half-erect habit, like the lobelia, sweet alyssum and russelia. These may droop somewhat, but are not of a truly vine-like habit. Some plants are more suitable than others for shady places; the selaginellas, are examples. Others thrive only with several hours of direct sunshine each day.

The following list of common trade names embraces a number of the most important basket plants, arranged according to habit of growth and blooming. The list is, of course, not complete. Any list would need amending from year to year to suit individual taste and experience. Plants that withstand considerable shade are marked with an asterisk (\*); those that will bear much shade are marked with two asterisks (\*\*):

## 1. Plants of vine-like habit.

### a. LONG-DROOPING.

\*\*English Ivy, \*Kenilworth Ivy, \*Vine major, \*V. Harrisoni, Saxifraga sarmentosa, \*Cissus discolor, \*Moneywort Ivy, Tropæolum (Nasturtiums), Lonicera Halliana, L. aurea var. reticulata, Nepeta Glechoma, Ampelopsis quinquefolia, A. Veitchii The ampelopsis is deciduous, and not suitable for winter baskets.

### b. CLIMBING.

Maurandia, \*\*Lygodium scandens, \*Senecio scandens, Thunbergia, Cobæa scandens, Japanese Variegated Hop, Manettia bicolor, Lonicera Halliana, L. aurea var. reticulata, Clematis coccinea, Tropæolum peregrinum, forms of Convolvulus.

### c. SHORT-DROOPING, OR HALF-ERECT.

\*Lobelia Erinus, \*Othonna crassifolia, \*Sweet Alyssum, \*Tradescantia, Petunias, Oxalis floribunda, \*Russelia juncea (also bears sun well), \*Fittonia, \*Fuchsia procumbens, Ice Plant, Verbena, \*Ivy Geranium, \*\*Selaginellas, \*Begonia glaucophylla var. scandens, \*Sedum Sieboldii, \*S. carneum var. variegatum, \*Asparagus Sprengeri, \*Passifloras, \*Panicum variegatum, Gazania splendens, Abutilon megapotamicum and var. variegatum, Lantana delicatissima, Solanum jasminoides, S. Seaforthianum, Convolvulus mauritanicus.

## 2. Plants of upright habit

### a. LOW-GROWING.

(1) *Flowering Plants.*—\*Torenia, \*Pansy, Cuphea platycentra, C. hysopifolia, \*Primula obconica, Dwarf Alyssum, Bellis perennis, Linum or Reinwardtia trigyna, Phlox Drummondii, Dutch bulbs.

(2) *Foliage Plants.*—\*Peperomia, \*Begonia Rex, \*Fartugium grande, Alternanthera, \*\*Maidenhair Fern, Geraniums (especially Mme. Sallerot), \*Isoplepis gracilis (droops with age).

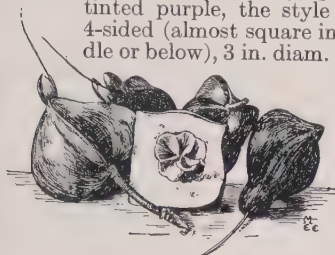
### b. TALLER-GROWING.

(1) *Flowering.*—Geraniums—\*Pelargonium, \*Fuchsias, Petunias, \*Begonias, Browallia, \*Stevia serrata var. nana, Madagascar Periwinkle, \*Nierembergia, Lantana, \*Impatiens Sultana, Cuphea llavea, Swainsona, Chrysanthemum frutescens, Salvia.

(2) *Foliage.*—\*Dusty Miller, \*Crotons, \*Palms, \*\*Ferns, \*Fancy Caladiums, Coleus, Achyranthus, \*Aspidistra, \*Cyperus alternifolius, \*Dracæna indivisa, \*D. terminalis, Coccobola platyclada.

Some of the above plants make large subjects when growing in the open ground. Of such, only young or smaller plants are available for use in hanging-baskets. Ordinarily, several different sorts of plants are used for filling a basket. In some cases, however, a satisfactory basket is made by using but one kind of plant. A hanging-basket filled with sword fern (nephrolepis), for example, makes a handsome object.

The soil used in hanging-baskets is simply good, common, florists' potting soil. This usually contains about 25 per cent of humus, and a small amount of sharp sand to make it porous. Prior to filling, wire baskets must be lined with moss. This is merely common woodland moss from rotting logs, or rich, damp



474. Fruit of Barringtonia. (× 1/6)



475. A hanging-basket.

soil. In filling baskets, a few drooping or climbing plants are disposed around the sides; then one or more upright-growing or half-erect plants, according to the size of the plants and basket, are planted in the center. Immediate effects require plants which have already made considerable growth. Florists usually carry a stock of suitable plants. In case seedlings or cuttings are grown for the purpose, it is usually best to start them in seed-pans or cutting-boxes, and transfer them later to the basket. Seeds may be sown or the cuttings started in the basket, but it is so long before they fill the basket that there is no advantage in it.

A common mistake in arranging baskets is crowding, or filling them too full. Fewer plants will appear more graceful, growth will be more vigorous, and the basket will retain its grace and beauty for a longer time. Exercise vigilance and care in watering. After the roots have well filled the basket, watering is best done by dipping the basket in a tub or barrel of water, and allowing it to remain until it is well saturated. Dipping the basket in weak liquid manure once or twice a month will greatly promote vigor when the plants have been long in the basket. These remarks also apply in a general way to vases and rustic stands.

Baskets of many patterns are obtainable from florists and other dealers. The baskets most extensively used, are made of strong wire, woven into hemispherical or other forms. These are sometimes plain, and again of ornamental character. The better form has a flat bottom, or a stand, formed of wire, to support the basket in an upright position when it is not pendent. Another style is formed of rustic work. Here the vessel or plant basin is covered about the sides with rough bark or knotted roots. For this purpose the roots of the laurel are much used. Above the basket there is an arch or handle by which it is suspended. Again, earthenware vessels, to be suspended by wires, are offered for sale in a variety of shapes. Some of these are molded and painted in imitation of logs, and are known as "stick baskets" and "log baskets." Such baskets are often without provision for drainage. When this is the case, holes should be drilled at the lowest point in the bottom. A special form of basket is much used for orchids. It is made of square cedar slats in raft- or log-fashion. Fern-fiber and broken bits of brick, flower-pots or charcoal, are used for filling them. See also the article *Vases*.



476. Rustic basket (with *Convolvulus*).

ERNEST WALKER.

**BASSWOOD:** *Tilia*.

**BATĀTAS:** *Ipomœa*.

**BATEMĀNNIA**, (James Bateman, a distinguished collector and cultivator, and author of important orchid works). *Orchidaceæ*. Epiphytic; greenhouse.

Stems thickened into pseudobulbs, 1-3-lvd.: lvs. plicate-veined: racemes arising from base of pseudobulbs; sepals and petals similar in shape; lip articulated to the foot of the column, the lateral lobes inclosing the column, the middle lobe short, entire; pollinia 2.—A single species, native of Guiana, rarely seen in cult.

**Cölleyi**, Lindl. Pseudobulbs 2-3 in. long: lvs. up to 10 in. long: raceme pendulous, with 4 or more distant fls. about 3 in. diam.; sepals and petals vinous, purple, the lateral sepals green-margined; lip white, red-

dish stained at the base of middle lobe. B.R. 1714. B.M. 3818.

GEORGE V. NASH.

**BATODÉNDRON:** *Vaccinium*.

**BAUËRA** (H. Gottfr. and Franz Bauer, German professor and painter, respectively). *Saxifragaceæ*. Choice little evergreen shrubs grown in greenhouses.

Leaves 3-parted and opposite, looking like a whorl of 6: fls. white to purple, axillary and solitary, but sometimes aggregated at top of the st.; calyx 4-10-divided; petals as many as the calyx-divisions; stamens few to many, borne on a disk: fr. a 2-valved caps., the valves again splitting.—Three species in Austral. and Tasmania, one of which is in cult.

These small shrubs make handsome specimen plants for the cool greenhouse, and flower most of the year, especially during the winter and spring months. Baueras are easily propagated from cuttings of half-ripened wood in spring; cut into lengths of about 2 inches, insert in equal parts of finely sifted peat and sharp sand in 3-inch pots, pricking them round the rim of the pot, and cover with a bell-glass in a greenhouse with a temperature from 55° to 60°. Give them a thorough watering at the time of insertion, and they will frequently root without further watering. When the cuttings begin to show signs of growing, they should be potted singly in 2-inch pots in the same mixture as above, and should be kept in a tight case for a few days. After they have gripped the soil, they should be cut back to about an inch above the pot, which will encourage them to branch. Baueras should never be allowed to become pot-bound until the desired size of plant is reached. The plants at all times should be kept in good shape by cutting back the strong shoots. In summer, baueras do better when plunged in a bed of coal-ashes out-of-doors, and strict attention given to watering. A cool greenhouse with a night temperature of 40° to 45° will be ideal all winter.

Water occasionally with soft-coal soot mixed in water, a handful to an ordinary watering-pot; water with clean water three times and the soot-water once. (Geo. F. Stewart.)

**rubroides**, Andr. Erect or prostrate, usually 1-2 ft. in cult., but becoming 6 ft. or more: lfts. oblong or lanceolate, somewhat acute,  $\frac{1}{4}$ - $\frac{1}{2}$  in. long, serrate: fls. pink or white, slender-pedicelled, the very obtuse petals exceeding the spreading or reflexed acute-toothed calyx-divisions. Inhabits swampy places. B.M. 715. L.B.C. 14:1313 (as *B. rubæfolia*).—An old favorite, blooming in spring.

L. H. B.

**BAUHÍNIA** (after John and Caspar Bauhin, sixteenth century herbalists, the twin leaflets suggesting two brothers). *Leguminosæ*. MOUNTAIN EBONY. ORCHID TREE. Tropical trees and shrubs, sometimes climbing, planted in southern Florida and southern California to some extent for the flowers, odd foliage, and general attractive appearance; distinguished by the usually bifid or binate leaves; allied to *Cercis*.

Trees, shrubs, or vines, with showy fls. ranging from white to purple and yellow: lvs. broad, entire or 2-lobed, in some cases the lfts. being entirely free; petiole prolonged into a short but characteristic awn between the lfts.: fls. in simple or paniced terminal or axillary



racemes; petals 5, somewhat unequal, usually narrowed into a claw; stamens 10, but sometimes reduced even to 3 and perhaps bearing sterile filaments; ovary stalked, stigma in some species peltate and in others oblique; fr. a long flat pod, dehiscent or indehiscent.—About 150 species in tropics of both hemispheres. The number and fertility of the stamens are important characters in determining the subgenera. The purplish fls. of some species suggest those of some kinds of pelargonium. The bauhinias are not papilionaceous. Some of the arboreal species (as *B. variegata*) produce ebony wood. Others are gigantic climbers, sometimes mounting the highest trees.

Bauhinias are frequent in plantings in many parts of the tropics. They are planted to some extent in southern Florida and southern California. Numbers of species are likely to be introduced from time to time because of their gorgeous appearance in the tropics. In the experience of Old World gardeners, the most reliable species under glass are *B. variegata*, *B. corymbosa*, and *B. natalensis*. These can be planted outside in southern Florida in summer, and kept over winter as oleanders are. *B. variegata* and *B. purpurea* are two of the commonest and showiest small trees of India, and, although frequently introduced into northern greenhouses, have rarely succeeded permanently. *B. variegata* is much cultivated in India. The astringent bark is used in tanning and dyeing, and the leaves and flower-buds as a vegetable, the latter being pickled. Bauhinias thrive in a variety of soils on our southernmost borders. They delight in high well-drained land, but will grow on lower lands in southern Florida if it is fairly well drained or if set on slight mounds; all of them are very tender and easily affected by low temperatures, but are easily saved by banking. *B. purpurea* and *B. variegata* (*B. alba*) have withstood a temperature of 26° F. in Florida. No particular care in tillage or fertilizing is necessary, but better bloom is secured if some attention is given to these details. From seeds in Florida bauhinias grow readily and bloom freely in three or four years. Cuttings root with difficulty, but some kinds propagate readily from suckers. Bauhinias are little known as greenhouse subjects; but in the tropics they make showy and very attractive shrubs or small trees or profuse vines. (E. N. Reasoner.)

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A. Plant climbing, or at least of climbing habit or tendencies.

1. *yunnanensis*, Franch. Vigorous, glabrous and glaucous throughout: lvs. coriaceous, bipartite; segms. obliquely elliptic, 3-4-nerved, rounded, 1½ in.: fls. in many-fld. pendulous racemes, rosy white striped with purple. Yunnan, China. B.M. 7814.

2. *corymbosa*, Roxbg. Woody climber, branching from the ground: branches grooved: tendrils opposite, revolute: lvs. 1½-2 in. long, outer edges slightly rounded, inner edges straight and parallel; lfts. nearly free from each other; nerves 2-4: fls. numerous, corymbose, 1 in. across, rosy, with fluted petals, and characteristic venation; stamens bright red, 3 very long, the rest abortive. China. B.M. 6621. G.C. II. 16:204.

3. *Galpinii*, N. E. Br. Half-climbing shrub, 5-10 ft.: lvs. 1-3 in. long, 2-lobed from one-fifth to one-half their length, 7-nerved; petiole about ¼ in. long: racemes 6-10-fld.; fls. borne continuously from spring to late autumn; petals 5, all alike, 1-1½ in. long; claw as long as the limb; limb orbicular, cuspidate, brick-red; fertile stamens 3: pod 3-5 in. long; seeds dark brown. S. and Trop. Afr. B.M. 7494.—Discovered 1891.

AA. Plant upright, a bush or tree.

B. Fls. white.

4. *acuminata*, Linn. Height 5-6 ft.: lfts. ovate, acuminate, parallel, 4-nerved, closing at night: fls. 2-3 in. across; fertile stamen long and nearly free, the other 9 short, connected, and sterile. India, Malaya, China. B.M. 7866. J.H. III. 44: 343.—One of the most satisfactory of all, either for open ground or greenhouse culture, as it will bloom the first summer, when but a few months old and but a foot or two high, and in succeeding summers blooms continuously from May to Sept.

5. *grandiflora*, Juss. Tree, to 20 ft.: lvs. oval or subcordate, tomentose beneath, not deeply divided, the lobes ovate-obtuse and 3-4-nerved, stipules spiny: fls. very large, pure white, opening at night, 1-3 on axillary peduncles; petals obovate, acute at apex, clawed. S. Amer. R.H. 1897, p. 393.

6. *natalensis*, Oliver. Small shrub: lvs. numerous; lfts. each 1 in. long, with a midrib and a few nerves, dark green; petioles ¼-½ in. long; lfts. entirely free: fls. single or in 2's, 1½ in. across, white, the midvein of the 3 upper petals reddish; petals erect or spreading, the 2 lower ones larger; stamens 10, 5 long and 5 short: pod 3 in. long. S. Afr. B.M. 6086.—Not advertised at present.

7. *picta*, DC. Unarmed: lvs. roundish elliptic, membranous, glabrous; lfts. semi-ovate, acutish, 5-nerved: fls. in solitary terminal racemes, white; calyx ferrugineous-tomentose; petals oblong. Colombia.

BB. Fls. colored (cream-color, yellow, or shades of red or purple).

8. *forficata*, Link (*B. furfuracea*, Hort.). Thorny shrub: lvs. cordate at base, glabrous, cleft to middle: fls. cream-color in summer, rather bell-shaped, the petals narrow. Brazil. B.M. 3741. Gt. 10:333.

9. *tomentosa*, Linn. ST. THOMAS TREE. Erect shrub or small tree, branches downy: lvs. broader than long, 1-2 in. long, coriaceous, the lobes obtuse, 7-nerved: fls. mostly in axillary pairs (sometimes 1 or 3) on pedicels bearing a pair of bractlets, yellow with red blotch on the upper petal, the petals 2 in. or less long, obovate, much exceeding calyx (which is entire): pod stalked, 4-5 in. long. India. B.M. 5560.

10. *Kappleri*, Sagot (*B. Krugii*, Urban). Fig. 477. Strong tree, to 50 ft.: lvs. 2½ in. or less long, long-petioled, longer than broad, truncate or somewhat cordate at base, divided about one-third of the length into obtuse lobes that are about 5-nerved: fls. in short racemes opposite the lvs., whitish rose with darker and purple markings, the petals spatulate and clawed; lower stamens fertile: pod 6-10 in., narrow and curved. Probably French Guiana; cult. and partly spontaneous in W. Indies.—Attractive.

11. *purpurea*, Linn. (*B. triandra*, Roxbg.). Small to middle-sized tree: lvs. coriaceous, glabrous, somewhat cordate, cleft one-third to one-half their depth, 9-11-nerved; lobes obtuse or somewhat acute: fls. in few-fld. axillary and terminal corymbs, fragrant; petals red, one streaked with white on the claw, oblanceolate, acute; fertile stamens 3-4, very long, the rest sterile or abortive: pod 1 ft. long. India, Burma, China.—One of the finest flowering small trees in S. Fla. Fls. are borne in the greatest profusion, 3-5 in. across, varying in color from almost white to a shade of rich purple, and marked and shaded with many tones. The plant is



477. *Bauhinia Kappleri*. (× ½)

robust and hardy, growing to a height of 15 ft. in less than 2 years, and blooms all winter and spring. What is known as *B. triandra* to Fla. cultivators is described as a very tender species but succeeding admirably there; growth like that of *B. purpurea* but with longer willowy branches that bear at the tips great clusters of pink fls. in late autumn or early winter, delicately scented.

12. *variegata*, Linn. Much like *B. purpurea* in habit: tree, 6–20 ft.: lvs. 3–4 in. across, somewhat broader than long, divided one-fourth to one-third the depth, 9–11-nerved, lobes rounded; petiole 1–2 in. long: fls. about 7, in a short raceme or corymb, 4 in. across; calyx spathe-like; petals 5, clawed, obovate-oblong, veined, rose-colored and variegated with red and yellow, the lowest one larger, broader above the middle, strongly marked with crimson; pod 1–2 ft. long. India. B.M. 6818.—The coloring of the fls. varies. Var. *cándida*, Roxbg. (*B. álba*, Buch-Ham.). Height 12 ft.: fls. white, beautifully veined with green: fls. Feb.–May. B.M. 7312.

Numbers of baubins may be expected to appear in plantings along the southern borders. The following names have already occurred: *B. andicans*, Benth. Closely related to *B. forficata*. Spiny: branchlets and racemes whitish tomentose: lvs. pubescent below, 9-nerved: petals nearly 3 in. long. Uruguay, Argentina.—*B. Hobkerv*, F. Muell. Large tree: fls. distinct, broad, very obtuse, 5–7-nerved: fls. white, edged with crimson, in few-fl. terminal racemes; petals clawed, the blade about 1½ in. long. Austral.—*B. Richardsonii*, said to be from Mauritius; unidentified.

L. H. B.†

BAY TREE: *Laurus*.

**BEAN.** A name applied to various plants of the *Leguminosæ*. The word is commonly used for herbaceous plants of the *Phaseolus* tribe, but it is sometimes employed for seeds of leguminous trees and shrubs. The species of true beans (*Phaseolus* and closely allied genera) are yet imperfectly understood. The bean differs from the pea, among other things, in being epigeal in germination (cotyledons appearing above ground). Some of the plants to which the name is applied are really peas.

The beans chiefly known to horticulture are of five types: (1) The Broad bean (*Vicia Faba*), or the bean of history, an erect-growing plant, producing very large and usually flat, orbicular or angular seeds. Probably native to southwest Asia (Figs. 478, 479 a). See *Vicia*. These types of beans are extensively grown in Europe, mostly for feeding animals. They are either grown to full maturity and a meal made from the bean, or the plant is cut when nearly full grown and used as forage

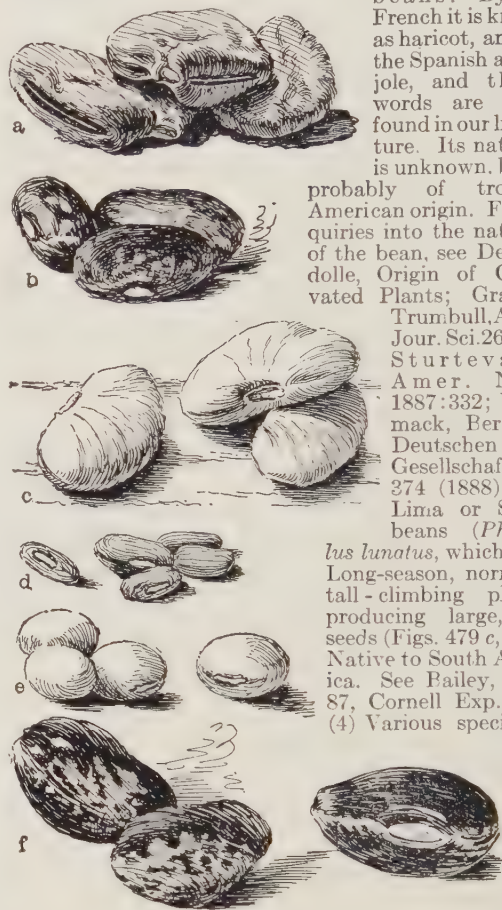
or made into silage. The Broad bean needs a cool climate and long season. In the United States, the summers are too hot and dry for its successful cultivation on a large scale, and the plant is practically unknown here. In Canada, the plant has been used with corn to make silage; and this combination has been called the "Robertson mixture." (2) Kidney bean (*Phaseolus vul-*

*garis*; Figs. 479b, 480). This is the plant which is everywhere known as bean in North America, comprising all the common field, garden, snap and string

beans. By the French it is known as haricot, and by the Spanish as frijole, and these words are often found in our literature. Its nativity is unknown, but is

probably of tropical American origin. For inquiries into the nativity of the bean, see DeCandolle, *Origin of Cultivated Plants*; Gray & Trumbull, *Amer. Jour. Sci.* 26:130; Sturtevant, *Amer. Nat.* 1887:332; Wittmack, *Ber. der Deutschen Pot. Gesellschaft*, 6: 374 (1888). (3) Lima or Sugar beans (*Phaseolus lunatus*, which see).

Long-season, normally tall-climbing plants, producing large, flat seeds (Figs. 479 c, 481). Native to South America. See Bailey, *Full.* 87, Cornell Exp. Sta. (4) Various species of



479. Types of beans. (Natural size.)

a. *Vicia Faba*. b. *Phaseolus vulgaris*. c. *Phaseolus lunatus*. d. *Dolichos sesquipedalis* (properly a *Vigna*). e. *Glycine hispida*. f. *Phaseolus multiflorus*.

*Dolichos* (as *D. sesquipedalis* of gardens), or closely related things. Vines which produce very long, slender pods and small, narrow beans (Figs. 479 d, 482). Native to tropical America. (5) Soy, or Soja, bean (*Glycine hispida*). A bushy, erect, hairy plant producing small pods in clusters, and pea-like seeds (Figs. 479 e, 483). In this country used mostly for forage. Native to China and Japan, where it is much grown.

Aside from these types, there are others of less economic importance. The Scarlet Runner type is a perennial *phaseolus* (*P. multiflorus*), grown in this country mostly for ornament (Figs. 479 f, 484). The Tepary bean, now gaining prominence in the Southwest, is a form of *Phaseolus acutifolius*, a native species. Various other species of *Phaseolus* are also cultivated in various parts of the world under the name of beans. *P. radiatus* is prized in Japan, and has been introduced into the United States as Adzuki Bean (see Georgeson, *Bull.* 32. Kan. Exp. Sta.). *Vigna sinensis*, known in North America as cowpea (which see), is sometimes called a bean. The Velvet bean of the South is a *Mucuna* (which see), recently, however, referred to *Stizolobium*. The Jack bean is a *Canavalia* (Fig. 485). Recent American studies on varieties and types of beans are Irish, *Rep. Mo. Bot. Gard.* 1901, 81–165;



478. Broad bean—*Vicia Faba*. (X ¼)



Jarvis, American Varieties of Beans, Cornell Bull. 260 (1908); Freeman, Ariz. Bull. 68 (1912).

The sea beans of the Florida coast are seeds of various tropical leguminous plants, and are transported by ocean currents (see Coe, in G.F. 7:503).

For botanical treatment, 'see *Dolichos*, *Glycine*, *Phaseolus*, *Vicia*, *Vigna*.

L. H. B.

### Culture of the bean.

For the purposes of the practical gardener, the various types and numerous varieties of the bean may be classified in two groups, in two different ways, namely,



480. Common or Kidney bean.—  
*Phaseolus vulgaris*.

either as "field beans" and "garden beans," or as "bush beans" and "pole beans." Field beans are grown on a large commercial scale for the dry-shelled seeds, either as a farm crop in regular rotation, as corn and potatoes are grown, or at times as a subsidiary or chance crop, or side line, in young orchards, and so on, but are not usually found in the home- or market-garden, where highly manured soil would tend to stimulate

growth of foliage at the expense of seed-production. Field beans belong mostly or entirely in the class of bush beans. The garden beans are more commonly grown for their succulent pods and immature seeds, and include both bush and pole or "running" sorts. The latter come almost exclusively under the head of "garden" beans.

The great economic value of the bean is generally recognized, not alone in respect to its high place as a farm and garden crop, but also as the most suitable material, next to animal products, in compounding a balanced ration for man, and to some extent for beast, and as a substitute for dear meats.

Beans are easily forced under glass, in a temperature suitable for tomatoes. They may be grown either in pots or beds. The bush varieties, as *Sion House*, are preferred. Keep them growing, and look out for red spider.

### Field beans.

Ordinary field beans like a fairly good warm farm soil, such as will suit corn or potatoes. They do not draw very heavily on the fertility of the land. Belonging to the legumes, they are able to make use to a large extent of atmospheric nitrogen, and if given a good start will not only look out for their own needs in that respect, but may leave the land better supplied with nitrogen than it was found at planting-time. They will not thrive on wet or badly drained land; otherwise good strong loams, or soils resting on limestone, are considered most desirable, with sandy loams and gravelly loams next in order. They should have a fair but not excessive amount of humus. A few loads of fine old stable manure spread evenly on the surface after plowing, if possible supplemented with fifty or a hundred pounds of muriate of potash and a few hundred pounds of dissolved rock (acid phosphate) or other phosphatic manure may be expected to give good re-

turns. Or, in the absence of these chemicals, 200 pounds or so of a commercial fertilizer such as is usually applied for grain crops, and which analyzes about 2 or 3 per cent of nitrogen, 8 of phosphoric acid and 3 or 4 of potash, may be applied broadcast after plowing. Although the planting should not be done until after the soil has become warm, in the northern states not before June, the customary planting-time in the great bean-producing sections extends from June 1 to June 25; it is, nevertheless, of great importance to plow the land early and keep it worked with disk or other harrows until planting-time; this for the purpose of preserving moisture and getting ahead of the weeds. Important also is the use of good hand-picked seed beans, not over one year old, and free from weevils and disease infection. The rows are to be made 28 to 36 inches apart, and for small areas, planting by hand or with a corn-planter will do. For planting on a larger scale, a regular bean-planter or a grain-drill with part of the tubes stopped up so as to bring the rows the correct distance apart should be used. If fertilizer is to be applied with the drill at the same time, it may be allowed to run from the hoe or tube on each side of each tube that discharges the seed beans.

Among the varieties generally grown in field culture are the *Pea or Navy*, the *Medium*, *Red and White Kidney*. The *Pea bean* is small but early and prolific, and considered to be about as profitable as any other under ordinary circumstances. It is particularly recommended for the small or home grower.

The harvesting comes when the pods have ripened and the leaves have dropped off, and is to be done with a bean-puller or harvester, taking two rows at a time, or in a small way by hand-pulling. The vines are put in small heaps, allowed to cure, and promptly stored out of the way of moisture, afterwards threshed with a bean thresher, or in a small way with the flail, cleaned, sorted by hand (in a large commercial way with the help of a bean-sorting device), and marketed.

### Garden beans.

The warm and fertile soil of the average home- or market-garden suits the requirements of the "garden" beans, as they are mostly grown for their tender and succulent pods and not for their seeds, or, as in the case of the lima and several others, for their seeds in an immature or half-developed state. The pods of all these garden beans should be picked promptly and clean in order to prolong the bearing period as much as possible. If the beans are allowed to ripen on the vines, the latter will soon give out. Only when these garden beans are grown for seed purposes is early and even ripening desirable, and in that case the pods, perhaps with the exception of the first setting if light, must all be left on. A good string bean has a thick, meaty pod which snaps off clean when broken, leaving no string along the back.



481. Large White Lima bean  
( $\times \frac{1}{2}$ )

Many varieties which answer this description are offered in the various seedsmen's lists, both green-podded and yellow-podded. *Early Valentine*, with its many strains (*Red*, *Black*, *Earliest Improved*, and so on), is still in favor with growers for a green-podded variety. A newer good one is *Stringless Green-Pod*. Quite numerous are the yellow-podded sorts. Among them are *Black Wax*,

Golden Wax, Davis Kidney Wax, Wardwell Wax, Hodson, and others.

#### *Pole beans.*

Pole or running varieties of beans require especially fertile soil; and for that kind of table beans, the lima of all forms, too much can hardly be done in the way of enriching the ground. Warm soil is one of the first essentials of success in growing pole beans. When poles are to be used for support, they should be set not less than 4 feet apart each way, before the beans are planted. Four or five beans are to be placed around each pole, 1 to 1½ inches deep. While it is a safe rule to put the seed eye downward, it is not a necessary condition of prompt and uniform germination. In case of absence or scarcity of poles, a serviceable, cheap and ornamental trellis may be constructed by setting posts firmly at proper distances along the row, connecting them with two wires, one a few inches and the other 5 or 6 feet from the ground, and finally winding cheap twine zig-zag fashion around the two wires. Cultivate and hoe frequently. A top-dressing of good fertilizer, or of old poultry- or sheep-manure, hoed in around the plants, may be of great help in keeping up the productiveness of the plants to the end of the season. To have a continuous supply during the entire season, the pods, when large enough, must be gathered frequently and clean. Among the varieties used both for string and shell beans, are the Green-podded Creaseback,



482. Yard-long Bean. A species of *Vigna*.

several wax varieties, Golden Cluster, and the popular Horticultural or Speckled Cranberry bean, besides any number of others. A very fine bean is the Dutch Runner (Fig. 484), which approaches the lima in quality and resembles it in habit of growth. The seed is of the largest size and clear white in color. Highly ornamental is the closely related Scarlet Runner, with its abundance of showy scarlet blossoms. This latter bean is grown in Europe for eating, but is rarely used for that purpose here.

#### *Lima beans.*

Of all pole beans, the limas have undoubtedly the greatest economic value. They enjoy a deserved popularity, and are usually grown with profit by the market-gardener. The varieties might be classed in three types,—that of the Large Lima, the Dreer Lima, and the Small Lima or Sieva. Each of them has a number of sub-varieties or strains, and appears in both pole and bush form. The old Large Lima (Fig. 481) is a very large, flat bean, and yet largely grown for main crop. To the same type belong Extra-Early Jersey, King-of-the-Garden, and others. The pods of these are very large, and the beans in them somewhat flattened.

There are dwarf forms of both sieva and the regular lima. The Burpee Bush Lima is a form of the large lima type. The Dreer Lima of both forms is appreciated especially for its high quality. The seeds are more roundish and crowded close together in the pods, the latter being much smaller than those of the Large Lima. The seeds of these two types are light-colored, with a

greenish tinge, but the Large Lima is also represented by red and speckled (red-and-white) sports. The Small Lima or Sieva, with its dwarf form, Henderson Bush Lima, seems to be hardier and earlier than the two larger types, but pod and bean are quite small. The color of this bean is nearly clear white, but there is also a speckled sub-variety of it. Wherever there is a place for the Sieva, its bush form will be appreciated. The bush forms of the two larger types, however, are not uniformly productive enough to take the place of the pole forms entirely. The latter will often be preferable when a season of continuous bearing is desired.

Lima beans require a long season, and therefore are not much grown along the northern borders and in Canada. They must be given warm and "quick" soil and kept constantly growing.

#### *Other beans.*

Three other members of the bean tribe might be mentioned in this connection; namely, the Black bean or cowpea of the South, the Japanese Soy bean, and the English or Broad bean. The cowpea takes, in some measure, the same place in the southern states that red clover takes at the North, being used both as stock food and as a green-manure crop. There are many varieties of it, early and late, some of strictly bush habit and some producing long runners. See *Cowpea*. Of greater value for the same purposes, north of New Jersey, seems to be the Japanese Soy bean, which is early enough to come to maturity almost anywhere in the United States. Its foliage is rather thin or open, however, which impairs its value for green-manuring. The dry bean constitutes one of the richest vegetable foods known, and its flavor seems unobjectionable to all kinds of stock. Sow one bushel to the acre. Similar to this in value is the English Broad bean, several varieties of which, as the Broad Windsor, the Horse bean, and others, are grown and are popular in England and in some parts of the European continent. In most parts of the United States they are scarcely known, and in none generally cultivated. Only a few of our seedsmen list them in their otherwise complete catalogues. Yet they are a decidedly interesting group of plants, and worthy of greater attention in the cooler parts of the country. Being about as hardy as peas, they may be planted much earlier than would be safe for ordinary beans. The Windsor is used in England in much the same way as lima beans are used in America; but the latter are so much better that in the United States there is no need of planting the former as a table vegetable. The varieties with smallish seeds are sometimes grown and used in parts of Europe for feeding pigeons and chickens, and under certain conditions might have some value here for the same purpose on account of the high protein content.

#### *Insects and diseases.*

The foliage of the various beans is rarely attacked by insects. A somewhat serious pest, however, which attacks the seeds both in the pod and dry, after being shelled, is the bean-weevil, a smaller brother of the pea-weevil, and having nearly the same general habits of development. If only beans free from live weevils are used for seed in a given locality, the product will be free from them also. For that reason, all beans to be used for seed, or for food, if suspected of being weevil-infested, should be subjected to the carbon-bisulfid treatment in the fall. It is simple, but care should be taken to keep the highly inflammable drug away from an open fire or light. Place the beans in a tight receptacle. Pour a quantity (half pint to barrel) of the bisulfid into a saucer or other flat dish, which place on top of the beans, and cover the receptacle tightly, leaving it thus for twenty-four hours or more.

Difficult to control is the bean blight, a disease which frequently affects field, garden and lima beans. Seed





XIII. Bean.—The Bush Lima.





from an affected field should not be used, nor should beans be planted again on a field for several years after having been affected. For bean anthracnose, also called bean rust (erroneously) and pod-spot, which is easily recognized by the dark or brownish spots on the pods and occurs both on field and garden beans, there is one sure preventive. Plant clean seed and grow a practically clean crop. It is advisable for the grower to select his own seed beans, carefully rejecting every pod that shows the least sign of the disease. The true bean rust is not so often met with, therefore not so serious.

T. GREINER.

#### Lima beans in California.

Lima beans are grown in California very extensively as a field crop, supplying the markets of the country with the bulk of the dry shelled product. The figures for the lima bean crop of 1910 in California are as follows:

	Sacks
Ventura County.....	800,000
Orange County.....	150,000
Santa Barbara County.....	75,000
Los Angeles County.....	75,000
San Diego County.....	60,000
Total.....	1,160,000

The above represents a total of about 82,850 acres devoted to this crop.

Lima beans delight in warm, summer weather, but if the relative humidity is low, they suffer in consequence. Along the California coast, which is the heaviest producing section, the fogs are remarkably constant in the night and early morning, and when for a week or ten days these fogs are lacking, the bean crop suffers markedly. The small pods that are just forming dry up and fall off without making seed. The heavy fogs which roll in may add a little moisture to the surface soil for a time, but not enough to reach the roots and aid the plants directly. The great benefit of the fog is in lessening evaporation and tempering the atmosphere, less water passing from the plant into moist atmosphere than would pass into dry atmosphere.

The profitable production of lima beans is limited to some extent by soil, though not so much as by climate. They are grown on soil ranging all the way from sandy to adobe. The lima bean plant does not grow well on an acid soil; neither does it thrive on an alkali soil. California soils, being mostly arid or semi-arid, are not

badly leached, and therefore lime is usually abundant, insuring freedom from acidity. But the same aridity and consequent lack of leaching is responsible for the accumulation in some lands of considerable amounts of alkali salts, enough to limit the area and the production in the counties where the bulk of the limas is grown. The amount of alkali which this bean can endure and still produce paying crops has not been definitely determined, but it is not high. However, experience has shown that the lima

will bear more alkali than the Blackeye, Lady Washington, or other beans of the common kidney type.

The difference in time of maturity is very great between sandy and clayey soils, and still greater between dry and moist soils. A difference of a week may be observed in the same field, due to physical variations in the soil, and much more than this difference in time has been frequently observed within the distance of a few miles. It seems that the water-supply of the soil more than the texture is responsible for this difference in time of ripening, as irrigation on light soils causes the same lateness in maturity. Thus, a tendency is found toward the perennial habit which the plant maintains under the humid conditions of the tropics.

Soils with much nitrogen tend to produce late maturity; hence the limas ripen later on land which has been recently manured. On the other hand, the mineral elements tend toward early maturity. Limas require a richer soil than do the white kidney beans; the pole varieties require a richer soil than the bush varieties.

The standard preparation of land for a bean crop is practised. Growers have learned by experience that good preparation pays; in fact, very much more cultivation is given the soil before seeding than after.

Planting is from May 1 to May 25, at the rate of forty-five to sixty-five pounds per acre, according to the moisture condition and fertility of the soil. The beans are planted in rows 30 to 36 inches apart, 8 to 12 inches apart in the row, a single seed being dropped in a place. On the heavier and more moist soils, where the growth of vines is rank, the wider distances are given between rows. Two inches in the moist soil is considered the best depth of planting.

The beans are tilled while young, one, two or three times, the average number of cultivations being two or a little more. The fields are ordinarily kept free from weeds from the time of working in the winter till the vines cover the ground. Cultivation must cease when the vines get large, as, not being provided with supports, they spread across the row and would be badly injured by the passage of the cultivator. After the vines have made such a growth as practically to cover the ground, the mulch is not so much needed to prevent evaporation.

#### Irrigation in California.

As there is normally no rain on the bean crop in California from planting till harvest, the ground, of course, becomes very dry. Hence irrigation has been found profitable, the production in many fields being doubled by the use of water. The most common method of irrigation is by the row system. Furrows are made between all the rows with an implement carrying four broad shovels, furrowing between four rows at a time. Water is run in these furrows for the desired time, after which the land is leveled by a shallow cultivation. This prevents excessive evaporation which would take place if the furrows were allowed to bake in the sun. Usually only one irrigation is given, and that about July 1st, just before cultivation ceases. Two and



484. *Phaseolus multiflorus*.  
( $\times \frac{1}{2}$ )



483. Soy bean.—*Glycine hispida*. ( $\times \frac{1}{4}$ )

one half to 3 acre-inches per acre are applied at this time.

#### *Harvesting, and caring for the product.*

In the sections of light and unirrigated land, the beans ripen from August 20 to September 10. In the irrigated parts and on heavier land, they ripen from September 10 to September 25 or October 1. These dates indicate the time the beans are harvested. Before the earliest date for each section there will be some dry pods in all the fields and at the latest date of harvest there are always green pods.

The beans are harvested by a seed-cutter with two runners 12 to 15 inches high. On the inner side of each a knife is set diagonally backward and toward the middle of the sled. A few inches above each knife is a bar of iron or wood set in a similar position. The sled-runners are such a distance apart that two rows of beans will pass between them. Hence each knife is drawn along the line of the row cutting the plants just below the surface of the ground. The diagonal position of the knife causes it to cut the plants clean without pulling up by the roots, and together with the diagonal bar above, pushes both rows to the middle, leaving them together in a windrow. These cutters are often mounted on wheels to bear the main weight of the sled and driver, the runner cutting into the ground just enough to hold it firmly to the row. Levers are provided to raise and lower the frame of the sled. A man with two or three horses, usually three, cuts from 8 to 12½ acres a day.

The vines, after lying in windrows for a few hours, as left by the cutter, are piled by hand with pitchforks. Three windrows are commonly placed together in one row of piles. Piles are 4 or 5 feet in diameter on the ground and 3 feet high. They remain in these piles till very dry, which is a length of time varying with the weather and the maturity of the beans, but usually from two to three weeks. A man is expected to pile about 5 acres a day, but frequently does not pile more than 2 or 3 acres. It requires from two to three men to handle the beans cut with one sled.

Threshing is done by itinerant machines, using for power either steam or gasoline engines. The machines thresh from 1,000 to 2,500 sacks per day, 1,500 being a fair day's work. In a few instances about 3,000 sacks have been threshed in a day. The charge is usually 25 cents a hundred pounds, equal to 20 cents a sack. The beans are stored in large warehouses until marketed, and are generally recleaned by a mechanical recleaner which is very satisfactory.

#### *Yield and value of crop.*

The average yield is about fourteen sacks, eighty pounds per sack, or about 1,120 pounds per acre. Some fields produce nearly three times this amount, but in

the best section an average of twenty-five sacks or 2,000 pounds per acre is considered to be satisfactory.

Another factor which is of importance, and which has only recently come to be appreciated, is the value of the bean straw as rough feed. It is generally regarded that the straw is worth about \$1 per ton in the field, loose.

GEORGE W. SHAW.

#### **Tepary beans.**

The tepary is a small white bean native to the southwestern region of the United States (*Phaseolus acutifolius* var. *latifolius*), long grown by the Indians and now receiving attention from general cultivators. The first full account is in Bulletin 68, Arizona Experiment Station (1912).

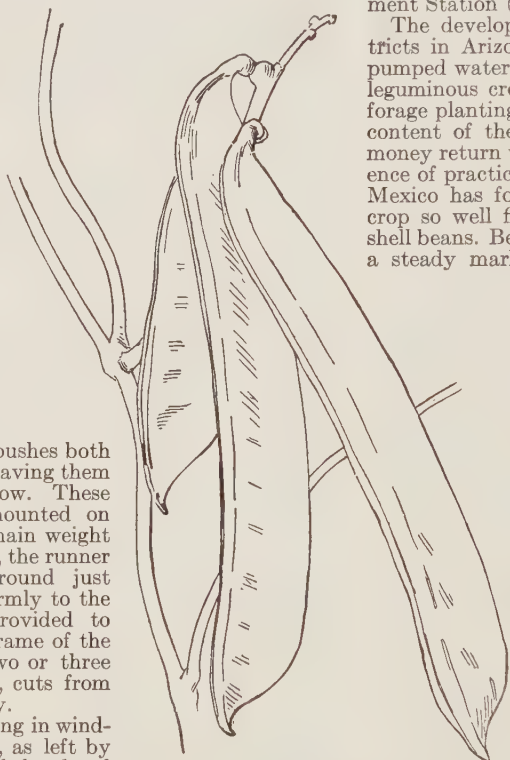
The development of artesian and dry-farming districts in Arizona, together with the increased use of pumped water for irrigation, have created a need for a leguminous crop which, used in rotation with grain or forage planting, will maintain the nitrogen and humous content of the soil and at the same time provide a money return which is sure and profitable. The experience of practical farmers throughout Arizona and New Mexico has for years demonstrated the fact that no crop so well fills this demand as the growing of dry shell beans. Being a countrywide food staple, they have a steady market which is little influenced by local

conditions other than transportation charges. As corn in Illinois, cotton in Texas or wheat in Kansas represent to their producers products of staple value, so may the dry-farmers of the Southwest, and those irrigating with artesian and pumped waters, look to the bean as a money-crop which at all times may be surely and readily turned into cash.

Varieties of beans originated in the humid sections of the East are of but little value when grown in Arizona. They do not withstand satisfactorily the extreme aridity and heat of the air during the summer months. Out of a large number of varieties tested at Yuma, only those of southwestern origin were at all successful.

Among these southwestern varieties of beans, first tested at Yuma in 1909, certain ones were noted which gave yields far in excess of all others, including even the much-prized pink bean, or frijole. Subsequent investigations developed the fact that this group of

varieties (known as teparies) was distinct from either the common kidney or snap bean. They were found to constitute a new species, hitherto unrecognized as a cultivated plant in botanical or horticultural literature. It has been described by the writer as a new variety of *Phaseolus acutifolius*. In its wild state, *Phaseolus acutifolius* is peculiar to the southwestern desert region. It may be found on the mountain-sides and in narrow valleys from the Pecos river westward across New Mexico and Arizona and southward into the adjoining states of Mexico. Domesticated from the neighboring cañons and cultivated in small patches, attended at best by a crude husbandry and dependent upon the precarious summer rains and uncertain floods from the mountain washes for irrigation, the tepary has lost none of its native hardiness. It has been cultivated by the Papago and Pima Indians from prehistoric times and in all probability formed one of the principal food-crops of that ancient and unknown agricultural race, the ruins of whose cities and irrigating canals are now the only witnesses of their former presence and prosperity.



485. The Chickasaw Lima, or Jack bean.—*Canavalia ensiformis*. ( $\times \frac{1}{2}$ )



While growing, the tepary may easily be distinguished from the common garden bean by its more slender vines and smaller leaves. The leaves are also thinner, smoother, narrower and more pointed at the apex than those of the bean. The pods are smaller than those of the bean, averaging about 3 inches long and  $\frac{3}{8}$  inch wide. Being somewhat flattened and having thin, rather tough walls, the pods might resemble rather closely a small variety of the lima. Teparies, however, differ markedly from either the bean or the lima in the length of the stems bearing the first pair of aerial leaves. For teparies these measure only about  $\frac{1}{8}$  inch, whereas for beans and limas they will average an inch or more. The seeds of the tepary are smaller than those of the other sorts mentioned and there are a number of minor differences which suffice to give them a distinctive appearance at least to those who are familiar with the group. The seeds of the white variety are very similar to those of the navy bean, with which they would in all probability be classed on the general market. A convenient test for shelled tepary beans is to immerse them in water. They will wrinkle in five to ten minutes; while other cultivated species commonly require forty-five minutes to one hour.

#### *The tepary as a food.*

There is considerable difference of opinion as to the relative palatability of beans and teparies. Among the Indians and Mexicans, the commercial pink bean is preferred to the tepary, as they say it has a better flavor. These people, however, make the same difference between the pink bean and the white navy which is shipped in from the East. Teparies should be soaked twelve hours before cooking, during which time they swell to at least twice their original volume and more than double in weight. In this respect they markedly surpass other beans. Well-cooked teparies are light and mealy and have a rich bean-like aroma. Boiled and baked with bacon or mashed and added to soups, they form most acceptable dishes. To such as are fond of the



486. Typical Snap, or String beans. (X  $\frac{1}{2}$ )

onion, a small amount of this vegetable finely chopped and stirred in during boiling makes a pleasing addition.

#### *Yields and culture.*

The superiority of the tepary over other beans for planting in the Southwest is exhibited in its greater productivity when grown under similar conditions. This statement is not only true in irrigated sections, but even more marked in regions devoted to dry-farming. In nine experiments in Arizona covering almost every condition of soil, culture and water-supply, and extending over three years, the average yield of the teparies has been slightly more than four times the average for varieties of the kidney bean. These greater yields are due to the ability of the tepary to germinate quickly in the presence of a low moisture-content of the soil, with the resulting better stands on dry lands. The tepary is also able to withstand protracted seasons of drought without permanent injury, returning to full vigor immediately when the rains come. Other beans do not possess this ability to a marked degree. The tepary is also inured to the greatest extremes of summer temperatures and will bloom and set seed any month from May to November. On the other hand, when the blooming period of common beans happens to

fall within a season of extreme heat, the buds will for the most part drop without setting pods. For these reasons the tepary is a more sure and dependable crop, often giving fair returns when beans are a total failure. With an ample supply of water, good soil and other conditions favorable, teparies should yield 700 to 1,200 pounds per acre. However, 1,500 pounds per acre have been reported from the Colorado Valley near Yuma. Under dry-farm conditions, yields of 450 to 700 pounds have been reported. On irrigated lands, teparies may be planted in southern Arizona any time from the early spring when danger of frost is past until August 10. The best crops however, are secured by early planting, March 20 to April 1, or by midsummer planting, July 12 to 25. In dry-farming, they are planted any time from the 10th to the 15th or 20th of July.



487. Bedding.—*Arundinaria Veitchii*.

GEO. F. FREEMAN.

**BEARBERRY:** *Arctostaphylos*.

**BEAR'S BREECH:** *Acanthus*.

**BEAUCÁRNEA:** *Nolina*.

**BEAUFÒRTIA** (Duchess of Beaufort, patron of botany). *Myrtaceæ*. Greenhouse red-flowered shrubs, blooming in spring.

Stiff, more or less heath-like shrubs: lvs. commonly opposite, small and rigid, often only 1-nerved: fls. in heads or short spikes, sessile; calyx 5-lobed; petals 5, spreading; stamens many, longer than the petals, in bundles opposite each of the petals; ovary 3-celled: fr. a loculicidal caps. borne in the hardened calyx-tube.—Twelve or 13 species in W. Austral. Requires the treatment of coolhouse Australian things, with peaty soil. Prop. by maturing shoots under glass.

**purpùrea**, Lindl. Small free-flowering shrub, with virgate branches: lvs. ovate-lanceolate or narrower, becoming linear on the small branches: fls. small, purplish red, the petals shorter than the erect subulate calyx-lobes.

L. H. B.

**BEAUMÓNTIA** (after Mrs. Beaumont, of Bretton Hall, Yorkshire, England). *Apocynaceæ*. Hothouse white-flowered twiner.

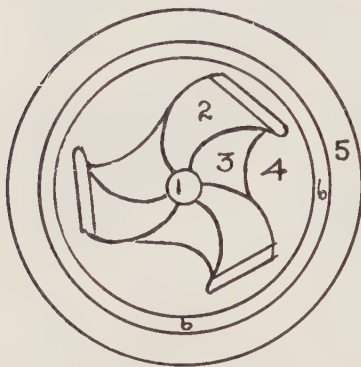
Corolla funnellform, short-tubed, without scales in the throat, with 5 broad lobes; stamens 5, included, attached to corolla; disk 5-lobed or of 5 scales. The genus is more nearly allied to the familiar greenhouse shrub *Trachelospermum jasminoides* than to the splendid tropical climbers in *Allamanda* and *Dipladenia*.—Four or 5 Indian or Javanese trees or tall climbers, with very large, white, fragrant, bell-shaped fls. in terminal cymes.

*B. grandiflora* has been neglected of late, presumably because it needs so much room. It should be planted out in strong, fibrous, loamy soil of a warm-house, as it rarely succeeds in pots. It is best trained to the roof, as full light is necessary for flowering, if not for growth. The shoots may be thinned if the large leaves cast too much shade on the plants beneath. The wood should be well ripened to produce an abundance of winter bloom. The flowers are produced on the



488. Bedding.—*Bambusa palmata*.

growth of the previous season. After flowering, the plant should be severely pruned to produce lateral shoots for the next season's bloom. In its native country, this vine climbs over very tall trees.



489. Oriental pattern.

1. White geranium. 2. *Calendula officinalis*, "Orange King." 3. *Coleus*, green. 4. *Verbena hybrida* Purple Mammoth, or Lemoine's heliotrope. 5. *Alyssum variegatum*. 6. Outline of black-red *coleus* bounding all parts.

shrub with white, fragrant, shallow bell-shaped fls. Cochin China. G.C. III. 49:306.—*B. Jerdoniána*, Wight. Similar to the above but with smaller parts, and with foliicles 10 in. long. Cult. only in rare collections. Wight Ic., pl. 1314.

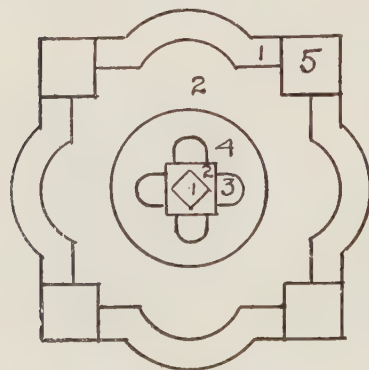
*grandiflora*, Wall. A tall-growing, woody vine: lvs. obovate, cuspidate, wavy margined: sepals 5, large, ovate, wavy, pink-tipped; corolla-tube veined with green, the limb 5-cleft. B. M. 3213. Gn. 45, p. 138; 49, p. 314. J.H. III. 28:243. Var. *supérba*, having larger whiter fls. than the type, is known.

*B. fragrans*, Pierre. Evergreen. N. TAYLOR.†

**BEDDING, or BEDDING-OUT.** The temporary use out-of-doors of plants that are massed for showy and striking effects. There are four main types: spring, summer, subtropical and carpet-bedding.

#### Spring bedding.

The most temporary of all forms of bedding is that designed only for spring effects. It is usually followed by summer bedding in the same area. It is the only kind that largely employs hardy plants, as crocuses, narcissi, daffodils, tulips, hyacinths, and other Dutch bulbs. All four types of bedding are commonly seen in public parks, but spring bedding is the most appropriate for amateur and home use, as the bulbs flower at a dreary time of the year, when their brave colors are most cheering, and also because they are much more familiar than the subtropical and foliage plants of summer. Moreover, hardy bulbs are more easily cultivated than any other class of plants, and they are cheap. The main principle is to plant them early enough to



490. French pattern.

1. *Calendula officinalis*, "Sulphur Queen." 2. *Ageratum nanum*, "Blue Perfection." 3. White geranium. 4. Scarlet geranium. 5. Pink geranium. Palm at center for accent. Whole design outlined with green *alternanthera*.

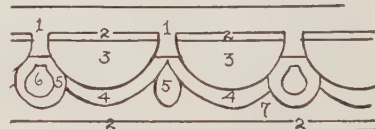
ding is the naturalizing of bulbs in the lawn. Crocuses and squills are particularly charming when they appear singly, or in twos or threes, at unexpected places in the lawn. Daffodils are frequently naturalized in large masses in spots where the grass is not mowed.

Pansies are the only other plants that are used extensively for spring bedding. English double daisies and catchflies are largely used for edgings. Pansies are set out between April 1 and 15. In large operations, pansy seed is sown in August of the preceding year, and the young plants are transplanted once and wintered in a coldframe. After flowering, the plants are thrown away. The other method is to sow the seed in a greenhouse in January. The August-sown pansies give larger and earlier blooms, but the January-sown pansies will last longer, and in partially shaded places will give scattering bloom all summer, especially if protected from drought.

#### Summer bedding.

Bedding for summer effects often follows spring bedding in the same space of ground, and employs chiefly geraniums, coleus, begonias, ageratum, salvia, vinca, alyssum, petunia, verbenas, heliotrope, grasses, cacti, and aquatic plants, the culture and varieties of which may be sought elsewhere in this work. As to tenderness, these fall into two groups, the first of which may be set out about May 15 in New York, and the second about June 1. Geraniums are the most important of the first group, and coleus is an example of the tenderest material, which is set out simultaneously with subtropical plants when all danger of frost is past.

As to fondness for sunlight, there are again two groups, but the only bedding plants of importance that



491. French border pattern.

1. *Marguerite*, "Queen Alexandra." 2. *Coleus*, "Golden Bedder." 3. Scarlet geranium. 4. *Cineraria maritima*. 5. *Calendula officinalis*, "Sulphur Queen." 6. *Ageratum nanum*, "Blue Perfection." 7. White geranium.

prefer shade are tuberous begonias and fuchsias. The popularity lately achieved by tuberous begonias in Europe will probably never be duplicated in America. The secret of their culture is shade, shelter, and moisture at the roots. Therefore, a clay bottom is desirable for a bed of tuberous begonias, as being more retentive of moisture than a sandy or porous soil. They enjoy cool air and as much indirect light as possible, but not the direct rays of the sun. The north side of a building is better for them than a station under trees, as the trees usually give too dense a shade, and their roots interfere. On the other hand, coleus is more highly colored in full sunlight than in shade.

The only fibrous-rooted begonias largely used for bedding are varieties of the semperflorens type, of which *Vernon* and *Erfordii* are popular varieties at present. In the manipulation of tender perennials, there are often two methods of propagation, either of which may be better, according to the ideal in view. As a matter of general tendency, propagation by cuttings gives bloom that is earlier but not so continuous or profuse as by seeds. Salvias and verbenas are pronounced examples. On the contrary, cuttings must be depended on, as a rule, to keep the choicest varieties true to type, as a function of seeds in nature seems to be to produce more variation than can be attained by non-sexual methods of propagation, as by bulbs or cuttings. Salvias are also an example of plants that are particularly effective when seen at a great distance, and also of plants that are generally massed for unity of effect, and not mixed with others. Verbenas are commonly grown by them-

to secure a strong root development. Therefore, they should be ordered early, and planted in the latter part of October or first of November. The colors may be massed or mixed according to taste, the terms massed and mixed bedding referring to unity or variety of effect, and being applicable in each of the four main types mentioned above.

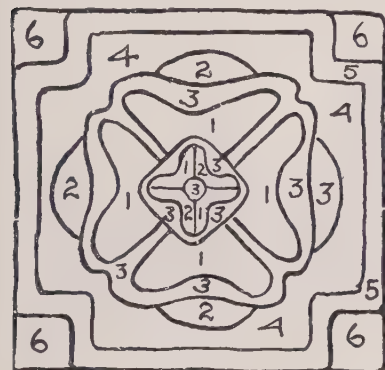
Opposed to this style of bed-



selves, but this is because they demand much room by reason of their trailing habit.

#### Subtropical bedding.

Summer bedding for subtropical effects employs chiefly cannas, musas, castor-oil plants, crotons, palms, ferns of coarser habit, screw-pines, dracenas, araucarias, elephant-ear caladiums, and, to a lesser extent, abutilon, acalypha, achyranthes, anthericum, *Carica Papaya*, sanchezia, and others. Cannas are by far the most popular at the present time, especially for mass-work. Sometimes the tall, purple-leaved old-fashioned, small-flowered types are used in the center or at the back of the bed, and the dwarf, modern, large-flowered types around the edges or in front. Frequently, massing with a single variety of canna is practised. Next to cannas in popularity probably come the crotons or codieums, — the broad-leaved types, as Queen Victoria, being better for this purpose than the narrower-leaved or simply curious kinds, as *Codiaeum interruptum* and *C. volutum*, which belong to fanciers' collections. For carpeting the ground in a croton bed, two variegated trailers can be used with good effect, the wandering Jew or tradescantia and *Oplismenus Burmannii*, which is familiar to gardeners as *Panicum variegatum*. The large leaves of bananas give a very rich tropical effect, especially if



492. Tudor rose pattern.

1. Scarlet begonia. 2. Lobelia erinus, white. 3. Echeveria secunda glauca. 4. Scarlet geranium. 5. Cineraria maritima. 6. Alternanthera paronychioides.

their marvelous growth from seed in a single season makes it one of the very best of all plants for rapidly filling up large areas temporarily. Grasses furnish an exception to the general rule that bedding plants are tender. There are some kinds of bamboos that are more or less hardy in the northern states, and these are bound to increase in popularity. Figs. 487, 488. A favorite combination of grasses for bedding is *Arundo Donax*, the giant reed, surrounded by eulalias. Grasses and their kind are particularly effective in aquatic groups.

No well-kept large establishment is complete without a pond or body of water in which aquatic plants are naturalized. For a more extended account of this attractive subject, see the article *Aquatics*.

There is a large class of tender material—as palms, screw-pines, the coarser ferns, dracenas, araucarias—a class of foliage plants that really does better outdoors during summer in a shady and sheltered position than indoors all the year round. In the more formal styles of ornamental gardening, such plants often form the nucleus of a subtropical bed, the large tubs of the palms being hidden by lower-growing plants, as begonias, or whatever may be left over from the spring operations. In less formal gardening, the tubs may be hidden by plunging them half-way into the ground and grading the sod, which has been previously broken, in such a manner as to conceal the tubs entirely. The

plants are arranged in a freer and more natural manner, and the outer fringe of begonias and the like may be dispensed with. The chief dangers to such plants are from the sun and wind. Palms once scorched or wind-whipped are ruined. Hence, a sheltered position on the north side of a building, or under the shade of trees, is usually the best spot for their summer vacation.

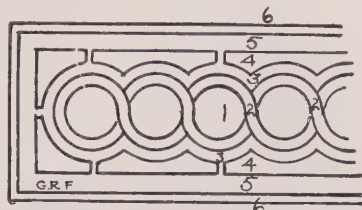
#### Carpet-bedding.

What is known as carpet- or design-bedding is the most formal and most expensive of all kinds of bedding, and employs plants that stand pinching and shearing, as coleus, achyranthes, alternanthera, lobelia, one of the dusty millers (*Centaurea gymnocarpa*,—*C. candidissima* will not bear the shears), and certain succulents of the hen-and-chickens type (as echeverias), and many others. The plants are started indoors, mostly by cuttings, and from very carefully selected stock. The terms "geometrical bedding" and "fancy bedding" are somewhat synonymous. Here belong the imitations of buildings and animals, the portraits of men, the lettered greetings to conventions, the calendars, floral clocks, and similar ingenuities.

The designs of carpet-beds are very numerous, but there are certain recognized standards. The diagrams (Figs. 489 to 494) give forms and planting material for a half-dozen unlike and regulated patterns, with harmonious color combinations. Forms of pattern-beds on the lawn are shown in Figs. 495, 496. A proper setting for pattern beds is indicated in Fig. 497. For designs and for extended cultural information, the reader is referred to the numerous German books on the subject, to Mottet's *La Mosaiculture*, and to a book published by Geo. A. Solly & Son, Springfield, Mass. This style of bedding requires the highest degree of technical skill, and is especially enjoyed by the Germans, whose gardeners excel in it.

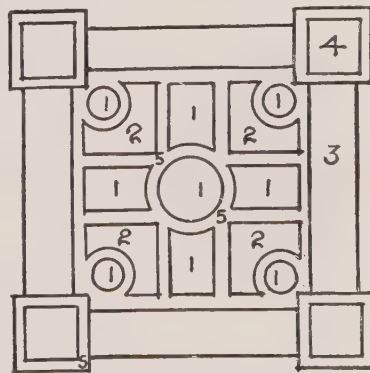
The position of a bed is far more important than the style of bedding or the kinds of plants that are used. The natural school of landscape gardening, as opposed to the various schools of ornamental gardening, makes no objection to beds

in themselves, but dislikes their usual position. They are commonly given the most conspicuous places, where they must be seen, whether people like them or not. They should be in a place by themselves where they do not interfere with the quieter and larger pictures of the whole place. Sunken areas, as in Fairmount Park, Philadel-



493. Eighteenth century English border pattern.

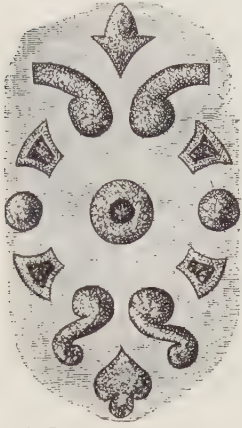
1. Lobelia erinus, blue. 2. Begonia, "Fairy Queen." 3. Cineraria maritima. 4. Calendula officinalis, "Sulphur Queen." 5. Lobelia erinus, white. 6. Alternanthera paronychioides. Alternative: Use pansies alone.



494. An Italian pattern.

1. Calendula officinalis, "Orange King." 2. Ageratum nanum, "Blue Perfection." 3. White geranium. 4. Scarlet geranium. 5. Alternanthera paronychioides as an outline separating parts of the design.

phia, are particularly commendable; a flower-bed should not be in the middle of a large lawn, because it distracts the attention from the larger picture, and because the lawn is the canvas upon which the landscape gardener makes his picture. The chief merit of beds is their attractiveness and brightness, which accounts for their presence in parks and public places. On the other hand, they are expensive, and they are at their best only two or three months in the year, while a mud-hole in a lawn for nine months of the year is an unsightly object. Formal beds, especially of foliage plants, with their gaudy colors and unchanging monotony, are considered by some the most unnatural and the least artistic style of gardening. Nevertheless, they require a high degree of technical skill, which deserves appreciation.



495. Lawn bedding pattern.

#### General instructions.

A few practical suggestions may be given for making any bed. The soil should be rich and full of vegetable matter. If a foot or 18 inches of the surface soil is so poor that it must be removed, it may be replaced by two parts of fibrous loam and one of well-rotted manure, with some upturned broken sods in the bottom for drainage. The fall is the proper time to apply manure, and if the bed be thoroughly spaded over and left rough during the winter, the alternate freezing and thawing will fine both the soil and the fiber of the manure. Beginners nearly always fail to supply perfect conditions for watering. A midsummer mulch of half-rotted manure enables the plants to take all the moisture they need during the drought and to keep it. The soil should be in ideal condition before the plants are set into it,—mellow, rich, full of fiber, and of firm and uniform texture. Begin in the middle and work toward the edges. When the bed is finished, give it one thorough soaking, to settle the soil at the roots.

**BEECH:** *Fagus*.

ROBERT SHORE.

**BEES IN HORTICULTURE.** Bees pollinate the greatest number of flowers of any insects. To them, therefore, horticulturists are indebted for a service that is inestimable, but it is usually disregarded. The progressive horticulturist, however, today is awake to the situation and ready to utilize the honey-bee in an effort better to meet competition.



496. Lawn bedding pattern.

the stigma, which latter is the female organ. Many flowers, for satisfactory fertilization, require a foreign pollen, and it is through the agency of bees that this is usually supplied. The intricacies of the mechanisms and the means of pollination have been described by a host of writers, including Darwin and Müller.

There are two kinds of bees, solitary and colonial (social). Solitary bees live isolated and singly, seldom

becoming numerous. Among the colonial bees are the bumblebee and honey-bee. While the honey-bee may be classed as wild when colonies escape from apiaries, wild bees may be considered to include all bees other than the honey-bee.

While wild bees are sometimes numerous and may be observed at work on the apple, raspberry and many other flowers, the honey-bee, in most localities, probably outnumbers them. If it were possible to calculate the value derived from pollination by the honey-bee alone, these returns would without doubt far exceed the total income of beekeepers through their honey and wax. In the bee, therefore, there is a source of double income.

Among the cultivated plants in northern latitudes that are pollinated by honey-bees, are the apple, pear, plum, quince, peach, raspberry, blackberry and strawberry (to some extent), mulberry, pea, bean, currant, grape, squash, melon, cucumber and the cranberry. The value of the honey-bee in the cultivation of the cranberry was but recently recognized and is mentioned on next page.

While growers of fruits and vegetables have usually recognized that bees play an important part in their croppage, they have largely depended on the wild bees or bees in neighboring apiaries for service. There is,



497. Pattern beds in a formal setting.

however, some risk in this, because the seasons vary and the prevalence of insect- and bee-life varies from year to year.

It is well known that the prevalence of all wild life, plant or animal, is subject to fluctuations due to favorable and unfavorable environmental conditions. Some years in a locality there is a pest of mosquitos or house-flies. In succeeding years they may be few. It is so with the game birds and the fish of the sea; they are plenty or scarce from time to time. Bees also have their periods of ups and downs. When favored, they rise to the crest of prosperity and prevalence. It may be that disease enters a locality and reduces their numbers. Hard winters may also depreciate them so that in a year when they are needed for their service as pollen-bearers, they are at a low ebb. Fig. 498 illustrates the hypothetical curve of this fluctuation.

When the horticulturist realizes that he is depending on this fluctuating service of wild bees, he asks what he can do to overcome the unreliability and assure himself of a maximum crop or a more even crop. The recommendation would be to establish an apiary in proportion to the size of the orchard or garden. This eliminates any dependency upon wild bees or honey-bees from neighboring apiaries. Yet their additional service will do no harm. It is far better to over-supply an orchard with bees during the blooming period than to have a scarcity. Furthermore, the cost of the small apiary is infinitesimal as compared with the possible benefits and returns.



It should also be remembered that during fruit-bloom particularly, weather conditions often prohibit free flight of bees. Hence they should be near at hand to perform their service. Numerous observations are on record in which orchards were successfully fertilized when the bees had less than a quarter of a mile to fly, while more distant orchards bore no crops. Thus the apiary in or adjacent to an orchard will safeguard failure.

A specific instance of the importance of bees to the practical orchardist, is shown in an observation on two orchards of about equal acreage in a western "pocket" in the foothills of an admirable fruit land, well drained and protected from frost. One grower secured large crops, while his neighbor secured none, although his fruit trees were of the same age and blossomed heavily each spring. The owner, in despair of financial ruin, called for assistance upon the State Experiment Station. A specialist, who was a pomologist and entomologist, investigated the two entirely comparable orchards, but was about to return without solving the problem when the question of bees arose. Upon inquiry it was asserted that no bees had been maintained for either orchard. Going over the ground more carefully, however, the specialist found in a neglected corner of the fruiting orchard, a fallen log partially sunken in the damp land. This sheltered a very large colony of bees; to it is attributed the success of the orchard. The following season bees were provided in the orchard which had previously failed, with the result that the owner netted \$3,800 on his crop.

#### *Special services of bees.*

*Various fruits.*—The honey-bee has been known to work the strawberry although it does not always frequent it. There is, however, a particular affinity in the raspberry for bees. One of the sources of the finest honey is the wild raspberry. The blackberry is less frequently visited. Plums benefit materially.

*Cranberry.*—Recently investigations have shown the bees to be of prime importance in the setting of cranberries. In cranberry-growing in Massachusetts, owners are maintaining their own apiaries. It may be desirable to have one colony for every two acres. The growers of melons use colonies of bees on their plantations with most marked success. Similarly, cucumber-growers for pickling-houses and squash-growers regularly maintain bees. General market-gardeners also believe in the benefits derived.

*Apple and peach orchards.*—Apple and pear crops as well as peach and plum are, without doubt, more even, larger and more constant when bees are kept. In Vermont it has recently been noticed that the largest apple crops occur in the vicinity of the commercial apiaries. It is fast becoming the custom among commercial growers to maintain their own apiaries adjacent to or in their orchards. Some advocate a colony of bees for every fifty trees.

*In greenhouses.*—For the fertilization of vegetables and fruits in greenhouses, bees are of material service, having largely done away with the use of the camel's-hair brush, impossible for commercial growers. For example, in Massachusetts, one grower of greenhouse cucumbers uses upwards of eighty colonies a year. The total number used annually in the state by greenhouse cucumber-growers exceeds 2,000 colonies. It is believed by some that tomatoes in the greenhouse benefit to some extent by the service of bees.

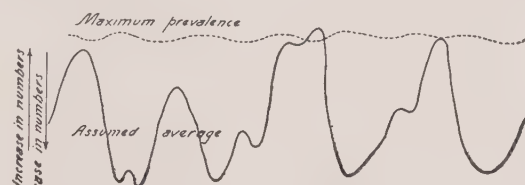
#### *The alleged injury to fruit by bees.*

Occasionally it is alleged that bees damage an orchard. It might be concluded when bees are seen upon peaches, grapes or pears, sucking at the flesh, that the bee is injurious. On the other hand if this act could have been traced, it would have been found that something other than a bee had first pierced the skin of the fruit. Investigation shows that wasps and birds do this,

or that a fungus may disintegrate the skin. In some such break in the skin the honey-bee can make a start; but to the satisfaction of all beekeepers and most orchardists, it has been proved by experiments and demonstrations that the honey-bee is physically incapable of puncturing a sound fruit. Thus, the injury by bees to fruit is a misconception; the news should be spread by successful orchardists.

#### *Securing of bees.*

Bees are available to horticulturists in several ways. A small number of colonies is sometimes hired for a period of a few weeks, during the blossoming period of the crop. Growers occasionally induce beekeepers to establish an apiary in their orchards by granting them privileges. Bee-keepers sometimes approach orchardists for the location of the apiary. The more thoughtful grower, however, considers it advisable to own his bees. These he maintains himself or hires kept by a practical apiarist. The practice is growing in favor, especially among moderate-sized orchardists or cranberry-growers, of hiring a practical apiarist to maintain the colonies on several adjacent farms. This coöperative plan insures a maximum efficiency of the colonies at a minimum cost and without burdening the horticulturist with additional detail. Those who use bees in



498. Hypothetical curve illustrating the fluctuation of wild-bee life, their periods of "ups" and "downs." Dotted line illustrates high efficiency secured by maintaining an apiary.

greenhouses will find it advantageous to maintain colonies rather than to purchase annually.

In buying bees it is particularly essential to secure disease-free stock. Bees are subject to at least two prevalent diseases, known as "American foul brood" and "European foul brood," to which they succumb rapidly. The inexperienced, therefore, should secure information and ascertain that the bees have been inspected for disease, when this is possible. Should disease set in, a considerable loss, both in bees and to the orchard, might result in a short time. Information concerning diseases can usually be had through the experiment stations or agricultural colleges as well as the United States Department of Agriculture.

#### *Manipulation of bees.*

There are numerous books and bulletins upon the manipulation of colonies. A few fundamental features are: Always keep the colonies strong; secure an amiable race so that the bees may be handled agreeably; keep the colonies in hives from which the combs may be removed; eliminate swarming; give adequate protection in winter; feed when necessary.

If the inexperienced grower is to manipulate his own bees, it is advised that he begin with a small number of colonies, say not more than five.

If the bee-moth becomes prevalent in the hive, it is a sign that something is radically wrong with the colony. An experienced apiary inspector always suspects the presence of disease when moths are found.

BURTON N. GATES.

**BEET.** A set of garden vegetables, grown for the fleshy roots and a few sorts for the thickened midribs; and some kinds in the ornamental garden for the highly colored foliage.

There are 4 or 5 species of the genus *Beta*, which are

sometimes cultivated under the name of beet, but *Beta vulgaris*, Linn., is the only one of practical importance. From it all our common garden varieties are derived. According to DeCandolle, the aboriginal slender-rooted species is found in sandy soil, and especially near the sea, throughout southern Europe, and on nearly all the coasts of the Mediterranean. It also occurs as far eastward as the Caspian Sea and Persia. "Everything shows

that its cultivation does not date from more than two or three centuries before the Christian era." It is now highly improved, principally in the one direction of large and succulent roots, and is much esteemed in all civilized countries. See *Beta*.

The beet grows at a low temperature and thrives best, therefore, in the cooler parts of the country. It is also an important winter crop at the South and an early spring crop at the North. The young plants will stand light frosts and after two weeks will stand fairly heavy frosts.



499. Bassano beet.

With the extension of glasshouse gardening, beets have come to be one of the important greenhouse crops. They are not usually made a main crop, however, but are grown between other crops, such as lettuce, beans, or even tomatoes. They are sown very thick and when the young plants begin to crowd, they are thinned out and the thinning sold for greens. As beets thrive best at relatively low temperatures, they may first be grown in a lettuce-house or other greenhouse having a temperature of 60° to 70°, rather than in a house piped for tomatoes or cucumbers.

The beet is grown exclusively from seed. Most table-beet seed for use in the United States is produced in Europe. It is possible, of course, for any gardener to grow his own seed, but in order to do this the roots must be taken up before the crown is exposed to severe frost, and carried through the winter in cool and moist but frost-proof storage, and planted in the garden the second year. Seed stems run up to the height of 4 feet. When the seeds are ripe the tops are cut and put in a warm storage house to dry. When fully dry the seed is winnowed out. Seed is usually sown where the crop is to grow, although the plants are easily transplanted. The transplanting is sometimes undertaken, especially when beets are to be grown as a catch-crop or intercrop in greenhouses.

#### Varieties and types.

Some of the most popular varietal types of the garden beet are: *Bassano* (Fig. 499).—Flesh white and light red mixed; an old-time early variety, now less grown than formerly. *Crosby*.—Slightly oblate, red flesh, excellent for general purposes, including forcing. *Early Blood Turnip*.—Rich, deep blood-red, flattened turnip-shape; an old and well-known sort. *Edmand*.—Moderate size; handsome, rounded, smooth, deep red; good grain and flavor; not quite first-early. *Eclipse*.—Uniformly globular, bright red; fine-grained and sweet; one of the best quick-growing early beets. *Egyptian Turnip*.—Tops quite small; roots fair size, rich, deep red; a standard early variety.

For field culture of culinary beets, the long-rooted varieties are chiefly used. These are sown in the field as soon as the weather is settled, in rows far enough apart to allow of tillage by horse. Most of them require the entire season in which to mature. They are grown mostly for storing for winter use. They were once grown for stock, but the mangel-wurzels give much greater yields. The various types of Long and Half-long Blood beet (Fig. 500) are chiefly used for field culture.

Favorite varieties of mangel-wurzels are Golden Tankard, Golden Yellow Mammoth, Mammoth Long

Red. Several sorts of sugar beets, mostly imported from Germany, are being grown in divers places in America. Of chard, there are few selected varieties offered in America.

The varieties of *Beta vulgaris* may be conveniently divided into five cultural sections, though the distinctions are somewhat arbitrary and of no fundamental importance. These sections are as follows:

1. GARDEN BEETS. Varieties with comparatively small tops; roots of medium size, smooth, regular and fine-grained; mostly red, but sometimes whitish or yellowish.

2. MANGEL-WURZELS, or MANGELS. Large, coarse-growing varieties, with large tops and often very large roots, the latter frequently rising some distance out of the ground; rather coarse-grained. Extensively grown for stock-feeding. See *Cyclo. Amer. Agric. Vol. II, p. 539* (Root Crops).

3. SUGAR-BEETS. Sometimes said to belong to another species, but doubtless to be classified here. Rather small-growing varieties, with medium tops; roots small to medium, usually fusiform, smooth, nearly always yellowish or whitish. See *Cyclo. Amer. Agric. Vol. II, p. 588*.

4. CHARD, or SWISS CHARD. Varieties with comparatively large tops, broad leaf-blades and very large, succulent leaf-stems, which are cooked and eaten somewhat like asparagus. The thrifty, tender young leaves make a very excellent pot-herb. Chard has sometimes been referred to a separate species, *Beta Cicla*, but should be included with *B. vulgaris*. See *Chard*.

5. FOLIAGE BEETS. A race which has been developed to produce luxuriant foliage of many colors and varied markings. Of such varieties are the Brazilian, Chilian, Victoria, and Dracena-leaved. The ribs of the leaves are usually beautifully colored. Where the leaf-blight fungus is not serious, these foliage beets make excellent borders when strong and heavy effects are desired, and they are excellent for bedding. Raised from seeds, as other beets are; roots may be kept over winter.

#### Cultivation.

Young beets constitute one of the most important early crops in truck-gardening. Many acres of them are grown near all the city markets, and as they bear transportation well, they are often grown at comparatively remote places. Large quantities are shipped early from



500. Half-long Blood beet.

Norfolk, Va., and from other southern points to northern markets. Like all root crops, the beet needs a loose, light, fresh, clean, rich soil, which must be in the best condition of tillage. No fermenting manure should be used, but instead fully rotted barn manure, with some good potash fertilizer. Light applications of nitrate of soda often produce marked beneficial effects. The seed for the first crop is sown early in spring, as soon as the soil can be well worked. When intensive garden-



ing is practised, the drills may be as close as 1 foot apart, in which case the young beets are thinned to 6 inches apart in the row. But in ordinary gardening, it will be found most convenient to run the rows 2 to 3 feet apart, allowing cultivation with the horse. The plants in such rows can be left 4 inches apart at thinning time. The thinning is done when the young plants are large enough to be pulled for "greens," for which purpose they find a ready market. Beets are also grown in quantities as a fall crop, and are stored for winter use. When this is to be done, the seed is sown in June, and the plantation is managed in all respects like the spring sowing. When the young roots are ready for the early market, they are pulled and tied in bunches of five or six. The fall crop is pulled soon after the first frost, the tops are removed, and the roots stored in pits or root cellars.

#### Marketing.

Greenhouse beets and early beets are usually bunched for market, three to six together, according to size. They are bunched together tightly with a string about the tops. All beets should be thoroughly washed before marketing. Considerable quantities of late beets and field-grown stock are sold in bulk, like potatoes. In this case the tops are cut off. Late-grown beets may be stored over winter in the same manner as potatoes. They are often buried in the fields in pits, but may be kept in a good cellar or storage house. The yield of mature beets varies from 200 to 500 bushels to an acre, 300 being an average yield.

#### Insects and diseases.

There are many species of insects that feed upon beets, but flea beetles are about the only ones of importance. These may be poisoned by spraying with paris green or arsenate of lead, and they are driven away in many cases by the use of bordeaux mixture which is also the most important preventive of leaf-spot. This leaf-spot is perhaps the worst disease which attacks beets, but this is more common upon the sugar-beets in the field than upon the more common varieties. The potato scab, very common on potatoes, is found also on beets, and as this disease lives in the soil from year to year, it is a bad practice to grow beets after a crop of potatoes.

F. A. WAUGH.

**BEGONIA** (named after Michel Begon, superintendent at St. Domingo, 1638-1710, a French promoter of botany). *Begoniaceæ*. **BEGONIA**. ELEPHANT'S EAR. BEEFSTEAK GERANIUM. A various group, ranging from hothouse to conservatory and window-garden subjects, many of them grown primarily for foliage, others for the showy bloom; treated mostly as single pot-specimens, but some kinds used for bedding.

More or less sappy or succulent herbs or undershrubs, having the st. in some cases reduced to a thick rhizome, in others to a distinct small tuber, while a few others possess a semi-tuber in which there are a number of closely set scales or suppressed lvs., resembling bulbs: lvs. variable, alternate, more or less unequal-sided, entire, or lobed, or toothed, ovate-acuminate, orbicular or peltate: fls. monœcious (bisexual variations are known: Dümmer, *Annals Bot.* xxvi. 1123), asymmetrical, usually in axillary cymes, the males usually with 4 parts, of which 2 are mostly small, the females with 5 (rarely 2), pink, white, rose, scarlet, yellow, and all shades of these, being represented; stamens numerous; filaments free or united at the base; styles 2 or 4, free, sometimes connate; stigmas branched or twisted like a corkscrew; ovary inferior: fr. usually a 1-3-winged caps., which is often colored; seed numerous, very minute.—The genus *Begonia*, with 400-500 species in warm countries around the globe, gives the name and definition to the *Begoniaceæ*. Only three other genera are recognized: *Hillebrandia*, with 1 spe-

cies in Hawaii; *Symbegonia*, 1 little-known species in New Guinea; *Begoniella*, 3 species in Colombia. The begonias are exceedingly variable, the genus running into about 60 well-marked sections, but the intergradations are so many and the essential floral characters so constant that it is impracticable to break up the great group into separate genera.

The begonia is one of the great groups of cultivated ornamental plants. Very many species have been introduced, and there are numberless hybrids and variations. The most popular single begonia is now probably the wonderfully floriferous *Gloire de Lorraine* (Fig. 505). The foliage begonias are of many original kinds, and the numerous hybrids and variations have given great choice to the cultivator. *B. Rex* is the chief basis of the foliage races. Many cultivators are unaware of the possibilities of the *Rex* derivatives, because they grow them in pots (for commerce) on benches, whereas the singular and characteristic results are secured by growing them in the earth against greenhouse walls or in rock pockets below the benches (Plate XIV).

Because of the great numbers of interesting forms, begonias have appealed strongly to collectors and fanciers. In recent years, however, the collections have been passing out in the large private places; and most dealers now carry only a few standard kinds (mostly modified cultivated forms), in addition to the florists' bedding and garden sorts and a general mixed stock of tuberous kinds. The following botanical account, therefore, does not accurately represent the present state of the begonia trade. It is to be regretted that the fanciers' collections are not kept: and it is partly in the hope that the desire for collections will return that this rather full treatment is given of the main species and stem-groups now in cultivation.

The foliage begonias of the *Rex* type are subject to an insidious disorder, affecting the leaves and eventually the entire plant. The remedy seems to be to discard all suspected stock and to propagate from wholly healthy plants, or to grow them out of it by planting them in a shaded airy greenhouse bench for a summer and potting again in fall.

The interest in begonias centers in their use as ornamental subjects. It is said that the stalks of some of the species are used as the leaf-stalks of rhubarb are used. The rhizomes of many species, particularly those from South America, are bitter and astringent and are employed locally for certain fevers and for syphilis. Some species contain purgative principles. The sour sap of one of the Asiatic species is said to be used for the cleaning of weapons.

The first begonia was introduced into England in 1777, *B. nitida*. Since then, about 200 have proved of value to the horticulturist. Few other plants have been improved or varied so rapidly, there being thousands of variations now in cultivation, displaying the most gorgeous colors in their flowers and beautiful coloring in their leaves. The development of the modern race of hybrid tuberous begonias followed the introduction of *B. Veitchii*, *B. rosæflora*, *B. Davisii*, *B. boliviensis*, *B. Pearcei* and others after 1860. The geographical distribution of begonias is very disjunctive and localized. They are indigenous to Mexico, Central and South America, Asia, and South Africa. They seem to have no genetic relationship with other plants now living. For literature, see Dryander, *The Genus Begonia*, *Trans. of the Linn. Soc.*, Vol. I, 1791; Klotzsch, *Begoniaceen-Gattungen und Arten*, 12 plates, 1855 (*Abh. Ak. Berlin*); DeCandolle's *Prodromus*, 15, 1, 1864; and floras of regions in which begonias are native.

L. H. B.

#### General culture and propagation.

For horticultural purposes, the begonias may be arranged in four groups: The socotrana or semi-tuberous set; the tuberous-rooted; the foliage kinds, mostly

rhizomatous; and the fibrous-rooted. The bedding begonias are mostly of the fibrous-rooted section, particularly in the *Semperflorens* group, although the improved tuberous kinds may be used for this purpose in special places.



501. Young plants starting from the incisions on a begonia leaf.

leaf-mold than the fibrous-rooted, and a temperature of 65° to 70° in the daytime and 60° at night. Of *Gloire de Sceaux* and some others, plants two years old will be found best for decorative purposes. For special notes on *B. socotrana*, see the treatment of that species, page 473.

(2) The tuberous begonias are grown in pots, boxes or baskets, under glass, or as bedding plants in a shaded border. If the plants are intended for pot-culture in the greenhouse, it is best to use the tubers. For early flowering, start the tubers in February or March, either in small pots or shallow boxes. The soil may be composed of loam, sharp sand and leaf-mold, and the temperature about 60° to 65°. When the plants are ready for repotting, well-rotted manure may be added, and when the roots have taken a fresh hold a cooler temperature may be maintained. For bedding purposes, seedling plants, as well as tubers, may be used, providing they are of a first-class strain. Tubers are preferred if early-flowering plants are desired. For further cultural notes, see the discussion on page 471.

(3) The Rex begonias are grown entirely for the beauty of their foliage. They may be propagated by means of either shoot- or leaf-cuttings, the latter being the better when plants have to be raised in quantity. Large and well-matured, but still healthy and vigorous leaves may have the principal nerves cut on the under side. The leaf is then pegged or weighted down on the surface of a well-drained propagating bed. If carefully shaded, roots will be formed at every cut, a tiny leaf will follow (Fig. 501), and the little plants may be inserted singly in small pots. Another method is to cut the large leaves into triangular parts, with a bit of the main petiole at the tip of each, and insert the pieces about 1 inch, with the lower or thickest end of the rib downward (Figs. 502, 503). Still another method is to cut the leaf in two, across the veins, and stand it edgewise in the propagating bed. The young plants may be potted-up into small pots, using a light, porous, sifted soil. Keep shaded in a low house with a moist atmosphere. The soil may be gradually made coarser with each potting until in the final shift; an unsifted compost of two parts loam, one part leaf-mold, one part well-rotted manure, and one part sand, is used, adding a sprinkling of lime. While watering, avoid wetting the leaves as much as possible, and keep



502. Triangular leaf-cutting of begonia.

large, well-developed plants in a shaded house, with plenty of ventilation day and night during the summer.

(4) The fibrous-rooted begonias comprise such species as *B. nitida*, *B. semperflorens* var. *gigantea*, *B. albopicta*, *B. Haageana*, and *B. Duchartrei*. Of these, cuttings taken from clean, healthy stems in spring will strike readily in an ordinary propagating-box or bench, and if potted-on, as they require root-room, will make fine plants for late winter and spring flowering. As

soon as one neglects good treatment, especially in regard to light, fresh air and fresh soil, the red spider, a physiological disease appearing like rust, and the dreaded nematodes, will soon attack them and give them a sickly and stunted appearance. They require a temperature of 55° to 60° at night and 65° to 70° in the daytime. The plants should be kept close to the glass in the early stages of growth, on account of the tendency of many of the varieties to send out rather long shoots. A good compost is three parts loam, one part well-rotted manure, and one part sand.

While begonias in general are injured by too strong sunshine during summer, they are benefited by all the sunshine they can get during the winter and early spring months. Strong sunshine, however, pouring through imperfect glass upon wet foliage, is liable to blister the leaves of any begonia. Such species as *B. Dregei* and *B. weltoniensis*, which produce at their base a thickened, fleshy stem like a potato, may be propagated either by division or by cuttings. Many kinds of the fibrous-rooted and rhizomatous sections can be grown by amateurs, and make excellent house-plants, especially *B. manicata*, *B. coccinea*, *B. speculata*, *B. argyrostigma* var. *picta*, *B. riciniifolia*, *B. heracleifolia*, *B. incarnata*.

ROBERT SHORE.

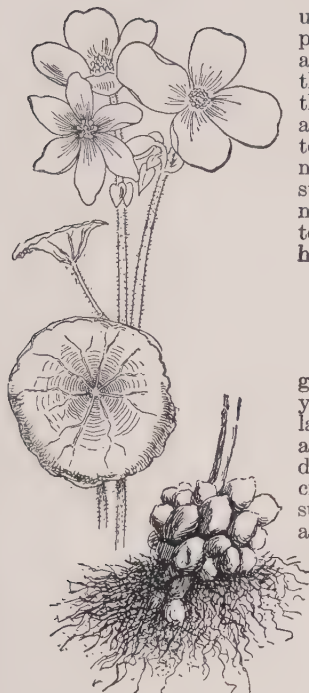
#### Begonia Gloire de Lorraine.

*Begonia Gloire de Lorraine* (Fig. 505) was raised by Lemoine by crossing *B. Dregei* and *B. socotrana*, and is one of the most useful and beautiful decorative plants introduced. If large specimen plants in 10- or 12-inch pans are desired, propagating should be begun about November or December of the year previous, as these plants are generally at their best about Christmas time. The best plants are obtained from leaf-cuttings. Select medium-sized, well-ripened leaves, cut off with a sharp knife, insert in a bed of sharp sand in a temperature of 70° and space them far enough apart, so that they do not touch one another. The propagating-bed should be at least 2 inches deep, but the stems should not be buried so deeply that the leaf lies on the top of the bed. These precautions prevent damping off. A further preventive against damping off is to dust powdered charcoal over the bed after the cuttings have been thoroughly watered. The leaf-cuttings of *Gloire de Lorraine* are far superior to shoots that start from the base of a cut-back plant, the leaf-cutting having greater vigor and breaking more shoots from the base of the plant. The leaf-cuttings will root in three weeks in the temperature recommended above, but they should be left in the sand until they begin to throw up shoots from the callus formed at the end of the leaf-stem, after which they should be immediately potted in 2-inch pots, in equal parts of fibrous loam and leaf-mold, with about a fourth part of charcoal. Never allow the plants to become pot-bound until they have attained the desired size, and for all future pottings use equal parts of the fiber of loam, half-decayed flaky leaves, well-rotted cow-manure or horse-droppings, and a fourth part of charcoal. Use this compost as rough as can be conveniently worked around the plant while potting. During the summer, they should be grown in a rather humid atmosphere near the glass, always lightly shaded from the sun until they begin to flower. Pinch the shoots two or three times during the season as this encourages breaks from the base of the plant. When well rooted in the final shift, waterings with manure-water will be beneficial. When the plants begin to flower, they should be neatly staked with thin twigs,



503. Plant arising from the base (or tip) of a triangular leaf-cutting.



504. *Begonia socotrana* ( $\times \frac{2}{3}$ ). No. 1.

by cuttings it can be done. Shallow boxes or seed-pans may be used in which to sow the seed about the beginning of February. They should be well drained and filled with a compost made up of equal parts of peat, leaf-mold and about a fourth of charcoal. As soon as the plants are large enough to handle, prick them out about 2 inches apart in the same soil as above, place them close to the glass, but always shaded from the bright sun, and in a moist atmosphere. When they have grown close together, transfer them to  $3\frac{1}{2}$ -inch pots, the best soil to use from now on being a spent mushroom bed, adding about a fifth part of charcoal. A 6-inch pot is generally large enough for the first season, and when they are well established in these pots should be kept as cool as possible. A house facing north is the best place for them during the summer, and all the air possible may be admitted night and day. On no account allow these plants to suffer for lack of water until fall, when they will begin to show signs of ripening off. During their growing period, they may be stimulated by frequent applications of cow-manure water, and soot diluted in water, an ordinary handful to two and a half gallons of water; water three times with clean water, and alternately with the other two. When signs of ripening begin to show, gradually withhold water until the growths decay, and then place the pots on their sides under a bench in a greenhouse where the temperature keeps around  $40^{\circ}$ . Be sure they are in a position where

unless desired for hanging plants, when they may be allowed to droop around the pan. When in flower they should be in a light airy greenhouse with a temperature of  $45^{\circ}$  by night. These plants are subject to mealy-bug and may be fumigated at intervals of two weeks with hydrocyanic gas.

GEO. F. STEWART.

### Tuberous begonias.

The tuberous-rooted begonias, which are every year becoming more popular, both as pot-plants, and for bedding out-of-doors, are the result of crossing several different species differing considerably in habit, and are easily cultivated. They are raised almost wholly from seed, and good strains in different colors may be obtained from any reputable seed firm. However, if one wishes to

increase these plants

water does not reach them. The tubers will be good for several years, but the best plants are in their second year. The plants may be started at intervals, having an earlier and a later lot. For bedding out in partial shade, these plants have no equals. Start the tubers in flats about the end of April, have the bed heavily manured and the soil level with the surface of the ground, as the roots run near the top of the ground, and consequently they have to be watered frequently. The top of the bed should be always moist, a mulching of well-rotted manure being of great assistance in retaining the moisture. Plant about a foot apart, all of one color, unless great care is exercised in blending the brilliant colors so that they do not clash.

GEO. F. STEWART.

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506. *Begonia Gloire de Sceaux* ( $\times \frac{1}{2}$ ). No. 3.

## HORTICULTURAL ARRANGEMENT OF SPECIES.

This arrangement often throws together species of no close botanical relationship, but it will aid the cultivator to understand the genus.

I. SPECIES BULBOUS OR ESSENTIALLY SO.  
*socotrana*.

## II. SPECIES TUBEROUS.

- A. Plant stemless, lvs. springing directly from the crown or tuber (*Davisii*, *rosæflora*, *Froebelii*, *Veitchii*, *octopetala*).  
 AA. Plant with sts., more or less branching.  
 B. Lvs. narrow (lanceolate to ovate-lanceolate) (*boliviensis*, *Sutherlandii*).  
 BB. Lvs. broad (ovate to cordate-ovate) (*Pearcei*, *Clarkei*, *Evansiana*, *gracilis*, *Dregei*, *weltoniensis*, *fulgens*).  
 BBB. Lvs. orbicular (*Baummannii*).  
 BBBB. Lvs. various, mostly broad-ovate at base, acuminate (*tuberhybrida*).

## III. SPECIES RHIZOMATOUS.

- A. Plant creeping, trailing, or climbing (*glaucophylla*, *scandens*).  
 AA. Plant upright, often diffuse.  
 B. The picture-lvd. species, grown for the foliage, which is large and prominent and blotched, strongly colored, blistered, or otherwise illustrated. The *Rex* set, and others.  
 C. Lvs. oblique, lobed at the base, not peltate (or only slightly so) (*Rex*, *xanthina*, *Griffithii*, *Rajah*, *Augustinei*, *dadalea*, *speculata*, *decora*, *imperialis*).

- CC. Lvs. markedly peltate (*modica*, *Gentilii*, *Binotii*, *goeocensis*).  
 BB. The essentially plain-lvd. rhizomatous kinds, although some of them are grown chiefly for foliage.  
 C. Lvs. prominently lobed, or parted or even divided (*ricinifolia*, *heracleifolia*, *Sunderbruchii*, *rubella*, *Verschaffeltiana*, *heraclei-cotyle*).  
 CC. Lvs. lanceolate to ovate or cordate-ovate to orbicular, not deeply lobed, often entire, and sometimes peltate.  
 D. Foliage small, the lvs. less than 2 in. wide (*hydrocotylifolia*).  
 DD. Foliage of usual or large size.  
 E. The lvs. peltate (*Feastii*, *nelumbiifolia*, *conchæfolia*, *Lubbersii*, *albo-coccinea*).  
 EE. The lvs. not peltate (*manicata*, *leprosa*, *magnifica*).

IV. SPECIES FIBROUS-ROOTED (*Rhizomes* small or O.)

- A. The herbaceous kinds—the plant small, succulent, never becoming very tall or woody (*semperflorens*, *gigantea rosea*, *Carrierei*, *Erfordii*, *Lyncheana*, *Lucianæ*, *Corbeille de Feu*).  
 AA. The woody or shrubby kinds, usually much branched when mature, and often tall.  
 B. Kinds slender, upright, small-leaved, mostly smooth, green or nearly so: lvs. many and usually not more than 1 in. across.  
 C. Fls. pink or red (*fuchsoides*, *Ingramii*, *Digs-welliana*, *incarnata*, *ascotiensis*).  
 CC. Fls. white, or tinted white (*foliosa*, *knowsleyana*, *acuminata*, *albo-picta*).  
 BB. Kinds low-growing, diffuse (*Schmidtiana*).  
 BBB. Kinds stiff, succulent white-scurfy (*peltata*, *venosa*).  
 BBBB. Kinds mostly tall and erect, some of them becoming 8 ft. high, distinctly shrubby and bushy.  
 C. Lvs. compound, or divided (*luxurians*, *Hemslayana*, *platanifolia*, *digitata*, *carolinæ-folia*, *diadema*).  
 CC. Lvs. not compound, although sometimes strongly notched or even lobed).  
 D. Whole plant hairy, or at least so much so as to give it the appearance of being a rough or pubescent species.  
 E. Foliage light green and plant pubescent (*ritifolia*, *Engleri*).  
 EE. Foliage markedly colored above or beneath, or both.  
 F. Fls. white (*echinosepala*, *erythrophylla*, *Scharfiana*, *Duchartrei*).  
 FF. Fls. colored (*Haageana*, *Credneri*, *Alleryi*, *Margaritæ*, *metallica*, *cathayana*, *deliciosa*, *laciniata*).  
 DD. Whole plant smooth or becoming so (a few hairs perhaps remaining on the lvs.), or so much so as to give it the appearance of being a glabrous species.  
 E. Lvs. medium to large, very broad, fleshy or thick, entire, often peltate (*sanguinea*).  
 EE. Lvs. medium size, stiff, green and shining, often elongated, mostly undulate or notched.  
 F. Fls. white (*angularis*, *ulmifolia*, *longipes*, *undulata*, *kewensis*).  
 FF. Fls. colored (*nitida*, *Teucheri*, *Bismarckii*, *carminata*, *polyantha*, *coccinea*).  
 EEE. Lvs. medium to large, the margins strongly toothed, incised or lobed.  
 F. Fls. white (*Madame de Lesseps*, *olbia*).  
 FF. Fls. colored, varying to tinted white (*argenteo-guttata*, *maculata*, *Thurstonii*, *dichroa*, *coronata*, *phyllomanica*, *President Carnot*, *lucerna*).

## I. BULBOUS BEGONIAS, AND SEMI-BULBOUS OR SEMI-TUBEROUS DERIVATIVES.

1. *socotrana*, Hook. Fig. 504. A winter-flowering species: st. annual, stout and succulent, forming at the base a number of closely set scales or suppressed lvs. resembling bulbs: lvs. dark green, orbicular, peltate, 4-7 in. across, center depressed, margin recurved,



crenate: fls. all male except the terminal one of each branch of the cyme, in terminal few-fl. cymes, bright rose G.C. II. 15:8. B.M. 6555. Gn. 21:163; 49:426 (as *B. Gloire de Lorraine*). J.H. III. 51:317. R.H. 1906, p. 130; 1909, p. 426. A.F. 13:587, 588.—Bulbs or semi-tubers were brought from the hot sandy island of Socotra by I. B. Balfour, and grown at Kew in 1880. The species was first described in *Gardeners' Chronicle*

in 1881, and in the same year in *Botanical Magazine*. See also Balfour, *Botany of Socotra*, p. 102, 1888 (Vol. 31, Roy. Soc., Edinburgh). An early study of the nature of the bulbs by Duchartre will be found in *Bull. Soc. Bot. de France*, 12 (1885).—This excellent plant requires to be grown in a light position in a stove to develop at its best. The bulbs should be shaken out of the old soil in Sept. or Oct. and potted up in a light soil, rich in humus, and placed in heat and moisture, and, when well established, should



507. *Begonia Davisii* ( $\times \frac{1}{4}$ ). No. 6.

be liberally supplied with manure-water. The fls. appear during the winter months, after which the plant dies down, forming a number of large resting buds or bulbs; the pots should then be placed in an intermediate temp. and be kept nearly dry until the following growing period comes round. On account of its habit of producing fls. in winter, this species has been largely used by the hybridist in the production of a race of winter-flowering begonias, of which there are many named varieties.

Following are leading *Socotrana* derivatives:

2. *Gloire de Lorraine* (*B. socotrana*  $\times$  *B. Dregei*). Fig. 505. One of the finest hybrid begonias ever raised: lvs. small, nearly regular, pure green: fls. almost exclusively male, 4-petaled, large, borne in broad panicles, covering the whole superior part of the plant, rose-colored, not deciduous. Gt. 42, p. 111. A.F. 12:842. G.F. 5:247.—Although *B. socotrana* is semi-bulbous and *B. Dregei* has a thickened rhizome, the hybrid forms show neither, but the base of the st. throws out many shoots, which can be separated and insure the multiplication of the plant. Intro. by Lemoine in 1892.—There are several forms of this plant now in cult. *Rothschilts* variety has larger and darker colored fls. than the type. *Turnford Hall* is a form with white fls. *Caledonia* also has white fls. but is far inferior as a garden plant to that of *Turnford Hall*. *Glory of Cincinnati*, a form with very lasting large satiny pink fls., is a seedling from *B. socotrana*  $\times$  a sport of *Gloire de Lorraine*: it bloomed first in Dec., 1908, and was intro. to trade in 1910 (J. A. Peterson).

3. *Gloire de Sceaux* (*B. socotrana*  $\times$  *B. subpeltata*). Fig. 506. Plant stout, half shrubby, erect, vigorous, compact, will form a plant as much as 8 ft. high in a year with good cult. and produce quantities of its large rose-colored fls. over a period of several months: lvs. dark metallic green, thick, large, red beneath, veins red above, suborbicular, slightly oblique: fls. profuse, beautiful rose-pink, shiny, females the last fl. on the cyme. Fls. from Dec. till May. R.H. 1884:516. G.F. 7:185.—Intro. in 1885.

4. *Triomphe de Lemoine* (*B. socotrana*  $\times$  *B. Roezlii*). St. herbaceous, spreading, then erect and branching into numerous flowering branches: lvs. large, coriaceous, orbicular, somewhat oblique, margins slightly crenate, 6 in. diam.: fls. in dichotomous cymes from axils of lvs., rose-carmine, female fls. exceedingly rare, males very profuse, plant resembling a large bouquet when in full bloom. G.F. 2:557.—Intro. by Lemoine in 1887. Retains its fls. after they are withered, a rare occurrence in begonias. Another hybrid from the same parent is *Triomphe de Nancy*, with fls. rich yellow in the center, double, and the outer petals of a paler hue.—Intro. 1888.

5. *incomparabilis*, Hort. (*B. socotrana*  $\times$  a garden tuberous form). Lvs. large, with the showy, well-formed orange-red fls. standing well above them. R.B. 33:60.

## II. TUBEROUS BEGONIAS, the plant passing the winter as a dormant tuber Nos. 6–30.

### A. Plant stemless: lvs. springing directly from the crown or tuber.

6. *Davisi*, Veitch. Fig. 507. Lvs. ovate-cordate, dull green, thinly hairy, above and below, upper side lighter veined and under side red, petiole short: peduncles, pedicels and fls. bright red. Peru. B.M. 6252. F.M. 1876:231. G.C. II. 15:669.—A favorite with hybridists, because of its rich coloring and its free flowering. It has given rise to numerous dwarf, erect-habited garden forms, with small but brightly colored fls.

7. *rosæflora*, Hook. Stout: petioles, scapes, bracts, and stipules bright red: lvs. green, 2–4 in. wide, on stout, hairy petioles, 2–6 in. long, orbicular, reniform, concave, margins lobed, red, toothed: fls. 2 in. across, rose-red. Andes of Peru, 12,000 ft. Intro. in 1867. B.M. 5680.—Light-colored seedlings of this species gave rise to *Queen of Whites*, put into commerce in 1878, and apparently an important factor in subsequent garden forms of the same color. The species itself is probably not now in cult.

8. *Froëbelii*, A. DC. More or less hairy: lvs. numerous, cordate, acuminate, green, covered with fleshy, purplish hairs: fls. in tall, lax, drooping, branching cymes, brilliant scarlet, large. Late autumn and winter. Ecuador. J.H. III. 32, p. 33. Journ. Roy. Hort. Soc. 19, p. xcii. Gn. 12, p. 376. Intro. about 1872–3 by Otto Froebel of Zurich.—A beautiful flowering plant, useful for conservatory work in winter. Var. *vernalis*, Hort., hybrid (*B. Froëbelii*  $\times$  *B. Dregei*), similar to type; intro. by Deleuil in 1880. Var. *nana*, Hort. Very dwarf: fls. dark scarlet.

9. *Veitchii*, Hook. Loosely hairy: st. very short or practically none, thick, fleshy, green: lvs. orbiculate, cordate, lobed and incised, margins ciliate, green, principal veins radiating from a bright carmine spot near the center, under side pale green; petiole thick, terete pilose: fls.  $2\frac{1}{4}$  in. diam., cinnabar-red: caps. smooth, unequal wings. Peru, 12,000 ft. B.M. 5663. F.S. 22:2326.—One of the progenitors of the tuberous race. Intro. 1867. Probably not now in cult., but a beautiful species.

10. *octopétala*, L'Her. (*B. grandiflora*, Knowl. & West). Lvs. on long, succulent downy petioles  $1\frac{1}{2}$  ft. long, cordate, deeply lobed and serrated, bright green: fls. seldom produced in cult., greenish white, in corymbs, males with 8 or 9 petals 2 in. across, females smaller and generally fewer. Intro. to Glasgow from Lima, Peru, in 1835. B.M. 3559. F.S. 20: 2056–7. A.F. 4:225 (var. *Lemoinei*). This species is of little or no horticultural value.

AA. Plant with st. (not scapes) evident and more or less upright, usually branching.

B. Lvs. narrow, lanceolate to ovate-lanceolate.

### 11. boliviensis, A. DC. Fig. 508.

Plant sparsely 508. *Begonia boliviensis* ( $\times \frac{1}{4}$ ). No. 11.



hairy: st. erect at first, but drooping and becoming slender with age, 2-3 ft. high, branching: lvs. lanceolate to ovate-lanceolate, acuminate, serrate, 3-5 in. long: fls. in drooping panicles, cinnabar-scarlet, long and fuchsia-like; males twice as long as females. Bolivia. B.M. 5657.—Intro. into England in 1864. It is a very useful basket-plant. This species has recently been crossed with some of the double and single garden forms of the tuberous race (of which this species was one of the ancestors), and has given rise to a pretty and distinct type with long pendulous sts. and drooping fls. which render them most useful as subjects for baskets. *B. Bertinii*, Hort., is closely allied, and perhaps a form of *B. boliviensis*. Fls. light scarlet, numerous and large, not so pendent. *Gt. 51*, p. 550, desc. R.H. 1894, p. 247. There is a dwarf form (var. *nana*) of this. *B. Worthiana*, Hort., said to be a seedling of *B. boliviensis*, with larger and shorter lvs. and more numerous and less pendent fls. *B. bolidavis*, Hort., is a hybrid of *B. Davisii* and *B. boliviensis*.

12. *Sutherlandii*, Hook. Slender and graceful, 1-2 ft. high, bright vinous red, from small tubers: lvs. 4-6 in. long, lanceolate, lobed and serrated, green, with red veins and margin; petioles slender, red: fls. numerous, coppery or salmon-red. Natal. B.M. 5689.—Intro. by Backhouse in 1867. Of little decorative value.

BB. *Lvs. broad-ovate to cordate-ovate.*

13. *Pearcei*, Hook. Pubescent, branching, 1 ft. high: lvs. oblique-ovate, cordate, acuminate, toothed, glabrous and velvety green above, tomentose beneath, pale red on under surface: fls. in loose, axillary panicles, large, bright yellow. Bolivia; intro. from La Paz, being sent by Mr. Pearce, collector for Messrs. Veitch. B.M. 5545.—A variable plant, both in habit, size, color of the fls. and in the degree of the venation of the strongly nerved lvs. It is the only yellow-fl. tuberous begonia in cult. It has been the chief factor in the production of the hundreds of yellow, buff and orange-colored garden forms. Intro. in 1865.

14. *Clárkei*, Hook. Stout and erect, 2 ft., puberulent, the st. purplish, fleshy: lvs. obliquely cordate-ovate, serrate: fls. in pendulous racemes, abundant,



509. *Begonia Dregei* ( $\times \frac{1}{6}$ ). No. 17.

large, bright red. Bolivia, 9,000-10,000 ft. B.M. 5663 (as *B. Veitchii*), 5675.—Resembles *B. Veitchii*. It was the seed parent of *Vesuvius* and *Emperor*, two important and useful varieties for bedding out. Probably not now in cult.



510. *Begonia tuberhybrida*. Single-flowered ( $\times \frac{1}{4}$ ). No. 21.

which are produced in quantities in the axils of the lvs. after flowering, and which will give flowering plants the following year. Stands some frost.

16. *gracilis*, HBK. (*B. bicolor*, Wats. *B. diversifolia*, R. Grah.). Smooth and shining, tall and st. erect, seldom branched, succulent: lvs. thinly scattered along sts., almost heart-shaped, slightly hairy, lobed, denticulate, ciliate: fls. on short, axillary peduncles, pink. Mex. B.M. 2966.—In axils of lvs. between stipules a cluster of bulblets is borne. These may be gathered and sown as seeds. Along with its varieties, *annulata*, *diversifolia*, *Martiana*, and others, it makes a very beautiful summer-flowering greenhouse begonia.—Intro. by P. Neill, of Cannonmills, Edinburgh, in 1829. This species should be treated in exactly the same way as the garden race of tuberous begonias as to cult. The variety *Martiana* is a large-fl. form with rose-colored fls. and frequently reaches 5 ft. in height. It is a pretty and desirable greenhouse plant, producing a succession of fls. for 2-3 months during the summer.

17. *Drégei*, Otto & Dietr. (*B. affra*, Meisn. *B. parvifolia*, Grah. *B. reniformis*, Hort.). Glabrous: sts. succulent, annual, 1-3 ft. high: from a rootstalk a fleshy irregular tuber: lvs. thin, small, oblique-ovate, green, deeply serrated, reddish on the under side: fls. white, small, profuse. Cape of Good Hope. B.M. 3720.—Received at Botanic Gardens, Edinburgh in 1836 from Berlin. A useful free-flowering greenhouse plant.

18. *weltoniensis*, Hort. (*B. Sutherlandii*  $\times$  *B. Drégei*). St. reddish, 1-3 ft. high: lvs. light green, smooth, ovate-acuminate, lobed, dentate,  $1\frac{1}{2}$ -2 in. across; petiole red,  $1-1\frac{1}{2}$  in. long: fls. pink, profuse, on short peduncles.—Frequently met with in cottagers' windows in England; of very easy cult. Intro. by Major Clark, of Welton Park, England. Var. *alba*, Hort., has white fls.

19. *fulgens*, Lemoine. Stout: st. short: lvs. large-reniform to cordate-ovate, more or less oblique, irregularly sinuate-toothed, sparsely hairy above and beneath, dull dark green above and reddish on the under side.

15. *Evansiana*, Andr. (*B. discolor*, R. Br. *B. grandis*, Dry.) Smooth: st. deciduous, branching, 2 ft. high: lvs. ovate-acute, subcordate, lobed, margins denticulate, green above, under side and petioles red, peduncles branching, axillary: fls. numerous, flesh-colored, large. Java, China, Japan. B.M. 1473.—A handsome and almost hardy species. Intro. in 1804 to Kew. Little cult. now. It makes a pretty and free-flowering plant for the cool greenhouse in summer. Readily prop. by bulblets,



fls. large (2 in. across) in many long-peduncled clusters, bright rich rose-red, fragrant. Bolivia.—A handsome plant, published by Lemoine in catalogue of 1893.

BBB. *Lvs. orbicular.*

20. *Baumannii*, Lemoine. Lódse-hairy or nearly glabrous, the sts. often very short and the plant appearing acaulescent, but becoming 1-1½ ft. high: lvs. large, orbicular, with short, thick petioles: peduncles 18 in. high, bearing panicles of 4-6 fls., which are rose-red, 4-petaled, from 3-4 in. across, and fragrant as roses. Bolivia, 8,000-9,000 ft. B.M. 7540. Gt. 40:1348; 42, p. 25. A.F. 7:561. G.F. 5:77.—It is described as plentiful in the moist valleys of the Cordilleras, where it is eaten by cattle. Distributed by Lemoine in 1890. Tubers as large as ostrich eggs. Habit of *B. socotrana*.

BBBB. *Lvs. various, mostly broad-ovate at base, acuminale, oblique.*

21. *tuberhýbrida*, Voss (*B. tuberósa*, Hort.). Figs. 510, 511, 512. The garden race of tuberous begonias, combined of many species and derived from many sources, very variable and yet for the most part agreeing in general lf. form. There are many named garden varieties.

OTHER TUBEROUS-ROOTED SPECIES.

22. *cinnabarina*, Hook. Puberulent: sts. short, green, zigzag, slightly downy: lvs. on short petioles, obliquely ovate, lobed and serrated: peduncles 9-12 in. long, red; fls. cinnabar-red, 2 in. across. Bolivia. B.M. 4483. P.M. 16:225.—Intro. 1849; not in cult.

23. *crinita*, Oliver. Slender, sparsely hairy: sts. red, hairy, 1 ft. high: lvs. ovate-cordate, irregularly toothed, tinged with red on the under side: peduncles erect, red, producing 3 pale rose-colored fls. Bolivia. B.M. 5897.—Intro. by Veitch in 1866.

24. *cyclophýlla*, Hook. Slightly hairy, slender, stemless: lf. solitary, orbicular, 6 in. across, green, with fimbriated margin: peduncles erect, 6 in. long; fls. rose-colored, with the fragrance of roses. China. B.M. 6926.—Intro. to Kew in 1885.

25. *geraniifolia*, Hook. Glabrous: st. 1 ft. high, erect, greenish: lvs. cordate, lobed, incised and serrated, green, margins red: fls. 2 or 3 on terminal peduncles, outer petals orbicular, red; the two inner obovate, white. Lima. B.M. 3387.—Intro. 1833.

26. *geranioides*, Hook. Small, 10-14 in., stemless, rootstock fleshy: lvs. radical, reniform, 6 in. across, lobed and toothed, green, hairy, petioles 8 in. long; peduncles erect, 6-12 in. long, reddish, hairy, bearing a lax panicle of fls., each 1¼ in. across, pure white, with a button-like cluster of yellow anthers. Natal. B.M. 5583.—Planted in a border in a sunny greenhouse, this is a fine begonia,



512. *Begonia tuberhybrida*.  
Double-flowered form. No. 21.

flowering profusely during Oct. and Nov. Intro. to Kew in 1866. Probably not now in cult. Allied to *B. Dregei*.

27. *natalénsis*, Hook. Glabrous: sts. fleshy, 1-2 ft. high: lvs. obliquely cordate, lobed, sinuate, 2-3 in. long, green, sometimes mottled with gray, veins reddish: fls. yellowish white, tinged with rose, 1 in. across. Natal. B.M. 4841.—Intro. to Kew in 1854.

28. *polypétala*, A. DC. St. short, fleshy: lvs. ovate-cordate, toothed, hairy, with raised veins, 10x8 in.: fls. with 9 or 10 ovate-oblong petals an inch long, red; ovary hairy, with 1 long wing. Peru. Gn. 14, p. 531.—Intro. by Froebel in 1878.

29. *rubricaùlis*, Hook. Pubescent, stemless, scapes red: lvs. 4-6 in. long, ovate, wavy, ciliate along the margins, deep green: fls. large, males 1¼ in. across, 5-petaled; females smaller, 6-petaled, reddish. Country unknown. B.M. 4131.—Intro. to Birmingham Botanic Garden in or about 1844.

30. *ténera*, Dry. (*B. Thwaitesii*, Hook.). Pubescent, stemless: lvs. radical, cordate, 5 in. long, coppery green, mixed with purple and blotched with gray, under surface very red: fls. white, tinged pink. Ceylon. B.M. 4692.—Chiefly interesting as a variegated plant. Intro. to Kew about 1852.

III. SPECIES RHIZOMATOUS: the rhizomes mostly shaggy and lying on top the ground or very nearly so (Fig. 516); plant making no proper upright stem or trunk. Nos. 31-59.

A. Plant creeping, trailing, or climbing.

31. *glaucophýlla*, Hook. (*B. glaucophýlla splendens*, Hort. *B. glaucophýlla scándens*, Hort. *B. Comte de Limminghe*, Hort. *B. Limminghei*, Hort.). Glabrous: sts. long, drooping or creeping, lending themselves to training on rafters: lvs. ovate, wavy, 3 in. long, glaucous green, reddish and variegated in bud, purple beneath and white-spotted above, the margin cartilaginous: fls. brick-red, males 1 in. across, with petals, females of equal petals. Brazil. B.M. 7219. Gn. 59, p. 336.—A good basket plant, flowering freely all winter. Excellent for a permanent position in a greenhouse; reaches 6-8 ft. or more high.

32. *scándens*, Swartz (*B. lucida*, Otto & Dietr. *B. elliptica*, HBK.). Glabrous: sts. climbing or trailing clinging by means of short aërial roots: lvs. ovate or broader, acuminate, notched at base, dentate, glossy green, 4 in. long: fls. small, white, hanging in ball-like clusters. W. Indies and S.—An excellent basket or climbing plant.



511. *Begonia tuberhybrida*. Double-flowered. No. 21.

AA. *Plant upright, often diffuse.*

B. *The picture-lvd. set: plants low and tending to be compact, the mature lvs. usually hanging nearly vertical, often variously colored and marked.*

C *Lvs. oblique, lobed at the base, not pellate (or only slightly so).*

33. *Réx*, Putz. Fig. 513. Very hairy: st. a short, fleshy rhizome, from which spring the long-stalked large ovate wavy lvs., which are hairy and colored a rich metallic green, with a zone of silvery gray: peduncles erect; fls. large, rose-tinted; males 2 in. across, with 4 unequal petals; females smaller, with 5 nearly equal



513. *Begonia Rex*, in its original form. No. 33.

petals; ovary 3-angled, with 2 short and 1 long wing. Assam. F.S. 12:1255-1258. B.M. 5101.—This noble species is the principal parent in the production of the numerous ornamental-foliaged begonias. It has been crossed with a few species in the first place, and then hybrid seedlings have been raised again and again from the progeny. Fig. 513 is a copy of a part of the original figure in *Flore des Serres* (1857), and is given here for the purpose of showing what this species was like when first known to horticulturists. There are very many named forms, but most of the listed kinds tend soon to pass out. One of them that has persisted, because of the odd quirk to the lf. is *Countess Louise Erdoedy* (*B. Alexander von Humboldt* × *B. argentea-cupreata*). Fig. 514. Lvs. obliquely cordate, ovate-acute, the smaller of the 2 lobes twisted in a spiral manner, with as many as 4 coils; upper surface silvery, with veins deep green; under surface reddish, pilose. I.H. 31:516. C.C. II. 22:205. Intro. by F. Nemeček, gardener to Count Erdödy, a Hungarian nobleman, in 1884.—Other *Rex* varieties of unknown or uncertain origin: *Louise Closson*. Lvs. ovate-acuminate, lobed, veins deep purple, surface blotched with deep purple bronze, metallic luster very bright. *Lucy Closson* is very similar, but more vigorous, with the blotches more numerous and better distributed. *Marquis de Peralta*. Lvs. small, margins hairy, numerous silvery spots on surface. Compact, dense grower. *Duchesse de Brabant*. Lvs. large, purple, margins and surface hairy, otherwise like *B. Rex*. *Louise Chretien*. Lvs. green, with a zone of glossy silver towards the center, covered with very small white spots. *Count Erdoedy*. Silver-white, green-striped along the veins, hairy; lobes twisted into a spiral, hairy.

34. *xanthina*, Hook. Similar to *B. Rex*: lvs. large, fleshy, cordate-ovate, acuminate, sinuate-ciliated, dark glossy green above, purplish beneath: fls. large, almost golden yellow, tinged on the back with red: caps. with one large wing. India. B.M. 4683. Var. *pictifolia*, Hook. Lvs. with rows and spots of silvery white: fls. yellowish white. B.M. 5102. Var. *Lázulii*, Hook. Lvs.

not spotted, tinted with bluish purple. B.M. 5107. This species is probably not now in cult.

35. *Griffithii*, Hook. (*B. picta*, Hort.). St.-lvs. and habit as in *B. Rex*: lvs. olive-green, with a broad zone of gray inside a purple margin, tinged with red on the under side, the basal lobes overlapping: fls. large, fleshy, pink; ovary curiously crinkled along the angles. Assam. B.M. 4984.—Intro. by Henderson, England, in 1856. Probably not now in cult.

36. *Rajah*, Ridley. Fig. 515. Lvs. from the rootstock, angular-orbicular, papery, the petioles and under veins setose, upper surface smooth and richly mottled from the green ribs and the brown or brown-red intermediate spaces, the margins serrate and setose: fls. small, pink, on hispid peduncles that stand about as high as the lvs. Malaya. G.C. III. 16:213.—A distinct and beautiful hothouse species, deserving of popularity. Said erroneously to be a garden hybrid.

37. *Augústinei*, Hemsl. A dwarf, compact species, allied to *B. Rex* but devoid of color in the lvs. as in that species: sts. branching freely, short-jointed: lvs. erect or spreading, elliptic or ovate, 3-6 in. long, reddish green above and below, covered on both sides with red hairs; petiole red, terete, provided with dense white hispid hairs: whole plant presenting a mixture of white or red hairs: infl. erect, few-flid.; fls. pink. China.—Differs from *B. xanthina* in its rough rugose hairy lvs. and rose-pink fls.

38. *dædalea*, Lem. (*B. strigillosa*, Dietr.). Hairy, *Rex*-like: st. a short, thick rootstock: lvs. large, green, ovate-acuminate, cordate, margins slightly serrate and beset with long reddish hairs, surface covered with a peculiar network of russet-brown: peduncles spotted and slightly hairy; fls. white, tinged with pink. Mex. I.H. 8:269.—A handsome foliage plant, not very widely known.

39. *speculata*, Hort. Probably a hybrid: st. a short, thick rhizome: lvs. broadly ovate, acuminate, cordate, lobed half way down the blade, on long, hairy petioles, dull green, rough, speckled with gray, hairy, reddish on the under side, veins very prominent, light green: fls. on long, hairy peduncles, pink-white, males and females both with 2 petals: caps. green, with small red



514. *Begonia Countess Louise Erdoedy* (× 1/2). No. 33.

spots.—Origin uncertain, although apparently common in cult. in this country. A hardy and useful begonia for conservatory and window-garden.

40. *decora*, Stapf. A small species of compact habit, allied to *B. Rex*: rhizome short, reddish green: lvs. 3-4 in. long, ovate, rich reddish brown with prominent yellow-green veins: whole plant covered with thick-set papillæ and short hairs: fls. pink, comparatively large for so small a plant. Perak.—This plant thrives best in a stove. It is readily crossed with many other species, notably with *B. Rex*, and the offspring are amongst the finest ornamental foliage plants.



41. *imperiâlis*, Lem. Very hairy, low: st. short, herbaceous, green: lvs. 4-6 in. wide, brownish green, with irregular bands of bright green along the nerves, making a striking contrast: fls. insignificant, white. Mex. I.H. 8:274. Var. *maculâta*, Hort., has brown lvs. with green blotches. Var. *smarâgdina*, Hort., has wholly bright green lvs. I.H. 7:262.—These plants require a hothouse treatment in winter.

cc. *Lvs. markedly peltate.*

42. *môdica*, Stapf. A spreading, dwarf plant with sts. green, slender: lvs. peltate, orbicular or broadly ovate, 2-4 in. long, pale green in color, margins pink, undulate, margins and veins ciliate; petioles greenish red, hairy, 3-5 in. long: infl. few-flid., males small, 2-petaled, orange-yellow, with red blotch at base of petals, females same as males in color; ovary 4-celled, ½ in. long, winged, hairy. W. Trop. Afr. B.M. 8258.—A recent species, requiring stove conditions.

43. *Géntilii*, De Wild. A near ally of *B. modica*: sts. creeping, red hairy: lvs. peltate, erect, ovate, acute, margins finely serrate, slightly reflexed, green suffused with light red, young lvs. red; petiole terete, red, hairy, 6-12 in. long; blades 3-4 in. long: infl. few-flid.; fls. orange-yellow suffused with red; ovary 4-celled, winged. Congo.

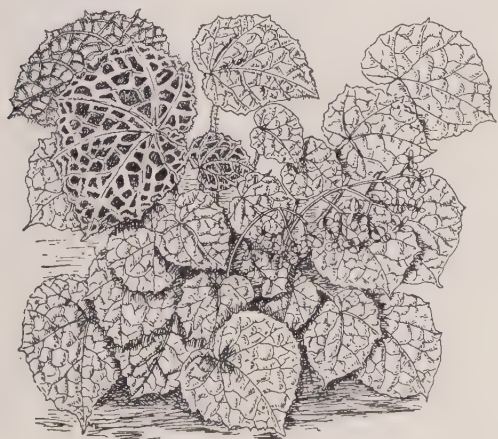
44. *Binôtti*, Hort. Plant rough-hairy like *B. Rex*: lvs. elliptic-orbicular, markedly peltate, green above and red-hairy beneath, blistered or bullate.—Very recently offered, and yet little known.

45. *goegoënsis*, N. E. Br. FIRE KING. Compact but large plant: st. a short, thick, greenish red rootstock: lvs. handsome, erect, peltate, ovate-orbicular, 6-9 in. long, surface blistered or puckered green, with dark bronzy blotches, prominently veined, dull red on the under side: fls. small, rose-pink, in a lax cluster 6 in. high. Goego, Sumatra.—A distinct and ornamental-ld. plant, requiring stove conditions; deserves the attention of amateurs.

BB. *The essentially plain-lvd. rhizomatous kinds, although some of them are grown almost wholly for the foliage. (Some of this group are bold and striking.)*

c. *Lvs. prominently lobed, or parted or even divided.*

46. *ricinifôlia*, Hort. (*B. heracleifôlia* × *B. peponifôlia*). St. a short, thick rootstock: lvs. large, bronzy



515. *Begonia Rajah* (× ½). No. 36.

green, lobed, resembling castor-oil plant: fls. numerous, on long, erect peduncles, rose-pink.—A useful free-flowering plant for the greenhouse, producing its fls. in winter and early spring. Var. *gigantëa odorâta*, Hort., is a double hybrid (*B. ricinifôlia* and *B. fulgens* × *B. Scharffiâna*) of German origin. Lvs. large, round-cor-

date, the lobes extending one-third or less deep and notched: fls. on long scapes, standing above the lvs., delicate rose-color and with tea-rose odor. Gt. 54, p. 42.

47. *heracleifôlia*, Cham. & Schlecht. (*B. jatrophæfôlia*, Hort.). Hairy: st. a short, thick rhizome: lvs. 6-12 in. across, with 5-9 deep and narrow notched and toothed



516. *Begonia magnifica* (× ½). No. 59.

lobes, rich green: peduncles 2-4 ft., long, straight: fls. white or rose-tinted, small, with 2 prominent rounded parts. Mex. B.M. 3444. B.R. 1668. J.H. III. 56:309. Var. *nigricans*, Hook., has the margins of the lvs. bordered with dark (almost black) green. B.M. 4983. Var. *longipila*, Hort., has long, fleshy hairs on the lf-stalks and peduncles. *B. Sûnderbruchii*, Hort., is an American form of this var.: lvs. bronze-green, silver bands along the nerves, purple underneath. Var. *punctâta*, Hort., has green lvs., reddish near the margin: fls. rose-colored, with deep red spots on the outside.

48. *rubëlla*, Hamil. Smooth: st. a short, thick rhizome: lvs. handsome, large, cordate, acuminate, deeply lobed, spotted with irregularly shaped dark brown marks: fls. pale pink, on long peduncles, decorative. Nepal.

49. *Verschaffeltiâna*, Regel (*B. Verschaffeltii*, Hort. *B. manicâta* × *B. carolinæfôlia*). Hairy: st. a thick rhizome: lvs. large, ovate, acuminate, lobed: fls. rose-colored, pendent on long peduncles. I.H. 2:68.—Tall, coarse and unsightly as an old specimen, but when well grown from year to year from cuttings makes an excellent plant and produces quantities of its small rose-colored fls. in early spring, which last for several months and have a considerable decorative value.

50. *heracleicôtyle*, Veitch (*B. heracleifôlia* × *B. hydrocotylifôlia*). A small, essentially smooth plant, with lvs. close to the rhizomes: lvs. thick, obliquely cordate-ovate, many-lobed and toothed, margins slightly ciliate, shining metallic green above and reddish beneath: fls. pink, small, freely produced on about 8 free-branching peduncles in early spring. Veitch, 1895.—A useful and decorative greenhouse plant.

cc. *Lvs. lanceolate to ovate or cordate-ovate to orbicular, not deeply lobed, often entire, and sometimes peltate.*

d. *Foliage small, the lvs. less than 2 in. wide.*

51. *hydrocotylifôlia*, Otto. Whole plant hairy: st. succulent, creeping: lvs. rotundate-cordate, repand bu-

entire, small, on short petioles and therefore clustered near the ground: peduncles 1-1½ ft. high, pilose; fls. dipetalous, rose-colored, small and numerous, showy. Mex. B.M. 3968.

DD. *Foliage of usual or large size.*

E. *The lvs. peltate.*

52. *Féastii*, Hort. (*B. manicata* × *B. hydrocotylifolia*). Shaggy-hairy on petioles and lf.-edges: st. a short, thick rootstock: lvs. suborbicular, thick, red beneath,



517. *Begonia semperflorens*. A recently struck cutting. To show the precocity of bloom. No. 60.

entire with long white hairs on margins; petioles short, irregularly marked: fls. light pink, on long peduncles. A.G. 23:335.—Intro. by John Feast, of Baltimore, before 1880. A common pot and house plant. *B. Bunchii*, Hort., is a form with edges of lvs. crested and frilled. Originated with Lloyd C. Bunch, Fredonia, Kan.

53. *nelumbiifolia*, Cham. & Schlecht. Hairy: st. a short, thick rhizome: lvs. large, 12-18 in. long, 8-12 in. wide, peltate, hairy on the under side, on long upstanding petioles: fls. many and small, white or rose-colored, in a dense erect much-branched cluster. Mex.—The foliage is bold and handsome, and distinct in general effect from any other cult. species.

54. *conchæfolia*, A. Dietr. Lvs. nearly peltate or semi-peltate, thick, cordate-ovate and the basal lobes or ears overlapping, margins entire or repand, becoming smooth above, shining green above and reddish beneath: fls. pink. Cent. Amer.

55. *Lubbersii*, E. Morr. Semi-shrubby, the short rhizome occasionally ascending and becoming gouty at the base: lvs. large, peltate, obliquely lanceolate, entire, green with many silvery blotches above, claret-colored beneath: fls. white, on long peduncles. Brazil. G.C. III. 3:301. R.H. 1888, p. 225.—Named in compliment to M. Lubbers, curator Brussels Bot. Gard. Has spots like *B. maculata*.—Of little horticultural value.

56. *álbo-coccinea*, Hook. (*B. Grahmiana*, Wight). Smooth and shining: rootstock creeping: lvs. peltate, ovate, leathery, 6 in. long: peduncles 1 ft. long, coral-red, springing from the crown; male fls. 1 in. across, with 4 petals; female fls. also of 4 petals, white above, coral-red beneath. Flowers in winter. India. B.R. 32:39. B.M. 4172.—A beautiful species, apparently little cult. now.

EE. *The lvs. not peltate.*

57. *manicata*, Cels. Essentially smooth except the hairy lf.-edges, short-stemmed, succulent: lvs. ovate, obliquely cordate, thick, fleshy, smooth, shiny green, 6-8 in. long; petioles covered with fleshy scale-like hairs: peduncles a foot or more long, bearing loose panicles of pink dipetalous fls. Mex. Var. *aureo-maculata*, Hort., has large blotches of yellowish white on the lvs. F.E. 8:1159. F.R. 2:435. A.G. 23:337.—Flowers profusely in spring, having a light elegant and feathery effect supported on long erect and free-branching peduncles. Var. *crispa*, Hort., has foliage with crispate margins; there is also a yellow-spotted form of it.

58. *leprøsa*, Hance. A dwarf, compact species, with short, free-branching rhizomes and erect, ovate, pale green lvs. with biserrate margins and reaching to a height of 6-9 in.: infl. few-fl.; fls. large for so small a plant, rose-pink, male with 4 petals and female with 6 petals: partially deciduous during the winter months. China.—Thrives best in a greenhouse.

59. *magnifica*, Lind. Fig. 516. Sub-frutescent, smooth and shining, the sts. creeping: lvs. large and bold, sometimes rising 2 ft., obliquely ovate-cordate, entire or obscurely lobed, serrate, slightly peltate, bright green, the margins ciliate: fls. long and fuchsia-like, numerous, the sts., bracts, fls. and hairs of the clusters all scarlet-red, showy. Colombia. R.H. 1870: 270.—One of the best of the rhizomatous begonias. Lf.-blades often 2 ft. across.

#### IV. SPECIES FIBROUS-ROOTED (*rootstock, if any, small*). Nos. 60-119.

A. *The small succulent herbaceous kinds, never becoming very tall or woody.*

60. *semperflorens*, Link. & Otto (*B. Sellowii*, Klotzsch). Fig. 517. Erect, smooth plants with st. herbaceous, green or reddish, 6-18 in. high: lvs. ovate, rotundate, obtuse at the base, toothed and ciliate along the margin, pale glossy green, tinged with red on the midrib and petiole: peduncles axillary, few-fl.; fls. white or rose-colored; males with 4 petals, females with 5 petals: caps. green, wings tinged with red. Brazil. L.B.C. 15:1439. R.H. 1897, p. 46. B.M. 2920.

—This is an exceedingly variable species. An endless number of garden forms has been produced from it. A very popular bedding begonia, and a persistent bloomer. Var. *Vernon* (*atropurpurea compacta*, Gt. 44, p. 570) is one of the best forms. *Triomphe de Lorraine* (Fig. 518) is one of the good bedding kinds. Fls. cherry-red, the stamens golden yellow. *Gloire de Châtelaine* is a form of dwarf habit and deep rose fls.; one of the best in England for bedding and pots, and a continuous bloomer.

61. Var. *gigantæarøsea* (*B. semperflorens* × *B. Lyncheana*). Very distinct: rootstock woody: sts. succulent, about 3 ft. high: lvs. on short petioles, ovate or reniform, obtuse, toothed at



518. *Begonia, Triomphe de Lorraine* (×½). No. 60.







XIV. Foliage begonias well grown in banks, with ferns and similar plants.



the margins, about 7 in. across, bright green, with a red spot at base of sinus: peduncles axillary stout, 4-8 in. long, bearing large panicles of large rosy red fls., of which the males have 2 ovate petals, the females 2-4 smaller petals. A.F. 13:586. A.G. 16:41.—One of the best begonias for winter decoration in the cool greenhouse. Intro. by Lemoine in 1888.

62. *Carrierei*, Hort. (*B. semperflorens* × *B. Schmidtii*. *B. Bruantii*, Hort. *B. Smilhii*, Hort.). DEWDROP. Compact, about 1 ft. high: lvs. like *B. semperflorens*: fls. nearly as large as in *B. semperflorens*, abundant, pure white. G. 6:557. J.H. III. 53:249.—Excellent bedding begonia; also a good late winter bloomer. Intro. by Bruant in 1883.

63. *Érfordii*, Hort. (*B. Schmidtii* × *B. semperflorens* Vernon). Very dwarf and bushy, 1½ ft. high: fls. abundant, rose-carmine.—Excellent for bedding. Intro. by Haage & Schmidt in 1894.

64. *Lyncheana*, Hook. (*B. Roëzii*, Hort., not Regel). Glabrous: rootstock stout, somewhat tuberous: st. erect, tall, succulent, smooth: lvs. green, smooth, ovate-cordate: sinus red: fls. in axillary, drooping cymes, deep reddish crimson. Mex. B.M. 6758.—Very like *B. semperflorens gigantea rosea*, but not so strong a grower. Perhaps not now in cult.

65. *Luciænæ*, Hort. (*B. Lyncheana* × *B. Bruantii*). Fls. large, in the axils of the lvs., rose.—Intro. by Bruant in 1889.

66. *Corbeille de Feu* (*B. semperflorens* × *B. fuchsioides*). Fig. 519. Intermediate in habit between its parents: fls. bright coral-red, produced in quantity nearly all the year round.—The plant branches freely from the base and makes an excellent bedding plant; the fls. are rich-colored and withstand the sun well. Intro. by Lemoine, 1891.

519. *Begonia Corbeille de Feu* ("Basket of Fire") (×½). No. 66.

AA. The kinds becoming woody or shrubby, mostly tall and much branched.

B. Plants slender, upright, small-leaved.

C. Fls. pink or red.

67. *fuchsioides*, Hook. Fig. 520. Smooth: rootstock woody, not prominent: sts. slender and erect, 2-3 ft., succulent: lvs. many and small, ovate, 1½ in. long, tinged with red when young: fls. drooping like a fuchsia, rich scarlet, males with 4 petals, females with 5 petals. Mex.—Requires the conditions of a warm airy greenhouse. If kept in a moist close atmosphere it is apt to damp off badly, and if kept too warm it makes a lot of growth and produces very few fls. It rapidly forms a large specimen if kept growing, and is a most attractive plant for greenhouse decoration during winter and spring months. B.M. 4281. Var. *miniata*, Lind. (*B. cinnabarina*, Hort.), differs only in having flesh-colored fls. and smaller lvs. R.H. 1855:221. F.S. 8:787.

68. *Ingramii*, Hort. (*B. nitida* × *B. fuchsioides*). Fig. 521. Combines the characters of the two species: very free-flowering and makes a most desirable bedding plant, and also blooms well in winter: fls. rose, large: foliage tinted with red when exposed to the sun. The

horizontal blooming side branches are characteristic of this plant as a greenhouse subject.—Intro. by Ingram in 1849.

69. *Digswelliana*, Hort. (*B. Sandersonii*, Hort.) A useful hybrid probably between *B. fuchsioides* and one of the numerous varieties of *B. semperflorens*: sts. erect or nearly so, green suffused with red: lvs. elliptic, serrate, 2-4 in. long, dark rich green in color: infl. medium in length and size; fls. rosy scarlet, pendulous.—A useful bedding plant or may be used for a cool greenhouse.

70. *incarnata*, Link & Otto (*B. aucubæfolia*, Hort. *B. insignis*, Grah.). Smooth: st. erect, sub-herbaceous, 2-3 ft. high: lvs. very unequally cordate, ovate-lanceolate, toothed: fls. rose-colored, abundant, males 1½ in. across, with 2 ovate and 2 narrow petals; females smaller, with 5 equal petals. B.M. 2900. A.G. 16:97. A.F. 12:724-5; 13:588; 17:857. R.H. 1870, p. 266; 1875:151. Var. *grandiflora*, Hort., is a much improved variety, very useful for cut-fls. or decoration in winter.

71. *ascotiensis*, Weber. Of hybrid origin, probably obtained from *B. fuchsioides* and one of the forms of *B. semperflorens*: lvs. ovate, 2 in. long, smooth, brown, margin green, dentate: fls. on peduncles 4 in. long, bright red.—An excellent bedding begonia.

CC. Fls. white, or tinted white.

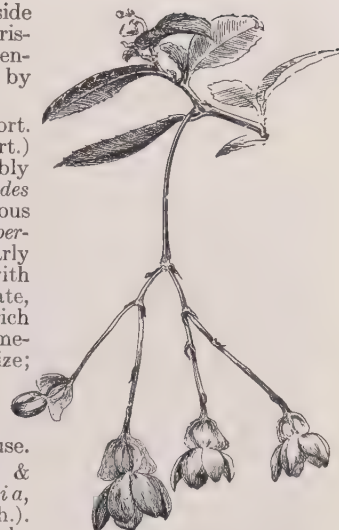
72. *foliösa*, HBK. Small, smooth, shrubby: sts. herbaceous, slender, branching: lvs. very many, frond-like, very small, somewhat 3-lobed, glossy green, distichous: fls. white, tinged with rose. Blooms early summer. Colombia.—An elegant little basket and ornamental plant.

73. *knowsleyana*, Hort. Much like *B. incarnata*, but lf. smaller, entire or nearly so: fls. nearly white. Named for Knowsley, seat of the Earl of Derby. Origin not known; probably a seedling of *B. acuminata*. A good winter bloomer, particularly in 6-in. pots. J.H. III. 49, p. 177.



521. *Begonia Ingramii* (×½). No. 68.

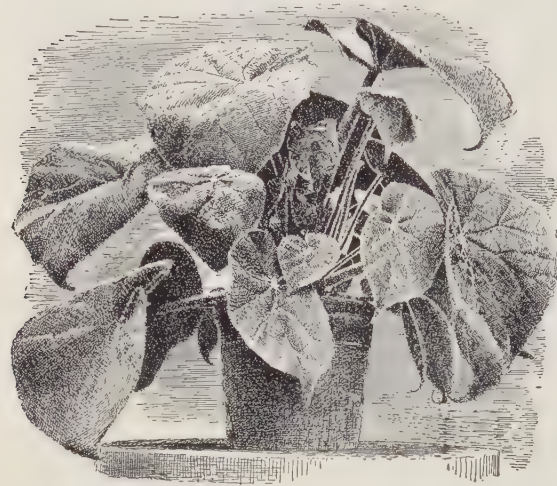
74. *acuminata*, Dry. Slender, 3-4 ft.: sts. nearly or quite smooth: lvs. 2-3 in. long, oblique-ovate, tapering to the point, toothed and serrate, the margin and veins underneath hairy: fls. white, 3-5 on a peduncle, nearly 1 in. across, spring and summer. Jamaica.—A



520. *Begonia fuchsioides* (×¾). No. 67.

useful plant for growing in baskets, thriving and flowering freely in a sunny position in a cool airy greenhouse. Intro. to Kew in 1790. B.M. 4025. B.R. 364.

75. *álbo-pícta*, Hort. Shrubby, compact growth, freely branched: lvs. elliptical, lanceolate, covered with



522. *Begonia Scharfiana*. No. 89.

numerous small silvery white spots: fls. greenish white. males with 2 broad and 2 narrow petals, females of 5 subequal petals. Brazil.—An elegant foliage plant, especially in the young state. Intro. by Bull in 1885.

BB. *Plants low-growing, diffuse.*

76. *Schmidtiana*, Regel (*B. Schmidtii*, Hort.). Herbaceous or half-shrubby, slender-branched, 1 ft. or less in height, the branches red-tinged: lvs. lobed, toothed, hairy, about 2 in. long, reddish beneath: fls. white, tinted with rose. Brazil. R.H. 1883, pp. 56-7. Gn. 17, pp. 268-9.—A very useful plant for summer bedding. Named for Mr. Schmidt, of the firm of Haage & Schmidt, Erfurt. Var. *rosea*, Hort., has rose-red fls.

BBB. *Plants stiff, succulent, white-scurfy.*

77. *peltata*, Hassk. (*B. Hasskarlii*, Zoll.). Upright: st. perennial: lvs. peltate, ovate-acuminate, very thick and succulent, covered with a whitish tomentum, 6-9 in. long: fls. small, white, on long peduncles. Brazil.—It is the only begonia in cult. with thick, felted, peltate, silvery lvs.

78. *venosa*, Skan. A tall, stout, erect species with white-frosted very fleshy foliage, and marked by very large inflated conspicuously veined stipules: lvs. reniform or ear-shaped, repand-entire, joined at the middle (not peltate) with the thick flattened petiole: fls. many, white, crowded on a reddish peduncle. Brazil. B.M. 7657.—Very distinct, and a striking plant when well grown. Requires a warm sunny position in the greenhouse, and to be kept rather on the dry side at the roots during winter.

BBBB. *Plants mostly tall and erect, distinctly shrubby.*

c. *Lvs. compound or nearly so.*

79. *luxurians*, Scheidw. Sts. and lf.-stalks hairy, the lf.-stalks reddish: pointed membranous stipules at the younger nodes: lvs. peltately compound, the 7-17 lfts. lanceolate (3-6 in. long and 1 in. broad), serrate, under surface glabrous and green, upper surface with stiff short hairs and red: fls. small, cream-color, in a

compound long-stalked cluster. S. Amer. G.C. III. 51:28.—Thrives in an intermediate temp.

80. *Hemsleyana*, Hook. Slightly hairy: habit dense, free-branching: sts. erect, red, hairy: lvs. digitate 6-12-parted, the parts or lfts. lanceolate or elliptic, slightly curved, serrate undulate, rich shining green above, dull greenish red beneath: petiole long, red: sts. and petioles covered with soft-tomentose hairs: infl. slender, few-fl.; fls. pink, large, 1-1½ in. diam. Yunnan, S. China. B.M. 7685.—One of the hardest species.

81. *platanifolia*, Hort. (Schott?). St. shrubby, smooth, 5-6 ft. high, erect, robust, smooth, green, joints annulated: lvs. 8-10 in. across, reniform, lobed half way down, hispid on both sides, dark green, lobes acute, toothed, ciliated: fls. in axillary dichotomous cymes, large, white, tinted rose. Brazil. B.M. 3591.—*B. gunneræfolia*, Lind. (*B. Washingtoniana*, Hort.), is very similar to this, but its lvs. are not so deeply lobed and the fls. are very insignificant. I.H. 22:212. Runs into many forms. See *B. Faureana* in supplementary list, p. 484.

82. *digitata*, Raddi (*B. palmata*, Hort.). St. short, gouty: lvs. palmate, 10-12-parted, somewhat pubescent, green above, brownish beneath: fls. white, in dense clusters. Brazil.—A species of little decorative value.

83. *carolinæfolia*, Regel. St. erect, thick, fleshy: lvs. palmately divided into 6-8 long ovate segms.: fls. small, pink, on long peduncles. Mex. Gt. 1:258.—Named for its lvs. resembling those of the *Carolinea* (*Pachira*). The lfts. are ovate, rather than narrow as in most begonias with divided or compound lvs., and in this regard peculiar.

84. *diadema*, Lind. Sts. short and fleshy, 2 ft. high: lvs. many, maple-like, deeply parted, bright green blotched with white, dentate: fls. insignificant, pink. Borneo. I.H. 29:446.—Attractive for its conspicuously marked foliage.

cc. *Lvs. not compound.*

d. *Whole plant hairy.*

E. *Foliage light green, and plant pubescent.*

85. *vitifolia*, Schott, not Lindl. (*B. grandis*, Otto. *B. reniformis*, Hook.).

Tall, strong species, 3-4 ft. high: lvs. large and grape-like (*Vitis vinifera*), orbicular or reniform, lobed and serrate, soft-pubescent, green above and rusty veined beneath, the petiole flat or canaliculate on top: fls. small, white, slightly downy, winter. Brazil. B.M. 3225.

86. *Engleri*, Gilg. (*B. Engleri*, Hort.). Striking species with mostly a single st.: conspicuously red-strigose-hairy and scaly, becoming 5 ft. tall: lvs. large and showy, thin,

oblique and ovate-oblong, deeply and evenly serrate, hairy, red-ribbed: fls. on long pendulous peduncles, numerous, pink. E. Trop. Afr.—Distinct, and worthy of attention on account of its handsome hairy lvs.



523. *Begonia Haageana*. Showing a very small cluster ( $\times \frac{1}{2}$ ). No. 91.



EE. *Foliage colored above or beneath, or both.*

F. *Fls. white.*

87. *echinosépala*, Regel. St. green, succulent, erect and branching freely: lvs. obliquely oblong, finely serrate, rather small: fls. on axillary peduncles, white, with curiously papillose sepals. Brazil.—A useful species for warm greenhouse, of very easy cult. and very free-flowering. One of the best for decoration.



524. *Begonia cathayana* ( $\times \frac{1}{2}$ ) No. 95.

88. *erythrophýlla*, Neum. Soft-hairy, the st. fleshy, strong: lvs. thick, reniform, long-stalked, dark green and lustrous above and red beneath, almost entire, strigillose: fls. small, white.—Probably of garden origin.

89. *Scharffiàna*, Regel. Fig. 522. A robust herbaceous perennial, 1–3 ft. high: lvs. large, thick, fleshy, hairy, olive-green above, crimson below: stipules very large and prominent: fls. waxy white with red hairs on under surface of petals, large. Brazil. Gt. 1888, p. 661.—This begonia requires warmth and care to succeed well. When well grown, it is an excellent bracket-plant.

90. *Duchártrei*, Hort. (*B. echinosépala*  $\times$  *B. Scharffiàna*). St. 2–3 ft. high, branched profusely, hairy, purple: lvs. ovate-lanceolate, acuminate, green above, hairy, red below: fls. large, waxy white, a few red hairs on the under surface of petals. R.H. 1892, p. 29.—Intro. by Bruant in 1892.

FF. *Fls. colored.*

91. *Haageàna*, Wats. (*B. Scharffi*, Hook.). Fig. 523. Tall-shrubby, whole plant hairy: lvs. ovate-cordate, acuminate, wavy, red-nerved above: fls. rose-pink, with a cyme 8–12 in. diam., males with 2 round and 2 narrow petals, females with 5 equal petals. Brazil. G.C. III. 16:633. B.M. 7028, (as *B. Scharffi*).—One of the most beautiful plants of the genus, and now one of the best known of the big tall red-hairy begonias; the hanging trusses of fls. (imperfectly represented in Fig. 523) are very conspicuous. Named for one of the firm of Haage & Schmidt. *B. Credneri*, Hort. (*B. Scharffiàna*  $\times$  *B. metálica*). Intro. by Haage & Schmidt, 1890. There is another plant named *B. Credneri*, which was raised by Lemoine in 1891 from the same parents. Bruant also used these two parents in 1891, and called his plant *B. pictaviensis*. All three plants can be distinguished from *B. Haageana* only by their smaller fls. and the peduncles standing erect and not gracefully bending over, as in *B. Haageana*.

92. *Alléryi*, Hort. (*B. metálica*  $\times$  *B. gigantèa*). Of the *B. Haageana* type: hairy, lvs. bronzy, red-veined beneath, toothed: plant becoming very tall (even 4–6 ft. in a single year), producing many large pendulous clusters of rose-colored fls.—A very fine warm greenhouse or stove variety, free-flowering, of easy cult. Shown in 1905 before Société National d'Horticulture de France by M. Allery Aubert of Tours.

93. *metálica*, G. Smith. Hairy: sts. perennial, succulent, 4 ft. high, branched: lvs. obliquely cordate, lobed and serrated, 3–6 in. long, upper surface green, shaded with a dark metallic color: fls. blush-white, under side of petals clothed with red bristly hairs. There are a number of varieties, e. g., var *variegata*, var. *velútina*, var. *cýprea*, but they do not differ much from the original. Bahia. R.H. 1844:218 (as *B. velútina*). G.C. II. 5:397.—A very attractive plant.

94. *Margaritæ*, Hort. (*B. metálica*  $\times$  *B. echinosépala*). Plant 1–2 ft. high: sts. purple, hairy: lvs. ovate-acuminate, sinuously dentate, green and purplish above, red beneath: fls. in cymes, large, rose-colored; sepals with long hairs at the base.—Intro. 1884.

95. *cathayàna*, Hemsl. (*B. Bowringiana*, Hort., not Champ.). Fig. 524. A beautiful ornamental-lyd. species, named in 1908: sts. fleshy and crimson-hairy, 18 in. high: lvs. hanging much like the *Rex* varieties, large, obliquely cordate, long-pointed, toothed and serrate, green with crimson nerves above and bright mottled crimson beneath, very showy: fls. large for the group, vermilion. Sept. China. B.M. 8202.—It propagates readily from cuttings of both sts. and lvs. It has been hybridized with *B. Rex*, producing very richly colored foliage. *B. Bowringiana*, Champ. B.M. 5182, is distinct from *B. cathayana*, and apparently is not in cult.; but the *B. Bowringiana* of gardens, as figured in G.C. Apr. 18, 1903 suppl., is the plant here described.

96. *deliciòsa*, Lind. Plant the size of *B. Rex*, but smooth or nearly so: lvs. large, obliquely cordate-ovate, many triangular-toothed or -lobed, marked above with many gray blotches, reddish beneath: fls. in dense clusters, pink, produced in winter. Ceylon.

97. *laciniàta*, Roxbg. Erect, 1–2 ft., becoming straggling, the sts. green: lvs. roundly ovate, sharply lobed, pubescent, black-purple, with a broad zone of green, reddish on the under side: fls. as in *B. Rex*. India, S. China. B.M. 5021. G.C. III. 34:368.—Odd.

DD. *Whole plant smooth.*

E. *Lvs. thick, broad and entire, often peltate.*

98. *sanguinea*, Raddi. Fig. 525. Very smooth and shining: sts. perennial, woody at the base, red: lvs. 4–6 in. long, subpeltate, obliquely cordate, abruptly pointed, thick, fleshy, bright green above, blood-crimson below: fls. small, white. Brazil. B.M. 3520.—A handsome evergreen-foliaged begonia, notable for its brilliant red-lined thick-edged lvs.



525. *Begonia sanguinea* ( $\times \frac{1}{2}$ ) No. 98.

EE. *Lvs. medium, stiff, green and shining.*

F. *Fls. white.*

99. *angulàris*, Raddi (*B. zebrina*, Hort.). Smooth, shrubby, very tall (to 8 ft.), much branched, the branches spreading or drooping: lvs. elongate, ovate-acuminate, shiny dark green, veins white, pale green and reddish tinged beneath, the margins undulate and crenate-serrate: fls. small ( $\frac{3}{4}$  in. across) and many in large cluster, white. Brazil. B.M. 7842.—A striking plant.

100. *ulmifolia*, HBK. (*Donaldia ulmifolia*, Klotzsch). Tall, green, the st. 4-angled and grooved, shedding its hairy scurf: lvs. small and elm-like (whence the name), thinly hairy, green on both sides: fls. white, small. Colombia. Gt. 1854:93.—Very free-flowering when grown large, the fls. appearing in winter and early spring.



526. *Begonia nitida* ( $\times \frac{1}{2}$ ).  
No. 104.

101. *longipes*, Hook. Tall and stout (3 ft. or more), the st. furrowed and more or less glandular but otherwise the plant green, smooth and shining: lvs. ample, reniform or nearly orbicular, oblique or lop-sided, glossy, serrate: fls. small, white, numerous in a long-stalked cluster, winter-blooming. Trop. Amer. B.M. 3001.—In some forms, the peduncles are excessively long.

102. *undulata*, Schott. Plant green and shining, although somewhat hairy when young: lvs. 2-ranked, oblong, very short-stalked, acuminate, wavy or undulate on the margins: fls. rather small, white, in short axillary clusters, the pistillate ones long. Brazil. B.M. 2723.

103. *kewensis*, Hort. Like *B. undulata*: slender, with spreading or drooping leafy branches: lvs. ovate to cordate-ovate about 6 in. long, smooth and shining, green: fls. many, in large clusters, small, white or slightly cream-colored,  $\frac{1}{2}$  in. across. Of garden origin.—There is a hybrid between this and *B. coccinea*. A good basket plant.

FF. Fls. colored.

104. *nitida*, Dry. (*B. minor*, Jacq. *B. speciosa*, Hort. *B. obliqua*, L'Her.). Fig. 526. Smooth: st. 3-4 ft. high, perennial, fleshy, woody at the base when old: lvs. obliquely ovate, wavy, 4-6 in. across, glossy dark green: fls. on long, axillary peduncles, pale pink, with a silvery blush; males  $1\frac{1}{2}$  in. across, with 2 broad and 2 narrow petals; females smaller, with 5 equal petals. Jamaica. B.M. 4046. A.G. 24:575. Gt. 2:192.—A very useful plant in the greenhouse, flowering all winter. Also interesting on account of being probably the first begonia intro. to cult. in Eu. (1777, at Kew, by Wm. Brown). Var. *odorata alba* is a very handsome variety of this species, which has smaller fls. of the purest white and sweet-scented. Dr. Nachtigal (*B. nitida* var. *odorata alba*  $\times$  *B. Lyncheana*), is similar in general form to the latter, but has fls. of a delicate rose-pink, especially on the inner surface of petals.

105. *Teuscheri*, Lind. Stout: st. 2-6 ft. high, erect, strong grower: lvs. large, oblique, fleshy, acutely lobed, ovate-lanceolate, margins serrate, bright green above, with large grayish blotches or in one form with dots, red and strongly veined beneath: fls. in axillary clusters, bright red, large. Malaya. I.H. 26:358.

106. *Bismarckii*, Veitch. Lvs. large and lobed, oblique, acuminate-pointed, 6 in. long: fls. in drooping clusters, satiny rose, males insignificant, females  $1\frac{1}{2}$  in. across and making a gorgeous display.—Very similar to *B. Teuscheri*.

107. *carinata*, Veitch. A handsome hybrid, the result of a cross between *B. coccinea* and *B. Dregei*: plant erect or nearly so, branching freely: st. green, shining: lvs. obliquely ovate-acuminate, deeply toothed, light green: fls. rosy scarlet in large pendulous cymes.—The male fls. do not remain on the plant long, the main feature being the large bright rosy scarlet female fls. and their brightly colored ovaries which remain on the plant for a considerable period. In this respect it greatly resembles its parent, *B. coccinea*. It is a very fine greenhouse plant and should be in every collection.

108. *polyantha*, Hort. Sts. green, red at the nodes, erect, free-branching: lvs. elliptic, rich green, glabrous or nearly so; petioles reddish green, 2-3 in. long: infl. numerous, 10-20-fl.; fls. pink,  $\frac{3}{4}$ -1 in. diam. Mex.—A strong-growing species of quick growth and producing a mass of charming fls. all over the plant in winter and early spring. One of the finest and best of the winter-flowering begonias. The plants often supplied as *B. natalensis* are said to be this species.

109. *coccinea*, Hook. (*B. rubra*, Hort. *B. maculata* var. *corallina*, Hort.). Fig. 527. Smooth: sts. tall, succulent: lvs. on short petioles, obliquely oblong, angular, with wavy red margins, 4-6 in. long: fls. deep coral-red; males  $\frac{1}{2}$  in. across, with 4 unequal petals; females more attractive, owing to the length and rich color of the



527. *Begonia coccinea* ( $\times \frac{1}{2}$ ). No. 109.

ovary, which has 3 small subequal wings. Brazil. B.M. 3990.—The fls. are very persistent and exceedingly ornamental, especially when planted out. Thrives well in a warm airy greenhouse. One of the most attractive and best-known members of the genus. It has been largely used by the hybridist, the well-known



President Carnot being one of its offspring. Intro. from the Organ Mts. of Brazil by William Lobb in 1841.

EEE. *Lvs. medium to large, the margins strongly toothed, incised or lobed.*

*F. Fls. white.*

110. *Madame de Lesseps*. Fig. 528. Showy, strong, erect grower: *lvs. acutely lobed, large, margins serrate, green above, red and strongly veined below: fls. large, white, in axillary clusters, males small.* Garden origin.



528. *Begonia Madame de Lesseps* ( $\times \frac{1}{2}$ ). No. 110.

111. *Olbia*, Kerchove. Erect, the st. 2-3 ft. high: *lvs. lobed, hairy and olive-green above, smooth and red beneath, margins reddish, petioles grooved, smooth, veins prominent as dark lines: fls. concealed by lvs., in small clusters directly on the st. without peduncles, large, white, male and female in same cluster.* Brazil.

*FF. Fls. colored, varying to tinted white.*

112. *argenteo-guttata*, Hort. (*B. albo-picta*  $\times$  *B. olbia*). Fig. 529. Profusely branching: *lvs. shining green, ovate-acuminate, slightly lobed, smooth, 2½ in. wide, 3-5 in. long, thickly dotted with white spots: fls. in clusters, variable; petals white, tinged with pink: caps. rose-pink.*—Intro. by Lemoine, 1889. Well worth a place in a collection on account of its decorative foliage.

113. *maculata*, Raddi (*B. argyrostigma*, Fisch.). Very smooth: st. erect, 2-3 ft., branching, woody when old: *lvs. cordate, lanceolate, wavy, 4-6 in. long, upper surface sometimes with large white roundish or circular spots: fls. pale rose or white, males with 2 ovate and 2 narrow petals, females with 5 equal petals.* It includes several forms. Brazil. B.R. 666. Var. *argyrostigma picta*, Hort., is a common form, with very large white spots on the *lvs.* An old greenhouse or conservatory plant. Var. *elegantissima*, Hort., a variety with more slender habit of growth than the type and only sparingly maculated on the *lvs.*, but forming a large free-flowering specimen. Var. *Wrightii*, Hort., a variety with large *lvs.* heavily maculated with white, especially in the young state: infl. pendulous, 10-20-fl.; *fls. white*, an in. diam.; males short lived; females green-

ish white, remaining on the plant for several weeks.—This variety does not branch very freely as with the preceding variety but has the habit of sending up long stout shoots, 6 or 8 ft. high, from which the fine handsome clusters of fls. hang in the form of a chain.—*B. coralina*, Hort., is a free-flowering form, useful for conservatory, 8-10 ft. on rafters: *lvs. dark glossy green, almost covered with bright coral-red long fls. in large drooping trusses.* J.H. III. 51:339.



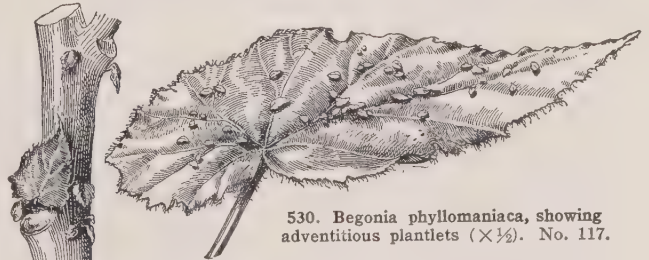
529. *Begonia argenteo-guttata* ( $\times \frac{1}{2}$ ). No. 112.

114. *Thurstonii*, Hort. (*B. metdillica*  $\times$  *B. sanguinea*). Smooth and shiny: st. 2 ft. high: *lvs. orbicular-acuminate oblique, rich purple, red on the under side, veins prominent: fls. insignificant, small, rosy white, on slender peduncles.* A.F. 7:729.—Excellent for bedding on the north side of a building, and as a pot-plant. Originated with C. Thurston, Paterson, N. J.

115. *dichroa*, Sprague. A tall-growing species but often remaining dwarf, woody in lower parts, habit half-pendulous: sts. green in upper parts only: *lvs. large for so dwarf a plant, elliptic-ovate, 6-12 in. long, rich green, glabrous on both sides, occasionally toothed, prominently veined: seedling plants beautifully maculated with white when young but the spotting is entirely lost in the adult stage: infl. dense, short, hidden amongst the upper lvs.; fls. large; males occasionally 2 in. diam., petals 4, rich brick-red; females smaller, ovaries brick-red shaded with white and prominently winged.* Brazil. B.M. 8412.—A distinct and handsome species, useful as a basket-plant.

116. *coronata*, Hort. (*B. carolinixifolia*  $\times$  *B. polyantha*). St. shrubby, coarse, 2-3 ft. high, covered with numerous withered stipules: *lvs. large, lobed, on long petioles: fls. pale pink, with large, somewhat drooping cymes.*

117. *phyllomaniaca*, Mart. Fig. 530. Hairy and shaggy: st. perennial: *lvs. obliquely cordate, attenuate, 4-6 in. long, slightly lacinated and fringed: fls. pale*



530. *Begonia phyllomaniaca*, showing adventitious plantlets ( $\times \frac{1}{2}$ ). No. 117.

pink. B.M. 5254. Brazil.—This species is peculiar in producing from the st., petioles and *lvs.* innumerable buds and small growths. It is one of the most interesting of plants. It is covered with small fls. in early spring.

118. *President Carnot*, (*B. coccinea*  $\times$  —?). Figs. 531, 532. Plant, 2-6 ft. high, spreading: *lvs. ovate-lanceolate, acute-lobed, ribs on the under side red: fls. in a large cluster; males small, insignificant; females large, bright red-carmine, 2 in. long, including caps.*—A striking and handsome plant and one that should be in all collections. It is of very easy





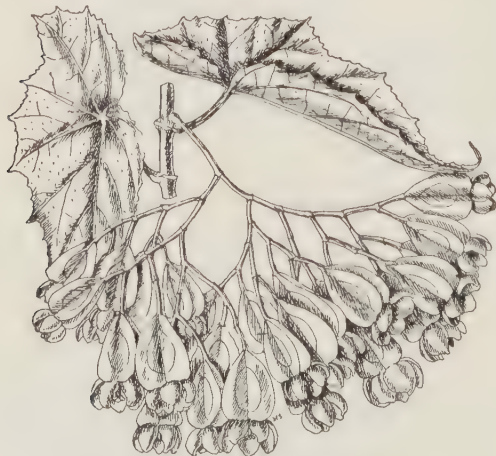
531. *Begonia President Carnot*.  
No. 118.

cult. and each shoot bears 1-3 of its immense clusters of brilliant female fls.

119. *lucérna*, Hort. Fig. 533. Hybrid of exceptional merit, with habit and constitution of President Carnot: lvs. heavily spotted with white, specially when young; fls. in long pendulous clusters that are often 1 ft. in diam.; male fls. 1 in. across; females much larger, with bright pink ovaries, giving the plant a distinctive appearance

as they persist for many weeks.—The plant succeeds well in a warm greenhouse. Should be in every collection. Named for Lucerne, where it originated. Intro. to commerce in 1903.

*B. amabilis*, Hort. A large-fl. form of the Gloire de Lorraine class, the clear brilliant pink blossoms being nearly 1½ in. across (Rochford).—*B. Balmisiana*, Ruiz (*B. populifolia*, Kunth) Var. *mitellifolia*, Dav. Tuberous rootstock: st. simple, erect, purplish, pubescent; lvs. reniform, obscurely lobed, irregularly serrate, whitish tomentose beneath: fls. pale rose, in a terminal raceme. Mex. R.H. 1911, p. 43.—*B. Barkeri*, Knowl. & Wesc. Fibrous-rooted: stiff, erect, sparsely branched: sts. somewhat woody, brown, densely hairy: lvs. peltate, ovate, acute, lobed, serrate, 5-7 in. long, light green in color; veins pale yellowish green; petioles long and fairly stout; infl. large and spreading, freely branched; fls. pink, produced in early spring. Mex.—A distinct and pretty begonia.—*B. calabárica*, Stapf. St. short and prostrate: lvs. peltate, oblique, broadly cordate-ovate, 2-3 in. long, ciliate on margins; fls. red, small. Calabar, W. Trop. Afr.—*B. crassicaulis*, Hort. (Lindl.?). Lvs. large, nearly circular, coriaceous, clear green: fls. many in vertical clusters, small, rose-white, the bloom being more beautiful than that of *B. manicata*, which it resembles.—*B. crispa*, Krelage. Fls. large, on long, erect peduncles above the lvs., the 5-8 perianth segms. crispate. Country unrecorded.—*B. cristata*, Hort. A form or race of tuberous begonias with a crested outgrowth in the center of the fl., the race is fixed and comes more or less true from seed.—*B. eldior*, Hort. Veitch, is a cross between *B. socotrana* and a tuberous begonia.—*B. Elsmeri*, Hort. Of garden origin, probably hybrid: fls. stellate, large, flesh-colored, in winter. European.—*B. Faureana*, Garn. Lvs. palmately parted to the middle into 3 or 5 main divisions and these divisions again parted or notched, beautifully colored with silvery white on a green ground and with brown-green on the ribs. Brazil. Intro. to France in 1892; named for the former President of France. I.H. 42:34.—Some at least of the *B. platanifolia* of gardens is this species.—*B. Forgetiana* Hemsl. Fibrous-rooted: nearly 2 ft., more or less branched: lvs. fleshy, glossy green, 6-7 in. long and 2 in. broad: fls. pink and white, 1 in. across, in clusters. Brazil.—Named for L. Forget, collector for Messrs. Sander. Allied to *B. undulata*.—*B. gemmata*, Hort. (*B. decora* × *B. Rex* var.). Lvs. angled, Rex-like, dotted with silver on a green ground: very attractive as a specimen plant. G.



532. *Begonia President Carnot* (× ¼).

22:123.—*B. gigantea*, Hort. Rootstock woody: st. 2-3 ft.: lvs. caudate-acuminate, becoming 1 ft. long: fls. many, small, white or pale pink. It is probably a form of garden origin.—*B. Gilsonii*, Hort. Plant, 2 ft. high: st. shrubby, coarse: lvs. large, lobed: fls. on long, erect peduncles, pale pink.—Interesting as being a double-fl. fibrous-rooted begonia. Named for Gilson, colored gardener to Mrs. Livingston, N. Y.—*B. Heddei*, Warb. Tall, branching: lvs. triangular-ovate or broadly elliptic, acuminate, jagged and notched and usually lobed toward the base, green above and red beneath: fls. light rose, borne amongst the lvs. German E. Afr.—*B. Ideala*, Hort. Veitch. Neat dwarf plant, *B. socotrana* × a tuberous begonia: 6 in.: fls. semi-double, 2 in. across, brilliant rose, long-lasting: winter. G. n. 61, p. 13. R.H. 1906, p. 131.—*B. Kümmeria*, Gilg. Fibrous-rooted: st. erect and free-branching, green suffused with red: lvs. ovate, 6 in. diam., shining, green veins and petiole red: infl. short, few-fl.; fls. bluish-white, tipped with rose; male, ¾ in. diam., female with bright yellow stigmas; ovary 3-celled bluntly triangular, swelling up to a large fleshy fr. some 2 in. long. Trop. Afr.—*B. Kunthiana*, Walp. St. erect: lvs. lanceolate, acuminate, serrate, smooth, green above, red below: fls. white, large. B.M. 5284. Brazil.—*B. Léhmbachii*, Warb. Allied to *B. Heddei*: herb, erect, 8-16 in., the sts. fleshy and red: lvs. oblique, 4-5 in. long, irregularly 5-lobed, dentate, light green and somewhat hairy above, red-green beneath: fls. axillary, small, tinted and red-striate. German E. Afr. Gt. 49:1476.—*B. Lindleyana*, Hort.—*B. incarnata*.—*B. lobulata*, A. DC. Fibrous-rooted: erect, branching: sts. light green: lvs. highly glabrous, pale green, ovate-acute, serrate, occasionally lobed, prominently veined, 6-8 in. long; petiole red: infl. rather short, densely fld.; fls. small, white. Mex.—*B. longicyma*, Bellair, is a garden hybrid of *B. Schmidtiana* and *B. semperflorens*,



533. *Begonia lucerna* (× ¼). No. 119.

of the fourth generation: much-branching, bushy: lvs. like those of *B. gracilis*: female fls. few or none, terminal; males lateral: fls. rose-tinted. R.H. 1905, p. 582.—*B. Martiana*, Link & Otto. Tuberous: st. 1-1½ ft., with erect branches, glabrous, leafy: lvs. oblique, cordate-ovate, acuminate, double toothed, 3-6 in. long: fls. solitary or clustered in axils, large, rose-pink, the males 4-merous and females 5-merous. Mex. Vars. *grandiflora*, *pulcherrima* and *racemiflora* are known to growers. B.M. 8322. All considered to be forms of *B. gracilis* (p. 474).—*B. Patria*, Hort. A garden hybrid of *B. socotrana* and *B. Pearcei*: plant dense and free-flowering, 10-12 in.: fls. many, rather small, bright rose-pink: lvs. similar to those of *B. socotrana*. (Lemoine).—*B. Pögei*, Warb. Fibrous-rooted: erect or spreading: sts. terete, woody in lower part, dull brownish green: lvs. only slightly oblique, elliptic, 4-6 in. long, dark green above, suffused with red beneath: infl. in short axillary clusters; fls. small, white veined with red, female with rather narrow petals; ovary distinct terete, not winged, bright red, 1-2 in. long; whole plant covered with rufous hairs. A remarkably distinct begonia, but of little horticultural value.—*B. pruinata*, A. DC. St. erect or spreading, seldom branched, covered with greenish white spots: lvs. peltate, fleshy, on long terete petioles, spreading or erect; blades broadly ovate, lobed and undulate, dark green above, with prominent veins of a greenish yellow color, and dull grey beneath: infl. erect, large, branching freely: fls. pure white. Costa Rica. A fine winter-flowering species.—*B. pyramidalis*, Lemoine. *B. manicata* × *B. carolinifolia*: lvs. large, palmate, entire, thick, brilliant green: fls. large, in panicles, white-rose or rose-tinted.—*B. Queen*. A garden hybrid: fibrous-rooted: erect with brilliant-colored foliage: sts. green, terete: lvs. ovate-acuminate, undulate, finely serrate, upper side a brilliant purple-red, the veins being green, under side bright red: fls. rosy red seldom produced. One of the finest and most ornamental of the fibrous-rooted begonias. It is somewhat difficult to grow into a large specimen and should be kept slightly drier at the roots than most plants of this section.—*B. Reichenheimii*, Hort. (*B. rubella* × *B. heracleifolia*). Lvs. all basal, large and long-petioled, parted to the middle: fls. on sts. upright above the lvs. Gt. 52, p. 207.—*B. Rochfordii*, Hort., is a bright rosy carmine begonia of the Gloire de Lorraine type, with larger fls. and foliage. F.E. 31 (1911), p. 434.—*B. Saulii*, Hort., named for the



late John Saul, was intro. from Guatemala: resembles *B. Feastii* in the shape and color of its lvs., but with a distinct red sinus at junction of petiole with lf. Probably not now cult. under this name.—*B. scéptrum*, Hort. Erect, sparsely branched: sts. light brown colored with red on young growth: lvs. large, broadly ovate, deeply lobed, margins serrate, pale green suffused with red and irregularly blotched with white, prominently veined on the underside; petioles bright red: fls. 10–20 in a cluster, pink or white.—*B. stigmōsa*, Lindl. St. a short, creeping rhizome: lvs. large, cordate-acute, irregularly toothed, smooth above, hairy beneath, green, with purple-brown blotches: fls. insignificant, white, in cymose panicles. Mex.—*B. Stürzii*, Hort. A floriferous form of *B. semperflorens*, with rose-pink fls. in broad panicles, and lvs. white-spotted.—*B. subpeltata nigricans*, Hort. (*B. nigricans*, Hort.). Plant 2–3 ft. high: lvs. ovate, acuminate, blood-red below, silvery and slightly hairy above, 4–8 in. long, 2–4 in. across: fls. rose-pink, profuse: caps. wings equal, pink. Very useful for decoration. Var. *Pres. de Boureuilles*, Hort., has lvs. of a much richer color, and more profusely studded with red hairs: fls. of a deeper pink.—*B. Tempelii*, Hort. Sport from *B. phyllomania* var. *variegata*: differs in having its regular blotches over the face of the lvs. varying from true yellow to light sulfur-color, often with blending of shades of pink: 2½–3 ft.: lvs. oblique, the margins ruffled and fringed. Originated with H. G. Wolfgang, of the Templin Co., Calla, Ohio, and put in the trade in 1905. F.E. 18:258.—*Trees*. A group of large-growing begonias produced by Mrs. Theodosia B. Shepherd, Calif. Some of them are described as a cross of Gloire de Joug by Rubra, having the cane-like growth of Rubra (*B. coccinea*), with its long-stemmed fls. but larger sepals and pistils; lvs. illuminated with red, terra-cotta, pink and yellow. Other giants are seedlings of Pink Rubra, with stronger canes, larger lvs., and more beautiful fls., the lvs. on young growth spotted with silver (Princess Alice, Rubra Bamboo, Striking Beauty, Hebe and others, are of this parentage).—*B. unifolia*, Rose. A singular begonia from Mex., recently described (Rep. Mo. Bot. Gard., 1904, p. 79, Fig. 28): tuberous-rooted: lf. 1, lying on the ground, sessile, nearly orbicular, double-toothed: fls. on slender scape to 2 ft. high, nearly white. Not in the trade.—Voss has called the hybrids of the rhizomatous group *B. rhizophōrida* and of the fibrous-rooted upright caulescent group *B. caulohōrida*; these names represent such various and often unlike forms that they will probably have little application in common practice, although useful for taxonomic purposes.

L. H. B.

**BELAMCÁNDA** (East Indian name). *Iridaceæ*.

**BLACKBERRY LILY. LEOPARD FLOWER.** A hardy, herbaceous perennial, which is an old garden favorite. The first of the popular names comes from the clusters of shining black roundish seeds, and the second from the flower, which is orange, spotted red. It is more commonly sold as a *Pardanthus*, which also means leopard flower.

Perianth segms. oblong, the 3 inner slightly shorter and spirally twisting as they fade: stamens in one group only at the base: caps. pear-shaped, the valves ultimately falling away. Prop. by seeds or by division. Of easy culture in rich, sandy loam and in a sunny place. Sometimes, but incorrectly, spelled *Bellemcanda*. One species.

*chinensis*, DC. (*Gemmingia chinensis*, Kuntze. *B. punctata*, Moench. *Ixia chinensis*, Linn. *Moræa chinensis*, Thunb. *Pardanthus chinensis*, Ker. *P. sinensis*, Van Houtte). Fig. 534. Height 2–3 ft.: rootstock short, stoloniferous lvs. about 6, equitant, striate, 1–1½ ft. long, 1 in. broad: outer spathe-valves ½–1 in. long: pedicels 1–2 in. long:

534. *Belamcanda chinensis*. (× ¼)

caps. 1–1½ in. long; valves reflexing, persistent. China and Japan. B.M. 171 (as *Ixia*). F.S. 16:1632. L.B.C. 19:1874.—The seed-stalks are sometimes used with dried grasses for decoration. It is said that the birds sometimes mistake the seeds for blackberries. N. TAYLOR.†

**BELGAUM WALNUT:**  
*Aleurites*.

**BELLADONNA:** *Atropa*.

**BELLADONNA LILY:**  
*Amaryllis*.

**BELLFLOWER:** *Campanula*.

**BELLIDIÁSTRUM** (*daisy* and *star*), is now referred to *Aster*. **B. Michéllii**, Cass. (*Aster Bellidiástrum*, Scop.), is a small European composite, 1 ft., perennial, with white heads single on naked scapes and lvs. in a rosette, sometimes planted but probably not in Amer.

535. *Bellis perennis*. (× ½)

**BÉLLIS** (Latin, *bellus*, pretty). *Compōsitæ*. **ENGLISH DAISY.** The true daisy: a low perennial with single heads on scapes, planted in borders and edgings and naturalized in grass land. Fig. 535.

The daisy, as it grows wild in England, has a yellow center, surrounded by numerous rays in a single row, but the favorite cult. forms are double, the rays rising in tier upon tier, and frequently crowding out every trace of a yellow center. The English daisy is essentially a pink or pinkish fl. in its general effect, the tips of the rays sometimes and the under surfaces usually being pink or red. There are about 10 species in the genus, only one of which is American. *B. integrifolia* is found in moist soil from Ky. and Tenn. to Ark. and Texas, but is too rare and sectional to become a general favorite. The plant that is most commonly called daisy in Amer. is *Chrysanthemum Leucanthemum*. For a list of the various plants known as daisies in Amer., see *Daisy*.

Daisies are favorite border plants, and are much used in spring bedding, especially for edging. They thrive in a cool soil and moist atmosphere, and are, therefore, much better adapted to English than American gardens. They can be grown, however, in a cool greenhouse where they will flower profusely during February and March. Although the English daisy is a perennial, it can be very easily grown as an annual. A light mulch is desirable for winter protection. In home gardening, the plants, after flowering, are divided into single crowns. These are planted about 6 inches apart in good rich garden soil. Each crown soon sends out side growths, which, in time, form new crowns. Before winter sets in the young clumps can be moved readily to any place in the garden in which they are wanted to bloom. Daisies are also forced by florists for winter bloom. When daisies are desired for edging spring flower-beds, the clumps are divided into single plants during the previous September, or early enough to allow the new plants to get a firm hold before winter, and are placed 3 inches apart in a narrow trench. These edgings must be renewed each year, as the plants, if they grow well, spread too wide, or irregularly. In dry summers many roots fail, and if they remain in the same spot year after year, the flowers will degenerate to the single condition.

The simplest way of propagating and growing English daisies for spring bedding in this country is to

sow the seed in shallow boxes about August 10. As soon as large enough to handle, transplant 5 inches apart into coldframes, and when the winter sets in put on the sash, giving air whenever the weather may be mild. Transplant to the flower beds as early as possible in the spring, where in a very short time they will be a mass of bloom, and will continue to bloom till the beginning of June, when they should be thrown out, and the summer bedding plants put in. Longfellow and Snowball are the two best varieties for this purpose. *Myosotis alpestris* and *Silene pendula* may be grown the same way, using the daisies as edging when in the beds, and the others as center pieces.

The daisy is propagated by seeds (which are sown early), and by divisions, the choicest varieties being maintained by the latter method. The main types grown from seed are the white, rose, quilled, and white with red center, all of which are double. A dark red is less common. Of kinds propagated by seed, Longfellow is now the best rose-colored, and Snowball the best white variety, the latter being especially prized by florists for cut-flowers, as it has long, stiff stems. Other varieties are Maxima, Snowflake, and Rob Roy, which is perhaps the best red.

**perennis**, Linn. TRUE OR ENGLISH DAISY. Hardy herbaceous perennial, 3-6 in. high: lvs. clustered at the root, spatulate or obovate: fls. 1-2 in. across, solitary, on hairy scapes. Apr.-June. W. Eu.; escaped in Calif.; rarely runs wild in the eastern states. B.M. 228. F.S. 6:584, which shows 11 well-marked types.—An interesting but not permanent form is the "hen-and-chickens daisy," in which a number of small fl.-heads are borne on short stalks springing out of the main fl.-head. Cockscomb forms, in which several scapes unite to produce a monstrous fl., are sometimes seen, but cannot be perpetuated. The rays are sometimes wholly incurved, or reflexed, or quilled. Other English names of the daisy are herb Margaret, ewe- or May-gowan, childing daisy, bone- or bruisewort, bone flower, March daisy, bairnwort.

J. B. KELLER, E. J. CANNING,  
and WILHELM MILLER.

**BÉLLIUM** (from its resemblance to *Bellis*, the daisy). *Compósitæ*. Miniature plants, sometimes planted in rock-gardens.

Leaves crowded or in a rosette, from which arise scapes bearing a single daisy-like head or "flower," white, with light yellow disk: differs from *Bellis* largely in its pappus, which is unequal and double, of bristles and scales.—Four to 6 species in the Medit. region, annual and perennial. Require treatment given rock-plants and sod-plants.

**bellidioides**, Linn. Annual, 2 in., with creeping stolons: lvs. spatulate: heads white, all summer.—Like a miniature daisy. Apparently little known in this country.

L. H. B.

**BELLWORT**: In England, any member of the *Campanulacæ*. In America, *Uvularia*.

**BÉLOU** (Brahman name for the Bael fruit). *Rutacæ*, tribe *Citræ*. An older name for *Ægle*, recently reinstated by American taxonomic botanists. See description under *Ægle*.

*B. Marmelos*, A. B. Lyon, = *Ægle Marmelos*, the Bael fruit of India. *B. glutinosa*, Skoels = *Chætospermum glutinosa*, Swingle.

**BELOPERÒNE** (name refers to the arrow-shaped connective). *Acanthacæ*. Hothouse evergreen shrubs of the *Justicia* group, rarely seen in cult. and apparently not in American trade. Lvs. entire: fls. usually red or purple, mostly in showy-bracted axillary or terminal clusters; corolla-tube narrow, often long, the limb 2-lipped; stamens 2, affixed on the tube; style filiform, entire or slightly 2-lobed: fr. an oblong or ovoid caps.—About 30 species inhabiting Trop. Amer., of which 2 or 3 are listed as cult. plants. *B. violacæa*, Planch. &

Lind., has lanceolate-acuminate lvs. and violet-purple fls. B.M. 5244. *B. oblongata*, Lindl., has oblong-lanceolate lvs. and axillary spikes of rose-purple fls. B.R. 1657. A recent species is *B. angustiflora*, Stapf, resembling *B. violacæa*, with oblong-elliptic lvs. and a very narrow corolla-tube with a violet-purple limb.

**BELVIDERE**, or SUMMER CYPRESS: *Kochia*.

**BENE**: *Sesamum*.

**BENI, JAPANESE**: *Caroypteris Mastacanthus*.

**BENINCÀSA** (name of an Italian nobleman). *Cucurbitacæ*. Annual running squash-like herbs grown sparingly for the edible fruits.

Leaves 5-lobed soft-hairy: fls. solitary, yellow, monœcious, the staminate long-peduncled, the pistil-



536. *Benincasa hispida*.

late nearly sessile; corolla deeply lobed; tendrils 2-3-branched.—Two species in Trop. Asia.

**hispida**, Cogn. (*B. cerifera*, Savi). Fig. 536. WAX GOURD. WHITE GOURD OF INDIA. ZIT-KWA. CHINESE PRESERVING MELON. CHINESE WATERMELON. Vine long, like a muskmelon, hairy, with cordate lobed lvs.: fr. mostly oblong, 10-16 in. long, hairy, white-waxy, with solid white flesh and small cucumber-like seeds. Cult. the same as muskmelon or cucumber. R.H. 1887:540.—Used for making preserves and sweet pickles; said to be eaten raw in warm countries, and the unripe frs. to be employed by natives in India in the making of curries.

L. H. B.

**BENJAMIN BUSH**: *Benzoin æstivale*.

**BENT-GRASS**: *Agrostis*.

**BENTHÂMIA**: *Cornus*.

**BENTINCKIA** (named for Lord Bentinck, governor of Madras, 1803-1805). *Palmacæ*, tribe *Géonomææ*. Tall stately unarmed palms, with equally pinnate, terminal leaves; not as yet well known to the trade, but deserving greater attention.

Leaves of many lfts. which are usually 2-lobed at the apex: spathes many, the 2 lower short and incomplete; spadix arising from among the lvs., branched; fls. small, monœcious or polygamous: fr. small, almost round, with a single seed pendulous from the top of the cavity.—There are only 2 species, both Indian. G.C. II. 22:595.

The following is a graceful palm "in general appearance not unlike the coconut palm, than which it is, however, much more graceful." The young leaves for the first year are bi-partite, quite like young coconut palms.

They should be grown in a warmhouse, never less than 60°, and should be given plenty of water at all seasons. A mixture of rich loam and peat or leaf-mold, half and half, makes the best medium for growth.

**nicobàrica**, Becc. ORANIA. St. 50-60 ft., solitary, usually from 7-10 in. thick: lvs. 5-8 ft. long; lfts. 1-2 ft., sessile, linear and leathery, the tips distinctly 2-lobed; petiole and rachis glabrous, the former short:



spadix 1½–2 ft., many times branched, the branchlets inserted in woolly grooves: fr. about as large as a cherry. India. R.H. 1896, p. 249. N. TAYLOR.

**BÉNZOIN** (of Arabic or Semitic origin, meaning a gum or perfume). Syn., *Lindera*. Lauraceæ. Ornamental woody plants, grown chiefly for their handsome aromatic foliage; some species also for their early yellow flowers and the brightly colored fruits in autumn.

Aromatic shrubs or trees: lvs. alternate, entire or 3-lobed, deciduous or persistent: fls. polygamous or dioecious, apetalous, small, in axillary clusters with an involucre of 4 deciduous scales; sepals 6, rarely more; staminate fls. with 9 stamens, pistillate with a globose ovary and 9–15 staminodes: fr. a 1-seeded drupe. —About 60 species, if *Daphnidium* and *Aperula* are included, in Temp. and Trop. E. and Cent. Asia and in N. Amer.

Some Asiatic species yield an odorous oil used in perfumery. The cultivated species, with the exception of *B. gracile*, are deciduous shrubs, with yellow flowers in small clusters before the leaves and red or black fruits in autumn. *B. æstivale* is hardy North and *B. obtusilobum* has proved hardy at the Arnold Arboretum in a sheltered position; *B. hypoglaucum* is of about equal hardiness; the other species are more tender.

They thrive best in peaty or sandy and moist soil. Propagation is usually by seeds, which must be sown after maturity, as they soon lose their vitality; also by layers, which root best in peaty soil; of greenwood cuttings under glass, one-half may be expected to root. The benzoin of the druggists is a balsamic resin obtained from *Styrax Benzoin*.

*æstivale*, Nees (*Bénzoin Bénzoin*, Coulter. *B. odoriferum*, Nees. *Lindera Bénzoin*, Blume). SPICE BUSH. BENJAMIN BUSH. WILD ALLSPICE. FEVER BUSH. Fig. 537. Shrub, 6–15 ft., nearly glabrous: lvs. oblong-obovate, finely ciliate, bright green, pale beneath, 3–5 in. long: fls. yellow, before the lvs.: berry red, oblong, spicy. New Eng. southward and west to Kan. Em. 365.—The bark is aromatic, stimulant, tonic, astringent; the fr. is likewise used medicinally. The shrub is attractive in early spring with its yellow, small, but numerous fls., and handsome in autumn with its foliage turning clear yellow and studded with the scarlet frs.

*B. gracile*, Kuntze (*Daphnidium gracile*, Nees). Lvs. ovate, 3-nerved, chartaceous, persistent. Habitat unknown. Stove plant. —*B. hypoglaucum*, Rehd. (*Lindera hypoglaucum*, Maxim. *B. hypoleucum*, Kuntze). Lvs. penninerved, glaucous beneath: clusters few-fl., with or before the lvs.: berries black. Japan. —*B. melissifolium*, Nees. Allied to *B. æstivale*. Branches pubescent: lvs. oblong, downy beneath. Southern states. B.M. 1470. —*B. obtusilobum*, Kuntze. Large shrub with very handsome foliage: lvs. 3-nerved, ovate or 3-lobed, grayish green and nearly glabrous beneath, 2–4½ in. long: clusters many-fl.: berries black. Japan. G.F. 6:295. S.I.F. 1:44. —*B. præcox*, Sieb. & Zucc. Lvs. penninerved, elliptic-oblong, greenish beneath, acuminate: clusters few-fl., before the lvs.: berries brownish, ½ in. diam. Japan. S.I.F. 2:19. —*B. sericeum*, Sieb. & Zucc. Lvs. penninerved, grayish pubescent beneath: clusters many-fl., with the lvs. Japan.

ALFRED REHDER.



**BERBERIDOPSIS** (from *Berberis* and Greek *opsis*, likeness). Flacourtiaceæ. Ornamental shrub cultivated for its crimson flowers and evergreen foliage.

Branches slender, terete: lvs. alternate, petioled, dentate: fls. perfect, long-pedicelled, in terminal racemes; bracts, sepals and petals gradually passing into one another, 9–15, the inner ones concave, larger; stamens 7–10 with very short filaments; ovary superior, 1-celled with many ovules; style short, with 3-lobed stigma: fr. a berry. —One species in Chile.

This is a low, glabrous, slightly climbing shrub, with deep green foliage and crimson flowers in drooping racemes, for temperate regions or the cool greenhouse, growing in almost any soil. Propagation is by seeds sown in spring, by greenwood cuttings in spring, or by layers in autumn.

*corallina*, Hook. Lvs. cordate, oblong-ovate, coarsely spinulose-dentate, 2–3 in. long: fls. globose, over ¼ in. long, crimson, in many-fl. bracteate racemes. B.M. 5343. F.S. 20:2137. F.W. 1875:97. G. 2:547. 32:175. H.F. 1863:148.

ALFRED REHDER.

**BÉRBERIS** (Arabic name). *Berberidaceæ*. BARBERRY. Ornamental deciduous or evergreen shrubs, cultivated for their handsome foliage assuming in most species brilliant autumnal tints, and for their bright yellow flowers and attractive fruit.

Spiny shrubs with yellow inner bark and wood: lvs. alternate, often fascicled, usually glabrous, simple, deciduous or evergreen: fls. in elongated or umbel-like, rarely compound racemes, or fascicled or solitary; sepals 6 with 2 or 3 bractlets below; petals 6, often smaller than sepals and usually with 2 glands near the base; stamens 6, included, the anthers opening with valves; ovary superior, 1-celled, with 1 to many ovules: fr. a berry with 1 or several oblong seeds. —Nearly 175 species in Amer. from Brit. Col. to Patagonia, in Asia, Eu., and N. Afr. Monogr. by Schneider in Bull. Hort. Boissier, Ser. II. 5:33, 133, 391, 449, 655, 800, 813 (1905). Mahonia is now considered by most botanists as a distinct genus, differing from the true barberries by the pinnate lvs., by the racemes appearing in the axils of the bud-scales and by the spineless branches. The spines of the barberry are, morphologically, lvs., and the lvs. are borne on short branches in their axils (Fig. 538). The stamens are sensitive; when the filaments are touched with a pin, the fls. first open, and the stamens fly forward upon the pistil. ALFRED REHDER.

The different species of hardy deciduous barberries are excellent decorative shrubs with pleasing habits of growth. The flowers of most of them in spring and early summer, whilst not conspicuous, are very attractive, and the fruits of nearly all are highly ornamental in late summer, fall and early winter on account of their red, dark blue or nearly black color. *Berberis amurensis*, *B. sinensis*, *B. diaphana*, *B. Poiretii*, *B. Regeliana*, *B. Sieboldii*, and *B. Thunbergii* all assume brilliant fall colors in varying shades of orange and red. Some species, as *B. Thunbergii*, *B. Sieboldii*, and *B. Rehderiana*, retain their bright red fruits unchanged until the following spring, while the fruits of the other species shrivel and dry up during the winter.

*Berberis aristata* is the strongest-growing species and attains a height of 12 to 13 feet in twenty years, with gracefully arching branches, and has violet-red fruits; the thickish leaves are semi-persistent. *B. canadensis* forms a neat compact bush 3 to 3½ feet with upright spreading branches. The small clusters of bright red fruits are very attractive. This is a rare shrub in cultivation, and *B. vulgaris* has often been sold for it. *B. sinensis* is a neat, graceful shrub with pendulous branches 3½ to 4 feet and bears numerous clusters of bright red fruits. *B. diaphana* forms a dense compact shrub 2½ to 3 feet, but its chief decorative value is in its rich fall coloring, as the solitary flowers and fruits

are inconspicuous. *B. Regeliana* has an upright dense habit, and grows from 5 to 6 feet. It has the largest leaves of any of the deciduous species, and the orange-red fruits are remarkably ornamental throughout late summer and fall, until midwinter. This is perhaps the most beautiful barberry in cultivation. *B. Sieboldii* is slow-growing, but is a very choice species. The habit is upright and compact, and the fall coloring is brilliant. The small vermilion-red fruit-clusters are very attractive. *B. vulgaris*, which is commonly grown and has become extensively naturalized, has large clusters of brilliantly colored fruits, and is a most useful shrub in border plantations. It is prolific in many varieties. Perhaps the most distinctive form is the one with yellow fruits, which are usually seedless, or, if the seeds are present, they are abortive. This species makes a good hedge plant as does also *B. amurensis*; for low ornamental hedges, *B. Thunbergii* is excellent. Since it makes a rather broad hedge, the plant is most beautiful when it is not necessary to trim it. *B. Wilsonæ* is a small beautiful shrub, 2 to 2½ feet with slender branches and small leaves. The coral-red fruits are very distinctive. The tips of the branches usually are winterkilled, but the plants recover rapidly in summer.

Few of the evergreen species are dependable in the northeastern states. *B. Sargentiana*, a handsome shrub, attaining a height of about 6 ft., with rather large oblong leaves, has proved quite hardy, and *B. burifolia*, *B. stenophylla* and *B. verruculosa* nearly hardy in Massachusetts. *B. Neubertii* rarely has the leaves scorched by winter's cold, but is very slow-growing. For other evergreen species, see *Mahonia* (formerly included in *Berberis*).

The root and the inner bark of several species are sometimes used for dyeing yellow. Some species have medicinal properties. The fruits of *B. vulgaris* are made into jelly. In wheat-growing districts, planting of *Berberis* should be avoided, as it is the host of the æcidium stage of *Puccinia graminis*, a fungus which causes the wheat-rust. Destroying the *Berberis*, however, will not check the propagation of the fungus, as it is able to grow and to spread for years without forming the æcidium stage.

To secure the best results from most of the barberries, they should be planted in moist, light loam, well drained. The deciduous species, however, can be grown in drier situations.

Barberries germinate readily from seeds. The seeds should be separated from the pulp by maceration and sown in "flats" or broadcast in beds in the fall, and they will germinate the following season. The seeds of rare and scarce species should be sown in the greenhouse where they will germinate during the winter. *Berberis Wilsonæ* will germinate in two to three weeks in the greenhouse if sown as soon as ripe. Some of the species cross when grown together, but *B. sinensis*, *B. Regeliana* and *B. vulgaris* appear to come true. The progeny of *B. Thunbergii* sometimes seem to show that they have been affected by the pollen of *B. vulgaris*.

Most of the barberries can be propagated from the green cuttings of the young wood taken from the first to the middle of June, and placed in sand in a shaded hotbed in precisely the same way as lilacs, viburnums or hydrangeas are treated. This is the best way to perpetuate individuals of strikingly characteristic habits. A very small percentage of the cuttings of the ripe wood placed in the greenhouse in the fall will "strike," but not enough to pay. Some species may be propagated by suckers. Rarer kinds and varieties are sometimes grafted on *B. vulgaris* or *B. Thunbergii*, in August or September under glass, or in early spring in the greenhouse. Grafting, however, is not to be recommended, for the stock usually throws up suckers which are often overlooked on account of the similarity of the foliage of many species; they will overgrow the cion

in a short time and smother it. A good plan is to use the purple-leaved barberry as a stock; the suckers are thus easily noticeable and may be removed in time.

JOHN DUNBAR.

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## KEY TO THE SPECIES.

- A. Foliage deciduous; lvs. membranous or chartaceous.
- B. Fls. in elongated racemes or panicles (few-fl'd. peduncled umbels in No. 7).
- C. Lvs. dentate or serrate.
- D. Infl. simple, racemose.
- E. Branches of last year gray, except those of the purple-ld. form of No. 1.
- F. Texture of lvs. rather thin, not distinctly reticulate beneath.
- G. Shape of lvs. generally obovate; setulose-dentate.
- GG. Shape of lvs. oblong or elliptic; densely ciliate-dentate.
- FF. Texture of lvs. firmer than in F, distinctly reticulate beneath, often obtuse.
- EE. Branches of last year reddish brown or yellowish brown.
- F. The lvs. spinulose-dentate.
- G. Fr. purplish blue, oblong-ovoid, longer than the stout pedicels: racemes longer than the lvs.
- GG. Fr. red, short-ovoid, shorter than the slender pedicels.
- H. Breadth of lvs. ⅓-¾ in., oblong-obovate to obovate, scarcely reticulate.
- HH. Breadth of lvs. ¾-1½ in., usually obovate, reticulate, rounded at the apex.
- FF. The lvs. densely setose-ciliate, oblong; racemes umbel-like, 3-6-fl'd.
- DD. Infl. compound, paniculate, 2-6 in. long.
- E. Branches angled, grayish brown; lvs. rounded at the apex, subcoriaceous.
- EE. Branches nearly terete, brown; lvs. acute, thin.
- CC. Lvs. entire, at least those of the flowering branches.
- D. Fr. red or purple; lvs. narrow-obovate or oblanceolate, acute or acutish, bright green.
- E. Bracts at least half as long as the short pedicels: lvs. green beneath, usually narrow-ob-lanceolate, entire.

1. vulgaris

2. amurensis

3. Regeliana

4. aristata

5. canadensis

6. koreana

7. Sieboldii

8. polyantha

9. Francisci-Ferdinandi

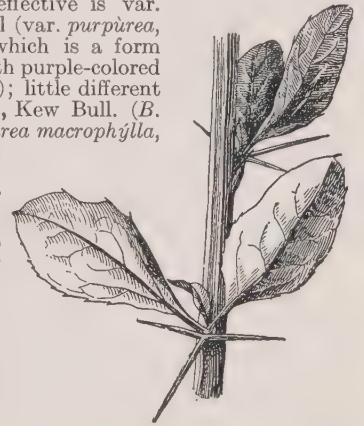
10. Poiretii



- EE. Bracts much shorter than the elongated pedicels: lvs. grayish or bluish gray beneath, those of the shoots often spinulose, broader. . . . . 11. *sinensis*
- DD. Fr. bluish or purplish black, bloomy: lvs. usually grayish or bluish green, broadly obovate to oblong-obovate. . . . . 12. *heteropoda*
- E. Racemes short, usually 5-7-fld.: branches slightly angular: ovules slender-stalked. . . . . 12. *heteropoda*
- EE. Racemes many-fld., dense: branches terete: ovules short-stalked. . . . . 13. *integerrima*
- BB. Fls. solitary or sometimes in few-fld. umbels or in dense fascicles (in a variety of No. 14 in 3-10-fld. short racemes).
- C. Lvs. always entire.
- D. Young branchlets glabrous: lvs. not reticulate, generally obovate,  $\frac{1}{2}$ - $1\frac{1}{2}$  in. long: fr. scarlet, rather dry. . . . . 14. *Thunbergii*
- DD. Young branchlets puberulous: lvs. reticulate, generally oblanceolate,  $\frac{1}{4}$ -1 in. long: fr. salmon-red, juicy. . . . . 15. *Wilsonæ*
- CC. Lvs. partly dentate, partly entire.
- D. Pedicels  $\frac{1}{2}$  in. long: lvs. chalky white beneath, not reticulate, less than 1 in. long: fr.  $\frac{1}{2}$  in. long. . . . . 16. *dictyophylla*
- DD. Pedicels  $\frac{1}{2}$  in. long; fls. nodding: lvs. glaucous beneath, reticulate, more than 1 in. long: fr. nearly  $\frac{1}{2}$  in. long. . . . . 17. *diaphana*
- AA. Foliage persistent or half-evergreen.
- B. Lvs. entire.
- C. Shape of lvs. obovate or elliptic: fls. solitary, long-pedicelled. . . . . 18. *buxifolia*
- CC. Shape of lvs. narrow-oblong to linear, revolute at the margin.
- D. Fls. 1-2, long-pedicelled: lvs. linear. . . . . 19. *empetrifolia*
- DD. Fls. 2-6, in peduncled umbels: lvs. narrow-oblong. . . . . 20. *stenophylla*
- BB. Lvs. dentate.
- C. Fls. in fascicles or solitary.
- D. Lower surface of lvs. white or glaucous,  $\frac{1}{2}$ -1 in. long: fls. 1-2.
- E. Branchlets angled, smooth. . . . . 21. *concinna*
- EE. Branchlets terete, densely verruculose. . . . . 22. *verruculosa*
- DD. Lower surface of lvs. green: fls. several to many.
- E. Shape of lvs. oblong to narrow-lanceolate, with many teeth.
- F. Texture of lvs. rather thin; lvs. usually about  $\frac{1}{2}$  in. broad, indistinctly veined.
- G. Pedicels slender,  $\frac{1}{2}$ -1 in. long; fls. 3-8: lvs. with 8-20 teeth on each side: fr. bluish black, bloomy. . . . . 23. *Gagnepainii*
- GG. Pedicels  $\frac{1}{4}$ - $\frac{1}{2}$  in. long; fls. many: lvs. with 5-12 teeth on each side: fr. jet-black. . . . . 24. *levis*
- FF. Texture of lvs. thick and firm; lvs.  $\frac{3}{4}$ - $1\frac{1}{4}$  in. broad: fls. many; pedicels about  $\frac{1}{2}$  in. long: fr. black. . . . . 25. *Sargentiana*
- EE. Shape of lvs. roundish to elliptic, with 3-6 teeth: fls. in dense globose clusters. . . . . 26. *hakeoides*
- GC. Fls. in racemes or panicles.
- D. Branches spiny; young branchlets pubescent or puberulous: lvs. always simple.
- E. Racemes simple.
- F. Ovary with long style: lvs. green beneath.
- G. Branchlets puberulous: lvs. 1-2 in. long: racemes shorter than lvs., 4-10-fld. . . . . 27. *ilicifolia*

- GG. Branchlets hairy: lvs.  $\frac{1}{2}$ - $1\frac{1}{2}$  in. long: racemes longer than lvs., many-fld. . . . . 28. *Darwinii*
- FF. Ovary with short style: branchlets puberulous: lvs. whitish beneath, 1- $2\frac{1}{2}$  in. long. . . . . 29. *asiatica*
- EE. Racemes compound: lvs. obovate-oblong, with few teeth above the middle or entire, 1- $2\frac{1}{2}$  in. long. . . . . 30. *chitria*
- DD. Branches spineless, glabrous: lvs. occasionally 3-foliate, half-evergreen. . . . . 31. *Neubertii*

1. *vulgâris*, Linn. COMMON BARBERRY. Fig. 538. From 4-8 ft., rarely 15: branches grooved, gray, upright or arching: lvs. oblong-spatulate or obovate, setulose-dentate, pale or grayish green beneath, membranous, 1-2 in. long: racemes pendulous, many-fld.; fls. bright yellow: fr. oblong-ovoid, scarlet, finally purple. May, June: fr. Sept., Oct. Eu. to E. Asia; escaped from culture and naturalized in E. N. Amer. Gn. 35:264.— Handsome in spring, with its golden yellow fls. and light green foliage; and in fall, with its bright scarlet frs., remaining through the whole winter. A very variable species. Of the many garden forms, the most effective is var. *atropurpurea*, Regel (var. *purpurea*, Hort., not Loud., which is a form with purple fr.), with purple-colored lvs. (Gt. 9:278, 1); little different is var. *macrophylla*, Kew Bull. (*B. vulgâris foliis purpurea macrophylla*, Paul & Sons), with larger lvs. of deep purple color. Other varieties are: Var. *albo-variegata*, Zabel, lvs. variegated with white, rather small; Var. *aureo-marginata*, Zabel, lvs. with yellow margin, rather large; var. *alba*, Don (var. *leucocarpa*, Hort.), white-fruited; var. *asperma*, Don (var. *apirena*, Hort.), seedless; var. *dulcis*, Loud. (var. *edulis*, Hort.), less acid; var. *lutea*, Don (var. *xanthocarpa*, Hort.), yellow-fruited; var. *macrocarpa*, Jaeger, with larger fr. The forms with black or purplish blue fr., as var. *nigra*, Don, and var. *violacea*, Don, do not belong here, but are either hybrids or belong to other species.



538. *Berberis vulgaris*. ( $\times \frac{1}{2}$ ). Showing the spines and foliage.

2. *amurënsis*, Rupr. (*B. vulgâris* var. *amurënsis*, Regel). Three to 8 ft.: branches straight, gray, upright, grooved: lvs. cuneate, oblong or elliptic, densely ciliate-dentate, slightly reticulate and bright green and lustrous beneath, 1-3 in. long: racemes upright or nodding, 6-12-fld., about as long as lvs.: fr. oblong-ovoid, scarlet. May: fr. Sept. Manchuria, N. China. Gng. 5:119. G. W. 7, p. 413. See page 3566.

3. *Regeliâna*, Koehne (*B. vulgâris* var. *japonica*, Regel. *B. amurënsis* var. *japonica*, Rehd. *B. japonica*, Schneid., not DC. *B. Sieboldii*, Hort., not Miq. *B. Hakodate*, Hort.). Fig. 539. Upright shrub, to 6 ft.: branches gray, grooved: lvs. elliptic-oblong and acute, or obovate or obovate-oblong and obtuse, 1- $2\frac{1}{2}$  in. long, setulose-dentate, often rather densely so, pale or grayish green and distinctly reticulate beneath, of firm texture: racemes upright or nodding, 6-12-fld., shorter or about as long as lvs.: fr. oblong-ovoid, scarlet, with slight bloom. May, June: fr. Sept., Oct. Japan. G.F. 3:249 (adapted in Fig. 539). A.G. 18:454.

4. *aristata*, DC. (*B. coriaria*, Royle. *B. floribunda*, Wall.). Shrub, to 8 ft.: last year's branches yellowish brown, slightly angular; spines mostly simple: lvs. elliptic to ovate-oblong, acute or obtusish, spinosely dentate, occasionally entire, 1-2½ in. long, of firm texture at maturity: racemes 10-25-fld., sessile, usually spreading and stout: fr. nearly ½ in. long, longer than the stout pedicels, bright red, finally bluish purple and bloomy; stigma on a short distinct style. June; fr. Sept., Oct. Himalayas. B. R. 27:46.—Hardy at the Arnold Arboretum. Hybrids occur with *B. vulgaris*.

5. *canadensis*, Mill. (*B. caroliniana*, Loud. *B. angulizans*, Hort.). Upright shrub, 1-3 ft., with arching branches: spines small, 3-parted: lvs. cuneate-oblong to obovate, remotely spinulose-dentate, rarely entire, usually obtusish, 1-2 in. long: racemes many-fld., longer than the lvs.; petals retuse or emarginate: fr. ovoid, scarlet. May, June; fr. Sept., Oct. Alleghanies. G. W. 1:101.—The plant sold under this name is usually *B. vulgaris*. Lower and more graceful than *B. vulgaris*; the foliage turns scarlet in autumn.

6. *koreana*, Palibin. Shrub, to 6 ft.: branches grooved, yellowish or reddish brown; spines short, scarcely ¼ in. long, usually simple: lvs. obovate, or oval, rounded at the apex, cuneate at the base, 1-2½ in. long and ½-1½ in. broad, spinose-serrulate, reticulate and pale beneath: racemes shorter than lvs., rather dense, slender-stalked, nodding: fr. subglobose-ovoid, ¼ in. long, bright red. May; fr. Sept., Oct. Korea. J.C.T. 26, 1:5.—Handsome species with broad lvs. coloring deep red in autumn and with bright red fr. persisting until the following spring; has proved perfectly hardy at the Arnold Arboretum.

7. *Sieboldii*, Miq. Shrub, to 3 ft.: last year's branches deep reddish brown, angular, 2-edged toward the end: spines 3-parted, slender: lvs. oblong-obovate, 1-2½ in. long, acute or obtusish, cuneate at the base, setosely ciliate and usually revolute at the margin, bright green below: racemes 3-6-fld., slender-peduncled, umbel-like: fr. ovoid to subglobose, ¼ in. long, rather dry, bright red and lustrous. May, June; fr. Sept. Japan. S.T.S. 1:14.—A very handsome shrub: lvs. purplish when unfolding and marked with green veins, deep vinous red in autumn: the fr. retains the bright color until the following spring. It has proved perfectly hardy at the Arnold Arboretum. Often *B. Regeliana* is cultivated under the name *B. Sieboldii*.

8. *polyantha*, Hemsl. Shrub, to 12 ft.: branches grayish brown, slightly angled, glabrous or puberulous with usually short spines: lvs. cuneate-obovate, rounded at the apex, leathery, spiny-serrate, rarely nearly entire, pale grayish green, ¾-1¼ in. long: fls. deep yellow in pendulous short-stalked panicles 2-6 in. long: fr. oblong-ovoid, narrowed into a distinct style, pale red, bloomy, ½ in. long. June, July; fr. Sept. W. China. G. 33:269.—Very handsome with its large panicles of deep yellow fls.; not quite hardy in Mass.



539. *Berberis Regeliana*.  
(× ¼)

9. *Francisci-Ferdinandi*, Schneid. Shrub, to 10 ft.: branches red-brown, nearly terete, with long spines: lvs. elliptic to ovate-lanceolate, acute, cuneate at the base, densely spiny-serrate, bright green, thin, 1-2½ in. long: fls. yellow in pendulous, usually narrow panicles, with the slender stalk 3-5 in. long: fr. ovoid-oblong, scarlet, almost ½ in. long, with nearly sessile stigma. May, June; fr. Sept. W. China.—The drooping panicles of scarlet frs. are very handsome.

10. *Poirétii*, Schneid. (*B. sinensis*, Hemsl., not Poir. *B. sinensis* var. *angustifolia*, Regel). Shrub, to 5 ft.: branches slender, arching, the younger grooved, purplish brown; spines about ½ in. long, usually simple: lvs. oblanceolate, to narrow-oblanceolate, ½-1½ in. long, entire, slightly reticulate and green beneath: racemes 8-14-fld., 1-2 in. long; pedicels scarcely ¼ in. long, bracts about half as long: fr. ovoid-oblong, deep blood-red. N. China, Amurland.—Hardy and handsome, but rare in cult. and usually confounded with the following species.

11. *sinensis*, Poir. (*B. spathulata*, Schrad. *B. ibérica*, Stev. & Fisch. *B. sanguinolenta*, Schrad. *B. Guimpelii*, Koch). From 4-6 ft., with slender, often arching branches, the younger grooved, reddish brown; spines 1-3-parted, ½-¾ in. long: lvs. cuneate, oblong or obovate-lanceolate, entire or sometimes with a few teeth, grayish green or glaucescent beneath, ½-1½ in. long: racemes pendulous, slender-peduncled, rather dense; pedicels slender, about ½ in. long, several times longer than the bracts: berries ovoid, purplish. Caucasus. B.M. 6573. G.O.H. 63. L.D. 7:487. G.W. 8:115. G. 34:379.—A hardy, graceful species, very handsome in fr.

12. *heteropoda*, Schrenk. Fig. 540. Three to 6 ft.: branches stout, spreading, the younger chestnut-brown, lustrous slightly grooved, spines sometimes to 2 in. long, often wanting: lvs. broadly obovate or oval, entire or sometimes remotely serrate, pale bluish green, 1-2 in. long, some short and some slender-petioled: fls. in stalked, usually 5-7-fld. racemes, orange-yellow, fragrant; ovules long-stalked: fr. ovoid, dark blue with glaucous bloom. May. Turkestan, Songaria. G.F. 8:455 (adapted in Fig. 540).—Handsome and very distinct species. *B. heteropoda* var. *oblonga*, Regel, see *B. oblonga* in supplementary list.

13. *integerrima*, Bunge (*B. nummularia*, Bunge). Shrub, to 6 ft.: last year's branches terete, purplish brown; spines usually simple, to 2 in. long: lvs. obovate or broadly obovate, usually entire, sometimes remotely setose-serrate, grayish green: racemes dense, usually many-fld.; fls. small, on short pedicels, about ½ in. long; ovules short-stalked: fr. black, globose-ovoid. May.—A variable species similar to the preceding.

14. *Thunbergii*, DC. Figs. 541, 542. Dense, low shrub, 2-5 ft.: branches spreading, deeply grooved, brown, with simple spines: lvs. obovate or spatulate, quite entire, glaucescent beneath, ½-1½ in. long: fls. 1-3, pale yellow: fr. elliptic or nearly globose, bright red. Apr., May. G.F. 2:53. B.M. 6646. R.H. 1894: 173. A.G. 18:357. Gng. 4:241; 5:119, 353, 355. Mn. 2:118. A.F. 8:526.—One of the most valuable species, especially remarkable for its low, dense, horizontal growth, its large brilliant red frs., remaining fresh till the following spring, and for its bright scarlet fall coloring; hardy. Very valuable for borders of walks and drives and for low ornamental hedges. Endures partial shade. Cattle and sheep do not browse it much. Var. *Maximowiczii*, Franch. & Sav., has the lvs. green beneath. Var. *pluriflora*, Koehne, has 3-10 fls. in short, umbel-like raceme. Var. *minor*, Rehd. (var. *Davsonii*, Bean). Very low, dense shrub, ½-2 ft. high, with small lvs. about ½ in. long. A variety with the lvs. variegated with white is var. Silver Beauty, which originated in



Franklin, Mass. G.C. III. 49:10. Hybrids with *B. vulgaris* occur.

15. *Wilsonæ*, Hemsl. Low shrub with spreading branches: last year's branches reddish brown, angular, puberulous; spines 3-parted, slender,  $\frac{1}{2}$ – $\frac{3}{4}$  in. long; lvs. oblanceolate or narrowly obovate,  $\frac{1}{4}$ –1 in. long, rounded and mucronate or acutish at the apex, rarely 3-pointed, pale green and dull above, glaucous beneath, reticulate, thickish; fls. golden yellow, in dense clusters or in very short-stalked umbels; fr. globose,  $\frac{1}{4}$  in. diam., salmon-red, usually yellow or whitish on the shady side. May; fr. in Sept. W. China. B.M. 8414. G.C. III. 42:372. Gn. 71, p. 541. G. 29:520. J.H. III. 55:425.—Very distinct handsome shrub, with small foliage, assuming a brilliant fall coloring. It has proved hardy at the Arnold Arboretum in somewhat sheltered positions.

16. *dictyophylla*, Franch. Shrub, to 6 ft. high, with slightly angular branches, usually covered with white bloom while young, reddish brown the second year: lvs. obovate to oblong-obovate,  $\frac{1}{2}$ –1 in. long, obtuse or acutish, entire or spinose-dentate, chalky white beneath: fls. solitary, pale yellow,  $\frac{1}{2}$ – $\frac{3}{4}$  in. diam., short-stalked; fr. red, ovoid,  $\frac{1}{2}$  in. long. May. S. W. China.—Very distinct, with its small foliage white beneath like the young shoots. Var. *albicaulis*, Hort., is a form with the young branchlets distinctly bloomy and the lvs. intensely white beneath. Var. *epruinosa*, Schneid. Branchlets angled, red-brown, not bloomy; lvs. light green beneath. Var. *approximata*, Rehd. (*B. approximata*, Sprague). Lvs. obovate, spinose-dentate, rarely entire, fls. smaller. B.M. 7833; the type of the species with all or nearly all lvs. entire is figured in Franchet, Plant. Delavay. 11.

17. *diaphana*, Maxim. (*B. yunnanensis*, Hutchins., not Franch.). Shrub, to 3 ft., with rather stout branches, grooved, light yellowish brown in their second year; spines 1–3-parted,  $\frac{1}{4}$ – $\frac{1}{2}$ , rarely to  $1\frac{1}{2}$  in. long; lvs. obovate to oblong-obovate, obtusish,  $\frac{3}{4}$ – $1\frac{1}{2}$  in. long, spinose-serrulate or sometimes entire, glaucous and reticulate beneath; fls. bright yellow,  $\frac{1}{2}$  in. diam., solitary, or in 2's or 3's on a common peduncle; pedicels  $\frac{3}{4}$  in. long; fr. oblong, often attenuated at the apex, scarlet, slightly bloomy, nearly  $\frac{1}{2}$  in. long. May; fr. in Sept. W. China. B.M. 8224. S.T.S. 2:109.—Remarkable for its large fr.; the lvs. turn scarlet in autumn. Hardy at the Arnold Arboretum.

18. *buxifolia*, Poir. (*B. dulcis*, Sweet). One to 3 ft.: branches brown, grooved; spines usually 3-parted, short; lvs. cuneate, obovate or elliptic,  $\frac{1}{2}$ –1 in. long; fls. solitary, on long pedicels, orange-yellow; fr. nearly globose, blackish purple. May. Chile to Strait of Magellan. B.M. 6505. S.B.F.G. II. 1:100. P.M. 10:171. L.B.C. 20:1941. H.F. 1857:122.—A very graceful, free-flowering shrub; one of the hardiest of the evergreen species; will stand the winter even N. if somewhat protected.

19. *empetrifolia*, Lam. Low, densely branched shrub, to 2 ft.: last year's branches slightly angular, brown, the young ones purplish, often bloomy; spines 1–3-parted,  $\frac{1}{4}$ – $\frac{3}{4}$  in. long; lvs. linear,  $\frac{1}{4}$ – $\frac{3}{4}$  in. long, strongly revolute at the margin, spiny pointed, bright green; fls. 1–2, on slender pedicels, about  $\frac{1}{4}$  in. long; fr. globose, bluish black, about  $\frac{1}{4}$  in. diam. May, June. Chile to Patagonia. B.R. 26:27. S.B.F.G. 4:350.—Less often cult. and not so handsome as the following hybrid, which has larger lvs. and umbellate fls.

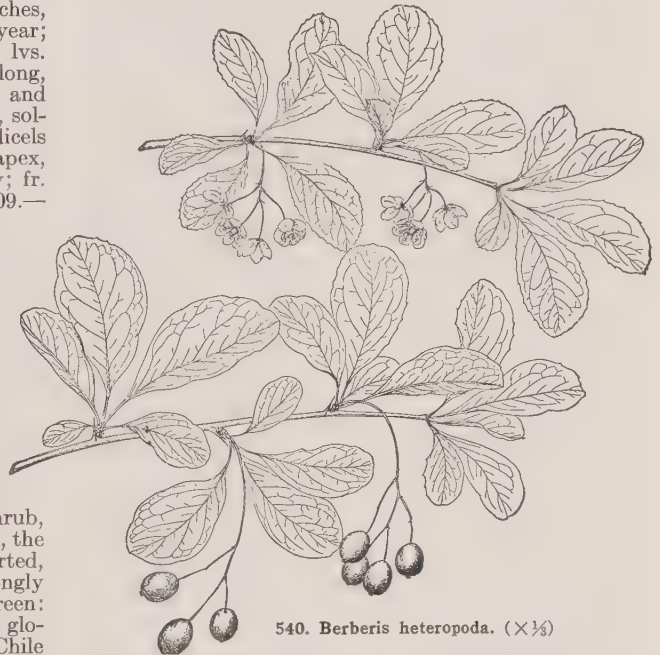
20. *stenophylla*, Mast. (*B. Darwinii*  $\times$  *B. empetrifolia*). Height 1–3 ft., with slender, arching branches: lvs. narrow-oblong, revolute at the margins, spiny pointed,  $\frac{1}{2}$ – $1\frac{1}{4}$  in. long, dark green above; fls. 2–6, in peduncled nodding umbels. Of garden origin. May. G.C. III. 7:619. A.F. 6:325. Gn. 14, p. 46; 61, p. 305

(habit); 69, p. 318. G.W. 14, p. 593; 15, p. 103.—Handsome shrub, hardy in sheltered positions at the Arnold Arboretum.

21. *concinna*, Hook. f. Low, spreading shrub, to 3 ft.: branches of last year pale brown, angular; spines 3-parted, slender; lvs. obovate,  $\frac{1}{2}$ –1 in. long, rather thin and only half-evergreen, remotely spinose-dentate, bright green above, glaucous beneath; fls. solitary or in 2's on slender stalks,  $\frac{3}{4}$ –1 in. long, bright yellow, over  $\frac{1}{2}$  in. across; fr. red, oblong-ovoid. June. Himalayas. B.M. 4744.—One of the most graceful barberries, similar to *B. dictyophylla*, but easily distinguished by the slender-stalked fls. and half-evergreen lvs. It has proved hardy at the Arnold Arboretum in sheltered positions.

22. *verruculosa*, Hemsl. & Wilson. Dwarf, spreading shrub, to 3 ft., evergreen: branches terete, densely verruculose, with slender spines often as long as lvs.: lvs. ovate or elliptic to ovate-lanceolate, remotely spiny-toothed, dark green and lustrous above, glaucous beneath,  $\frac{1}{2}$ –1 in. long; fls. 1–2,  $\frac{1}{2}$  in. across; fr. violet-black, bloomy, ovoid  $\frac{1}{2}$  in. long, with sessile stigma. June; fr. Oct. W. China. B.M. 8454.—Very handsome with its dense dark green and lustrous foliage. Has proved hardy at the Arnold Arboretum.

23. *Gagnepainii*, Schneid. Evergreen shrub, to 6 ft.: branches yellowish gray, terete, with slender, rather long spines; lvs. narrow-lanceolate, spiny-serrate, revolute at the margin, light green beneath, indistinctly veined,  $1\frac{1}{2}$ – $3\frac{1}{2}$  in. long; fls. fascicled, 3–8,  $\frac{1}{2}$  in. across; pedicels  $\frac{1}{2}$ –1 in. long; fr. ovoid, about  $\frac{1}{2}$  in. long, bluish black, bloomy, with nearly sessile style. June; fr. Oct. W. China. G.C. III. 46:226. B.M. 8185 (as *B. acuminata*).



24. *lêvis*, Franch. Shrub, to 5 ft., evergreen: branches light yellowish gray, angled, usually with long spines; lvs. narrow-lanceolate, remotely spiny-serrate, slightly or not revolute at the margin, light green beneath, indistinctly veined, 1–2 in. long; fls. in many-fl. fascicles,  $\frac{1}{2}$  in. across; pedicels short,  $\frac{1}{4}$ – $\frac{1}{2}$  in. long; fr. short-ovoid, about  $\frac{1}{4}$  in. long, black; stigma on a short

25. *Sargentiana*, Schneid. Evergreen shrub, to 6 ft.: branches nearly terete, grayish brown, with usually short spines: lvs. coriaceous, elliptic-oblong, with usually lanceolate, acute or acuminate, densely spiny-serrate, dark green above, light green and reticulate below,  $1\frac{1}{2}$ –4 in. long: fls. fasciated, many,  $\frac{1}{2}$  in. across; pedicels  $\frac{1}{2}$ – $\frac{3}{4}$  in. long: fr. globose-ovoid,  $\frac{1}{3}$  in. long, black, with sessile stigma. May, June; fr. Sept., Oct. W. China.—Very handsome with large dark green lvs. At the Arnold Arboretum it has proved the hardest of the evergreen barberries. See page 3566.

26. *hakeoides*, Schneid. (*B. congestiflora* var. *hakeoides*, Hook. f. *B. congestiflora*, Hort., not Gay). Shrub, to 6 ft.: last year's branches angular, grayish brown; spines small or oftener leafy, and semi-orbicular with



541. *Berberis Thunbergii*.

spiny teeth: lvs. oval to nearly orbicular, 1–2 in. long, rigid, spinose-dentate, bright green above, glaucous beneath: fls. in dense globose clusters; clusters very numerous along the branches and forming spikes toward the end which is often leafless: fr. ovoid,  $\frac{1}{4}$  in., bluish black. Chile. G.C. III. 29:295. B.M. 6770.—Very handsome with its numerous bright yellow fl.-clusters. Not hardy N.

27. *ilicifolia*, Forst. Shrub, to 8 ft.: last year's branches angular, purplish, minutely pubescent when young: lvs. obovate,  $\frac{3}{4}$ –2 in. long, dark green above, coarsely spiny-toothed: racemes 5–10-fl., shorter than the lvs. with the peduncle about 1 in. long; fls. orange-yellow. Patagonia. B.M. 4308. F.S. 3:291.—Similar to the following. Very rare in cult.; for the plants usually cult. under this name see No. 31.

28. *Darwinii*, Hook. Shrub, 1–3 ft.: branches brown, pubescent when young: lvs. cuneate, obovate, spiny-toothed and usually 3-pointed at the apex, glossy dark green above, light green and lustrous beneath,  $\frac{1}{2}$ –1 in. long: racemes 6–20-fl., longer than the lvs., with the peduncle 2–4 in. long, pendulous; fls. orange-yellow, often reddish outside; style as long as the ovary: fr. dark purple. June; fr. Aug., Sept. Chile to Patagonia. B.M. 4590. F.S. 7:663. P.F.G. 2:46. J.F. 2:111. G.M. 44:660.

29. *asiatica*, Roxbg. (*B. hypoleuca*, Lindl.). Shrub, to 10 ft.: last year's branches grayish yellow, grooved, puberulous when young; spines small: lvs. obovate to oblong, 1–3 in. long, entire or with few teeth, whitish beneath: racemes 8–25-fl., 1–2 in. long: fr. purple, with distinct style. Apr. May. Himalayas. J.H.S. 2:246.—Hardy only S.

30. *chitria*, Lindl. (*B. aristata*, Sims, not DC.). Shrub, to 6 ft.: last year's branches yellowish or reddish brown, slightly grooved or nearly terete; spines slender, to  $\frac{3}{4}$  in. long: lvs. oblong, or oblong-obovate, cuneate at the base, 1–3 in. long, spinose-serrate or entire, subcoriaceous: fls. deep yellow, often reddish, in long-peduncled panicles: fr. purplish, ovoid-oblong, with distinct style. June, July. Himalayas. B.R. 9:729. B.M. 2549 (a few-fl. form, as *B. umbellata*).—Often

confused with *B. aristata*, which is easily distinguished by its simple sessile racemes.

31. *Neubertii*, Lem. (*B. vulgaris* × *Mahonia Aquifolium*). Branches grayish brown, without spines, upright: lvs. simple, oval or ovate, or sometimes oblong, cuneate at the base, often with 1 or 2 smaller lateral lfts., spiny-toothed, dark grayish green above,  $1\frac{1}{2}$ –3 in. long: fls. in racemes. Of garden origin. I.H. 1:111. G.C. III. 9:73, 75. Var. *latifolia*, Rehd. (*B. ilicifolia*, Hort., not Forst. *B. latifolia*, Hort.). Lvs. broader, those of the shoots more rigid, with fewer and broader, more spreading spines, with broader often nearly truncate base.—Hardy in sheltered positions at the Arnold Arboretum, but not evergreen; in the S. the lvs. are persistent.

*B. actinacantha*, Mart. Evergreen shrub, to 3 ft.: spines 4–7 parted: lvs. obovate to oblong,  $\frac{1}{2}$ –1 in. long, spiny: fls. slender-stalked, in clusters. Chile. B.R. 31:55.—*B. acuminata*, Franch. Allied to *B. Gagnepainii*. Evergreen shrub: branches yellow, terete: lvs. lanceolate, 4–7 in. long, acuminate, with numerous small spiny teeth: fls. fasciated; pedicels about 1 in. long. S.W. China. J.H.F. 1900:191.—*B. acuminata*, Stapf= *B. Gagnepainii*.—*B. acuminata*, Veitch= *B. Veitchii*.—*B. atnensis*, Presl. Low, dense, deciduous shrub: branches yellowish gray, angular with numerous spines, about  $\frac{1}{2}$  in. long: lvs. oblanceolate or ovate, spinose-serrate,  $\frac{1}{2}$ –1  $\frac{1}{2}$  in. long: racemes short, 8–14-fl. Sicily, Sardinia, Corsica.—*B. aggregata*, Schneid. Allied to *B. polyantha*. Lvs. oblong-obovate, spiny-toothed,  $\frac{3}{4}$ –1 in. long; panicles short and very dense, about  $\frac{1}{2}$  in. long: fr. subglobose, salmon-red. W. China.—*B. Andreeana*, Naudin= *B. laurina*.—*B. angulosa*, Wall. Deciduous shrub, to 4 ft.: young branchlets puberulous, angular, spiny: lvs. oblong-obovate,  $\frac{1}{2}$ –1  $\frac{1}{2}$  in. long, whitish beneath, entire or sparsely spinulose: fls. solitary or few, slender-stalked: fr. red. Himalayas. B.M. 7071.—*B. Aquifolium*, Pursh= *Mahonia Aquifolium*.—*B. arguta*, Ball= *Mahonia arguta*.—*B. Belstaniana*, Hort.= *B. virescens*.—*B. Bergmannii*, Schneid. Allied to *B. Sargentiana*. Evergreen shrub, to 6 ft.: lvs. coriaceous, elliptic, indistinctly veined, 1–1  $\frac{1}{2}$  in. long; fls. fasciated, many: fr. oblong-ovoid, black, bloomy. Cent. and W. China. Var. *acanthophylla*, Schneid. Lvs. to 2 in. long, sinuately spiny. W. China. Only the variety is in cult.—*B. Bretschneideri*, Rehd. Allied to *B. koreana*. Shrub, to 8 ft.: branches terete, reddish brown with few and small spines: lvs. obovate-oblong,  $1\frac{1}{2}$ –2  $\frac{1}{2}$  in. long, setose-serrate: racemes about 1  $\frac{1}{2}$  in. long: fr. oblong, purplish. N. China. S.T.S. 2:110. Hardy N.—*B. brachypoda*, Maxim. Allied to *B. amurensis*. Shrub, to 6 ft.: lvs. elliptic-oblong, acute, pubescent on both sides,  $1\frac{1}{2}$ –3  $\frac{1}{2}$  in. long: racemes pubescent, slender, 2–3 in. long: fr. scarlet. Cent. China.—*B. candidula*, Schneid. (*B. Wallichiana* var. *candidula*, Schneid. *B. Wallichiana* var. *palida*, Boiss.). Allied to *B. verruculosa*. Evergreen prostrate shrub: branchlets glabrous, yellowish: lvs. elliptic with few spiny teeth, white beneath, about 1 in. long: fls. solitary. Cent. China. V.F. 15.—*B. Caroli*, Schneid. (*B. integrerrima* var. *stenophylla*, Maxim.). Similar to *B. Poiretii*. Shrub, to 6 ft.: lvs. oblanceolate, usually entire,  $\frac{3}{4}$ –1  $\frac{1}{2}$  in. long: racemes 8–14-fl. Mongolia. Var. *hoanghensis*, Schneid. Racemes many-fl., 1–1  $\frac{1}{2}$  in. long, pedicels  $\frac{1}{2}$  in. long: fr. subglobose, salmon-red. W. China. Only the variety is in cult.—*B. cerasina*, Schrad. Allied to *B. sinensis*, but lvs. more often toothed, racemes shorter, hardly longer than the lvs. and spines shorter, usually simple. Of unknown origin.—*B. congestiflora*, Gay. Allied to *B. hakeoides*. Lvs. oblong-ovate to orbicular, often entire: fls. in dense umbels on upright stalks  $\frac{1}{2}$ –1 in. long. Chile.—*B. cratægina*, DC. Shrub, to 5 ft.: branches brownish red, nearly terete: lvs. deciduous, oblanceolate to oblong-obovate,  $\frac{1}{2}$ –1  $\frac{1}{2}$  in. long, usually entire: racemes 6–20-fl., 1–2 in. long: fr. bluish black. Asia Minor.—The true *B. cratægina* does not seem to be in cult.—*B. crética*, Linn. Deciduous shrub, to 3 ft.: branches purplish with



542. Fruiting twig of *Berberis Thunbergii*. ( $\times \frac{1}{2}$ )

numerous spines often nearly 1 in. long: lvs. lanceolate,  $\frac{1}{4}$ – $\frac{3}{4}$  in. long, usually entire: fls. 3–7, in short umbel-like racemes. S.E. Eu. Orient.—*B. crispata*, Gay. Allied to *B. hakeoides*. Branches puberulous: lvs. thinner, ovate or oval, spiny-toothed,  $\frac{1}{2}$ –1  $\frac{1}{2}$  in. long: fls. 5–8, on slender pedicels, clustered. Chile.—*B. dealbata*, Lindl. Lvs. persistent, nearly orbicular, with few spiny teeth: racemes short, dense, nodding. Mex. B.R. 21:1750.—*B. elegans*, Hort.= *B. Lycium*.—*B. emarginata*, Willd. Possibly *B. sibirica* × *vulgaris*. Low shrub: spines 1–5-parted: lvs. obovate to obovate-oblong,  $\frac{1}{2}$ –1  $\frac{1}{4}$  in. long, setulose-dentate: racemes shorter than the lvs., upright; petals usually emarginate. Of unknown origin. G.O.H. 62.—*B. Fendleri*, Gray. Allied to *B. canadensis*. Shrub, to 5 ft.: spines 3–5-parted: lvs. obovate-lanceolate,  $\frac{3}{4}$ –1  $\frac{1}{4}$  in. long, lustrous, entire or spinulose: racemes dense, long-peduncled, pendulous. Colo. to New Mex. G.F. 1:462.—*B. Fortunei*, Lindl.= *Mahonia Fortunei*.



—*B. Fremontii*, Torr.=*Mahonia Fremontii*.—*B. glauca*, Benth., not Kunth= *B. Jamiesonii*.—*B. gracilis*, Hartw.=*Mahonia gracilis*.—*B. haematocarpa*, Wooton= *Mahonia haematocarpa*.—*B. heterophylla*, Juss. Allied to *B. ilicifolia*. Branches glabrous, yellowish brown; spines 3-5-parted: lvs. persistent, obovate to oblong,  $\frac{1}{2}$ -1  $\frac{1}{2}$  in. long, entire, or with 2-4 spiny teeth: fls. solitary: fr. purplish black. Straits of Magellan. H.E. 1:14.—*B. heterophylla*, Zabel= *Mahonia heterophylla*.—*B. Hookeri*, Lem. (*B. Jamiesonii*, Hort., not Lindl. *B. Wallichiana*, Hook., not DC.). Allied to *B. Sargentiana*. Branchlets angular, stout, pale yellowish brown: lvs. elliptic-oblong to oblong-lanceolate, sinuately spiny-toothed, 1-2 in. long: fls. 3-6; pedicels slender: fr. oblong, large, with 4-8 seeds. Origin uncertain; probably Himalayas. I.H. 6:207. B.M. 4656.—*B. Hutchinsiana*, Rehd.=*Mahonia arguta*.—*B. Jamiesonii*, Lindl. (*B. glauca*, Benth., not Kunth). Evergreen shrub: branches terete, brownish red: lvs. oblong, 2-3 in. long, entire or with few teeth, lustrous, pale green beneath: fls. in close panicles; pedicels  $\frac{1}{2}$  in. long. Peru.—Often confused with *B. Hookeri* and *B. Verschaffeltii*.—*B. japonica*, Spreng.=*Mahonia japonica*.—*B. Knightii*, Hort.=*B. Wallichiana* var. *latifolia*.—*B. laurina* Billbg. (*B. Andreae*, Naudin). Allied to *B. buxifolia*. Shrub, to 5 ft.: branches glabrous, terete; spines to 1 in. long: lvs. oblanceolate, 1-3 in. long, entire, pale beneath: racemes pendulous, to 5 in. long: fr. black, bloomy. S. Brazil. R.H. 1899, p. 9.—*B. lariflora*, Schrad. Allied to *B. amurensis*. Lvs. oval to oval-elliptic, obtuse, serration less dense, grayish green beneath: racemes pendulous, 2-3  $\frac{1}{2}$  in. long. Of unknown origin.—*B. Liechtensteinii*, Schneid. Deciduous shrub, to 5 ft.: branches slightly angled, purplish with strong spines: lvs. ovate to lanceolate, sinuately spiny, light green beneath,  $\frac{1}{2}$ -2  $\frac{1}{2}$  in. long: fls. in racemes 1-1  $\frac{1}{2}$  in. long: fr. globose, red, with 2 seeds. W. China.—*B. lucensis*, Benth. Lvs. persistent, oblong-obovate, entire or sometimes with a few spiny teeth, lustrous: fls. small in peduncled, loose racemes. Peru. F.S. 6, p. 69.—*B. lucida*, Schrad. Allied to *B. vulgaris*. Lvs. elliptic to elliptic-oblong, dark green and lustrous above, obtuse, remotely and finely serrate: racemes spreading, about 2 in. long: fr. red. Of unknown origin; possibly variety of *B. vulgaris*.—*B. Lycium*, Royle (*B. ruscifolia*, Hort., not Lam. *B. elegans*, Hort.). Shrub, to 6 ft. or more: branches terete, yellowish gray: lvs. sub-persistent, obovate-lanceolate,  $\frac{3}{4}$ -2 in. long, entire or spinulose: racemes sessile, longer than the lvs., drooping: fr. violet. Himalayas. B.M. 7075.—*B. macrophylla*, Hort.=*B. Wallichiana* var. *latifolia*.—*B. macracantha*, Schrad. Possibly *B. aristata*  $\times$  *vulgaris*. Branches yellowish gray: lvs. elliptic, acutish, remotely spiny-toothed, 1-2 in. long: racemes nodding, 1  $\frac{1}{2}$ -2  $\frac{1}{2}$  in. long: fr. red. Of unknown origin.—*B. microphylla* var. *serrata*, Hort.=*B. serrata*.—*B. Mouillacana*, Schneid. Deciduous shrub, to 10 ft.: branches grooved, purplish, with simple spines: lvs. obovate-lanceolate, obtuse, usually entire, light green beneath,  $\frac{1}{2}$ -2 in. long: fls. in racemes, to 1  $\frac{1}{2}$  in. long: fr. scarlet, with 2 seeds. W. China.—*B. oblonga*, Schneid. (*B. heteropoda* var. *oblonga*, Regel.). Allied to *B. heteropoda*. Branches angular: lvs. obovate: racemes 10-20-fld., usually compound near the base; ovary with 2 sessile ovules: fr. oblong. Turkestan.—*B. nepalensis*, Spreng.=*Mahonia nepalensis*.—*B. nervosa*, Pursh= *Mahonia nervosa*.—*B. pallida*, Benth.=*Mahonia pallida*.—*B. parviflora*, Lindl.=*B. ruscifolia*.—*B. parvifolia*, Sprague. Allied to *B. Wilsonae*. Low shrub: lvs. half-evergreen, oblanceolate, entire or occasionally spiny-toothed, glabrous and reticulate beneath: fls. fascicled, 3-6: fr. globose, terra-cotta color. W. China.—*B. pinnata*, Lag.=*Mahonia pinnata*.—*B. Pratii*, Schneid. Allied to *B. polyantha*. Shrub, to 10 ft.: lvs. oblong-obovate, entire or with few spiny teeth, reticulate, thinner: panicles narrow, to 6 in. long: fr. globose, salmon-red. W. China. Var. *recurvata*, Schneid. Raceme narrow, spike-like: fr. on reflexed pedicels. W. China.—*B. pruinosa*, Franch. Evergreen shrub: branches brownish yellow, nearly terete; spines to 1 in. long: lvs. ovate-oblong,  $\frac{3}{4}$ -2 in. long, strongly spiny-toothed, whitish beneath: fls. 8-25, fascicled, rarely in a peduncled umbel: fr. bluish black. S.W. China.—*B. Rehderiana*, Schneid. Allied to *B. koreana*, but much smaller in every part, branches reddish brown, slightly angled; spines 3-5-parted: lvs. obovate to oblong, spinose-serrate,  $\frac{3}{4}$ -1  $\frac{1}{2}$  in. long: fls. 8-15, in a peduncled raceme: fr. sub-globose, bright red. Origin unknown.—Hardy, graceful shrub; the fr. remains unchanged until the following spring.—*B. repens*, Lindl.=*Mahonia repens*.—*B. rotundifolia*, Hort.=*Mahonia repens* var. *rotundifolia*.—*B. ruscifolia*, Lam. (*B. parviflora*, Lindl.). Allied to *B. buxifolia*. Branches terete, yellowish gray: lvs. oblong, entire or with a few coarse teeth,  $\frac{1}{2}$ -1  $\frac{1}{2}$  in. long: fls. in 4-5-fld. peduncled raceme: fr. bluish black. Argentine. J.H.S. 2:243.—*B. ruscifolia*, Hort.=*B. Lycium*.—*B. sanguinea*, Franch. Allied to *B. Gagnepainii*. Lvs. narrow-lanceolate,  $\frac{3}{4}$ -2 in. long, spinose-serrate, pale beneath: fls. with red sepals, in fascicles of 2-4; pedicels  $\frac{3}{4}$  in. long: fr. bluish black. W. China. V.F. 16.—*B. serotina*, Lange. Allied to *B. sinensis*. Lvs. light green, oblanceolate, usually entire: racemes short and dense. Origin unknown.—*B. serrata*, Koehne (*B. microphylla* var. *serrata*, Hort.). Low, deciduous shrub: branches grooved, reddish or yellowish brown: lvs. oblong-lanceolate,  $\frac{1}{2}$ -1 in. long, spinulose-serrate: racemes dense, short. Origin unknown.—*B. sibirica*, Pall. Deciduous shrub: branches angular, yellowish brown; spines 3-9-parted: lvs. obovate, remotely toothed: fls. solitary or 2, short-pedicelled: fr. red. Siberia. B.K. 6:487.—*B. Silve-Taroucana*, Schneid. Deciduous shrub, to 10 ft.: branches grooved, brown; spines small or wanting: lvs. oblong-lanceolate or obovate-oblong, obtuse, entire or with few small teeth, pruinose beneath,  $\frac{1}{2}$ -2 in. long: racemes 1-2  $\frac{1}{2}$  in. long: pedicels  $\frac{1}{2}$ - $\frac{3}{4}$  in. long: fr. globose-ovoid, scarlet, with 1-2 seeds. W. China.—*B. subcaulata*, Schneid. Deciduous shrub: branches strongly angulate: lvs. oblanceolate,  $\frac{1}{2}$ -1 in. long, acute, rarely 3-pointed at the apex, whitish beneath: fls. in very short, 6-8-fld. racemes or rarely fascicled, nodding: fr. globose, red. W. China.—*B. tenuifolia*, Lindl.=*Mahonia tenuifolia*.—*B. thibetica*, Schneid. Deciduous shrub: branches angular, purplish, bloomy: lvs. obovate-lanceolate,  $\frac{1}{2}$ -1 in. long, rounded or acutish, mucronulate, entire, whitish beneath: fls. in

1-5-fld. fascicles; pedicels about  $\frac{1}{2}$  in. long. W. China.—*B. Tischleri*, Schneid. Allied to *B. diaphana*. Shrub, to 8 ft.: branches angled, gray, spiny: lvs. obovate to oblong, obtuse, spinulose-serate, pruinose beneath,  $\frac{1}{2}$ -1  $\frac{1}{2}$  in.: racemes 4-15-fld.; pedicels  $\frac{1}{2}$ -1 in. long: fr. oblong, with a distinct style, pale red, pruinose. W. China.—*B. toluacensis*, Hort.=*Mahonia heterophylla*.—*B. triacanthophora*, Fedde. Allied to *B. Gagnepainii*: evergreen shrub, to 5 ft.: branches terete, brown: lvs. linear-lanceolate with 2 to 5 spiny teeth on each side or entire, glaucous beneath, 1-2 in.: fls. 2-5, slender-stalked: fr. black, ovoid, with sessile style. Cent. China.—*B. trifoliolata*, Hartw.=*Mahonia trifoliolata*.—*B. trifoliolata*, Moric.=*Mahonia trifoliolata*.—*B. trifurca*, Forbes= *Mahonia japonica* var. *trifurca*.—*B. umbellata*, Wall. Deciduous shrub: branches angular, gray: lvs. oblanceolate, usually entire, rarely sparsely serrulate: racemes long-peduncled, usually umbel-like, sometimes elongated. Himalayas. B.R. 30:44.—*B. Veltchii*, Schneid. Allied to *B. levis*. Evergreen shrub: lvs. narrow-lanceolate, acuminate, sinuately toothed with long and strong spines, 2-4 in. long: fls. 5-8, slender-stalked: fr. ovoid, bluish black. Cent. China.—*B. Verschaffeltii*, Schneid. (*B. Jamesonii*, Lem., not Lindl.). Evergreen shrub: lvs. oblong, 2-3 in. long, sparingly spiny-toothed: fls. orange in drooping panicles. Ecuador. I.H. 6:201.—*B. viridescens*, Hook. Deciduous shrub, 2-5 ft.: branches yellowish red or red, lustrous, terete: lvs. obovate,  $\frac{1}{2}$ -1  $\frac{1}{2}$  in. long, spiny-toothed or entire, light green, whitish beneath: fls. pale yellow, few, fascicled or in peduncled umbel-like racemes: fr. purple, bloomy. Himalayas. B.M. 7116.—Graceful shrub. Hardy at the Arnold Arboretum.—*B. Wallichiana*, DC. Allied to *B. Sargentiana*. Evergreen shrub, to 10 ft.: branches grooved, spiny: lvs. elliptic to lanceolate, spiny-serrate with numerous small teeth, lustrous above, light green beneath, reticulate, 2-4 in. long: fls. 10-20; pedicels about  $\frac{1}{2}$  in. long: fr. ovoid, black, with usually 1 long-stalked seed. Himalayas. P.F.G. 1, p. 79. Var. *latifolia*, Hook. f. & Thoms. (*B. Knightii*, Hort., not Koch. *B. macrophylla*, Hort.). Branchlets less grooved: lvs. broader, thinner.—*B. Wallichiana*, Hook.=*B. Hookeri*.—*B. yunnanensis*, Franch. Allied to *B. diaphana*. Branches grooved, gray: lvs. obovate-oblong, 1 in. long, entire, glaucous beneath: fls. 3-5, fascicled. S.W. China.—Has been confused with *B. diaphana*. See page 3566.

ALFRED REHDER.

**BERCHÈMIA** (derivation uncertain). *Rhamnaceae*. Ornamental woody climbers, grown chiefly for their bright green graceful foliage.

Deciduous twining shrubs: lvs. alternate, entire or nearly so, petioled, with conspicuous numerous parallel veins: fls. perfect; sepals, petals and stamens 5; calyx-tube shallow; ovary free, 2-celled, with a 2-parted style: drupe oblong to cylindric with a 2-celled stone.—About 12 species in S. and Cent. Asia, N. Amer. and E. Afr.

These slender climbing shrubs have inconspicuous greenish white flowers in terminal panicles followed by berry-like, small, usually oblong, black or red fruits. The cultivated species are not quite hardy North and prefer sunny positions; they grow in almost any soil and are useful for trellis-work, when no dense shade is desired. Propagation is by seeds and by root-cuttings in spring under glass; also by layering the young shoots and by cuttings of mature wood in fall under glass.

*scandens*, Koch (*B. volubilis*, DC.). SUPPLE-JACK. Ten to 15 ft.: lvs. ovate or oblong-ovate, acuminate, often undulate, 1-3 in. long, with 9-12 pairs of lateral veins: fls. greenish white in small terminal panicles: fr. bluish black,  $\frac{1}{4}$ - $\frac{1}{2}$  in. long. June. Southern states. B.B. 2:404. S.O.B. 3:153.

*racemosa*, Sieb. & Zucc. Closely allied to the former. Lvs. cordate, ovate, 1-2  $\frac{1}{2}$  in. long, with 6-8 pairs of veins: fls. greenish in large terminal panicles: fr. first red, becoming black at length. July. Japan, China.—Hardier than the former, not high-climbing; attractive in late summer, with its red frs.

*B. Giraldiana*, Schneid. Allied to *B. racemosa*. Lvs. ovate-oblong, 1-3 in. long, grayish white beneath, with 9-11 pairs of veins; petioles  $\frac{3}{4}$  in. long. W. China.—*B. lineata*, DC. Allied to *B. scandens*. Lvs. smaller, oblong-ovate, obtuse, with about 9 pairs of veins, grayish white beneath. N. and W. China.

ALFRED REHDER.

**BERGAMOT**. Name applied to various aromatic plants, particularly to members of the *Labiatae*, as menthas and monardas. The bergamot essence of commerce is made from a citrous fruit. See *Citrus*.

**BERGEROCÁCTUS** (named for Alwin Berger, Curator of the Hanbury Garden, at La Mortola, Italy). *Cactaceae*. A low, much-branched, day-blooming cactus with cylindrical, low-ribbed sts.: areoles close together,

bearing many yellow spines: corolla short, funnel-shaped, greenish yellow: fr. globose, densely spiny.—A single species known.

**Émoryi**, Brit. & Rose (*Cereus Émoryi*, Engelm.). Prostrate or ascending, 6–10 in. high, 1–2 in. diam., often forming thick masses 10–20 ft. in diam.: fls. 1–2 in. broad: fr. 1–1½ in. diam. On mainland and isls. of S. Calif., and N. Low. Calif.—This species, native of Calif., can easily be grown in the open in the southern part of that state. It forms large masses and care must be taken that it does not preempt more than its share of the garden. The species has long been in the trade, but it does not do well in the greenhouse, and it is hardly to be recommended for the small collection. Its slender sts., covered with striking yellow spines, are very unlike any of our other cereus-like plants.

J. N. ROSE.

**BERMUDA GRASS:** *Cynodon dactylon*.

**BÉRRIA** (after Dr. Andrew Berry, a Madras botanist). Syn., *Berrya*, DC., not Klein. *Tiliaceæ*. A timber tree of India, which has been sparingly introduced into this country. One species.

**Ammonilla**, Roxbg. High tree: lvs. entire, heart-shaped, long-petioled, smooth, 5–7-nerved, alternate: fls. in racemes, small, white, very numerous: fr. a 3-celled caps. with 6 wings, the 3–12 seeds with stiff hairs, which readily penetrate the skin and produce a painful itching.—Grows abundantly in British India, Ceylon, the Malay Archipelago, and the Philippines. The wood is smooth-grained, yellow, with dark red heart; used for house-building, agricultural implements, oil-casks, boats, and the like. Exported as “trincomalee wood.”

G. T. HASTINGS.

**BERSÂMA** (Abyssinian name). *Sapindaceæ*. Trop. and S. African trees and shrubs, of perhaps a half-dozen species, probably not cult. Lvs. alternate, odd-pinnate; lfts. entire or serrate: fls. silky, white, of 5 sepals and 5 unequal clawed petals. *B. usambarensis*, Guerke, a recently described species from German E. Afr., has been discussed in horticultural journals: tree, 50 ft.: lvs. more than 2 ft. long, with winged rachis, the lfts. oblong-lanceolate and somewhat cut, prickly-margined.

**BERTHOLLÈTIA** (after Louis Claude Berthollet, French chemist). *Myrtaceæ*. BRAZIL-NUT. BUTTER-NUT. PARA-NUT. CREAM-NUT. NIGGER-TOE. Large



543. *Bertholletia excelsa*. Cross-section of husks, showing Brazil-nuts. ( $\times \frac{1}{4}$ )

trees: lvs. alternate, bright green, leathery, about 2 ft. long, 6 in. broad: fls. cream-colored; calyx parts united and tearing into 2 parts when the flower opens; petals 6; stamens many, united into a hood-shaped mass, the upper ones sterile: fr. round, about 6 in. diam., with a hard shell containing 18–24 3-sided nuts (Fig. 543).—Species several, all furnishing Brazil

nuts and usually

described as *B. excelsa*. The common trade name is Castanea, the name of the genus including the chestnuts. **excelsa**, Humb. & Bonpl. Fig. 543. A tree 100–150 ft. with a smooth trunk 3–4 ft. in diam.: branches near the top.—It forms large forests on the banks of the Amazon and Rio Negro. The natives gather the nuts in large quantities, chopping the fr. open. They are

exported in large quantities, chiefly from Para. An oil is expressed from the kernels, and the bark is used at Para for caulking ships. The tree is of little value for decorative purposes, and, is too tender for growth anywhere in the U. S.

G. T. HASTINGS.

**BERTOLONIA** (after A. Bertolini, Italian botanist). *Meistomaceæ*. Excellent greenhouse foliage plants from Brazil.

Always dwarf, and sometimes creeping; the garden forms with membranaceous, 5–11-nerved lvs. 5–8 in.



544. *Bertolonia marmorata*.

long, and purple beneath: fls. white, purple or rose-colored, 5-petaled, in scorpioid racemes or spikes. There are only 9 species, 5 of which were distinguished when the last edition was issued. (A. Coigneaux, in DC. Mon. Phan., Vol. VII.) Some earlier botanists do not separate certain allied genera which usually cannot be distinguished by habit alone. The surest character is the inflated and 3-angled or 3-winged calyx of Bertolonia. In Bertolonia, fl.-parts are in 5's, but the ovary is 3-celled. *Gravesia* has a 5-celled ovary, and *Sonerila* is trimerous. In Bertolonia, the connective of the anthers has no appendage; in *Salpinga* there is a spur below and behind the connective; in *Monolena* there is a spur in front, and the calyx is not hairy.

Bertolonias are essentially fanciers' plants. It is somewhat difficult to bring out their true characteristics under ordinary stove treatment, as they require a more humid atmosphere than can usually be maintained, even in a small house. The additional shelter of a small frame should be provided, where the atmospheric conditions will be much more easily regulated. A plentiful supply of water at the roots is necessary; syringing or sprinkling overhead is not advisable.—The most convenient method of propagation is by cuttings, which strike readily, in a moderately close propagating-case filled with sharp, clean sand. The pots should be thoroughly clean and drained, and the compost open and porous. They may also be grown from seed. They thrive in dense shade. Old plants are not so brilliant as young ones. (Wm. Scott.)

Bertolonias and their allies furnish an excellent example of Van Houtte's triumphs in hybridization. The two species described below have probably been important factors in the plant-breeding, and *Gravesia guttata* even more so. *Gravesia* is a Madagascar plant, and has, perhaps, been crossed with the Brazilian bertolonias. Unfortunately, the pictures in Flore des Serres show no flowers, and the pedigree is not given. The bertonerilas figured and described in I.H. 43, pp. 188 and 189, with colored plates 64 and 68, are presumably hybrids between Bertolonia and Sonerila. Excepting *B. maculata* and *B. marmorata*, the following are hybrids:

*A. Veins not lined on both sides with a colored band.*

**marmorata**, Naudin. Fig. 544. St. less densely hairy than *B. maculata*: lvs. more narrowly ovate, ovate-



oblong, acute, sparsely hairy, streaked with white along the veins: calyx sparsely hairy, not glandular; petals somewhat blunter, dilute purple. R.H. 1848:381 (as *Eriocnema marmorata*, Naudin). F.S. 7:750 (as *B. maculata* var. *marmorata*, Planch.). Coigneaux recognizes 2 varieties, var. *genuina*, with lvs. green above, and banded with white along the veins; var. *ænea*, (*E. ænea* and *B. ænea*, Naudin), with lvs. dark green with a coppery cast, but not spotted or only slightly so.

**Mirándæi**, Van Houtte. Spots red on the lower lvs. and white on the upper or younger ones: lvs. purple beneath. F.S. 21:2235 (1875).

AA. *Veins lined on both sides with a white or colored band.*

B. *Bands and spots magenta or purple.*

**maculata**, DC. St. short, decumbent, rooting at the base, densely clothed with rusty hairs: lvs. long-petioled, cordate, broadly ovate, obtuse, hispid above and at margins, dark velvety green above, often spotted: calyx densely clothed with glandular hairs; petals obovate, somewhat acute, rose-colored. B.M. 4551.

**Houtteana**, Van Houtte (*B. Van Houttei*, Hort.). Lvs. purple beneath. F.S. 20:2120.—This was a sensational plant of 1875, and Van Houtte refused \$2,000 for his stock of it.

BB. *Bands and spots silvery white.*

c. *Spots very distinct.*

**Hrubyana**, Van Houtte. This has bars of white connecting the veins. The under side of the lvs. seems to be green instead of purple, at least toward the tip. F.S. 23:2381.

**Rodeckiana**, Van Houtte. Distinguished from the above and all others of this group by the abundance of dark red color on the upper surface of the lvs.: veins of the under side prominent and green. F.S. 23:2332.

cc. *Spots very faint.*

**Legrelleana**, Van Houtte (*B. Legrelle*, Hort.). There are a few longitudinal bars, but they do not connect the veins. Referred to *Gravesia guttata* by Coigneaux. F.S. 23:2407.

Other trade names are *B. guttata*, Hook. f.—*Gravesia guttata*.—*B. margaritacea*, Hort. Bull.—*Salpinga margaritacea*.—*B. primulaeflora*, Hort.—*Monoleuca primulaeflora*.—*B. pubescens*, Hort., with long white hairs, and a chocolate band down the center. Ecuador.—*B. punctatissima*, Hort.—*B. superbissima*, Hort. (*B. superba*?, Hort.), with rose-colored spots, which are larger and brighter near the margin. F.M. 151 (1875).—Probably a variety of *Gravesia guttata*.

WILHELM MILLER.

N. TAYLOR.†

**BERTONERILA**. A class of handsome foliage plants, presumably hybrids between *Bertolonia* and *Sonerila*. *Bertonerila* is a combination of the names *Bertolonia* and *Sonerila*. I.H. Vol. 43 (1896), pp. 188–190. For culture, see *Bertolonia*.—Rare in this country, perhaps not in cult. outside of a few botanic gardens. Some of the best-known forms are: Madame Cahuzae, Madame de Brezetz and Madame Treyeran.

**BESCHORNËRIA** (after H. Beschorner, German botanist). *Amarylhidaceæ*. Succulent desert plants, allied to Bravao, Fourcroya and Doryanthes, planted far south and in California, and sometimes seen in collections under glass in the North.

Leaves in a rosette, glaucous, roughish at the margins, not so thick, firm or fleshy as in *Agave* (which has a strong end-spine and horny marginal prickles): root-stock short, tuberous: fls. accompanied by showy colored bracts. In *Beschorneria*, the perianth is usually reddish green, funnelliform but with a very short tube and with long, oblanceolate segms.; in *Doryanthes* the perianth is bright red, the segms. long, narrowly falcate; in Bravao the perianth is red or white, the tube curved, sub-cylindrical, and the segms. short. From Fourcroya, to which the genus is closely related, *Beschorneria* is

distinguished by its tubular-shaped perianth, long and narrow segms., thin and slender filaments, which are only slightly thickened below the middle. The perianth of Fourcroya is campanulate, with spreading, ovoid or elliptic segms., and short thickened filaments; the fourcroyas are larger plants, and without large showy bracts, and often produce bulbils, which *Beschorneria* never does.

The species are very closely allied, and difficult to distinguish. The following are the only kinds well known, and they are all from Mexico. If in good condition they bloom every year in warm countries from suckers of the previous year, but in the North they are likely to bloom only at long irregular intervals. The species succeed best when treated similarly to agaves, with the exception of the soil, which may be made richer by the addition of crushed bone and a little vegetable-mold. All of the species need greenhouse protection in the northern states. They are hardy in the warmest parts of the British Islands. Useful for bedding as striking foliage subjects.

**tubiflora**, Kunth. No st. or trunk: lvs. 12 or more, 1½–2 ft. long, 1 in. broad, linear, long-acuminate, roughish on both surfaces, tufted, more or less recurved, thickened and triangular at base, minutely striated, glaucous-green: scape 4 ft., terminating in an erect raceme; fls. drooping, 2–4 together, the perianth divided to the top of the ovary, brownish green. B.M. 4642.—The oldest and best-known species.

**Tonéllii**, Jacobi (*B. Tonelliana*, Jacobi). Allied to *B. tubiflora*, but with looser habit, much broader foliage, bright red-purple scape and a colored panicle with drooping branches, longer purple and red fls. with more acute segms.: st. or trunk very short: lvs. very glaucous, roughish beneath and on the margins, 15–20 in number, 1–1½ ft. long, 2–2½ in. broad, short-acuminate, and contracted below the middle into a flat thick petiole 1 in. broad. B.M. 6091.

**Dekosteriana**, C. Koch (*B. Decosteriana*, Baker). Lvs. 15–20 or more, 2–2½ ft. long, 2–2½ in. broad, oblanceolate, long-acuminate, very gradually tapering both ways from the middle, 1–1¼ in. broad above the base, which is very thick: fls. in a deltoid panicle, green, 1½ in. long, cut nearly to base, the ovary protruding. B.M. 6768.

**bracteata**, Jacobi. Stemless: lvs. 20–30, 1½–2 ft. long, 2 in. broad, short-acuminate, texture thin but firm, contracted to less than 1 in. wide above the dilated base, glaucous green, scarious or dry on the margin: scape 4–5 ft., the panicle reddish brown; fls. 1½ in. long, segms. free but connivant, green, changing to yellowish red. B.M. 6641.

**yuccoides**, Hook. f. St. none, or apparently present by shedding of older lvs. in the rosette: lvs. about 20, 1–1½ ft. long, 2 in. broad, lanceolate, short-acuminate, narrowed to ½ in. above the base, glaucous green: scape 3–4 ft., with fls. on drooping red branches in the panicle; fls. about 3 in. long, dark green, tinged yellow. B.M. 5203. G.C. III. 46:8, 309, 313.—The lvs. are broader than in *A. tubiflora*, shorter acuminate, and more boldly narrowed below the middle.

**Wrightii**, Hook. f. Allied to *B. Dekosteriana*, but fls. pubescent: st. or trunk 18 in.: lvs. about 50, densely crowded, spreading or recurved, ensiform, 4–5 ft. long by 2 in. at the middle, the tip narrowed to a long brown stiff point, the base dilated and very thick and bi-convex, the margins very narrowly scarious, denticulate: panicle pyramidal, 8 ft.; fls. fascicled, nodding, greenish, pubescent. B.M. 7779.

**pubescens**, Berger. Smaller: lvs. 2 ft. long by 2 in. broad, glaucous, rather stiff and fleshy along the midrib, nearly smooth underneath, rough only near tip, margins finely and deeply denticulate: panicle 4–5 ft., rather slender, the scape bright red; fls. fascicled in axils of

ovate bracts, green, fading to yellow, pubescent. G.C. III. 40:350.

*B. argyrophylla*, Hort.=*B. Dekosteriana*.—*B. californica* is a nomen nudum.—*B. superba*, Hort. and *B. viridiflora*, Hort.=*B. yuccoides*.

G. W. OLIVER.  
L. H. B.†



545. *Bessera elegans*.

**BESLÈRIA**  
(after Basil Besler, Nuremberg apothecary, and reputed author of the superb Hortus Eystettensis, 1613).

*Gesneriaceæ*. A genus of 50 species of Trop. American plants, mostly subshrubs, with somewhat 4-angled sts., large, membranaceous, opposite, petiolate lvs. prominently veined beneath, and yellow, white or purple fls.: calyx campanulate, at length globose, shortly 5-toothed; corolla tubular. *B. Imray* is herbaceous, with serrate lvs. and yellow axillary fls. B.M. 6341. Prop. by cuttings over bottom heat. None is known to be offered in Amer.

*lutea*, Linn. St. 6–10 ft., glabrous or nearly so; lvs. elliptic or elliptic-oblong; calyx about half as long as the yellow slightly gibbous corolla. Trop. Amer.

N. TAYLOR.†

**BÉSSERA** (after Dr. Besser, professor of botany at Brody). *Liliaceæ*. MEXICAN CORAL DROPS. An exceedingly pretty summer-flowering bulbous squill-like plant.

Umbels pendulous; fls. vermilion outside, with a white corona or cup within, and long, purple stamens; perianth cup-shaped, the tube shorter than the oblong-lanceolate segms.; stamens 6.—A monotypic genus allied to *Androstephium*. Culture simple. Bulbs planted out, and lifted when ripe. May be prop. by offsets.

*élégans*, Schult. f. Fig. 545. Bulb globular, 1 in. thick, tunicated; lvs. 2–3, about 10–12 in., or even 2 ft., long; scape 1–2 ft. long, hollow, fragile; umbels 4–10-fld.; pedicels 1–1½ in. long; perianth 9–10 lines long, keeled on the back, variously marked with white within, but usually with vermilion margins and center-band; fls. borne through two months of late summer and early autumn. G.F. 4:125 (adapted in Fig. 545). Gn. 25:42. B.R. 1546 (as *Phorium fistulosum*); 25:34. F.S. 4:424 (as *B. miniatum*).—Strong bulbs sometimes throw up 6–10 scapes, with 12–20-fld. umbels.

WILHELM MILLER.

**BÈTA** (ancient name). *Chenopodiaceæ*. BEET-ROOT. BEET. Annuals in cultivation, or biennials by the wintering of the roots, grown for the thick edible roots, edible leaves, and ornamental foliage.

Glabrous, mostly thick-rooted herbs, with alternate, entire or sinuate lvs.: fls. perfect, bracted; perianth urn-shaped, 5-lobed, adhering at base to the ovary, becoming hardened in fr.;

stamens 5 on a fleshy ring or disk; ovary partly inferior, in fr. covered by the withered and corky remains of the perianth; the fls. usually stand 2 or more together and cohere into a “seed” or “ball” that is more than 1-seeded.—The species of Beta are much confused, but probably all of them can be referred to a half-dozen species. Eu., N. Afr., Asia.

*vulgàris*, Linn. (*B. maritima*, Linn.). The supposed source of the cult. beets and foliage beets. Probably a development from the perennial beet of the coasts in parts of Eu., a much-branched decumbent plant (Fig. 546), with thick, long and hard (not really fleshy) perennial roots. In cult. forms, the plant is erect in fls. and fr., with greenish clustered fls., and ovate-oblong, smooth, more or less thick and wavy-margined lvs. There are 3 main races of the cult. beet-plant:

Var. *cràssa*, Alef. BEET-ROOT. BEET of American gardens and fields, characterized by its thickened root of many forms, some of which are developed for their sugar-producing qualities. See *Beet*.

Var. *crúenta*, Alef. (*B. horténsis* and *B. rubra*, Hort.). RED and VICTORIA foliage beets. Root not highly developed: lvs. large and showy, red or green, with yellow ribs. Var. *metállica* is a form of this. In many brilliant forms, often used in bedding and for strong color effects.

Var. *Cícila*, Moq. (*B. Cícila*, Linn. *B. brasiliénsis* and *B. chilénsis*, Hort.). LEAF-BEET. SICILIAN BEET. SEA-KALE BEET. SPINACH BEET. CHILIAN BEET. ROMAN KALE. POIREI. Root small and branched, not thick or fleshy: lvs. very large, thick-ribbed, green, yellow-green, reddish green or even red, often with very wide and thick petioles.—Used as a pot-herb. Differs widely in the coloration of the lf.-ribs, and shape and development of lf.-blade. One form of it is *Chard* (which see).  
L. H. B.

**BETEL**, or **BETLE**. The leaf of *Piper Belle*, a kind of pepper used in wrapping the pellets of betel-nut and lime which are commonly chewed in the Orient. The pellets are hot, acrid, aromatic, astringent. They redden the saliva and blacken the teeth, and eventually corrode them. The betel-nut is the fruit of *Areca Catechu*, a palm. See pp. 16 and 24.

**BETÓNICA** and **BETONY**: *Stachys*.

**BÉTULA** (ancient Latin name). *Betulaceæ*. BIRCH. Ornamental deciduous woody plants grown chiefly for their bright green handsome foliage. Page 3566.

Trees or shrubs: winter-buds usually conspicuous, sessile, with several imbricate scales: lvs. alternate, petioled, serrate or crenate; fls. monœcious, apetalous, in catkins, staminate formed in autumn and remaining naked during the winter, every scale bearing 3 fls., each with a minute 4-toothed calyx and with 2 stamens divided at the apex; pistillate catkins oblong or cylindrical, bearing 3 naked ovaries in the axil of every scale



546. *Beta*. The wild perennial form of the beet plant as it grows on the coasts of England.



consisting of 3 connate bracts: fr. a minute nut, often erroneously called seed, with membranous wings, dropping at maturity with the 3-pointed scales from the slender rachis of the strobile.—About 35 species in N. Amer., Eu., N. and Cent. Asia, especially in the northern regions. No tree goes farther north than the birch, in N. Amer. *B. papyrifera* reaches 66° north latitude, and in Eu. *B. pubescens* goes to the N. Cape, and is still a forest tree at 70°. Monogr. by Regel: Monographische Bearbeitung der Betulaceae (1861); and in De Candolle, *Prodromus*, 16, 2, p. 162 (1869); and by Winkler in Engler's *Pflanzenreich: Betulaceae*, p. 56, quoted below as W. B.

The birches are often conspicuous on account of their colored bark, and slender usually pendulous staminate catkins before the leaves and much smaller pistillate catkins, followed by subglobose to cylindric strobiles. The hard and tough wood is often used in the manufacture of furniture and of many small articles, in making charcoal, and for fuel; from the bark, boxes, baskets, and many small articles are made; also canoes from that of the *B. papyrifera*; in Russia and Siberia it is used in tanning leather. The sap of some species is used as a beverage. The birches are very ornamental park trees, hardy, except two or three Himalayan species, and especially valuable for colder climates. They are essentially northern trees and are short-lived in warmer regions, particularly mountain species like *B. lutea*, while *B. nigra* and *B. lenta* are better suited for a warmer climate than most other species. Their foliage is rarely attacked by insects, and turns to a bright or orange-yellow in fall. Their graceful habit, the slender, often pendulous branches, and the picturesque trunks make them conspicuous features of the landscape. Especially remarkable are those with white bark, as *B. papyrifera*, *B. populifolia*, *B. pendula*, *B. Ermanii*, and also *B. Maximowiczii* with yellow bark.

Most birches prefer moist, sandy and loamy soil; but some, as *B. pendula* and *B. populifolia*, grow as satisfactorily in dry localities and poor soil as in swamps and bogs, and they are especially valuable in replanting deserted grounds as nurses for other trees; both are comparatively short-lived trees.

Propagation is readily accomplished by seeds, gathered at maturity and sown in fall, or usually kept dry during the winter, or stratified; but *B. nigra*, which ripens its fruits in June, must be sown at once, and by fall the seedlings will be several inches high. The seeds should be sown in sandy soil, rather thick, as the percentage of perfect seeds is not very large, slightly or not at all covered, but pressed firmly into the ground and kept moist and shady. The seedlings must be transplanted when one year old. Rarer species and varieties are grafted, usually on *B. lenta*, *B. papyrifera*, *B. nigra* or *B. pendula*. Cleft or tongue-grafting in early spring, on potted stock in the greenhouse, is the best method. Budding in summer is also sometimes practised. Shrubby forms may also be increased by layers, and *B. nana* by greenwood cuttings under glass.

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A. Veins of lvs. 7 pairs or more, usually impressed above. Trees.

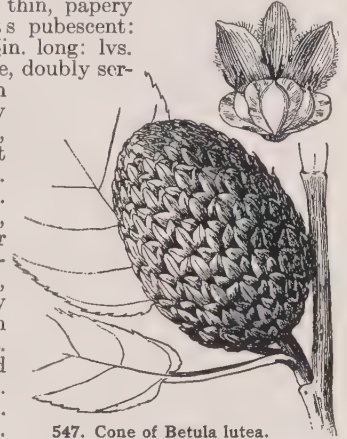
B. Lvs. large, 4-6 in. long, deeply cordate: cones cylindrical, racemose, 2-4.

1. *Maximowiczii*, Regel. Tree, 80-90 ft., with smooth, orange-colored trunk and dark reddish brown branchlets: lvs. long-petioled, broadly ovate, coarsely and doubly serrate, membranous, pubescent on younger trees, nearly glabrous on older ones: cones  $\frac{1}{2}$ -3 in. long, slender, nodding; fr. with very broad wings. Japan. B.M. 8337. S.I.F. 1:23. W.B. 90.—This is probably the most beautiful of all birches, perfectly hardy N. and of rapid growth; its large foliage and the yellow color of the trunk render it a highly ornamental and conspicuous park tree.

BB. Lvs. 2-5 in. long: cones solitary: wings narrower than the fr.

C. Under side of lvs. glaucescent: lvs. rhombic-ovate, cuneate at base with 7-9 slightly impressed pairs of veins.

2. *nigra*, Linn. (*B. rubra*, Michx.). RED or RIVER BIRCH. Tree 50-90 ft.: bark reddish brown, or silvery gray on younger branches, separating into numerous thin, papery flakes: branchlets pubescent: petioles scarcely  $\frac{1}{2}$  in. long: lvs. rhombic-ovate, acute, doubly serrate, pubescent when young, at length only on the veins beneath, pale or glaucescent beneath, 2-3 $\frac{1}{2}$  in. long: cones 1-1 $\frac{2}{3}$  in. long, cylindrical, ripening in May or June; scales pubescent, with erect, linear-oblong, nearly equal lobes. From Mass. south to Fla. and west to Kan. and Minn. S.S. 9:452. L.B.C. 13:1248. G. F. 2:591. Gn. 55, p. 161 (habit). W. B. 63. H.T. 122, 123.—



A moisture-loving, graceful tree, with slender, very numerous branches, and remarkable for its torn and ragged bark.

CC. Under side of lvs. light green: lvs. rounded or truncate at the base, with 8-14 pairs of impressed veins.

D. Shape of lvs. ovate or oblong-ovate, rounded and often cordate at the base, broadest about the middle; veins distinctly impressed above: petioles less than  $\frac{3}{4}$  in. long. See page 3566.

E. Cones peduncled, cylindric.

3. *utilis*, Don (*B. Bhojpattrā*, Wall.) Tree, 40-60 ft.: trunk with reddish brown bark: branchlets pubescent while young, not glandular: lvs. ovate, rounded at the base, acuminate, densely irregularly serrate, pubescent on the veins beneath, 2-3 in. long, with 8-12 pairs of veins: cones peduncled, cylindrical, 1-2 in. long, with erect oblong lobes, the middle one much longer. Himalaya. Japan. S.I.F. 1:23.—Not quite hardy N.

EE. Cones sessile or nearly sessile, ovoid or ovoid-oblong.

4. *lenta*, Linn. (*B. carpinifolia*, Ehrh.). CHERRY, SWEET, or BLACK BIRCH. Tree, 60-70 ft.: trunk dark reddish brown, young bark aromatic, of agreeable flavor: lvs. oblong-ovate, usually cordate at the base, sharply and doubly serrate, hairy beneath when young, nearly glabrous at length, 2-5 in. long: cones ovoid-oblong, 1-1 $\frac{1}{2}$  in. long; scales about  $\frac{1}{2}$  in. long, lobed

only at the apex, the middle lobe slightly longer. From Maine to Ala., west to eastern Ohio. S.S. 9:448. H.T. 124, 125. Em. 232.—Very handsome tree, round-headed, and with pendulous branches when older; attractive in spring, with its long staminate catkins. Bark and lvs. largely used in domestic practice; branches and foliage yield an oil very similar to oil of wintergreen, and employed for all conditions in which the latter proves useful; bark as well as the oil much used for flavoring.



548. *Betula pendula*.

cent outside. From Newfoundland west to Minn., south along the Alleghanies to the high peaks of N. C. and Tenn. S.S. 9:449. Em. 235. H.T. 126, 127.—One of the most valuable forest trees in the northern states, much resembling the former in habit. Var. *persicifolia*, Dipp., has larger and longer lvs., often ovate-lanceolate.

DD. Shape of lvs. ovate, broadest near the base and usually truncate or sometimes cordate; veins not impressed above; petioles to 1 in. long.

6. *ulmifolia*, Sieb. & Zucc. (*B. costata*, Trautv.). Tree, 50 ft.: bark yellowish brown; branches not, or slightly glandular; lvs. ovate, rarely oblong-ovate, irregularly doubly serrate, with 9–14 pairs of veins, long-acuminate, 2–3½ in. long, hairy when unfolding, glabrous at maturity; cones elliptic; scales glabrous, with short, rhombic or obovate lateral lobes; wings about half as broad as nutlet. Japan. Manchuria. S.I.F. 1:22. W.B. 63.

7. *Ermánii*, Cham. Tree, 60 ft.: trunk white; branches yellowish white or orange-colored; branchlets usually glandular and pubescent when young; lvs. broadly triangular-ovate, acuminate, irregularly coarsely serrate, 2–4 in. long, hairy when unfolding, with 7–10 pairs of veins; cones oblong; scales pubescent, with linear-oblong lobes, middle one somewhat longer; wings about one-third as broad as nutlet. N. E. Asia, Japan. S.I.F. 1:22. W.B. 63.—Handsome round-headed tree, with slender branches. See page 3566.

AA. Veins of lvs. 7 or less pairs, not impressed.

B. Wings usually broader than the nut.

C. Bark white.

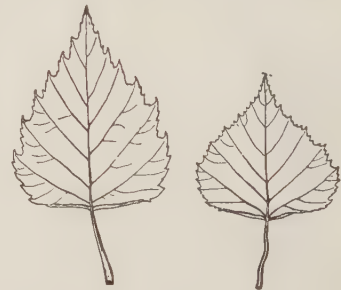
D. Branchlets glabrous and glandular; lvs. usually rhombic-ovate; scales of strobiles with divergent broad lobes larger than the middle lobe.

8. *populifolia*, Ait. (*B. alba* var. *populifolia*, Spach). WHITE BIRCH. Small tree, exceptionally 40 ft., with smooth white bark; branchlets with numerous resinous glands; lvs. slender, petioled, triangular or deltoid, long-acuminate, coarsely doubly serrate, glutinous when

young, glabrous at length and shining; cones slender stalked, cylindric, about 1 in. long; bracts pubescent the lateral lobes divergent, about as long as the middle one. From New Brunswick to Del., west to Ont. S.S. 9:450. H.T. 118, 119. Em. 1:242.—A small, graceful, but short-lived tree, yet thriving in dry and poor soil. Var. *laciniata*, Loud. Lvs. incised-laciniate. Var. *pendula*, Loud. Branches distinctly pendulous. Var. *purpurea*, Ellwanger & Barry. Lvs. purple when young, green at length. *B. populifolia* × *B. papyrifera* is shown in G.F. 8:356. It has been found wild in several localities, but is apparently not in cult.

9. *pendula*, Roth (*B. verrucosa*, Ehrh. *B. alba*, Linn., in part). Figs. 548, 549. Tree, to 60 ft., with slender, in older trees usually pendulous, branches: young branchlets usually glandular; lvs. rhombic-ovate, ¾–2½ in. long, glutinous when young, glabrous, usually cuneate, sometimes truncate at the base, acuminate, doubly serrate; petioles slender, about 1 in. long; strobiles cylindric, about 1 in. long, slender-peduncled, usually pendulous; wings of nutlet about one and a half to two and a half times as broad as its body. Eu. to Japan. H.W. 2:15, p. 20. W.B. 76. Var. *Taüschii*, Rehd. (*B. japonica*, Sieb. *B. alba* var. *Taüschii*, Shirai. *B. pendula* var. *japonica*, Rehd.). Lvs. broadly ovate, truncate or sometimes subcordate at the base, sometimes puberulous beneath and often with tufts of hairs in the axils. S.I.F. 1:21. Var. *dalecarlica*, Schneid. (*B. laciniata*, Wahl. *B. hybrida*, Blom). Lvs. more or less deeply lobed with irregularly serrate-acuminate lobes; branches on older trees pendulous.—A very graceful tree. Var. *fastigiata*, Koch (*B. alba fastigiata*, Carr. *B. pendula pyramidalis*, Dipp.). With straight upright branches, forming a narrow columnar pyramid. G.C. III. 41:151. M.D.G. 16:164. Var. *tristis*, Schneid. With very slender, strongly pendulous branches, forming a round regular head. Var. *Yöungii*, Schneid. (*B. alba pendula Yöungii*, Moore. *B. pendula elegans*, Dipp. *B. alba elegantissima pendula*, Hort.). Branches very slender, strongly pendulous; primary branches spreading or recurved, forming an irregular picturesque head; similar in habit to the weeping beech. F. 1873, p. 60. R.H. 1869, p. 136. Gn. 6, p. 528. Var. *gracilis*, Rehd. (*B. alba laciniata gracilis pendula*, Hort. *B. elegans laciniata*, Hort.). Habit like the preceding, with lacinate lvs. Much slenderer and of slower growth than var. *dalecarlica*.

Var. *purpurea*, Schneid. (*B. vulgaris purpurea*, André. *B. alba atropurpurea*, Lauche. *B. pubescens atropurpurea*, Zabel). Lvs. dark purple. R.B. 4:185.



549. Leaves of *Betula pendula*. (× ½)

DD. Branchlets pubescent and slightly glandular or glandless; lvs. generally ovate, rounded at the base; bracts with the lateral lobes upright or spreading, shorter than the middle lobe.

10. *pubescens*, Ehrh. (*B. odorata*, Bechst. *B. alba*, Linn., in part). Tree, to 60 ft.: branches upright or spreading, rarely pendulous in old trees; branchlets pubescent and glandless; lvs. ovate or rhombic-ovate, 1–2 in. long, rounded, truncate or cuneate at the base, acute, usually unequally and doubly serrate, pubescent beneath, at least while young; strobiles cylindric, about 1 in. long, upright or nodding; scales puberulous, lateral lobes upright or spreading, rarely recurved. N. and Cent. Eu. to E. Siberia. H.W. 2, pp. 24, 25. Var.



*urticifolia*, Spach (*B. urticifolia*, Regel. *B. alba asplenifolia*, Hort.). Lvs. small, deep green, irregularly incised. Var. *variegata*, Zabel (*B. alba foliis variegatis*, Hort.). An inconstant form with variegated lvs. There are also a number of geographical varieties as var. *carpatica*, Koch; var. *songarica*, Regel; var. *tortuosa*, Koehne; var. *Murithii*, Grenf., which are rarely met with in cult. and horticulturally are of no importance. —In the wild state this species is generally found in moist places, often in swamps, while the preceding species prefers drier situations.

11. *papyrifera*, Marsh. (*B. papyracea*, Ait. *B. grandis*, Schrad.). PAPER OR CANOE BIRCH. Figs. 550, 551. Tree, 60–80, exceptionally 120, ft.: branchlets slightly glandular, hairy when young: lvs. ovate, narrowed to cordate at the base, acuminate, coarsely and usually doubly serrate, pubescent on the veins beneath or nearly glabrous,  $1\frac{1}{2}$ – $4\frac{1}{2}$  in. long: strobiles peduncled, 1–2 in. long; scales with short and broad divergent lateral lobes. Northern states from the Atlantic to Pacific coast. S.S. 9:451. Em. 238. G.F. 8:223. H.T. 120, 121. I.T. 4:125.—Ornamental tree, with very white trunk and a loose, graceful head when older. Bark known for its use in making Indian canoes. Var. *cordifolia*, Regel (*B. pyrifolia* and *B. platyphylla*, Hort.). Lvs. broadly ovate, usually cordate. S.S. 14:724. Var. *minor*, Tuckerm. Low, bushy tree with smaller lvs. and frs. Mts. of New England and N. Y.

cc. Bark orange-brown: branchlets glandular and hairy when young: lateral lobes of scales upright, shorter than the middle lobe.

12. *occidentalis*, Hook. (*B. Lyalliana*, Koehne. *B. papyracea* var. *occidentalis*, Dipp.). Tree, to 100 ft.: branches in older trees often pendulous: lvs. ovate, 3–4 in. long, usually rounded at the base, acute, coarsely and mostly doubly serrate, resinous while young and villous on the veins, glabrous at maturity except on the puberulous veins: strobiles cylindric,  $1\frac{1}{4}$ – $1\frac{1}{2}$  in. long; scales ciliate, with rhombic-ovate upright lateral lobes, about half as long as the oblong middle lobe. B. C. to Wash. S.S. 14:725.

bb. Wings narrower than the nut: shrubs, 1–15 ft.: lvs. small, short-petioled: cones erect.

c. Branchlets glandular, not pubescent.

13. *glandulosa*, Michx. Only 1–4 ft.: lvs. short-petioled, rounded or cuneate at the base, orbicular or broadly ob-ovate, obtuse, dentate, glabrous,  $\frac{1}{4}$ – $1\frac{1}{2}$  in. long: strobiles peduncled,  $\frac{1}{2}$ – $\frac{3}{4}$  in. long; lobes of scales nearly equal, slightly spreading; wings of nut-

orbicular or oval, acute or obtuse, coarsely dentate, pale and glabrous or pubescent beneath,  $\frac{1}{2}$ –2 in. long: strobiles peduncled,  $\frac{1}{2}$ –1 in. long; lateral lobes of the pubescent scales spreading, shorter than the middle one; wings of nutlet half as broad as its body or narrower. Newfoundland to Minn., south to Ohio. B.B. 1:511. W.B. 71. Var. *fastigiata*, Rehd. (*B. humilis fastigiata*, Hort.). Shrub, with upright branches, forming a narrow pyramid: branchlets soft pubescent: lvs. broadly rhombic to suborbicular, 1– $1\frac{1}{2}$  in. long, broadly cuneate at base, pubescent beneath only on the veins, resin-dotted on both sides.

15. *nana*, Linn. Low, spreading, rarely 4 ft.: lvs. orbicular or cuneate-obovate, crenate, rounded at apex, glabrous,  $\frac{1}{4}$ – $\frac{3}{4}$  in. long: strobiles nearly sessile,  $\frac{1}{4}$ – $\frac{1}{2}$  in. long: the upper scales usually entire, the lower ones 3-lobed; wings of nutlets very narrow. Arctic N. E. Amer., N. Eu., Siberia. B.B. 1:511. W.B. 71.—A low, graceful shrub for rockeries and rocky slopes.

*B. acuminata*, Wall.=*B. alnoides*.—*B. al-skana*, Sarg. Allied to *B. occidentalis*. Tree, to 40, rarely 80 ft.: bark grayish white: branchlets densely glandular: lvs. rhombic-ovate,  $1\frac{1}{2}$ –3 in. long, truncate to broadly cuneate pubescent on the veins beneath or finally glabrous; petiole about 1 in. long: scales of strobiles ciliate. Alaska. S.S. 14:726.—*B. alleghaniensis* Brit. Intermediate between *B. lenta* and *B. lutea*. Bark either close and furrowed or peeling off in thin flakes: young branchlets pubescent: lvs. usually cordate at base and pubescent beneath: strobiles obovate-oblong, about 1 in. long; scales  $\frac{1}{4}$  in. long, 3-lobed about to the middle. Quebec and Mich. to Ga.—*B. alnoides*, Hamil. (*B. acuminata* Wall. *B. cylindrostachya*, Wall.). Allied to *B. Maximowiczii*. Tree, to 60 ft.: young branchlets pubescent; bark brown: lvs. ovate-oblong to ovate-lanceolate,  $2\frac{1}{2}$ –6 in. long, rounded at the base, doubly cuspidate-serrate, with 10–13 pairs of veins: strobiles in racemes. Himalayas, S.W. China. W.B. 90.—*B. alpestris*, Fries=*B. intermedia*.—*B. Borgrævei*, Zabel (*B. papyrifera* × *B. pumila*). Shrubby. Intermediate between the parents, but more similar to *B. pumila*. Raised at Hann. Muenden, Germany, from American seed.—*B. cærulea*, Blanch. Allied to *B. pendula*. Tree, to 60 ft.: young branchlets hairy: lvs. ovate, 2– $3\frac{1}{2}$  in. long, rounded or cuneate at base, acuminate, sharply serrate, dull bluish green above, slightly hairy along the veins beneath: scales of strobiles similar to those of *B. populifolia*. Vt., Me. S.M. 201.—*B. carpinifolia*, Sieb. & Zucc.=*B. grossa*.—*B. carpinifolia*, Ehrh.=*B. lenta*.—*B. corylifolia*, Regel. Allied to *B. nigra*. Lvs. broadly elliptic or obovate,  $1\frac{3}{4}$ – $2\frac{1}{2}$  in. long, coarsely dentate, silky on the veins beneath, with 10–14 impressed pairs of veins: strobiles cylindric. Japan. S.I.F. 2:14. W.B. 60.—The plant cult. under this name is usually *B. Ermanii*.—*B. cylindrostachya*, Wall.=*B. alnoides*.—*B. dahurica*, Pall. Allied to *B. pubescens*. Tree, to 60 ft.: bark brown: branchlets glandular, hairy when young: lvs. ovate, 1–2 in. long, pubescent on the veins beneath: strobiles oblong; wings of nutlet half as broad as body or less. Dahuria, Manchuria. Pallas, Fl. Ross. 39.—*B. excelsa*, Ait. (*B. alba* var. *excelsa*, Regel). Allied to *B. pubescens*. Large tree: bark yellowish brown: young branchlets densely pubescent: lvs. broadly ovate to obovate, 1– $2\frac{1}{2}$  in. long, rounded or subcordate at the base, acute, pubescent beneath: strobiles cylindric-oblong, upright or nodding; lateral lobes of scales slightly shorter than the middle one. Of unknown origin. W.D.B. 2:95. N.D. 3:52.—*B. fontinalis*, Sarg. (*B. occidentalis*, Nutt., not Hook. *B. rhombifolia*, Nutt., not Tausch). Allied to *B. occidentalis*. Small tree, to 40 ft. or shrubby: bark dark bronze color, lustrous: branchlets glandular: lvs. broadly ovate, 1–2 in. long, truncate to broadly cuneate, sharply, often doubly serrate: strobiles cylindric-oblong, 1– $1\frac{1}{2}$  in. long; scales glabrous or puberulous. B. C. to Calif., east to Dak. and Colo. S.S. 9:453 (as *B. occidentalis*).—*B. fruticosa*, Pall. (*B. Gmelinii*, Bunge). Allied to *B. glandulosa*. Shrub, to 15 ft.: branchlets glandular and pubescent: lvs. ovate-elliptic,  $\frac{1}{2}$ – $1\frac{1}{2}$  in. long, glabrous at length and usually glandular beneath: strobiles oblong-cylindric,  $\frac{3}{4}$ –1 in. long, wings about as broad as nutlet. Siberia, Manchuria. Pallas, Fl. Ross. 40.—*B. globosipica*, Shirai. Allied to *B. ulmifolia*. Tree, to 60 ft.: bark grayish brown: lvs. broadly rhombic-ovate,  $1\frac{1}{2}$ – $2\frac{1}{2}$  in. long, short-acuminate, unequally serrate, with about 10 pairs of veins, pubescent on the veins beneath: strobiles subglobose or ovoid, about  $1\frac{1}{2}$  in. long; scales deeply 3-lobed with spatulate lobes. Japan. S.I.F. 1:21. W.B. 68.—*B. Gmelinii*, Bunge=*B. fruticosa*.—*B. grossa*, Sieb. & Zucc. (*B. carpinifolia*, Sieb. & Zucc.). Tree: branchlets glabrous: lvs. ovate, 2–4 in. long, unequally serrate, with 10–15 pairs of veins, pubescent on the veins beneath and glandular-punctate: strobiles nearly sessile, elliptic-ovoid; middle lobe of the scale slightly longer than the lateral ones. Japan. S.I.F. 1:22.—*B. humilis*, Schrank. Allied to *B. glandulosa*. Shrub, 2–6 ft.: branchlets glandular and slightly pubescent at first: lvs. ovate or suborbicular,  $\frac{1}{2}$ – $1\frac{1}{4}$  in. long, crenately serrate, glabrous: strobiles ovoid, about  $\frac{1}{2}$  in. long. N. and W. Eu., N. Asia. G.W.H. 2:149. H.W. 2:



551. Catkin of *Betula papyrifera*. (×  $\frac{1}{2}$ )



550. Staminate catkin (natural size) and flowers (enlarged) of *Betula papyrifera*.

let sometimes as broad as its body. Newfoundland to Alaska, south to Mich., and in the Rocky Mts. to Colo. B.B. 1:510.

cc. Branchlets pubescent or nearly glabrous, not glandular.

11. *pumila*, Linn. Usually 2–8, rarely 15, ft.: branchlets tomentose or pubescent, at least when young: lvs.

p. 26. R.F.G. 12:1279.—*B. intermedia*, Thomas (*B. alpestris*, Fries. *B. pubescens* × *B. nana*). Shrub: lvs. orbicular or ovate,  $\frac{1}{2}$ –1 in. long, crenate-serrate, usually pubescent while young, and often glutinous, finely glabrous: strobiles oblong; lateral lobes of scale upright and usually shorter than the middle one. N. Eu.—Natural hybrid; very variable.—*B. Jäckii*, Schneid. (*B. lenta* × *pumila*). Shrub: bark of the odor of *B. lenta*: lvs. usually obovate, 1–2 in. long, usually with about 7 pairs of veins: strobiles oblong,  $\frac{1}{2}$ – $\frac{3}{4}$  in. long; lateral lobes of scales spreading, somewhat shorter than the middle one. Originated at the Arnold Arboretum. G.F. 8:245.—*B. kerdica*, Evans. Allied to *B. occidentalis*. Tree, to 40 ft.: bark grayish white or light reddish brown: branchlets glabrous, not or slightly glandular: lvs. ovate,  $1\frac{1}{2}$ –2 in. long, cuneate or rounded at the base, irregularly, often doubly serrate, glabrous: strobiles cylindrical-oblong, about 1 in. long, glabrous. Alaska. S.S. 14:723.—*B. Kähnei*, Schneid. (*B. papyrifera* × *peadula*). Intermediate between the parents. Tree: branchlets sparingly pubescent: lvs. ovate, 2– $3\frac{1}{2}$  in. long, usually truncate at base, acuminate; rather finely and doubly serrate: scales of strobiles similar to those of *B. papyrifera*. Origin unknown.—*B. luminifera*, Winkl. Allied to *B. alnoides*. Lvs. ovate, subcordate at the base, serrate with acuminate teeth, 3–5 in. long: strobiles solitary, 2–3 in. long. Cent. China. W. 92.—*B. Medwedewii*, Regel. Allied to *B. utilis*. Tree: young branchlets hairy: lvs. broadly ovate to obovate, 2–3 in. long, rounded or sometimes subcordate at the base, short-acuminate, glabrous or pubescent on the veins beneath: strobiles cylindrical-oblong, 1– $1\frac{1}{4}$  in. long; wings of nutlets: often 4 times narrower than its body. Caucasus. Gt. 36, p. 384.—*B. occidentalis*, Nutt., not Hook.—*B. fontinalis*, —*B. Purpusii*, Schneid. (*B. lutea* × *pumila*). Shrubby or small tree: lvs. oblong-ovate, 1–2 in. long, with 7–9 pairs of veins, soft-pubescent beneath. Intro. to Eu. from Mich.—*B. Raddeana*, Trautv. Tree: lvs. ovate-pubescent on the veins beneath, with 6–7 pairs of veins, 1–2 in. long: strobiles oblong, upright,  $\frac{3}{4}$  in. long; wings as broad as nutlet. Caucasus. Gt. 36, p. 384.—*B. rhombifolia*, Nutt.—*B. fontinalis*.

ALFRED REHDER.

**BIARUM** (old and obscure name). Incl. *Ischarum*. *Araceæ*. Dwarf, tuberous perennials of the same tribe with our native jack-in-the-pulpit. They are hardy in England, but probably are suitable only for pot-culture in the Northern United States.

Biarums have a spathe which is tubular at the base, mostly with a long limb, and usually a long tail-like spadix; otherwise much as in *Arum*. They grow a few inches high. Odd. Little known in Amer. A few species in Eu. and Asia Minor.

**tenuifolium**, Schott (*Arum tenuifolium*, Linn.). Lvs. linear-lanceolate or spatulate, appearing after the fls. decay: spathe long-acuminate, at length recurved and twisted spirally, about 10 in. long, outside green, streaked purple; inside dull purple, spotted; margins wavy; spadix 15 in. long. Spain. B.M. 2282.

**Pyrámii**, Engler (*Ischarum Pyramii*, Schott). Lvs. oblong above the middle, narrowing abruptly to a very long petiole, resembling *Calla palustris*: spathe green outside, shining, velvety purple within, shorter and broader than in *B. tubiflorum*, at length revolute; tube swelling, connate only at the very base; spadix thicker and shorter. Syria. B.M. 5324.

**Bövei**, Blume. Lvs. similar to *B. Pyramii*; spathe-tube connate a fourth of its length; blade of spathe longer and more narrowly lanceolate, green outside, dark purple within. Syria, Asia Minor. L. H. B.

**BIDENS** (Latin, *two-teeth*, in reference to the awns). *Compositæ*. BUR-MARIGOLD. STICK-TIGHTS. TICK-SEED. Annual, or rarely perennial, herbs, mostly American, related to *Coreopsis*, *Dahlia*, and *Cosmos*.

Leaves opposite, serrate or incised, often pinnately or ternately divided: heads radiate or discoid; rays yellow or white; disk yellow; involucre double, the outer set of bracts green and more or less foliaceous, the inner of quite different texture and shape, more appressed, thinner, more scarious and striate: achenes flat or angled; pappus of 2–4 stiff bristles or awns, usually retrosely barbed.—Plants grown as garden annuals. *B. frondosa*, a common weed, is the well-known boot-jack bur, or stick-tight.

A. Achenes obovate or cuneate-oblong, more or less flattened or triangular, the faces uni-costate: texture of lf. medium.

B. Size of achenes small (1–2 lines long) with firm glabrous margins: inner involucre dark dotted.

**coronata**, Fisch. (*Coreopsis aurea*, Ait.). St. 1–4 ft. high, branched above, glabrous or nearly so: lvs. ter-

nately or pinnately divided: outer involucre about equaling the dark-dotted inner: achenes dark, very small, 1–2 lines long, narrowly cuneate, 3-angled, margin firm and glabrous; pappus of 2–4 minute awns and some chaff. S. E. U. S.—Very variable.

BB. Size of achenes larger (2–4 lines long) with hispid margins: involucre not dotted.

**trichosperma**, Brit. (*Coreopsis trichosperma*, Michx.). St. tall, 2–5 ft. high, glabrous, branched above: lvs. pinnatifid: outer involucre about equaling the undotted inner: achenes dark, larger,  $2\frac{1}{2}$ –4 lines long, cuneate, moderately flat, margin firm, usually pubescent; pappus of 2 upwardly hispid broad-based awns about  $\frac{1}{2}$  line long. E. U. S. Var. **tenuifolia**, Brit. Lf.-segms. narrowly linear: achenes 2–3 lines long.

**aristosa**, Brit. (*Coreopsis aristosa*, Michx.). St. 1–4 ft. high, branched above, nearly or quite glabrous: lvs. pinnatifid, often pubescent beneath: outer involucre about equaling the undotted inner: achenes olive or brownish, large, 2–4 lines long, broad and very flat 1– $2\frac{1}{2}$  lines broad, abruptly contracted at summit, margin thin and hispid, often crenulate; pappus awns 2, each 1–2 lines long, divergent, stramineous, upwardly or downwardly barbed, or sometimes entirely wanting. Cent. U. S. B.M. 6462. R.H. 1869:72.

AA. Achenes linear-spindle-shaped, tapering gradually above, angled or costate: texture of lf. usually firmer.

B. Lvs., in part, finely dissected: rays large, golden yellow.

**grandiflora**, Balb. St. 1–4 ft. high, branched, glabrous and somewhat glaucous: lvs. pinnatifid, the divisions either lanceolate and serrate or dissected into narrowly linear divisions: outer involucre about equaling the more or less hirsute inner; rays large, golden yellow: achenes 3–6 lines long; awns 2, downwardly barbed, about 1 line long. Mex.—A showy plant sometimes cult. in Amer.

BB. Lvs. or their divisions lanceolate to ovate: rays pale yellow or whitish.

**Warszewicziana**, Regel. Erect, glabrous perennial: lvs. simple, or pinnate or rarely bipinnate, the lobes lanceolate or ovate-lanceolate: heads corymbose, the involucral bracts ciliate; petals whitish or yellowish, of medium size: achenes compressed, angular, the angles ciliate. Guatemala.—Hardy N. only with protection.

**pilosa**, Linn. St. 2–5 ft. high, much branched, nearly glabrous: lvs. ternate or pinnate, divisions lanceolate, incised-serrate with somewhat rounded teeth: outer involucre about equaling the glabrous or minutely puberulent inner: rays short, 1–3 times as long as the involucre, creamy-white: achenes 4–7 lines long; awns 2–4, downwardly barbed,  $1\frac{1}{2}$  lines long. Tropics.—Sometimes grown in botanic gardens.

*B. dahlioides*, Wats. A perennial with dahlia-like tubers. Mex. G.C. III. 48:226. R.H. 1910, p. 475.

K. M. WIEGAND and N. TAYLOR.

**BIENNIALS**. Plants that bloom a year after the seeds are sown, then make seeds and die. Familiar examples among vegetables are cabbage, turnips, celery and onions, but in warm or long-season climates they become annuals. Even in northern gardens, celery, carrots and beets, if permitted to crowd, will often run to seed the first year. On the other hand, many biennials, such as hollyhocks and others, are practically perennial because they self-sow, or multiply by offshoots, so that there is little danger of losing them. Such cases give rise to discussion as to whether a plant is an annual, biennial, or perennial, but the practical problems are few and simple, and are commonly connected with the following favorite flowers:

Hollyhock (*Althæa rosea*), snapdragon (*Antirrhinum majus*), English daisy (*Bellis perennis*), Canterbury



bells (*Campanula Medium*), steeple bellflower (*Campanula pyramidalis*), sweet william (*Dianthus barbatus*), foxglove (*Digitalis purpurea*), horned poppy (*Glaucium luteum*), French honeysuckle (*Hedysarum coronarium*), morning campion (*Lychnis dioica*), evening campion (*Lychnis alba*), rose campion (*Lychnis Coronaria*), honesty (*Lunaria annua*; *L. biennis*), pansy (*Viola tricolor* ×) tufted pansies (*Viola cornuta* ×).

Every beginner desires to know what to do with the seedlings that spring up in every border by the dozen or hundred around sweet williams, foxgloves, larkspurs, hollyhocks, and the like. All that is necessary is to thin the seedlings and transplant some at any convenient time before autumn to the positions in which they are to bloom next year. This practice, however, does not suit those who want only the finest varieties, for these do not come true from seed. Therefore, they must buy seeds every year of the best varieties of highly-bred groups, such as sweet william, foxglove, English daisy, Canterbury bells, and hollyhocks, or else buy plants. If a very fine variety appears, it is desirable to multiply it by methods other than seed-sowing if possible, e.g., by offsets, cuttings or division. Named larkspurs cannot be kept a long time, owing to disease, unless propagated by cuttings every year. Double hollyhocks can be maintained by division and by keeping the leaves coated constantly with ammoniacal copper carbonate, which is less unsightly than bordeaux. A German cultivator avers that one should save seeds from diseased hollyhock plants instead of healthy ones, and declares that he has raised 1,500 such seedlings that proved immune. So far as known, this has not been thoroughly tested in America.

Those who do not want such expense and care, and prefer lusty, many-flowered plants of ordinary varieties to sickly specimens of high-bred types, will find it cheaper and easier to collect seeds as they ripen and sow them immediately. Color discords can be mitigated by thinning out or transplanting offenders. This is the way to secure gorgeous masses of blue delphiniums, if one cares more for color than size and form.

What to do with famous English spring flowers that dislike our hot summers is another common problem. The beginner finds that violets, pansies, daisies, primroses, polyanthus, and auriculas, will not bloom all summer, as they do in the cool, moist climate of England, unless in similar climates (e.g., at the seashore or in the northern tier of states), and then only with special care in seed-picking, cutting-back, fertilizing, watering. At best the summer bloom is only intermittent, rarely massive, and the common practice is to treat these species frankly as spring bedding plants (April 15 to May 15 near New York), and when their glory is past discard them or move them to some moist, shady spot in which there is a better chance for casual summer bloom and a tolerable autumn show than in the hot sunny border.

Those who cannot afford greenhouses may easily have larger and better flowers of the species just named by the use of coldframes. They are particularly enjoyable while the snows of March are on the ground.

In these days of cheap greenhouses, everyone wants cut-flowers the year round, especially long-stemmed, long-lasting kinds in many colors. Consequently snapdragons and ten-weeks stocks have become popular.

The commonest way of raising biennials is to sow the seeds in an outdoor seed-bed in summer, and in autumn transplant the seedlings to their permanent quarters. English books have always disappointed Americans by advising that this be done in June. But in America the best time is early August. Not only does one save two months' care, but June-sown biennials and perennials in our climate make plants that are too large to winter easily in coldframes, and they often try to bloom just when the killing frost of autumn comes.

A much better way is to sow the seeds in flats in coldframes (for protection against summer showers) and to winter the young plants in frames. This is the way to secure the finest white foxgloves, Canterbury bells, larkspurs, and steeple bellflowers.

Professional gardeners often prefer to treat biennials as half-hardy annuals, i.e., they sow the seeds in greenhouses in March and set the young plants outdoors in May. On new places this saves a year; it is especially worth doing with snapdragons and intermediate stocks.

Many of the flowers named above are technically perennial, but in practice they are so short-lived that it usually pays to raise a fresh batch from seed every year.

WILHELM MILLER.

**BIFRENARIA** (Latin for *twice* and *strap*, referring to the two stalks of the pollinia). *Orchidaceæ*. Epiphytic plants, with pseudobulbs, plicate-veined lvs., and lateral infl.: fls. sometimes single and large, or more frequently smaller and several to many in a raceme; sepals about equal, spreading, the lateral adnate to the foot of the column; petals similar to the dorsal sepal; lip articulated to the apex of the column-foot, 3-lobed; pollinia 4, on 2 stalks.—About 25 species in Trop. Amer.



552. *Bifrenaria Harrisonia*. (× ¼)

A. Foot of column or mentum short and broad: fls. deep yellow with golden purple spots.

**aurantiaca**, Lindl. Pseudobulbs ovoid, up to 1½ in. long: lvs. up to 8 in. long and 2 in. broad: raceme few- to several-flid.; fls. about 1 in. across, deep yellow and spotted with golden purple. Guiana and Trinidad. B.M. 3597. B.R. 1875.

AA. Foot long, acute: fls. not colored as above.

B. Fls. large, 1-3.

C. Lip purple, darker-veined: fls. ivory-white.

**Harrisonia**, Reichb. f. Fig. 552. Pseudobulbs broadly ovoid, up to 2½ in. long, 1-ld.: lvs. up to 1 ft. long and 4 in. broad: peduncle with 1 or 2 ivory-white large fls. about 3 in. across, the lip purple with darker veins. Brazil. Lind. 5:239. B.R. 897. B.M. 2927 (as *Maxillaria*).

CC. Lip white, yellow or rose: fls. apple-green.

**inodora**, Lindl. Resembles *B. Harrisonia* in pseudobulbs, lvs., infl. and size of fls.: sepals apple-green; petals of the same color but brighter, smaller; lip white, yellow or rose; spur half as long as ovary. Brazil.

BB. Fls. small, several.

**vitellina**, Lindl. Pseudobulbs ovoid, up to 1½ in. long, 1-ld.: lvs. up to 1 ft. long and 1½ in. broad: fls. about 1 in. across, orange-yellow, with a purple spot on the lip; lip cordate. Brazil. B.R. 25:12. (As *Maxillaria*.)

*B. bicornaria*, Reichb. Allied to *B. aurantiaca*. Fls. orange-colored. Brazil.—*B. Fuerstenbergiana*, Schlecht. Fls. yellow Brazil.—*B. melanopoda*, Klotzsch. Sepals and petals light green, lip fringed, white. Brazil.—*B. tetragona*, Hort. Fls. wax-like with greenish sepals and petals. Brazil.—*B. tyrianthina* var. *Goodsonae*, Reichb. Fls. light purple.

GEORGE V. NASH.

**BIGELÔVIA** (after Dr. Jacob Bigelow, author of *Flora Bostoniensis*, Medical Botany of United States, etc.). Frequently written *Bigelowia*. *Compósitæ*. More than thirty species of western American herbs or low shrubs, one or two of which are sometimes offered by dealers in native plants.

Heads 3-30-fld., without ray fls., small; involucre narrow, its bracts mostly lacking herbaceous tips. The only species in cult. is the one originally described, which resembles a goldenrod, to which *Bigelovia* is very closely related. It differs in not having the racemiform infl. of goldenrods. Prop. by cuttings and by seed.

**gravêolens**, Gray (*Bigelôwia dracunculoides*, DC.). Low shrub, 1-3 ft. high, densely white-tomentose when young, smoother in age, much branched, very leafy, malodorous only in drying; lvs. linear, 1-2 in. long; fl.-heads yellow, 5-8 lines high, very numerous, crowded, in terminal corymbose cymes, rayless. Alkaline soils Dak. to B. C. and south to S. Calif. and Ariz.—An extremely variable species. **Var. albicaulis** is more permanently and densely woolly, dwarfier, and has been recommended in the West for low hedges and edgings.

N. TAYLOR.†

**BIGNAY:** *Antidesma*.

**BIGNÔNIA** (The Abbé Jean Paul Bignon, 1662-1743, Court librarian to Louis XIV). *Bignoniaceæ*. Woody tendril-climbers, grown in the open in the warmer parts and also under glass.

Leaves opposite, compound (in proper representatives of the genus), the terminal lft. often represented by a tendril: fls. large, tubular or bell-shaped, enlarged above the calyx, obtusely 5-lobed, and more or less 2-lipped, the calyx slightly or not at all toothed; stamens 4, paired, and sometimes a sterile rudiment: fr. a 2-celled septifragal caps. flattened parallel with the partition; valves thickened; seeds winged.—The genus *Bignonia* is variously understood. By Bentham & Hooker it is regarded as a polymorphous group of 150 or more species; by Schumann (in Engler & Prantl) it is reduced to 2 species with claw-like (not disk-bearing) tendrils, *B. exoleta*, Vell., and *B. Unguis-cati*, Linn. By the former authors *Bignoniaceæ* is held to contain about 50 genera, and by the latter about 100. Schumann distributes the bignonias of Bentham & Hooker into several genera: the common East American *B. capreolata* goes to *Doxantha*, a disposition that has not

been accepted by American botanists. As here employed, *Bignonia* is deprived of many of the tropical species that have been placed in it in horticultural literature, and the student is referred to *Clytostoma*, *Cydistia*, *Phædranthus*, *Pithecoctenium*, *Pyrrostegia*, *Tabebuia* and others. Very recently the name *Bignonia* has been used for the species described in this work under *Campsis*, because *Bignonia* originally was based mainly on *B.*



553. Cross-section of stem of a tropical climber of the bignonia family.

*radicans* = *Campsis radicans*. In this case, the generic name for *B. exoleta* and *B. Unguis-cati* above becomes *Doxantha*; otherwise, this latter name remains a synonym of *Bignonia*, although, as stated above, Schumann has used it as the generic name of *B. capreolata*; but the correct name for this plant appears to be *Anisostichus capreolata*, of Bureau. The other species described here under *Bignonia* probably belong to different genera, but their correct botanical affinity has not yet been ascertained.

The bignonias are American climbers, mostly tropical, some of them and their allies constituting lianas of great length; and the profusion and beauty of

their flowers makes them conspicuous and interesting. The stem of some species shows a 4-parted or cross-like arrangement in cross-section, whence the name "cross-vine;" and on this account, some of the natives of Spanish America attribute sacred virtues or attributes to the plants, calling them "bejucos de la cruz." Fig. 553.

The bignonias (using the term in the horticultural sense) are strong and rapid-growing evergreen greenhouse climbers, requiring considerable space for their best development, such as the roof of a large conservatory, or the back wall of a lean-to greenhouse. If convenient, they should be planted out under the plant stage of the greenhouse, or otherwise in boxes placed on the stage. A box 5 feet by 1½ feet and 1 foot deep will be found a convenient size for them. As with most greenhouse climbing plants, the roots like considerable freedom; but with bignonias the roots must be somewhat restricted (though not to the limitations of a flower-pot), otherwise an immense growth and few flowers will be the result. They are not very fastidious as to soil. A good, fibrous loam, to which one-third well-decomposed cow or sheep manure has been added, suits them admirably. A winter temperature of 45° to 50°, with a gradual rise as the days lengthen, should be given them, admitting air freely whenever the weather is favorable. They like plenty of moisture at the roots—especially during the spring and summer (the growing season)—but perfect drainage should be insured, as the soil at no time must become saturated or sour. Except when in flower, a good syringing on all fine days will be very beneficial. They should also be sprayed once or twice a week with a moderately strong solution of kerosene emulsion, or kerosene and water, to keep them free from mealy-bug, as they are very subject to this pest. The vines should be trained so as to allow a free circulation of air among the branches for the purpose of ripening the wood, as upon this depends the assurance of flowers. All superfluous branches and weak shoots should be removed, and before the growing season begins all the branches should be shortened from 1 to 3 feet, according to their strength; this will throw the energy of the plant into the lateral buds, which will produce the flowering branches, providing the wood has been properly ripened the previous season.—Propagation is effected by cuttings taken in late spring and inserted in sand under a bell-glass, or in a propagating-box, in a warm temperature. Choose, if possible, stout, short-jointed lateral growths for the purpose. They must be carefully watered until rooted, which usually takes from six to ten weeks. (E. J. Canning.)

A. Lvs. compound: fls. yellow or yellow-red.

**Chàmberlaynii**, Sims (*Anemopægma racemodsum*, Mart.). Glabrous: lfts. ovate-acuminate, glabrous, shining above, paler beneath, more or less tapering at base: fls. tubular, contracted below, 3-4 in. long, the limb comparatively short and spreading, bright yellow; cluster many-fld. Brazil. B.M. 2148. F.S. 3:235. P.M. 14:3-4.—One of the freest and most beautiful tropical climbers, flowering well in a small house. Should be in all collections of tropical plants. This plant bears the name of Consul-General Chamberlayne, stationed about 100 years ago in Brazil. The genus *Anemopægma* is kept distinct by many.

**Ūnguis-cāti**, Linn. (*B. Tweediana*, Lindl., not Griseb.). Lvs. evergreen; lfts. 1 pair, lanceolate and pointed, cordate, 3 in. or less long, with 3-parted claw-like tendrils: fls. trumpet-shaped, 2 in. long, allamanda-like, tube clear bright yellow, upper surface of limb orange-yellow, and throat with orange lines, the limb of rounded, spreading lobes and from 2-4 in. across. Argentina. B.R. 26:45. Gn. 40:10.—Will stand a little frost if grown in the open in the S. *B. Tweediana*, Griseb., is a *Macfadyena*.



**capreolata**, Linn. (*B. crucigera*, Linn., in part. *Anisostichus capreolata*, Bur. *Doxantha capreolata*, Miers). TRUMPET-FLOWER. CROSS-VINE. QUARTER-VINE. Climbing to great heights (often 50 ft. or more), glabrous, evergreen: lvs. stiffish, ending in a branched tendril that cordate by small disks; lfts. stalked, oblong-acuminate, cordate, entire: fls. in many 2-5-fl. short-peduncled cymes, yellow-red and lighter within, tubular (2 in. long), with a stout limb. Native from Md. south and west, and often a pest in orchards, climbing on the trees. B.M. 864. Gng. 1:370-1.—Handsome vine for outdoor use. Good for covering walls. Sometimes grown in conservatories. Not hardy N., but will survive in Mass. as a creeping plant.

Var. **atrosanguinea**, Hook. f. (*B. atrosanguinea*, Hort.). Lvs. longer and narrower: fls. dark purple, the lobes short and triangular-ovate. B.M. 6501. F.R. 2:27.—Handsome.

AA. Lvs. simple, opposite (horticultural names, plants evidently not of this genus: perhaps *Tabebuia*).

**magnifica**, Bull. Free-growing and floriferous, needing warm treatment: lvs. ovate-elliptic, stalked, entire: fls. paniced, large ( $3\frac{1}{2}$  in. across), ranging from mauve to purple-red, the throat primrose. limb wide-spreading. Colombia. G.C. II. 12:73.—Requires hot sunny position under tropical conditions.

**regalis**, Hort. Lvs. elliptic-lanceolate; fls. large, yellow and red. Guiana.—Requires warm treatment.

**argyreο-violascens**, Hort. Lvs. ovate, cordate at base, short-stalked, purple when young, but becoming beautifully veined and blotched with white: fls. purple. S. Amer. (?). I.H. 13:469.

*B. adenophylla*, Wall.=*Heterophragma*.—*B. æquinoctialis*, Linn.=*Cydista*.—*B. alba*, Hort.=*Pithecoctenium*.—*B. buccinataria*, Mair.=*Phædranthus*.—*B. Cherère*, Lindl.=*Phædranthus*.—*B. ekrysantha*, Hort.=*Tabebuia*.—*B. grandiflora*, Thunb.=*Campsis*.—*B. jasminoides*, A. Cunn.=*Pandorea*.—*B. Lindleyi*, DC.=*Clytostoma*.—*B. littordis*, HBK. Hairy on branchlets: lfts. roundish-ovate, acuminate, hairy: fls. red, pubescent, funnel-shaped, in axillary panicles. Mex.—*B. pallida*, Lindl.=*Tabebuia*.—*B. picta*, Lindl.=*Clytostoma*.—*B. purpurea*, Hook.=*Clytostoma*.—*B. radicans*, Linn.=*Campsis*.—*B. rugosa*, Hook. Hairy: lfts. 2, oblong-acuminate: fls. axillary, 2-2½ in. long, primrose-color, limb short. Venezuela. Probably a *Macrodiscus*. B.M. 7124.—*B. speciosa*, Grah.=*Clytostoma*.—*B. suaveolens*, Thunb.=*Stereospermum*.—*B. Thunbergii*, Hort.=*Campsis*.—*B. venusta*, Ker.=*Pyrostegia*. L. H. B.

BILIMBI: *Averrhoa*.

**BILLARDIÈRE** (after J. J. Labillardière, French botanist and traveler). *Pittosporaceæ*. Six or eight species of tender Australian undershrubs, with twining branches, and terminal flowers suitable for outdoor planting South and for growing under glass.

Leaves entire or sinuate, alternate: fls. solitary or 2-3 together, sometimes as many as 15, yellow, purple or rarely blue, showy in *B. longiflora*: fr. succulent or fleshy, edible in some species. Prop. by cuttings under a bell-jar or by seeds, which, at least in England, are produced freely in some of the species. *B. longiflora* and *B. scandens* are cult. abroad as greenhouse climbers. *B. cymosa* is cult. outdoors at Santa Barbara, Calif.

**scandens**, Smith. Fig. 554. Sts. twining, often extensively so: lvs. variable, ovate-lanceolate to linear, obtuse or with a recurved point, 1-2 in. long, entire or undulate: fls. solitary, rarely 2 together, greenish yellow, violet or purple. Sweet. Fl. Aust., pl. 54. B.M. 801.—Offered by Montariso Nurseries, Santa Barbara, Calif.

**cymosa**, F. Muell. Shrubby with the branches more or less twining: lvs. oblong or lanceolate, sessile or nearly so, 1-2 in. long, obtuse or acute: corymbs several-fl.; sepals usually lanceolate-subulate; petals 7-8 lines long, bluish or violet-purple.

**longiflora**, Labill. Lvs. lanceolate, entire: fls. greenish yellow, often changing to purple, solitary; pedicels glabrous: berries blue. N. TAYLOR.

**BILLBERGIA** (for the Swedish botanist, J. G. Billberg). *Bromeliaceæ*. About forty tropical American evergreen epiphytal herbs, now much cultivated by amateurs and in fancy collections. A few kinds are well known to florists. A closely allied genus is *Æchmea*, which see for botanical differences.

The fls. are in a spike or spicate panicle, which rises from the center of the rosette of long, spiny-edged, and usually stiff, pineapple-like lvs., showy, with 3-parted calyx and 3 long petals, 6 exserted stamens, thread-like style, and berry-like fr. The colored bracts of the fl.-clusters are usually very showy. Cf. Charles Mez, the latest monographer, in DC. Phaner. Monogr. 9. Species confused: but the artificial arrangement given below may aid the gardener.



554. *Billbergia scandens*. ( $\times \frac{1}{4}$ )

Billbergias can be cultivated best in greenhouses, planted in pans, pots, wooden cribs, or wire baskets, with loose, light material about their roots, such as pieces of charcoal, roots of very fibrous plants, or fern roots and sphagnum moss, and such material. They demand little water at the roots in winter, and nothing but light sprinkling over the foliage is required to keep them alive during that time. But in summer, when the heat is great and they are making their growth, they can withstand an abundance of moisture at the roots as well as at the top, most of the time holding water in the funnel-like center or body of the plant. They usually produce their conspicuous showy bloom in the spring, when moisture overhead or sprinkling should be withheld in order to prolong the beauty of the flowers. They require at night a temperature of 50° to 75°, but, of course, can stand any amount of heat in summer. Billbergias, like all other bromeliads, make very good house plants, and they will thrive exceedingly well in a living-room temperature. They love plenty of light and sun. All first-class private garden establishments should have at least a few of this class of plants.—They are propagated best from suckers or sprouts, which arise from the base of the old plant, usually after it has bloomed and performed its functions. The old plant then gradually deteriorates, sending out two to five young plants from its base. These can be taken off as soon as they are hardy and substantial enough, and can be mounted or potted into the same kind of material. Then, suspended in the greenhouse, conservatory, or window for an exhibition, they thrive best.—Besides their beautiful and attractive flowers, billbergias have very handsome foliage, which is of a tough and leathery texture. Billbergias, æchmeas, and the like, are natives of the tropics, and, therefore, require a warm temperature. Æchmeas are usually larger than billbergias and tillandsias. (H. A. Siebrecht.)

A. *Peals curling spirally after fl. expands.* (*Helicòdea*.)

**zebrina**, Lindl. (*Bromelia zebrina*, Herb. *Æchmèa zebrina*, Hort.). St. very short, or none: lvs. sheathing, deep green, with blotches and zones of gray-white, strongly spine-margined: fl.-cluster loose, long and drooping; fls. green or yellow-green, the stamens becoming long-exserted; bracts salmon or rose, long-lanceolate. S. Amer. L.B.C. 20:1912. B.M. 2686.

**decòra**, Poepp. & Endl. (*Helicòdea Baraquiniana*, Lem.). Differs from the last in having longer petals,

denser spikes and longer bracts: lvs. 8-10, from 1-2 ft. long, mealy, white-blotched and banded. Brazil. I.H. 11:421. B.M. 6937.

AA. *Petals not spirally twisting.*

B. *Infl. nodding.*

c. *Fls. in panicles.*

**speciosa**, Thunb. (*B. amana*, Lindl. *B. pallida*, Ker). Lvs. strap-shaped, connivent, and forming a tube at the base, 1-2 ft. long, somewhat spine-margined, green above and lepidote and somewhat striped on the back: fl.-cluster large and loose, drooping; bracts rose; fls. pale green or whitish, tipped with blue. Brazil. —An old and well-known species.

cc. *Fls. in racemes.*

**nütans**, Wendl. Stemless, stoloniferous: lvs. linear and long-pointed, 1-2 ft., distantly small-toothed, finely striate on the back: fls. 4-8, in a loose, drooping raceme; petals green, blue-edged; bracts lanceolate, red. Brazil. B.M. 6423. Gn. 32, p. 107.

**Morélii**, Brongn. (*B. Moreliana*, Hort. *B. Wetherellii*, Hook.). Lvs. short, 1-1½ ft., with few weak spines, wide, glabrous and green: fl.-cluster exserted and drooping, with showy, pointed red bracts, the rachis woolly; fls. with red sepals and purple-limbed petals. Brazil. B.M. 4835. J.F. 2, pl. 138. —Very showy.

BB. *Infl. erect.*

c. *Fls. red.*

**thyrsoides**, Mart. Lvs. 1-2 ft., broad-ligulate, spine-margined, concave on upper surface, green above and paler beneath, abruptly acuminate: fl.-cluster shorter than lvs., farinaceous, densely red-bracted; fls. numerous, bright red, petals reflexing. Brazil. B.M. 4756. J.F. 3, pl. 267. —Showy. Runs into several varieties, some of them with purple-tipped fls. (as vars. **splendida** and **fastuosa**, André, R.H. 1883:300). *B. splendens*, Hort., is evidently one of the forms. Species too near the next.

**pyramidalis**, Lindl. (*Bromelia pyramidalis*, Sims. *B. Croyiana*, De Jonghe). A foot high: differs from the last in having more gradually acuminate lvs., which are more strongly and distantly toothed and whitish, or even banded on the back: fl.-cluster less farinaceous, broader and looser, the fls. less numerous. Peru. B.M. 1732.

cc. *Fls. purple.*

**vexillaria**, André. Fig. 555. Hybrid of *B. thyrsoides* and *B. Morelii*. Fls. purple; lower bracts long-pointed and red; spike erect, exceeding the lvs. R.H. 1889:468.

**vittata**, Brongn. (*B. Leopoldii*, Hort., not Morr.). Vigorous, 2-3 ft.: lvs. long and large, concave above, recurved at the summit obtuse, or abruptly pointed, red-spined, cross-banded on the back: fl.-cluster loose and nodding, shorter than the lvs., red-bracted; fls. deep blue, with recurving limbs. Brazil. Gn. 32:106. R. H. 1869, p. 87.

**Liboniana**, De Jonghe. Small, 1-1½ ft., produc-

ing runners: lvs. long-linear or strap-shaped, spiny, very sharp-pointed, concave and green above and whitish-mealy below: fl.-cluster erect or nearly so, rather slender, the bracts not prominent; fls. with red sepals and erect blue petals. Brazil. B.M. 5090. F.S. 10:1048. J.F. 2, pl. 197.

In the American trade the following names have been used: *B. clavata longifolia*, once offered by Pitcher & Manda, is probably an *Æchmea*—*B. fasciata*=*Æchmea fasciata*.—*B. máxima*=(?).—*B. ornata*=(?).—*B. Quesneliana*=*Quesnelia*.—*B. rhodocyanea*=*Æchmea fasciata*.—*B. stricta*=(?).

Any of the following may be expected to appear in the American trade at any time: *B. andegavensis*, Hort., is *B. thyrsoides* × *Morrellii*: fls. red and blue.—*B. Bakeri*, Morr. (*B. pallescens*, Baker). Fls. greenish, tipped purple. B.M. 6342.—*B. Breuteana*, André (*B. pallescens* × *vittata*), has reddish, purple-limbed fls. R.H. 1885:300.—*B. Brantii*, Hort. (*B. Bakeri* × *decora*). Fls. greenish, bracts red.—*B. Enderi*, Regel. Small: fls. very deep blue; bracts coral-red. Brazil.—*B. Forgyana*, Hort. Lvs. large with bands of white on a green ground. G.C. III. 33:258.—*B. iridifolia*, Lindl. Fls. red and yellow, blue-tipped. Brazil. B.R. 1048.—*B. Liétzei*, Morr. Fls. and bracts rose. Brazil.—*B. nobilis*, Bull. Cat. Bracts cerise-carmine, petals green, curling spirally after flowering: lvs. barred.—Perhaps only a form of *B. decorata*, Poepp. & Endl.—*B. Portena*, Brongn. Fls. green, the petals rolling spirally. Brazil. B.M. 6670.—*B. Sanderiana*, Morr. Fls. green, tipped blue. Brazil.—*B. Saundersii*, Bull. Fls. greenish, tipped blue: lvs. striking, green above, reddish beneath, white-blotched and red-spined. Brazil. Gt. 39:1316.

L. H. B.

GEORGE V. NASH.†

**BILSTED**: *Liquidambar*.

**BILTIA**: *Rhododendron Vaseyi*.

**BINDWEED**: Name applied to various twining weedy plants, particularly to various kinds of *Convolvulus*.

**BIOPHYTUM** (life-plant, some of the species being sensitive to the touch). *Oxalidaceæ*. Oxalis-like perennial herbs, sometimes grown under glass as curiosities: lvs. abruptly pinnate, with many lfts.: valves of caps. separating to base. There are about 20 species in Trop. Asia, Afr. and Amer. **sensitivum**, DC., with 6-15 pairs of lfts., has lvs. that contract at the touch: fls. small, yellow: 6 in. Generally spread in the tropics. B.R. 31:68 (as *Oxalis*). **B. Föxii**, Sprague, is a recently described species from Peru, with st. 2 in. high and bearing 8 lvs. at the apex in a whorl: lfts. 3-6 pairs: fls. white.

**BIOTA**: *Thuja*.

**BIRCH**: *Betula*.

**BIRD CACTUS**: *Pedilanthus*.

**BIRD-OF-PARADISE FLOWER**: *Strelitzia*; also *Czsalpinia Gilliesii*.

**BIRDS**. The horticulturist has the opportunity to avail himself of a mighty band of helpers in the birds. It seems not to be understood that it is perfectly possible for a bird to be eating something useful to man at some particular moment, and at the same time to be spending by far the greater part of its time eating things that are harmful to man, for which service it should be carefully protected. Very thorough studies of the food of birds have proved that the great majority are helpful to one who raises crops. Most birds are beneficial most of the time, and very few have no redeeming traits in this regard. Moreover, if useful birds are protected at all times, so as to encourage the natural increase, they will do their part in an emergency, such as an invasion of insects. Aside from these economic reasons for bird-protection is the gaia that comes from their presence as attractive and interesting objects in nature, as much to be desired as blossoms and gardens.

It is said that there is less need of birds now that insects are being destroyed by arsenical sprays. This is perhaps to some extent true, but even in fruit-plantations the birds are still effective; and there are hosts of insects that are not effectively held within bounds by the sprays. Spraying will never take the place of birds.

*Protection of birds from their enemies.*

Birds should be both protected and attracted. Men and boys with guns and sling-shots, cats, and the Eng-



555. *Billbergia vexillaria*.



lish or house sparrow are the most common enemies or destroyers of birds. The red squirrel, weasel, crow, and shrike are destroyers as well, but they seem to be regulated naturally, although frequently one may interfere to good effect, particularly in the case of squirrels in parks. But man, the cat and the English sparrow should be controlled. Our boys can be educated to protect the wild birds. It is being done in many homes and schools. As soon as a boy learns the interesting habits of the common birds he loses the desire to kill, and he prefers to protect and observe. A bluebird or wren nesting on the premises will do more than all the laws to correct the lawlessness of boys.



556. Pouring the food on the "food-tree."

Experience shows that one must deal with the house or English sparrow, if one is to win back our insect-eating birds in any great numbers. The increase of other birds is in inverse ratio to the decrease of English sparrows. However, not everyone should be allowed to take part in the warfare against them. Schoolboys and inexperienced men make too many mistakes in trying to destroy them and their nests; and the taking of the eggs from the nest seems too much like an outrage on the instinct of motherhood, to be tolerated. The English sparrows should be kept within bounds as to numbers. They can be kept in check by the use of poisoned grain in winter. Some persons object to this practice from sentimental reasons, but it is no worse to despatch house sparrows than mice, prairie dogs, insects or other pests; and if man does not keep the sparrows within limits, they will destroy or drive away other birds. A certain number of house sparrows is desirable in winter, particularly in towns where there are few other winter birds, but they should not be allowed to become nuisances. See page 507.

It has been estimated that a cat destroys on an average about fifty song birds in one season. A new attitude toward cats is needed. They should no more be allowed to roam at will than should chickens or goats. All cats away from home are trespassers, and should be so regarded; they should fall to the care of a bird-warden. Bird-killing cats should be destroyed or kept within doors.



557. The "food-stick."

To attract birds, it is of course necessary to win their confidence. They must feel comfortable and secure. They must be aided to live through severe winter weather, and they must have adequate nesting-places and drinking-places. Measures to secure these ends have been put to the test and found to be genuinely satisfactory.

#### Feeding birds in winter.

Many birds perish for want of food in every severe winter. They digest their food so quickly that lack of it for a few days results in death. The real necessity is in the time of blizzards and continued cold, when they cannot find their natural food.

For insect-eating birds, suet and fat pork or a split bone may be fastened to the trunks of trees by means of wire netting and stout cord. Woodpeckers, nut-hatches, and chickadees will be attracted. The netting prevents crows, jays and squirrels from carrying off the whole piece of food

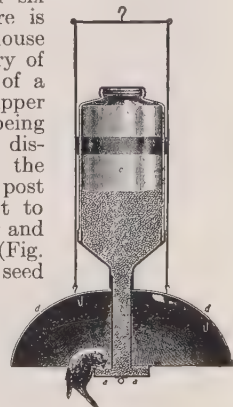
Seed-eating birds may be fed crumbs, nuts, millet, chaff, sunflower seeds, squash seeds, and various grains, including corn; also any kind of poultry-food, and even dog-biscuit. These materials may be placed on the ground after removing the snow, but should be protected to prevent waste. Many a bob-white has survived a heavy snowstorm by coming regularly to such a place. All kinds of sparrows, juncos, and snow buntings are among the birds that are attracted by such supplies.

Many ways for feeding birds near the residence have been more or less successful, depending largely on the prevalence of the English or house sparrows. The tree-shelf, window-shelf, moving shelf or counter, and the coconut filed with pork and kernels of nuts, are among the most useful devices.

In Germany, Baron von Berlepsch has experimented effectively in the winter-feeding of birds, with the idea of securing the protection of the food, and of making it accessible at all times to all birds. On his estate at Seebach he uses the "food-tree," the "food-stick," the "food-house" and the "food-bell," all of which were devised after many years of study of the habits of birds. The food-tree (Fig. 556) imitates a coniferous tree closely covered with insect eggs and larvæ. A mixture of hot liquid food which hardens as it cools is poured upon the tree. This food consists of white bread (dried and ground), meat (dried and ground), hemp, millet, sunflower seeds, and other seeds mixed with water. The food-tree is especially interesting to children and has brought good results in the study of winter birds. The food-stick (Fig. 557) is merely a part of a branch with six holes in which the food mixture is placed at intervals. The food-house (Fig. 558) is the most satisfactory of all ways of feeding. It consists of a roof on four corner posts with upper and lower food-tables, the lower being used only until the birds have discovered the upper table. Below the roof a strip of glass is fixed from post to post. This is very important to protect the food from the weather and also to admit light. The food-bell (Fig. 559) is a device for making hemp seed always accessible to the birds. It is very popular, except with the English sparrows. It may be placed on trees or buildings.



558. A "food-house" that can be easily made.



559. Section of "food-bell."

a, food-dish; b, tube; c, food reservoir; d, metal bell.

#### Nesting-houses.

The birds that naturally make their nests in holes in trees are the ones that have been induced to build in artificial houses. Accordingly, the most successful houses are those that somewhat resemble a hollow limb, although great success has been attained with board houses, and other styles, as gourds, and coconuts, and even tin-cans. In fact, some bird will adapt itself to almost any kind of house, provided cats, red squirrels and English sparrows are kept away.

A most satisfactory cat-proof box for a bluebird can be made of weather-stained boards, if the following

precautions are taken: The hole should be well near the top with no perch near; the roof should slope from the back toward the front and should project about three inches. If the box is deep, the young bluebirds find it difficult to leave the house until they are strong and able to care for themselves, and this is a great advantage. The roof prevents rain from beating in, and keeps the cats out. From whatever direction the cat may attempt to reach the hole, the projecting roof stands in the way of reaching the nest. Twelve by 6 by 6 inches are good dimensions for such a house. It should be placed 8 to 15 feet above the ground.

The house wren is the easiest of birds to attract. It will easily appropriate any little house if the English sparrow does not interfere. A good size is 7 by 5 by 5 inches, with the hole only as large as a 25-cent piece. It should be placed 6 to 8 feet from the ground, with the long axis of the box backward. The wren has the habit of filling the front of the house with sticks and leaving a hollow in the rear for the eggs. The hole should be in the upper half of the box. The middle of April is not too early to place it, in the northern states, although houses put out late may attract for the second brood. It is well to make the house so that it can be opened, to permit of its being cleaned for the second brood, for the wren will choose a clean house if it can find one.

The purple martin is an attractive neighbor. Unlike the wrens, which will not nest near one another, the martins are gregarious, so that the houses should have a number of compartments, each part 9 by 11 inches, with entrance  $2\frac{3}{4}$  inches across. The house should be placed 15 to 20 feet above the ground. To prevent English sparrows from building before the martin arrives in the spring, the openings should be covered until April; or better, the house may be taken down in the fall and put up again in April.

Woodpeckers may be induced to live in houses. The opening should always be circular and with an upward slant; the bottom of the nesting cavity should be gourd-shaped and end in a pointed trough within which a few shavings are placed; and the inner



561. Berlepsch Nesting-box.



562. Longitudinal section of Berlepsch's nesting-box.

walls should be roughened somewhat to allow the young birds to cling more easily. Of the 10,000 or more of these houses tried in parts of Germany, more than 90 per cent are occupied.

#### Drinking- and bathing-places for birds.

Birds need free access to water. If a brook or pond is near by, no more is necessary; but, otherwise, special provision should be made. The presence of water is a great factor in inducing birds to nest in a given locality.

There are many kinds of bird-fountains, but the chief characteristics are that the water be shallow, that the edge of the container be not slippery, and that they be placed where there are no hiding-places for cats. Most interesting styles have been devised, varying from constructions of natural rocks holding little pools, with wild flowers and ferns close by, to those made of flower-pot saucers, or of special pans, placed safe from molestation. School children are readily interested in the pla-



560. The Hilbersdorfer food-house.

cing of bird-fountains and in watching the birds that come to drink and to bathe.

#### Nesting-places for birds that build in the open.

Birds breeding in the open nest in bushes and trees and on the ground, and among reeds or in banks. These comprise by far the larger class, and yet these birds are finding it more and more difficult to secure nesting-places. One cuts off hedges along roads and fences, cleans the pastures and meadows, digs away the banks and seals up the roofs of barns with little thought of the birds that would like to nest there.

While all trees provide more or less shelter for birds, the conifers are most useful for this purpose. It is practicable so to plant as to have wild fruits for birds at all times of the year, and especially in cold winter days, and perhaps during the time in which one wishes to protect cultivated fruits. It seems to be agreed that the best single tree is the mulberry, either the white or the Russian. The fruiting season is long, and the trees are easily grown. Four good plants are: early sweet cherry, Juneberry or shadbush, mulberry, Virginia creeper. Probably more birds visit these plants than any others. Many other shrubs and herbs are of great value, as elder, black cherry, rasp-

berry, blueberry, dogwood, pokeberry, and mountain-ash. Many growers protect their cherries and strawberries with mulberry and shadbush; or they plant a sweet early variety of the given fruit, to be left unpicked especially for the birds. Elder, Virginia creeper, and black cherry will serve as protectors for grapes. Raspberries and blackberries may be protected by mulberry, chokecherry, and elder.

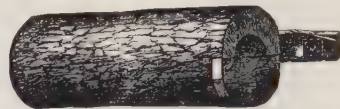
Germany recognizes Seebach as the great bird experiment station. Repre-

sentatives of many states and countries have visited the place, making effective observations of methods. For these students, special winter courses in bird-protection have been arranged, including not only theory

but practical instruction. They find many acres of wood, thicket, and park made attractive to birds, with luxuriant undergrowth about the trees, special care as to the species, the shrubs specially pruned (Figs. 565, 566); hundreds of nesting-houses; food-houses and food-bells in various situations for winter-feeding. In the spring of 1905, the trees of the Hainich wood, south of Seebach, were stripped bare by the larva of a little moth (*Tortrix viridana*), whereas the wood at Seebach with its nesting-boxes was untouched. At a distance of a little more than a quarter of a mile the first traces of the plague were apparent.

#### THE ECONOMIC IMPORTANCE OF FAMILIAR BIRDS.

Woodpeckers are especially fitted for the care of trees. The downy is the most useful woodpecker. It is the bird of the old orchard, preferring neglected trees, under the scales of which the codling-moth larva lies during the winter. It has been known to visit as many as 181 woodland trees between 9:40 A.M. and 12:15 P.M., making, meanwhile, twenty-six excavations for food, most of



563. Nesting-box.



564. Nesting-box.



565. One-year-old whorls recently pruned, to provide nesting places.



566. Old whorls recently pruned.



which exposed galleries of wood-boring ants. The hairy woodpecker (Fig. 567) is equal to the downy in importance, being fond of wood-boring beetles and wood-boring ants. Its large size and strong beak give it much power in drilling deep. A few ears of corn and a little suet will attract him. He is becoming less common than the other woodpeckers. The flicker is much misunderstood. Ants constitute about 40 per cent of his food, and he eats, also, many beetles, grasshoppers, and caterpillars, besides some wild fruit. The



567. Hairy woodpecker.  
(Length 9 in.)

red-headed woodpecker is especially fond of beech-nuts and acorns. It stores them for winter use. In its storehouse are often to be found quantities of dried grasshoppers also. It is an irregular permanent resident in the East, but in the West it migrates regularly. The yellow-bellied sapsucker (Fig. 568) doubtless does considerable harm; in fact, it is responsible for most of the objections to woodpeckers in general. Whether the good done in destroying insects in the breeding season balances the harm done in sucking sap is an open question. The sapsucker drills holes in the trunks of many of the most valuable trees, as sugar maple, birch, pignut hickory, pine, apple, mountain-ash, beech, and others. The death of the trees may result not only from the loss of sap, but from the work of borers that deposit eggs in the holes. If the sapsuckers are to be destroyed, care must be taken not to kill the downy woodpecker at the same time. Fortunately, the sapsuckers are resident in fruit sections for only a short time in the spring and autumn. In their northern breeding-grounds they destroy many noxious insects. The red-bellied woodpecker annoys growers of Florida by its fondness for orange juice. Else-

where it is of much value as a destroyer of ants and beetles and other insects.

The chickadee is a permanent resident. Many other birds seek their company, so that one has but to follow them as they rove to find many smaller birds. This is particularly true in spring and fall, when the warblers are in migration. In an experiment in Massachusetts, chickadees were attracted to an orchard in the winter by means of suet fastened to the trees. The birds destroyed multitudes of eggs of the fall canker-worm moth. The conclusion was reached that one chickadee would destroy in one day 5,550 eggs; and in the twenty-five days during which the canker-worm moths crawl up the trees 138,750 eggs might be taken by one chickadee. Chickadees readily accept a nesting-box.

The white-breasted nuthatch is the constant companion of the chickadee and the downy woodpecker. It takes from the bark great numbers of eggs of canker-worms, and many of the oyster-shell bark-louse, and even the hairy caterpillars of the gypsy moth. It is easily attracted by suet and will often eat crumbs as well. The red-breasted nuthatch, a smaller bird with dull reddish breast, comes from the North in September, spending the winter in attending to tree-trunks, and returning North in the spring.

The brown creeper, with its long curved beak, rounded back, and stiff tail, is especially valuable for service among shade trees. It starts at the base of the trunk, ascending spirally, quietly investigating crevices as it goes.



558. Yellow-bellied woodpecker, or sapsucker. (Length  $8\frac{1}{2}$  in.)

The slate-colored junco, or snowbird, comes from the North in autumn and remains all winter, busy all the time in reducing the number of weed-seeds. The snowbirds rove in little flocks, and easily respond to seeds and crumbs put in any open place. In the North the junco destroys many insects, for the young eat insect food only.

The American robin (Fig. 569), (which is a very different bird from the robin of Europe), is protected by law in all of the United States excepting seven of the southern states. The National Association of Audubon Societies is making efforts to secure the passage of laws better calculated to protect it. An examination of the

stomachs of 330 robins showed that vegetable food constituted about 58 per cent of the contents. Of this, 47 per cent was wild fruit, with only a little over 4 per cent cultivated fruit. The United States Department of Agriculture has shown by recent investigation that in the South the robin is essentially an insect-eating bird. The robin is the great enemy of the white grub, the young of the May-beetle or June-bug. The robin is an inveterate devourer of earth-worms in spring. Although the earthworm is useful to the soil, if it were allowed to increase naturally, with no interference by the birds, it would rapidly become a pest. The favorite food of young robins is the cutworm, and this is important, since there are frequently two or three broods of robins in a season and a young



569. The American robin. (10 in.)

robin's appetite is nearly insatiable. The cutworm feeds at night and is going back to its hole at daybreak, when the robin intercepts it. One may prevent the robin from eating cherries by planting trees that are in fruit at the same time, as the Russian mulberry, and the shadblow and wild cherries, or even a cheap variety of cherry. The strawberry-grower may plant a variety of inferior strawberries to attract the robins from his choice fruit.

The bluebird (Fig. 570) destroys quantities of cutworms and other caterpillars. In August and September grasshoppers constitute more than 60 per cent of its food. It is fond of wild fruit, especially berries. Unfortunately, the bluebird is becoming uncommon.

The sparrows are among the most valuable birds to the farmer. The food of the native sparrows, as a family, consists of 25 to 35 per cent of vegetable matter, and 65 to 75 per cent animal matter. Young sparrows are almost entirely insectivorous until they leave the nest. Many sparrows rear two broods in a season. As soon as the insect season is over, they turn their attention to weed-seeds, of which Beal estimates that tree sparrows alone eat 875 tons in one season; and even this estimate may be too low. Forbush found, among other things, that a song sparrow, even after it had been eating seeds for about an hour before he began to count, ate 154 seeds in ten minutes and forty-five seconds. Song sparrows eat the seeds of such troublesome things as chickweed, purslane, sorrel, dandelion, and dock; also pests like plant-lice and cutworms, and caterpillars of the brown-tail and gypsy moths. The field sparrow (Fig. 571) is smaller than the song sparrow and very shy. It scarcely comes into our towns, but its clear trill from the fields suggests the warm days of late spring and early summer. It has been seen to eat May-beetles, leaf-hoppers, saw-flies, spiders, ants, and some earthworms. In the field it prefers weed-seed to grain. The chipping sparrow has the distinction of being the most useful sparrow, having an astonishing list of services to its credit. In the spring it feeds largely upon small caterpillars, as the gypsy, brown-tail, and tussock moths. It destroys at least three species of caterpillars on the cabbage; it is fond of wild cherries, chickweed seeds



570. Bluebird. (7 in.)

and seeds of ragweed, smartweed and many other weeds, including dandelions and the crab-grass of the lawn. The vesper sparrow is nearly as abundant as the song sparrow. It eats quantities of grasshoppers and beetles and weed-seeds. The English sparrow was introduced into the United States in 1850 for the purpose of destroying cankerworms and other insects just then becoming numerous. At first it was received with delight. A very short time, however, showed conclusively that it did more harm than good, and now every locality has its "sparrow problem." The charges against the English sparrow are serious. An investigation in Illinois showed that out of twenty-five stomachs of English sparrows at a time when 30 per cent of the food of the robin, 30 per cent of the food of the catbird, and 90 per cent of that of the bluebird consisted of insects, no insects were found in these sparrows, excepting traces of grasshoppers making perhaps 6 per cent of the food. However, during the first sixteen days of the nestlings' life, 40 per cent of the food consists of caterpillars, 10 per cent of beetles, and 40 per cent of small grains. This is perhaps the best that can be said for the English sparrow. It is so pugnacious that it has driven most of the bluebirds, wrens, and purple martins from the towns, while they themselves do not eat the insects that these birds would eat. Organized warfare against them has been more or less successful. But to



allow the public in general to attempt destroying the nests, poisoning them or shooting them, is running a great risk in the use of guns and poison; and to offer prizes for their nests and eggs is sure to result in the destruction of many nests of valuable sparrows. This work should be done systematically by specially appointed persons at the public expense. In some European cities, there is an official known as the "Sparrow Warden," whose duty it is to proceed energetically against the sparrows.

The house finch, or linnet, has been the source of much complaint on the part of the fruit-growers of California, so that the investigations of the Biological Survey were of great interest. It appears that its claim to protection is in its enormous consumption of the seeds of weeds, as well as for its esthetic value,—for it certainly is a trim little bird and a good singer. Inasmuch as the linnet's food has been proved to be 86.2 per cent weed-seeds, and since examination of the contents of many stomachs shows that fruit is far from being its principal article of diet, many Californians protect the bird and plant shrubs and trees to attract them away from the fruit. These birds are fond of elderberries and many other wild fruits.



571. Field sparrow. (5½ in.)

The cedar waxwings or cherry-birds (Fig. 572), go in small flocks in search of food. Their fondness for cedar berries has given them their name although they have a wide range of food. In early summer they feed almost exclusively on insects and become expert flycatchers. Unfortunately, they have a bad reputation among fruit-growers because of their fondness for cherries. It has been shown, however, that they abundantly pay for the cherries taken. From an orchard infested with canker-worms, the stomachs of seven cedar-birds were examined, all of which were full of worms, averaging 100 to each. It was estimated that this flock would destroy 90,000 of the pests if they stayed in the orchard a month. At Washington, 152 stomachs of cedar-birds were examined showing that 74 per cent of the food consisted of wild fruits, 13 per cent of cultivated fruits, 5 per cent of which was cherries. The remainder consisted of grasshoppers, bark-lice, and beetles, among them the elm-leaf beetle.

The Carolina wren adapts itself to civilized conditions, and often nests about houses and farm buildings, as well as in old logs and tree-trunks. It is an eminently useful species, destroying great numbers of beetles, ants, weevils, especially the boll-weevil, which it destroys during its period of hibernation. Like its relative, the house wren, it may be attracted by nesting-houses. It is not migratory and may be heard all the year round from the Gulf north to Connecticut and Illinois. The house wren (Fig. 573) will occupy almost any little box, provided it be water-tight. The English sparrow will do its best to drive the wren away, but with a small opening the wren is safe and will usually win in the contest. The diet of the wren is mainly insectivorous, consisting of grasshoppers, ants, beetles, grubs, spiders, and hairy caterpillars. Many a fruit tree has been saved from the ravages of the tussock moth caterpillar by a family of wrens in the vicinity. Wrens gather spiders' egg-sacs full of eggs, putting them inside the house on the wall, ready for the first meal of the young birds.

The catbird (Fig. 574) is fond of fruit. The robin is often blamed for the deeds of the catbird. Inasmuch as the nestlings eat 95 per cent animal food, mainly insects and spiders, it is far better to



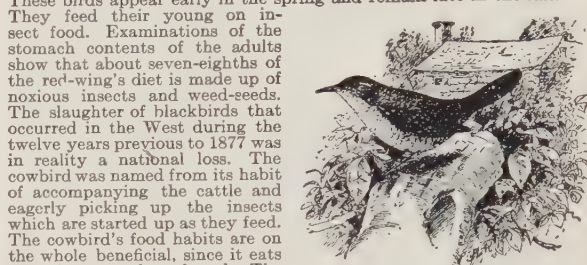
572. Cedar-bird, or cedar waxwing. (Length 7 in.)

plant fruit trees especially for the catbirds than to destroy them on account of their fruit-eating habits. In case of insect outbreaks, the catbird attacks gypsy, brown-tail, canker-worm, and tent-caterpillars.

The attacks that the Baltimore oriole makes on the cherries, grapes, and the pea-pods, are more than paid for by its destruction of insects. Tent-caterpillars and other hairy larvae that many other birds will not touch are eagerly eaten by it. The oriole does not swallow the whole caterpillar, but carefully removes a small portion of the inside. The orchard oriole is a related bird. Investigations in the cotton fields of Texas and Louisiana show that nearly a third of the specimens examined contained remains of the cotton-boll-weevil. Like the Baltimore oriole, it is mainly insectivorous in its diet and destroys a great many injurious species.

Blackbirds are of several kinds. The purple grackle and the bronzed grackle are together known as crow blackbirds (Fig. 575). Their food has been thoroughly studied. An examination of 2,258 stomachs showed that corn is consumed every month. At the same time, were found insects, spiders, myriapods, crawfish, earthworms, sow-bugs, hairsnakes, snails, fishes, tree-toads, salamanders, lizards, snakes, birds' eggs, and mice. Of the 48 per cent of animal food, 46 per cent consisted of insects. Of these, beetles were present in the greatest numbers. Many stomachs were crammed with large white beetle grubs. Often more than thirty grasshoppers were found in a single bird. Young blackbirds are fed on insect

food entirely. They flock to caterpillar outbreaks. Many cases are reported in which fields have been entirely freed of sudden growths of grasshoppers and crickets. The red-winged blackbird has a bad reputation and is unprotected in many states. These birds appear early in the spring and remain late in the fall. They feed their young on insect food. Examinations of the stomach contents of the adults show that about seven-eighths of the red-wing's diet is made up of noxious insects and weed-seeds. The slaughter of blackbirds that occurred in the West during the twelve years previous to 1877 was in reality a national loss. The cowbird was named from its habit of accompanying the cattle and eagerly picking up the insects which are started up as they feed. The cowbird's food habits are on the whole beneficial, since it eats many insects and weed-seeds. The fact, however, that each young cowbird is raised at the expense of several more valuable birds (by appropriating their nests) makes it too costly. Brewer's blackbird is the western representative of the eastern rusty blackbird. Examination of 146 specimens gave the following facts: (1) Grasshoppers constitute more than half of its animal food; (2) more than 88 per cent of the vegetable food is grain, which is freely eaten at all seasons, even when insects are abundant; (3) seeds of harmful weeds are eaten sparingly. On the other hand, it does not attack fruit, which is an important point in a California bird. The yellow-headed blackbird, while wintering in the South, wanders over the country in quest of scattered and wild grain, weed-seeds, various insects, grubs and worms, and does little harm. In the spring, however, the birds congregate at their nesting-haunts and supplement their insect and waste-seed diet by various grains planted by the farmer of the Great Plains, and they are deservedly regarded as a great problem. In the plowing season, they follow the plow and greedily devour the earthworms and insects turned out, also the white grub, the cockchafer, and grasshoppers, the last forming a large part of the food of the young. So far as it has gone, the published work of the Biological Survey on the food of the yellow-headed blackbird, indicates that on the whole the good done by this bird somewhat overbalances the harm.



573. House wren. (4¾ in.)

The meadowlark destroys quantities of grasshoppers, cutworms, beetles, chinch-bugs, crane-flies, and "thousand-legs," where it takes only a few useful insects and a little scattered grain. In summer, 99 per cent of its food consists of insects, and in winter it takes many weed-seeds. The kingbird (bee martin) (Fig. 576) is esteemed by agriculturists for its pugnacious disposition in driving off crows and hawks. Ninety per cent of its food consists of flying insects. It belongs to the family of flycatchers, of which the phoebe, the wood pewee and the great crested flycatcher are conspicuous members. They all obtain their food on the wing, darting off frequently from some chosen limb and back again. Bee-keepers have contended that the kingbird catches and kills honey-bees. In an investigation of 281 stomachs, only fourteen contained any remains of bees, fifty in all, of which forty were drones, four were workers, and six undetermined. At the same time, nineteen robber-flies were found, which more than compensated for the four workers. It is probable that kingbirds do eat a few bees, mostly drones, but they certainly also protect bees from insects that prey upon them.

Of swallows, there are five species in Eastern North America that one may expect to see: the barn swallow, the cliff swallow, bank swallow, tree swallow, and the purple martins. All of them do valuable work in clearing the air of insects, but the horticulturist will do well to encourage especially the purple martin. It feeds largely on some of the greatest pests: rose-beetles and May-beetles, the striped cucumber-beetle, as well as house-flies and flies that trouble cattle and horses.



574. Catbird. (Length 9 in.)



The blue jay (Fig. 577) has been shown by investigation to be beneficial as a rule, and that, except in cases in which it is discovered actually engaged in doing harm, it should be protected. Nearly 300 stomachs showed that the real food is composed of about 25 per cent animal matter, and about 75 per cent vegetable matter. The animal matter is, chiefly insects, with a few spiders, myriapods, snails, fish, salamanders, tree frogs, mice, and birds. Remains of birds were found in only two out of 300 examined. Only three contained eggs of small birds. Apparently its nest-robbing propensities are not so general as is supposed. In August, the percentage of insects reaches 66 per cent. They prefer mast, or seeds of trees and shrubs, to corn or any other vegetable food. Corn is the only vegetable food of which the farmer suffers any loss, and here the damage is small. The California jay is a problem. Very careful and extensive investigations of the bird have resulted in the conviction that it has many more bad qualities than good. In fact, it has few redeeming virtues. Something may be said in its favor, from the esthetic side, as he is a handsome bird, and people interested in country life would no doubt miss his presence. Beal says that if they could be reduced to a fourth or a half of their present numbers, the remainder would probably do no serious harm. They eat very few insects, and destroy many eggs and young birds. They eat grain from the newly sown fields, but do not pull it up after it has sprouted, so that this is of minor importance. They are insatiable fruit thieves, not only eating enough for present need, but storing it away for future use.

The black-billed and yellow-billed cuckoos are valuable to the forester, orchardist, and the farmer. They feed mainly on the medium-sized and larger caterpillars and grasshoppers, as well as many other insects. In May and June, when the tent-caterpillars are defoliating forest trees, these insects constitute half of the cuckoo's food. One stomach was so full that the bird had evidently

study. From 353 stomachs of bush-tits collected in every month, less than 1 per cent of the food was found to consist of fruit, and over four-fifths consisted of insects and spiders. The largest item was plant-lice, or bark-lice, or scale insects. Several stomachs were entirely filled with them. The stomachs of eight nestlings contained pupæ of the codlin-moth. It would probably be difficult to find a more valuable bird than the bush-tit. The birds live in flocks nearly nine months of the year.

The black-headed grosbeak has been the subject of complaint by the Pacific coast fruit-growers, for it is fond of figs, cherries, and berries. However, it eats many insects that cost the horticulturists much annoyance. The codlin-moth, canker-worm, flower-beetles, and scale insects are among its favorites. An examination of 226 stomachs, the majority of which were collected in California, shows that during the six months of its stay in that state the bird consumes about 34 per cent of vegetable food, and 66 per cent of animal food, with a distinct preference for the black olive-scale, one of the most destructive insects of the coast. This insect alone constitutes a fifth of the entire food. To put it graphically, the black-headed grosbeak, for every quart of fruit eaten, eats more than three pints of black olive-scales, and more than a quart of flower-beetles, besides a generous supply of canker-worms and pupæ of codlin-moths.

The mourning dove has scarcely an equal as a weed-eradicator. The Biological Survey has shown that of 237 stomachs examined, over 99 per cent of the food consisted of seeds. Wheat, oats, rye, corn, barley, and buckwheat, were found in 150 of the stomachs and constituted about 32 per cent of the whole food. Three-fourths of this however, was waste grain picked up from the fields after the harvesting was over. Wheat was the favorite grain, and about the only one taken when in good condition. Corn, the second in amount, was damaged grain, taken after the harvest. The principal and almost constant diet, however, is weed-seed eaten at all seasons, constituting 64 per cent of the annual food-supply and showing little variation in any month. Three mourning doves which were examined had destroyed 23,000 prospective weeds. Yet they moved silently, and no one knew of their work.

The dickcissel, or black-throated bunting, is common in field and prairie in the Middle West, where its plaintive song gives variety to the silent days of July and August. Its food is more than half grasshoppers and crickets, and the remainder seeds of weeds and grasses. In some localities it is known as the "little meadowlark," its color being like that of the meadowlark, even to the black locket on a breast of brilliant yellow.

The cardinal and his mate are indeed a conspicuous pair. They are known as cardinal grosbeaks, redbirds, crested redbirds, and Virginia nightingales. They are most abundant in the southern United States, although frequent records show the limit of their range to be approximately a line drawn from New York City westward to southern Nebraska, and thence south to Texas. The cardinals' food is varied, consisting of seeds of numerous plants, especially those of rank weeds and grasses. The large and powerful beak readily breaks into large seeds, as corn, wheat, rye, and oats. It eats great quantities of adult beetles, especially rose-beetles; also crickets, grasshoppers, flies and ants. It enjoys grapes, berries,



576. Kingbird. (8½ in.)



575. Crow blackbird, or purple grackle. (Length 12 in.)

devoured the whole tent-colony. It is impossible to over-estimate the value of the cuckoo's work. The cuckoo of Europe is a bird of very different habits.

The common crow is a subject of much dispute. In a report of the United States Department of Agriculture, 1895, the evidence for and against the crow is clearly summarized as follows: (1) Crows seriously damage the corn crop and injure other farm crops, usually to a less extent; (2) they are very destructive to the eggs and young of domesticated fowls; (3) they do incalculable damage to the eggs and young of other birds; (4) they do much harm by the distribution of seeds of poison-ivy, poison sumach, and perhaps other noxious plants; (5) they do harm by the destruction of beneficial insects. On the other hand, they do much good: (1) By the destruction of injurious insects; (2) by the destruction of mice and other rodents; (3) they are valuable occasionally as scavengers. On the whole, it seems that the crow is not to be encouraged, although it need not be altogether exterminated.

The bobolink does nothing but good while it is feeding the young, insects forming about 85 per cent of the food. No fault can be found with him in the North, although he becomes a veritable pest in the South, destroying much rice. The annual slaughter of the "rice-birds" in the South accounts for the gradual decrease in numbers in New England.

An examination of eighty-two specimens of California thrasher shows that vegetable food exceeds the animal in the proportion of 59 to 41. Since it is eminently a bird of the ground, it is surprising to find that in addition to very many beetles, caterpillars, ants and spiders, a great number of bees and wasps were found in the food, also. There were many more wasps than bees. The vegetable food consisted of fruit, poison-oak seeds, and miscellaneous material. The thrasher must be added to the list of birds that assist in the dissemination of poisonous plants. It is not probable that the thrasher will ever become a resident of the orchard.

The western tanager, like the robin, sometimes becomes a nuisance in the orchard. It breeds north of the fruit-growing sections of California, but does injury to the cherry crop on its way north during the migration period. The investigation of the Biological Survey shows that it has a fair right to protection at the hands of the farmer, and even of the orchardist. It is suggested that wild cherry trees planted around cherry orchards may attract the birds away from the fruit.

The California bush-tit has been made the subject of special



577. Blue jay. (11½ in.)

mulberries, cedar-berries, preferring the wild varieties always. These habits, added to the striking beauty of its plumage and of its song, make the cardinal a great favorite.

The mockingbird is omnivorous. While investigating the feeding habit of this remarkable bird, Beal found that in fifty-two specimens 29 per cent of the food consisted of vegetable matter, of which 50 per cent was fruit. The birds' appetite for fruit and



berries in some communities becomes at times so marked that many fruit-growers complain, while others plant more fruit to provide enough for both man and bird. Besides fruit and berries, its food includes the seeds of dogwood, holly, red cedar, and pokeberry. It eats a great many noxious insects, including grasshoppers, beetles, cotton-worms and boll-weevils.

The bird pictures herewith are adapted from Farmers' Bulletin 54, U. S. Dept. Agric. on "Some Common Birds in Their Relation to Agriculture," by F. E. L. Beal.

CORA A. SMITH.

BIRD'S-NEST FERN: *Thamnopteris*.

BIRD'S-TONGUE FLOWER: *Strelitzia*.

BIRTHWORT: *Aristolochia*; also *Trillium*.

**BISCHÓFIA** (for G. W. Bischoff, Professor at Heidelberg early in nineteenth century). *Euphorbiaceæ*. Ornamental tropical tree.

Lvs. alternate, trifoliolate; calyx imbricate; ovules 2 in each cell. The one species is being used to some extent in recent years in the warmer parts of the U. S. It is said to grow freely in sandy soil.

**trifoliata**, Hook. (*B. javánica*, Blume). Toog. A fine tree, with bronze-green lvs.; lfts. stalked; sepals 5; petals none; fr. berry-like. Trop. Asia and Pacific Isls. Hook. Ic. Pl. II. 5:844.

J. B. S. NORTON.

**BISMÁRCKIA** (in honor of Prince Bismarck). *Palmaeæ*, tribe *Borasseæ*. Sometimes referred to *Medemia*. A genus nearly related to *Latania* and distinguished by having only 6 stamens instead of many. Forms a tree 200 ft. high, with a gigantic crown of palmate lvs. with white-streaked petioles and blades 10 ft. in diam.; fr. borne in large, drooping clusters, dark brown, plum-like, 1½ in. diam., with a thin outer shell and a fibrous inner one inclosing a rounded, wrinkled seed 1 in. diam., reticulated like a walnut and ruminated as in the nutmeg. Cult. as for *Latania*, but the winter temperatures should be from 65-70° and summer temperature from 80-90°. G.C. II. 22:596.

**nóbilis**, Hildeb. & Wendl. In young plants petiole convex on the back, channelled above, finely serrate on the ridges above, thinly clothed with tufts of fibrous scales, half as long as the blade; blade blue-green, rigid, 3 ft. in diam.; segms. 20, 2 in. wide, 1 ft. long, apex blunt, obtuse, with a long curved filament from the base of each sinus. Madagascar. G.F. 6:246. F. R. 2:257. Gt. 1221.

JARED G. SMITH.

N. TAYLOR.†

BITTER-SWEET: *Solanum*; also *Celastrus*.

**BÍXA** (S. American name). *Bixaceæ*. A monotypic genus of tropical trees with large, entire lvs. and showy fls. in terminal panicles: lvs. entire, long-petioled, dotted; sepals 5, distinct, imbricate, deciduous, alternating with exterior glands; petals 5. *B. Orellana* is cult. in the E. and W. Indies for the annatto dye prepared from the orange-red pulp that covers the seeds. It is the coloring matter chiefly used in butter and cheese. It is also used in dyeing silks, and preparing chocolate.

**Orellana**, Linn. ANNATTO-TREE. Height 30 ft.: lvs. cordate; fls. pinkish or rose-color. B.M. 1456.—It is rarely grown in northern greenhouses as an ornamental. Cuttings taken from a flowering plant will produce flowering plants of a convenient size. Plants from seed usually flower less freely, and must attain a greater size before flowering.

N. TAYLOR.†

**BLACKBERRY**. Cultivated blackberries are the progeny of several species of the genus *Rubus*. The common garden blackberries are all natives of America, while two little-known but quite distinct forms, the Oregon Evergreen, much grown on the Pacific coast for its fruit and as an ornamental, and the Himalaya, comparatively recently introduced in commercial plantations, come from the Old World. Blackberries are erect-growing perennial plants, bearing black or occasionally whitish fruits which do not separate from

the juicy receptacle. Dewberries are distinguished from blackberries only in being procumbent plants, while raspberries differ chiefly in bearing variously colored fruits that fall from a dryish receptacle when ripe. Blackberries are now largely grown only in North America but they are being introduced in gardens in

other parts of the world, from some of which, notably in New Zealand, they have escaped and have become troublesome field and roadside plants.

The kinds.

There are many forms of blackberries, species, subspecies and varieties with many hybrids and intergradients abounding. At present it is impossible to group the forms with the expectation of a permanent classification. (For a botanical classification see *Rubus*.) The following is the common arrangement of the horticultural varieties (Bailey): (1) The Long-Cluster varieties are probably



578. Wild Blackberry—*Rubus allegheniensis*. ( $\times \frac{1}{2}$ )

best known. These belong to *Rubus allegheniensis* (Fig. 578). The plants in this group are tall and shrubby with purple canes armed with stout, straight prickles. The fruits are sub-cylindric or thimble-shaped, sweet, dull-colored, with many small closely packed drupelets, and are borne, as the name implies, in long clusters. The White blackberry, having amber-colored fruit and rounder lighter-colored canes, is an albino form of the Long-Cluster blackberry. Taylor and Ancient Briton are the most prominent representatives of the Long-Cluster group, while Iceberg best represents the albino form. (2) Var. *sativus* furnishes a number of varieties roughly grouped by horticulturists as the Short-Cluster blackberries (Fig. 579). These are characterized by smaller and weaker plants than the preceding, with green and nearly unarmed canes, short, leafless clusters, composed of globose glossy berries of few, large, juicy, irregularly set drupelets. The varieties most commonly grown are Agawam, Kittatinny, Lawton and Snyder. (3) The Leafy-Cluster blackberries belong to a species doubtfully known as *R. argutus*, Link, and are characterized by low bushy plants bearing short clusters with leaves intermingled with the flowers. Here belong the old Dorchester, one of the first varieties cultivated, and Early Harvest, a valuable commercial sort. (4) The Loose-Cluster blackberries are probably hybrids (Fig. 580) between the first group named and the dewberry (*R. procumbens*, Muhl.). The plants are low and spreading, with broad, jagged notched leaves, short clusters of large, roundish berries with juicy, glossy, loosely set drupelets. Early Wilson and Wilson Junior are the best known varieties of this group. (5) The Sand blackberry (*R. cuneifolius*, Pursh) is the parent of a few unimportant sorts, of which Topsy or the Tree blackberry is the best known. The plants of this group are low and shrubby, with stout recurved prickles; the clusters bear from one to four roundish berries of loosely set drupelets (Fig. 581).





XV. The American blackberry.—The Agawam; about natural size.





(6) The Evergreen blackberries, of unknown origin, to which the Himalaya is closely related, are commonly put in *R. laciniatus*, Willd., but may be but a cut-leaved form of the European bramble (*R. fruticosus*, Linn.). The vines are clinging, the foliage evergreen or nearly so, and the berries in the Pacific coast climate are large, black, sweet, and ripen through a period of two or three months. The Oregon Evergreen is the typical variety.

#### Propagation.

In nature the blackberry propagates itself from suckers and under cultivation young plants from suckers are thriftiest, but many varieties produce but few suckers and the natural process is a slow one with all kinds. A more expeditious method is to use root-cuttings. Such cuttings are usually made during the dormant season by taking up old plants and cutting the roots with pruning-shears into parts 2 inches long. The cuttings are then started under glass, or sown in furrows in well-prepared nursery beds in the spring. The cuttings should fall in sowing 2 inches apart in furrows 3 inches deep and should be covered with well-pulverized soil. The soil must be such that it does not bake as the young shoots appear. It sometimes requires two summers to produce plants ready for setting, but in the South, the Pacific coast, and under favorable circumstances in the East, yearling plants are strong enough for setting. Cuttings should be made from the roots of thrifty, healthy plants, preferably from a young plantation. It is contended and there are many facts to substantiate it, that propagating successive generations of blackberries from root-cuttings results in unproductive or even sterile plants.

Some blackberries from the several varietal groups may be grown in almost every condition of climate and soil in temperate regions, yet this fruit does best in a carefully selected environment. Blackberries cannot stand, without protection, more winter cold than the peach. In dry, hot climates the plants suffer and the berries are few, small, poorly colored and lacking in flavor. A deep, mellow, clay loam, well filled with humus, is most suitable for this fruit. Gravelly and sandy lands are usually too hot and dry. Flat wet lands are quite unsuited and in such soils the plants suffer alike from cold and heat; whatever else may be said of the soil, good drainage is imperative. A northern exposure is usually desirable. Fertilizers are little needed if the land be rich enough naturally to grow fair farm crops. Stable manure often induces rank-growing canes which produce but little fruit. Cover-crops of vetch or clover and some grain as oats or barley, sown in August, will supply much-needed humus and about all the plant-food usually necessary to add.

#### Field cultivation.

The plants are set in rows, 7, 8, or 9 feet apart, depending on the soil and the variety, and from 3 to 4 feet apart in the row. There should be room between

the rows for a two-horse harrow or cultivator to keep the plantation in good condition. Planting may be done by spade or in furrows 6 or 7 inches deep. A hoed-crop is usually grown between the rows the first year but seldom the second, as the plants need all the food and moisture to make sufficiently strong plants to bear a crop the third season. The canes are allowed to grow the first year to a height of 18 to 30 inches, when they should be cut back a few inches. The plants are thus pruned to cause them to grow low, stocky and upright, with many lateral branches, and so avoid the necessity of a trellis and yet be able to hold the crop up well. Trellising is troublesome and expensive.

Subsequent training and pruning consist in keeping the plants well branched, low and stocky, and in regulating the amount of bearing wood. Success in growing blackberries depends largely upon proper training and pruning. The fruit is borne upon one-year-old canes which should be removed as soon as the crop has been harvested. To allow them to stand through the growing season jeopardizes the proper development of the new canes, and often exposes them to infection from fungi. Five or six canes to the plant are quite enough; if there are more, the size and quality of the crop will be reduced. The canes should be headed-in annually during the growing season, as recommended for the first year. In the spring laterals are shortened-in, the amount of cutting-back depending upon how close the fruit is borne to the cane on the variety in hand. The laterals are usually left from 12 to 20 inches long. This spring pruning may be and often



579. The short-cluster garden blackberry. ( $\times \frac{1}{2}$ )

should be made a thinning process. Managed according to the directions just given, the plants need neither stakes nor trellises. In some plantations, however, a wire is stretched along each side of the row to hold the plants up, and in others, notably along the Hudson River, the plants are trained on two-wire trellises. In northern climates the training must be such as to provide for winter protection for many varieties.

Winter protection consists in laying down the canes and covering them wholly or in part with a thin mulch of straw or earth. The method of laying down must be varied with the variety, the soil and the amount of protection to be given. Three men can do the work most expeditiously; one goes ahead and digs the earth from the front and back of the roots, a second with fork or foot pushes the plant forward to the ground, the third puts on the mulch of earth or straw. Tender varieties are wholly covered, but the harder sorts need only a covering on the tips of the canes. The plants are raised in the spring just before or as the buds begin to



purst. Care must be taken not to break or split the canes. Such protection at present prices of labor will cost from eight to twelve dollars per acre. Winter injury is sometimes a matter of moisture as well as of temperature, and, in irrigated regions, late irrigation may obviate the necessity of a winter covering.

Thorough cultivation is essential for the proper conservation of moisture in a blackberry plantation, abundant moisture being a prime requisite for this fruit. It must be frequent and constant until the berries begin to turn in color. After the crop is harvested, the cultivator should be used to put the ground in shape for the cover-crop. The cultivator must be shallow-cutting since deep cultivation injures the roots, thereby weakening the plants, and inducing suckering. Mulching to take the place of cultivation is not to be recommended, except in small patches, and in the row with cultivation between rows.

Blackberries should not be harvested until fully ripe, and the sooner eaten after picking the better the quality. The fruits are not ripe when they attain full color but must be left on the bushes until soft, at which time they should part from the stem readily when the cluster is shaken. In picking, the berries should not be exposed to the sun. Well treated, the plants should bear some fruit the second season, and the third summer should give a fair crop. The length of time the plants will bear depends upon the variety, the soil and the treatment. When the stools become thin, the canes weak and the fruits small, the plantation should be cut down, this time coming usually when the bushes are ten or twelve years old.

Blackberry-growers have several troubles to contend with. Late frosts occasionally do much harm in northern latitudes. Borers often do much damage to canes and can be circumvented only by cutting out infested stalks. Two fungous diseases, orange rust and anthracnose, are dangerous, and are successfully kept in check only by cutting out the diseased wood. Root-galls are often found but it is doubtful whether they do much damage, and it is certainly not worth while trying to control them. Good treatment, especially as regards cultivation and pruning, with careful attention to destroy-

ing the pests mentioned as soon as practicable, will keep the plants in health.

The yields and profits in blackberry-growing are most encouraging to small-fruit-growers. In a plantation well cared for, a crop of two hundred bushels per acre may be expected. Blackberries are not suitable for long-distance shipments and monetary rewards come from local markets and here they are often large when climate, soil and general conditions are favorable. U. P. HEDRICK.

**BLACKBERRY LILY:**  
*Belamcanda.*

**BLACKWOOD:** *Acacia.*

**BLADDER-NUT:** *Staphylea.*

**BLADDERWORT:**  
*Utricularia.*

**BLAKEA** (Stephen

Blake, gardener, of the island of Antigua in the West Indies, who wrote "Compleat Gardener's Practice," London, 1664). *Valdesia*, Ruiz & Pav. *Melastomaceæ*. Rhothouse or greenhouse evergreen shrubs, of which two species are in cultivation for the showy flowers and prominent foliage.

Erect or scandent woody plants, sometimes small trees: lvs. opposite, leathery, mostly prominently 3-7-nerved, petioled, nearly or quite entire, often rusty-pubescent beneath: fls. rose-purple or white, showy and large, solitary or fasciated in the axils; calyx with 4 or more scales or bracts at base; petals 6, oblong or obovate; stamens 12 with thickened filaments, the anthers cohering and opening by 2 pores at the apex; ovary adhering to calyx, 4-6-celled: fr. a fleshy berry.—About 30 species in W. Indies and S. Amer. By some the genus *Amaraboya* (which see) is included with *Blakea*; *Amaraboya* has capsular rather than baccate fr.

*trinervia*, Linn. Shrub, in the wild the branches supporting themselves on neighboring bushes, and roots sometimes springing from the sts.: lvs. oval-oblong to elliptic, dark green above, often rusty-tomentose beneath, prominently 3-nerved: fls. pink or rose-color, solitary, on long stalks, in early summer. Mountain woods, Jamaica.—

A good plant for the warm conservatory.

*gracilis*, Hemsl. Compact shrub, 2-3 ft.: lvs. elliptic, acuminate, leathery, glabrous: fls. solitary, fragrant, 2 in. across, the petals white with a rose-colored spot at the base. Costa Rica.—Needs an intermediate temperature. L. H. B.

**BLANDFORDIA** (after George, Marquis of Blandford). *Liliaceæ*. Tender rhizomatous plants from Australia and Tasmania, placed by



581. Sand blackberry.  
( $\times \frac{1}{2}$ )



580. Wild, probable hybrid of blackberry and dewberry.



Baker (Jour. Linn. Soc. 11:364) between *Kniphofia* and *Funkia*; adapted to culture in greenhouses. *Blandfordia* of Andrews is a synonym of *Galax*.

Roots thickly fibrous: lvs. in two vertical ranks, narrowly linear, hard, persistent: fls. large,  $1\frac{1}{2}$ -3 in. long, showy, nodding, in short racemes, usually orange-red to crimson, with yellow tips.—The authorities recognize only 4 botanical species, but those below are horticulturally distinct from one another.

Being tenderer than the poker plant, and of more difficult culture, *blandfordias* are rarely grown in America. *B. flammea* var. *princeps* is the best kind. In New South Wales they grow in peat bogs and on shady mountain sides. During the growing season they must be shaded from bright sunshine, and during the resting season they may be placed in a light pit, in which they are not crowded or shaded by taller plants. They like a moist atmosphere and plenty of air, but not draughts. The chief element of the potting soil should be peat; if the peat is heavy, use freely; if light, use some loam, and pack firmly; if spongy, add some charcoal. Pot after flowering, in early spring, being careful not to overpot, and plan to leave roots undisturbed for two years at least. A top-dressing each year and liquid manure during growing season, is necessary to produce a good flowering. Perfectly hardy in central Florida when grown in lath-houses.—Propagation is by seeds sown in sandy peat with mild bottom heat, or usually by careful and not too frequent divisions of the root, made in early spring, after flowering, at the time of repotting, and preferably when strong offsets are formed.

A. *Margin of lvs. not roughish.*

**Cunninghamii**, Lindl. Lvs. 18-24 in. long, 3-4 lines wide, broader than in *B. flammea*: fls. 10-15, or even 20. Blue Mts. of Austral. B.M. 5734. Gn. 24:366.—This has been held to be synonymous with *B. grandiflora*, but it is horticulturally distinct, and the pedicels are shorter. Considered by Bentham the same as *B. grandiflora*.

AA. *Margin of lvs. roughish.*

B. *Fls. golden yellow, without any red.*

**aurea**, Hook. f. Lvs. 8-12 in. long,  $1\frac{1}{2}$ -2 lines wide: fls. 3-6, the only ones in the genus not touched with red; perianth wide-swelling, sometimes nearly as wide as long, more bell-shaped than any other species. New S. Wales. B.M. 5809.—By some considered a mere variety of *B. flammea*.

BB. *Fls. red-tubed and yellow-tipped.*

c. *Perianth long, 3-4 times as long as wide.*

**nobilis**, Smith. Lvs. 12-18 in. long,  $\frac{1}{2}$ - $\frac{3}{4}$  lines wide, dark green, sharply 3-angled: fls. 4-9, smallest of the genus, and narrowest. Near Port Jackson. B.M. 2003. B.R. 286. Var. **imperialis**, Hort. Fls. bright orange-red, margined with yellow or gold; larger than the type.

**flammea**, Lindl. Lvs. 12-18 in. long, 2-2 $\frac{1}{2}$  lines wide: fls. 4-12, typically constricted near the base of the tube and much lower down than in *B. Cunninghamii*. E. Austral. B.M. 4819. P.M. 16:353. F.S. 6:585; 18:1829 (as *B. Cunninghamii*). Var. **princeps**, Baker (*B. princeps*, W. G. Smith), has larger and brighter-colored fls. and is the best of the genus. The perianth is longer and less spreading than in the type, and swells very gradually from the base, instead of being constricted near the base. B.M. 6209. F.M. 1875:170. F.S. 22:2314. Gn. 47:324.

cc. *Tube short, scarcely twice as long as wide.*

**grandiflora**, R. Br. Lvs. 12-18 in. long, 3-4 $\frac{1}{2}$  lines wide: fls. 10-30. Distinguished from all others by having the filaments inserted instead of at the middle, but in var. **intermedia**, Baker, which connects *B. grandiflora* and *B. nobilis*, the filaments are inserted at the middle of the tube, the lvs. are narrower, and the fls. smaller.

Tasmania. B.R. 924.—The name *B. grandiflora* is now a misnomer, as the fls. are smaller than in any other species except *B. nobilis*.

*B. cordata*, Andr.—*Galax aphylla*.

WILHELM MILLER.

**BLANKET FLOWER**, *Gaillardia*.

N. TAYLOR.†

**BLAZING STAR**: *Liatris*; also *Mentzelia*.

**BLÉCHNUM** (Greek name for some fern), *Poly-podiaceæ*. Rather coarse greenhouse ferns, with pinatifid or pinnate lvs., and rows of almost continuous sori parallel to the midvein and close to it, covered with a membranous indusium. *Blechnum* is here recognized as including the species sometimes classified under the generic name *Lomaria* in addition to those species which all writers agree to put in *Blechnum*. The differences on which *Lomaria* has been based are very slight and are not recognized by leading European fern students. Besides, if the species included in *Lomaria* are kept separate, it is practically certain that they must be classified under the older name *Struthiopteris*.

In *Blechnum* occurs a singular knot in nomenclature. Linnaeus described two species in 1753, and to the West Indian one he gave the name *B. orientale*, citing figures, etc., showing that it is the plant that recent writers call *B. occidentale*. His East Indian plant he similarly called *B. occidentale*. The normal or ordinary usage has been followed below, the name *B. orientale* being given to the eastern plant.

*Blechnums* will thrive in almost any compost, but their leaves quickly turn brown and then black if watered overhead. Propagation of *Blechnum* is effected by spores.

*Blechnums* are very useful to florists for jardinières, and for specimen ferns. To attain best results, it is necessary to maintain an abundance of moisture at the roots, with a drier atmosphere than most other ferns require, to prevent leaves from turning brown during winter months. Average temp. 60° to 65° F. Soil, equal parts of rich loam and leaf-mold or peat. The spores of most *blechnums* germinate very freely if sown on a compost of loam and leaf-mold or peat in equal parts, and placed in a moderately moist and shady position in a temperature of 60° to 65° F. Some of the species send out creeping rhizomes, which develop young plants at the ends. When of sufficient size these may be detached and potted, and in a short time they will develop into good specimens. Some very attractive species are found among the hardy British *blechnums*. (N. N. Bruckner.)

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A. *Fertile lvs. not strongly different from the sterile lvs.*

B. *Pinnæ strongly decurrent at the base, joining with the one next below.*

1. **brasiliense**, Desv. Fig. 582. Growing from a stout, slightly arborescent trunk 1 ft. or more long: lvs.



582. *Blechnum brasiliense*.

2-3 ft. long, 1 ft. or more wide, with the pinnæ set at an acute angle with the rachis, the lower much shorter and more distant. Brazil. S. 2:4.—Rather tender in Cent. Fla. and needs protection during winter.

2. *nítidum*, Presl. Habit of *B. brasiliense*, but much smaller: lvs. pinnate; pinnæ oblong-falcate, thickish, 2-4 in. long, serrate. Brazil.—Plants 1-2 ft. high.

3. *corcovadense*, Raddi. Pinnæ not cut to the rachis, much crowded and shorter than the last; longest pinnæ less than 6 in. long, attenuate at the tips; lvs. crimson when young, and gradually turning to a metallic hue before becoming permanently green. By some considered a variety of *B. brasiliense*. Brazil. Var. *crispum*, Hort., with wavy edges, may be commoner in cult. than the type.

BB. Pinnæ contracted at the base to the midrib, forming a very short stalk.

4. *occidentale*, Linn. Fig. 583. Lvs. from an erect rigid st., which is covered with brownish scales, 9-18 in. long, 4-6 in. wide, with the pinnæ truncate or even cordate at the base and slightly falcate. Mex. and W. Indies to Brazil.—A beautiful small fern.

5. *serrulatum*, Rich. Growing from an ascending nearly naked rootstock: lvs. 1-2 ft. long, 6-15 in. wide, with numerous narrow pinnæ, which are contracted at the base and of nearly uniform width throughout; margins finely serrulate; texture coriaceous. Fla. to Brazil.—Especially adapted for the edges of boggy ponds, river banks and the like. Soon forms dense clumps 2-3 ft. high.

AA. Fertile lvs. distinct from sterile lvs., very much narrower. (*Lomaria*.)

B. Plant with an erect rigid st.

C. Lvs. 6-12 in. long.

6. *Moorei*, C. Chr. (*Lomaria ciliata*, Moore). St. 6 in. high, 1½ in. thick: stipes blackish: lvs. 8-12 in. long, the upper pinnæ with a rounded auricle at the lower side of the base;

fertile lvs. narrow-linear. New Caledonia.

7. *lanceolatum*, Sturm. St. elongate, densely clothed with dark brown scales: lvs. 6-12 in. long, 2-4 in. wide, with close, slightly falcate pinnæ; texture leathery; fertile pinnæ linear spreading. Austral. and Polynesia.

CC. Lvs. 1½-3 ft. long.

D. Lower pinnæ connected at base.

8. *discolor*, Keys. St. ascending: stipes black, glossy, with dense scales at base: lvs. 1½-3 ft. long, 4-6 in. wide, with pinnæ narrowed suddenly toward the point; fertile pinnæ narrower and shorter. Austral. and New Zeal.

9. *gibbum*, Mett. St. 2-3 ft. high: stipes short, with black scales: lvs. 2-3 ft. long, 6 in. wide; fertile pinnæ narrower, 4-6 in. long. Var. *platyptera* is advertised. *L. intermedia*, Hort., may be derived from this species. New Caledonia.

DD. Lower pinnæ narrowed at base and distinct.

10. *tabulare*, Kuhn (*Lomaria Boryana*, Willd.). St. stout, erect 1-2 ft. high, woody, densely scaly: lvs. 1½-2 ft. long, 6-8 in. wide, narrowed and sometimes auricled at base; fertile pinnæ narrow-linear, close. W.

Indies to Patagonia, Mauritius and S. Afr.—Probably includes 2 or 3 species, among them *L. zamiaefolia*, Hort.

BB. Plant with a stout, short, creeping rhizome.

11. *spicant*, With. Sterile lvs. lanceolate, 6-9 in. long, 1-1½ in. wide, gradually narrowed below; fertile lvs. 1 ft. long, with longer stalks (6-9 in.) and narrowly linear pinnæ. Eu., W. N. Amer.—The large Californian form with lvs. 2-3 ft. long is possibly a distinct species. The European plant was early called *Struthiopteris spicant* by Scopoli, by which name it is now cited as the earliest generic name. Hardy; needs deepest shade. *Lomaria nipponica*, Kunze, Japan, usually larger than preceding, is much like it in other respects and probably is better to be considered as a form of *B. spicant* rather than as a distinct species.

*B. orientale*, Linn., is a large E. Indian and Polynesian fern with lvs. often 3 ft. long.—Well worthy of cult.

L. M. UNDERWOOD.

BLEEDING HEART: *Dicentra*.

R. C. BENEDICT.†

BLÉPHARIS (Greek, *eyelash*; referring to fringed bracts). *Acanthaceæ*. A large (80 species) genus of dwarf, often spiny shrubs and herbs, allied to *Acanthus*, and of similar culture. Fls. in bracted spikes; calyx cruciate, 4-parted nearly to the base, the 2 inner sepals much shorter than the outer; corolla short-tubed, the limb blue or white; caps. ellipsoid, flattened and woody.

*carduifolia*, T. Anders. (*Acanthus carduifolius*, Linn. *Acanthodium carduifolius*, Nees). Plant villous: lvs. lanceolate, sinuate-dentate, spiny: spike terminal, cylindrical: bracts roundish, palmately 5-spined at the apex. S. Afr.—Not commonly cult.

N. TAYLOR.†

BLEPHAROCALYX (*eye-lash* and *calyx*, probably referring to a fringed condition). *Myrtaceæ*. Woody plants, differing from *Myrtus* in having a thin crustaceous testa of the seed instead of a thick and horny one, and other minor characters, and by some authors united with that genus. There are about 30 species in S. Amer., but very little known in cult. B. *spiræoides*, Stapf (*Eugenia myriophylla*, Hort.), is a much-branched shrub, 9 ft. high, free-flowering: lvs. lance-linear, ¾ in. or less long: fls. small, pale yellow, in terminal panicles; petals 4. Brazil. B.M. 8123.

BLÉTIA (named for Louis Blet, a Spanish botanist). *Orchidaceæ*. Terrestrial orchids with globose or depressed pseudobulbs, from the apex of which arises a leafy st.; mostly hothouse plants.

Leaves plicate-veined: fls. borne on a lateral leafless st.; sepals and petals spreading, similar, or the latter broader; lip attached to the base of the column, 3-lobed, the lateral lobes erect, the middle lobe spreading, the disk with several entire or denticulate-crisped ridges; pollinia 8.—A genus of about 20 species in Trop. Amer.

A. Middle lobe of lip much crisped.

B. Petals as wide as sepals: fls. rose.

*verecúnda*, R. Br. Lvs. up to 3 ft. long, 2-4 in. wide: scape 2-4 ft. tall, the upper portion a raceme or panicle of numerous rose-colored fls. W. Indies and Fla. G.C. II. 26, p. 141. B.M. 3217 (as *B. acutipetala*).

BB. Petals broader than sepals, undulate: fls. deep purple.

*Shépherdii*, Hook. Lvs. up to 2 ft. long, 3-4 in. broad: scape, 2-3 ft. tall, the upper portion a raceme or panicle of numerous deep purple fls.; sepals oblong, acute, the petals broader, undulate; lip with the lamellæ white. Jamaica. B.M. 3319. P.M. 2:146.

AA. Middle lobe of lip not crisped.

*Sherrattiána*, Batem. Lvs. up to 4 ft. long, 3-4 in. broad: fls. bright rose, in a raceme of 10 or more; sepals oblong-lanceolate, obtuse; petals much broader,



rounded at apex; middle lobe of lip not crisped, deeply emarginate. Colombia. B.M. 5646.

*B. campanulata*, La Llave & Lex. Fls. bell-shaped, purple, with white center. Mex.—*B. hyacinthina*, R. Br.=*Bletilla*.—*B. patula*, Hook. Fls. up to 2 in. across, deep pink. Said to be a native of Haiti. B. M. 3518.—*B. Tankervillei*, R. Br.=*Phaius*.

GEORGE V. NASH.

**BLETILLA** (diminutive of *Bletia*). *Orchidaceæ*. Terrestrial orchids with pseudobulbs, and a leafy st. with a terminal infl.: sepals and petals nearly alike, somewhat spreading; lip 3-lobed, furnished with lamellæ, the lateral lobes surrounding the slender column; pollinia 8.—Outdoor orchids.

**hyacinthina**, Reichb. f. (*Bletia hyacinthina*, R. Br.). Pseudobulbs tuberiform: sts. up to 1 ft. tall, with 3-6 plaited lvs.: fls. racemose, on short pedicels; sepals and petals amethyst-purple; lip 3-lobed, amethyst-purple, the middle lobe nearly quadrate, denticulate. China and Japan. Gt. 15:527. Gn. 16:416. B.R. 33:60 (as *Bletia Gebina*). B.M. 1492 (as *Cymbidium*).—Grows beautifully in half-shady, moist places, soon forming large clumps. Prop. by division of the clumps.

GEORGE V. NASH.

**BLIGHIA** (W. Bligh, British mariner, who wrote on a journey in the South Seas, 1792). *Sapindaceæ*. Trees and shrubs with pinnately compound lvs. and axillary, racemose fls.; differs from *Cupania* in having a deeply cut calyx (rather than separate sepals) with the parts only slightly imbricate, and also in the fr.—One species in Guinea, now naturalized in the W. Indies, and yielding the akee, a 3-parted fr. with edible red aril that is much improved by cooking. The fls. are so fragrant as to deserve distilling. The tree reaches a height of 30 ft., and is cult. in Jamaica to an altitude of only 3,000 ft., but can endure slight frost. It is also cult. in S. Fla.

**sápida**, Kon. (*Cupania sápida*, Voigt.). **AKEE TREE**. Fig. 584. Lfts. 3 or 4 pairs, obovate-oblong, entire, veined; fls. pubescent, the oblong petals white and rather showy, bearing scales and stamens.

N. TAYLOR.†

**BLIGHT**. An indefinite term, popularly used to designate any sudden and inexplicable death of plants. The term is now restricted by botanists to parasitic diseases. These diseases are of two classes,—those due to bacteria or microbes, and those due to parasitic fungi. For an account of these troubles, see *Diseases*.

**BLITE**: *Chenopodium*.

**BLOODROOT**: *Sanguinaria*.

**BLOOMÈRIA** (named for Dr. H. G. Bloomer). *Liliaceæ*. Small summer-blooming bulbous plants of the allium kind.

A genus of 2 species, natives of S. Calif. In every way they are closely allied to *Brodiaea*, but differ in having the perianth parted nearly to the base. Bloomerias have a flattish corm, much like *Crocus*, covered with fiber, and not

often producing offsets. The lvs. are radical, slender, and grass-like: scape slender but stiff, 6-18 in. high, naked, except for short bracts beneath the many-rayed umbel; pedicels slender, jointed; fls. nearly rotate, less than an inch across, orange.

Bloomerias prefer a sandy, warm and well-drained soil. In northern California, with a minimum temperature of 15° above zero, they are perfectly hardy. In a colder climate, a covering of straw or leaves or a position in the coldframe would be a judicious precaution. Plant early, and see that the soil is light and sweet. They like the sun, and are good for forcing. The light soil and warmth of a pot more nearly approximates natural conditions than the open ground does in cooler climates. After ripening, it is best to dig and replant in fall. The seeds grow readily, and the plants flower in three to four years.

**aùrea**, Kellogg. Fig. 585. Scape roughish, 6-18 in.: lf. 1/4-1/2 in. broad: fls. numerous, bright orange, in a dense umbel; stamens nearly as long as the perianth,



585. *Bloomeria aurea*. (× 1/4)

the filaments dilated at the base. B.M. 5896 (as *Nothoscordum aureum*). G.C. III. 20:687.

**Clèvelandii**, Wats. More slender: lvs. 3-7: fls. smaller, keeled with brown, the stamens shorter. G.C. III. 20:687.—Less valuable than the other.

CARL PURDY.

**BLUEBELL**: *Campanula*.

**BLUEBERRY-CULTURE**. Fig. 586. Blueberries are fruit-bearing shrubs of the genus *Vaccinium*, long gathered wild in North America in great quantities and now about to be cultivated with success.

Success in blueberry-culture rests especially on the recognition of two peculiarities in the nutrition of these plants: first, their requirement of an acid soil; second, their possession of a root-fungus that appears to have the beneficial function of supplying them with nitrogen.

If blueberries are planted in a soil with an alkaline or neutral reaction, such as the ordinary rich garden or fertile field, it is useless to expect their successful growth. In such a situation they become feeble and finally die. Blueberries require an acid soil, and they thrive best in that particular type of acid soil which consists of a mixture of pure sand and peat. The peat may be of either the bog or the upland sort.

Good aëration of the soil is another essential. It is commonly but erroneously supposed that the swamp blueberry (*Vaccinium corymbosum*), the species chiefly desirable for cultivation, grows best in a permanently wet soil. It is to be observed, however, that the wild plants of the swamps occupy situations which though perhaps submerged in winter and spring are exposed during the root-forming period of summer and autumn, or, when growing in permanently submerged places, they build up a hummock or a cushion of moss which rises above the summer water-level and within which the feeding-roots of the bush are closely interlaced. In actual culture, moreover, it has been found that the swamp blueberry does not thrive in a permanently wet or soggy soil.



584. *Blighia sapida*. (× 1/6)

Although some species of *Vaccinium*, such as the common low-bush blueberry, *V. pennsylvanicum*, grow and fruit abundantly in sandy uplands that are subject to drought, the swamp blueberry grows best in soils naturally or artificially supplied with adequate moisture.

These then are the three fundamental requirements of successful blueberry culture: (1) An acid soil, especially one composed of peat and sand; (2) good drainage and thorough aëration of the surface soil; and (3) permanent but moderate soil-moisture. Under such conditions, the beneficial root-fungus which is believed to be essential to the nutrition of the plant need give the cultivator no concern, for it will propagate itself spontaneously and adequately, without any necessity of soil or plant inoculation.

#### Propagation.

Blueberry plantations may be formed by the transplanting of unselected wild bushes or by the growing of seedlings, but such a course is not the best. Seedling plants, even from the largest-berried parents, produce small berries oftener than large ones. Until nurserymen are prepared to furnish plants asexually propagated from superior stocks, the cultivator should begin by the transplanting of the best wild bushes, selected when in fruit for the size, color, flavor, and earliness of the berry, and the vigor and productiveness of the bush. These he should propagate by layering and by cuttings until his plantation is completed. By means of a combination of these two methods, a valuable old plant can be multiplied by several hundred at one propagation, the fruit of the progeny retaining all the characteristics of the parent.

Large berries cost less to pick than small ones and bring a higher price. A berry  $\frac{1}{2}$  of an inch in diameter has already been produced under cultivation and others of still larger size are to be expected.

While grafting and especially budding are useful in experimental work, neither method is suitable for commercial plantations because blueberry bushes are continually sending up new and undesirable shoots from the stock. The best season for budding is from the middle of July to the end of August. The budded plants should be protected from direct sunlight, and special care should be taken that the raffia wrapping does not become wet for the first three weeks.

The easiest way to propagate the swamp blueberry is by a special process of layering known as "stumping." In early spring, preferably before the buds have begun to push, all the stems of the plant, or as many as it is desired to sacrifice for propagation, are cut off close to the surface of the ground. The stumps are then covered to the depth of 2 inches with a mixture of about four parts of clean sand and one of sifted peat. The sand-bed must not be allowed to become dry, except at the very surface. The new growth from the stumps, which without the sand would consist of stems merely, is transformed in working its way through the sand into scaly, erect or nearly erect rootstocks which on reaching the surface continue their development into leafy shoots. Although roots are formed only sparingly on the covered bases of stems, they develop quickly and abundantly on these artificially produced rootstocks. By the end of autumn the shoots are well rooted at the base. They should remain in place in the sand-bed through the winter, exposed to freezing temperatures. Early in the following spring, before the buds have begun to push, each rooted shoot is carefully severed from the stump. The upper portion of the shoot is discarded, the cut being made at such a point as to leave on the basal portion about three buds above the former level of the sand-bed. The rooted shoots are potted in clean 3-inch porous pots in a soil consisting of two parts of rotted upland peat to one of sand and one of clean broken crocks. They are then plunged in

sand in a shaded coldframe or greenhouse, with abundant light but no direct sunlight. For the first two months the temperature should be kept below 65° F. When subjected to high temperatures, the newly cut shoots are liable to die and rot from the base upward. Watering should be infrequent, only sufficient to keep the soil moist but well aërated. The frame should receive ventilation but not enough to cause the new twigs to droop. They are very susceptible to over-ventilation and overheating just before they complete their primary growth. After the new twigs have stopped growing and their wood becomes hard, new root-growth takes place. Then secondary twig-growth follows. Not until this has occurred is the life of the plant assured. Those plants that make sufficient growth to require repotting during the first summer should be transferred to clean pots of 2 inches larger diameter in a standard blueberry soil mixture.

A very successful potting mixture, or nursery-bed mixture, for blueberry plants consists of one part of clean or washed sand, nine parts of rotted upland peat, either chopped or rubbed through a sieve, and three parts of clean broken crocks. No loam and especially no lime should be used. Manure is not necessary, and in the present state of our knowledge may be regarded as dangerous, although in small amounts it serves to stimulate the plants, at least temporarily. The danger from manure apparently lies in its tendency to produce an alkaline condition in the soil.



586. Swamp Blueberry. A cluster of berries on a budded greenhouse plant. ( $\times \frac{1}{2}$ ).

The use of crocks in the potting mixture is based on the fact that the rootlets seek them and form around them the same mats that they form at the wall of the pot, thus increasing the effective root-surface and the vigor of growth.

The peat most successfully used for potting blueberry plants is an upland peat procured in kalmia, or laurel, thickets. In a sandy soil in which the leaves of these bushes and of the oak trees with which they usually grow have accumulated and rotted for many years untouched by fire, a mass of rich leaf-peat is formed, interlaced by the superficial rootlets of the oak and laurel into tough mats or turfs, commonly 2 to 4 inches in thickness. These turfs, ripped from the soil and rotted from two to six months in a moist but well aërated stack, make an ideal blueberry peat. A good substitute is found in similar turfs formed in sandy oak woods having an underbrush of other ericaceous plants than laurel. Oak leaves raked, stacked, and rotted for about eighteen months without lime or manure are also good. The leaves of some trees, such as maples, rot so rapidly that within a year they may have passed from the acid condition necessary for the formation of good peat to the alkaline stage of decomposition, which is fatal to blueberry plants. Even oak leaves rotted for several years become alkaline if they are protected from the addition of new leaves bearing fresh charges of acidity.

By ordinary methods, cuttings of the swamp blueberry have been rooted only in occasional instances. Two successful methods, however, have been especially devised for these plants. The most novel of these but the one



easiest of operation is that of "tubering." This method involves the same principle as that employed in stumping, namely the forcing of new shoots in such a manner that their basal portions are morphologically scaly rootstocks, with a strong rooting tendency. This method of propagation from stem cuttings is called tubering because the treatment as well as the behavior of the cuttings is essentially identical with that which takes place in reproduction from tubers, as in the case of the potato.

The cuttings are made in late winter or early spring, and the whole plant may be used, including old stems an inch or more in diameter. With a saw and knife cut the wood in pieces about 4 inches long. Lay these horizontally in a shallow, well-drained box containing a bed of clean sand and cover them with half an inch of the same material. Water the sand well, cover the box with glass, and keep it at a temperature of 60° to 65°, or less if the equipment does not permit the maintenance of such a temperature. The sand-bed must be kept moist, although if there are only slight apertures beneath the glass, a second watering may not be required for several weeks.

At the temperature already specified, shoots should begin to appear above the sand within six weeks. The boxes should then be placed in good light but protected from direct sunlight, and, when warm weather approaches, they should be given the coolest situation available so as to keep the temperature below 65° as long as practicable. When the first shoots have stopped growing and their foliage has turned to a mature green color, they are ready to produce roots. A half-inch layer of finely sifted rotted peat should then be added to the surface of the sand-bed and thoroughly wet down with a fine spray. The box should remain in this condition, with a little ventilation but a saturated or nearly saturated atmosphere, until new shoots cease to appear. Meanwhile, during the spring and early summer the older shoots will have formed roots between the surface of the ground and the point at which they sprang from the cutting. After a shoot is well rooted it will make secondary twig-growth, and if the development of roots has not already been ascertained by direct examination, the making of such secondary growth is good evidence that rooting has actually taken place. If the rooted shoots have not already disconnected themselves from the dead cuttings they should be carefully severed with a sharp knife. They are then potted in 2-inch pots in the standard blueberry soil mixture already described, and during a period of three or four weeks they should be gradually changed from their saturated atmosphere and full shade to open air and half sunlight. If preferred, the shoots may remain in the original cutting-bed until the following spring, before potting, the cutting-bed being exposed to freezing temperatures during the winter.

When blueberry plants, either large or small, are grown in porous pots, the surface of the pot should never be allowed to become dry, for the rootlets, which grow through the soil to the wall of the pot for air, are exceedingly fine and easily killed by drying, to the great injury of the plant. This danger may be eliminated by plunging the pots to the rim in a well-drained bed of sand, or by setting the pot in another pot of 2 to 4 inches greater diameter, with a packing of moist sphagnum between, and crocks at the bottom.

A burning of the young leaves and growing tips of twigs is often produced by the hot sun from the middle of June to the middle of September. Plants in pots or nursery beds are easily protected from such injury and forced to their maximum growth by a half-shade covering of slats, the slats and the spaces between being of the same width. On cloudy days the shade should be removed. It should not be used in fall or spring.

During the winter the rooted cuttings or one-year-old plants should be kept outdoors, exposed to freezing temperatures, their soil mulched with leaves, preferably oak leaves. When kept in a warm greenhouse during the winter they make no growth before spring. Even then their growth is abnormal, often feeble, or sometimes deferred for a whole year.

Plants from cuttings or rooted shoots are ready for permanent field planting when they are two or three years old and about 1½ to 2 feet high. They are best set out in early spring before the buds have begun to push.

#### *The field plantation.*

It is a curious fact that these plants send out no new roots in spring until they are in full leaf, their flowering is nearly or quite finished, and their principal twig-growth has ceased. It is important, therefore, in taking up either a wild or a cultivated plant from the open ground, that as much as possible of the old root-mat be lifted with the plant, for upon this they depend for moisture until their new rootlets are formed.

In the case of mature wild bushes with very large root-systems, when it is practicable to secure but a fraction of the root-mat, say a disk only 3 or 4 feet in diameter, it is the best procedure to cut all the stems to the ground at the time of transplanting. The bush will then produce a new and symmetrical top of a size suited to the capacity of the roots. The wood that is removed may be used for cuttings if the plant is sufficiently valuable.

A plant pollinated with its own pollen, or with pollen from its asexual offspring, produces fewer, smaller, and later berries than a cross-pollinated plant. In a field of plants propagated from cuttings or layers, two parent stocks should be used, a row of plants from one stock being followed by a row from the other.

In the permanent field plantation the bushes should be set 8 feet apart each way. When they reach mature size they will nearly or quite cover the intervening spaces.

To secure full vigor of growth, the ground between the bushes must be kept free from all other vegetation. On rocky uplands a continuous mulch of oak leaves, when it is practicable to secure them, will help toward this end as well as keep the soil in the necessary acid condition. It is more economical, however, to choose such a location for the plantation as will permit the use of horse-drawn machinery, and will make mulching unnecessary.

The most favorable location for blueberry-culture is a boggy area with a peat covering and sand subsoil, the peat preferably of such a thickness that a deep plowing will turn up some of the underlying sand.

The land should be so ditched that the water-level can be kept at least a foot below the surface of the ground during the growing season or can be raised for subirrigation during a drought.

The ground should be plowed to the depth of about 8 inches and repeatedly harrowed during the season preceding the planting, in order to kill the vegetation. After the plants are old enough to have formed a root-mat, the harrowing should be very shallow, not more than 2 or 3 inches, so that the roots will not be injured.

By proper manipulation in the greenhouse, seedling blueberry plants can often be made to ripen a few berries in less than a year, but they do not come into commercial bearing in field plantations until they are about five years old, when the plants are 3 to 4 feet high. They then increase slowly to full size and full bearing.

The field plantings resulting from the recent experiments in blueberry culture are too young to show the mature yield. Fortunately, however, there has been found, near Elkhart, Indiana, a small blueberry plant-

ing of mature age, believed to be the only commercial plantation in existence, which sets forward our knowledge of yields by at least a decade. The plantation is a little less than two and a half acres in extent. It was started in 1889 in a natural blueberry bog, which was first drained and then set with unselected wild blueberry bushes. Exact records of yield and receipts are available only for the years 1910 to 1912. They are as follows:

Year	Yield Qts.	Price (approx. avg. per qt.)	Receipts
1910 (a year of "almost total failure" because of late spring freezes) . . . . .	1040	17 1/8 cts.	\$178 25
1911 . . . . .	5620	12 7/8 cts.	725 25
1912 . . . . .	5900	12 7/8 cts.	758 25

The annual expenses for weeding, cultivation, and irrigation were about \$50. The cost of picking was 5 cents a quart. The general cost of maintenance of the equipment was about \$5 per year, the crates and boxes being used repeatedly.

Estimating an annual charge of \$30 for interest, \$5 for taxes, and \$10 for depreciation, the profits for these three years are computed as follows:

Year	Profits per acre
1910 . . . . .	\$10
1911 . . . . .	139
1912 . . . . .	147

It must be borne in mind that these figures are based on the yields from wild bushes transplanted without selection as to individual productiveness or the size of the berries. With bushes propagated from selected stocks, the yield should be greater and the berries much larger, this greater size probably effecting a reduction in the cost of picking and certainly an increase in the selling price.

FREDERICK V. COVILLE.

BLUE FLAG: *Iris*.

BLUETS: *Houstonia*.

**BLUMENBÁCHIA** (after Dr. J. F. Blumenbach, professor at Göttingen, 1752-1840). *Loasacæ*. S. American plants allied to *Loasa* and *Mentzelia* (prairie lilies), not cult. in Amer. because of their covering of stinging hairs. The fls. are odd and pretty, axillary, solitary and bracteate: lvs. opposite, lobed. The garden forms are mostly treated as tender annuals. Prop. by seeds, to be sown in pots in spring. Transplant only when danger from frost is over.

*B. chuquitensis*, Hook. f. Lvs. 8-10 in. long: fls. 1 1/2-2 in. long, brick-red, tipped yellow without, and yellow within; petals 5-10, boat-shaped. Peru, Ecuador. F.S. 22:2358. B.M. 6143.—*B. coronata*, Haage & Schmidt. 1 1/2 ft.: lvs. narrow, bi-pinnatifid: fls. half hidden by the lvs., 2 in. diam., pure white. R.H. 1874, p. 58. F.M. 1874. 139.—*B. grandiflora*, Don (B. contorta, Hook. f. B.M. 6134). Lvs. 4-6 in. long: fls. 1 1/2-2 in. long, wholly red; scales 1/2 in. long, cup-shaped, green; stamens in 5 bundles, with long filaments. Peru. *B. insignis*, Schrad. St. climbing, 4-sided: petals white, unguiculate. B.M. 2865.—*B. intertia*, Brit. (Cajophora lateria, Benth.) Lvs. pinnate, with roundish lobed lflets: fl-stalks, twin, single-fld.: fls. orange-red. S. Amer. B.M. 3632. B.R. 24.22.

N. TAYLOR.†

**BOCCÒNIA** (after Dr. Paolo Bocconi, Sicilian botanist and author). *Papaveracæ*. PLUME POPPY. TREE CELANDINE. Tall garden herbs, suitable to the hardy border.

Herbs, but sometimes almost shrubby, glaucous: lvs. lobed: fls. small, many, in terminal panicles; sepals 2, colored; petals wanting; stamens many: fr. a stalked caps., few-seeded.—Four or 5 species in American tropics, and China and Japan. The well-known China-Japanese species, *B. cordata*, is by some recent authors referred to *Macleya*, *B. frutescens* and *B. integrifolia*

(latter apparently not cult.) representing *Bocconia* as limited.

The large, handsome leaves remind one, by their texture and lobing, of bloodroot and *Stylophorum*, which belong to allied genera. The flowers are very unlike our common poppies, being small and without petals, but they are borne in great feathery or plummy masses, in terminal panicles raised high above the heavy foliage, making the plant unique in its picturesque general appearance. Hence, it is much used for isolated lawn specimens, or for very bold and striking effects, being especially adapted to be viewed at long distances. It is also placed in shrubberies, wild gardens, and at the back of wide borders. It spreads rapidly by suckers, any of which, if detached, will make a strong plant in a single season. The plume poppy seems to be much hardier in America than in the Old World. It was popular early in the century, but was neglected,



587. *Bocconia cordata*.

probably because it spread so rapidly. Lately it has become popular again. It deserves to be permanently naturalized in the American landscape. To produce the largest specimens, it is well to plant in very rich soil, give the old clumps liquid manure in spring, and cut off the suckers. Propagation chiefly by suckers. See *Pflanzenreich*, hft. 40, p. 217 for the latest monograph.

*cordata*, Willd. (*B. japonica*, Hort.). Fig. 587. Hardy herbaceous perennial: height 5-8 ft.: lvs. large, glaucous, heart-shaped, much lobed, deeply veined: fls. pinkish; stamens about 30. China, Japan. B.M. 1905. Gn. 54, p. 279. Gng. 5:342.

*microcarpa*, Maxim. Perennial, 9 ft.: fls. golden brown or bronzy, in immense panicles, summer: lvs. much as in *B. cordata*. N. China. R.H. 1898, p. 362, f. 125.

*frutescens*, Linn. Perennial, somewhat shrubby, 4-9 ft.: lvs. pinnatifid, pale green, often glaucous beneath, ovate-oblong, cuneate at the base, 6-12 in. long: fls. greenish, the panicle often a foot long. Oct. Mex. and Peru. L.B.C.: 83.—Intro. by Franceschi in 1895.

*B. integrifolia*, Humb. & Bonpl. 9 ft.: fls. greenish: lvs. nearly entire. Peru. Is sometimes cult.—*B. macrocarpa*, *B. Giráldea* and *B. Thunbergii* are trade names, the first two referable to *B. cordata*, the last probably to *B. microcarpa*.

N. TAYLOR.†



**BOËA** (name obscure, probably personal). Sometimes spelled *Boëa*. *Gesneriaceæ*. Allied to *Streptocarpus*, sometimes found in choice collections. Differs from *Streptocarpus* in having a short corolla-tube and a broadly campanulate fl., no disk, and very minor characters. Boeas are perennial herbs with ovate or oblique lvs. radical or opposite on a very short st.: peduncles axillary or elongated leafless scapes, the fls. small or medium in size, blue.—Species 16–20 in E. Asia and to Austral. and Seychelles. **B. Clarkeana**, Hemsl., from China, has been offered in the trade: lvs. radical, roundish, strongly crenate, petioled, bronze-green above and maroon-red beneath: fls. 3–4 on each peduncle, clear azure-blue with a whitish spot.

**BOEHMERIA** (G. R. Boehmer, a German botanist). *Urticaceæ*. A fiber plant; and a greenhouse shrub or tree.

Leaves alternate or opposite, often 3-nerved: fls. monœcious or dioecious, in dense clusters; petals none; sepals 2–5: fr. a flattened achene. *B. nivea*, Gaud., of Trop. Asia, is cult. in some countries as a fiber plant, and has been intro. into this country for that purpose. Now grown extensively in Calif. and La. for its fiber. See Report No. 2, office of Fiber Investigations, U. S. Dept. Agric., and *Cyclo. Amer. Agric.* II, p. 284. It produces ramie. It is a strong-growing, large-lvd. perennial, well suited to the border as an ornamental subject. A genus of 45 widely distributed species of shrubs, trees or herbs.

**argentea**, Lind. Fig. 588. Tree, 10–30 ft.: lvs. alternate, ovate, long-acuminate, 8–10 in. long, 3–5 in. wide, usually silvery: fls. in an axillary compound catkin-like cluster, 6–10 in. long. Mex.—An excellent warmhouse plant, cult. mostly in botanic gardens, but worthy of wide attention.

*B. macrophylla*, Don. A shrub or small tree: lvs. lanceolate, 6–9 in. long, serrate, prominently 3-nerved: spikes slender, usually shorter than the lvs. Himalayan region. N. TAYLOR.

**BOG-GARDENING.** The growing of plants in swamps, marsh-spots and bogs: distinguished from water-gardening or aquatic-gardening in the fact that the plants are not immersed or floating but grow mostly free above the soil. When water-gardening is made to include bog-gardening, confusion in practice is likely to result because the cultural requirements are unlike.

Bog-gardens may be separate areas in themselves, or they may comprise the edges of water-gardens or the spongy ground along runnels or the margins of pools. Bog-gardening is mostly a practice in colonizing plants, finding the ones that are specially adapted to the particular place. The artistic scheme is one of informality. If the place is very soft, stepping-stones may comprise the walks. Hereabouts may be grown the many marsh and wet-land plants, many of which are showy and also little known to cultivators. The sparganiums, pontederias, some of the hibiscus (page 338), many orchids, loosestrifes, cephalanthus, utricularias, and a host of others will occur to frequenters of morasses and distant shores. L. H. B.

**BOLÁNDRA** (H. N. Bolander, Californian botanist). *Saxifragaceæ*. Two species of small W. American herbs offered for borders and wild gardens.

Flowers purplish in lax corymbs; petals 5, inserted on the throat of the 5-lobed calyx; stamens 5, alternate with petals. Delicate herbs, suitable for rockwork where there is a plentiful supply of moisture.

**oregana**, Wats. A foot or 2 high, pubescent and glandular: lvs. laciniately toothed and lobed: fls. deep purple; tube of the calyx equaling the teeth and a little shorter than the petals: pedicels reflexed in front. Ore. and Wash.—Intro. by Gillett in 1881.

The first-described species, *B. californica*, Gray, seems not to have been offered in the trade. It is a smaller species, less pubescent

with smaller fls., the lower lvs. round-reniform and 5-lobed: plant 3–12 in. high, the sts. weak and slender.

**BOLDÔA FRAGRANS**, cult. in S. Calif.: *Peumus*.

**BOLËTUS**: *Mushroom*.

**BOLLEA** (in honor of Dr. Karl Bolle). *Orchidaceæ*. Epiphytic greenhouse orchids without pseudobulbs, with flat lvs., and lateral 1-fl. peduncles: sepals and petals nearly alike, spreading, the lateral sepals forming a distinct chin; lip articulated to the column-foot, entire, the margin revolute, furnished with a thick ridged plate, over which the stout column extends; pollinia 4.—A Trop. American genus of 4 species.

*A. Recurved tip of lip purple.*

**violaceum**, Reichb. f. (*Hüntleya violacea*, Lindl. *Zygopetalum violaceum*, Reichb. f.). Fls. deep violet; sepals and petals broad, undulate; lip ovate, cordate, the tip recurved. British Guiana. F.S. 7:678. P.M. 8:1.



588. *Boehmeria argentea*.  
( $\times \frac{1}{2}$ )

*AA. Recurved tip of lip yellow.*

*B. Fls. violet or purple.*

**cælestis**, Reichb. f. (*Zygopetalum cæleste*, Reichb. f.). Lvs. up to 1 ft. long and 2 in. broad: fls. 3–4 in. across; sepals and petals bluish violet, with yellow tips, the dorsal broadly obovate; petals similar to the dorsal sepal; lip colored like the petals, the crest buff. Colombia. B.M. 6458. Gt. 31:1075. Lind. 2:61. G. 16:99. Gn. 31, p. 121.

*BB. Fls. rose-colored.*

*c. Sepals and petals light rose.*

**Pátinii**, Reichb. f. (*Zygopetalum Pátinii*, Reichb. f.). Lvs. up to 1 ft. long and 2–3 in. wide: fls. 3–4 in. across; sepals and petals light rose, undulate, the lower side of the lateral sepals darker; lip triangular-hastate, yellow. F.M. 1875:147. G.C. II. 3:9.

*cc. Sepals and petals dull rose, tipped with yellow and margined white or yellow.*

**Lalindei**, Reichb. f. (*Zygopetalum Lalindei*, Reichb. f.). Lvs. as in *B. Pátinii*, but fls. smaller and darker; lip ovate-hastate, yellow. Colombia. B.M. 6331. O.R. 8:369.

GEORGE V. NASH.

**BOLLEO-CHONDRORHYNCHA.** A cross of *Bollea cælestis* with probably *Chondrorhyncha Chestertonii*, with both of which it was found growing in Colombia, whence it was intro. to the collection of Otto Froebel of

Zurich in 1898. It has received the name *B.-C. Froebeliana*, Cogn. This natural hybrid has a slender erect peduncle 4 in. long, at the top bearing 2 membranous bracts half the length of the ovary: fl.  $3\frac{1}{4}$  in. wide, the sepals and petals lanceolate-ligulate, yellow-white, lightly tinged with rose, especially at the summit; dorsal sepal pointed, curving outward at the top, the lateral ones much incurved; petals obtuse, almost flat, curved



589. *Boltonia latiquama* ( $\times \frac{1}{2}$ )

back at the tip; lip somewhat thick and fleshy, more delicate than in *B. cernitoides*, the blade widely obovate and rounded; crest orange-yellow, with a yellowish border and an edge of brown-purple.

**BOLOCANTHUS, BOLUSANTHUS:** *Lophocarpus*.

**BOLTÔNIA** (James Bolton, English botanist). *Compositæ*. FALSE CHAMOMILE. Four or 5 species of aster-like glabrous often glaucous herbs of the United States and eastern Asia, sometimes planted in borders and wild gardens.

They are tall and leafy plants, blooming profusely in late summer and autumn, and excellent for the hardy border. They have alternate, entire and sessile or clasping lvs. and angled, often striate, sts. Differs from Aster in having very few pappus bristles which in Aster are numerous, and in other technical characters.

Boltonias are of easiest culture. They take care of themselves when once established. Propagation is effected by division. Should be better known to gardeners. They stand without staking.

**asteroides**, L'Her. (*B. glastifolia*, L'Her.). Sts. 2-8 ft., simple below and branching at the top; lvs. broadly lanceolate or the upper narrower: heads short-peduncled, numerous, the rays varying from white to violet and purple; involucre bracts lanceolate and acute, greenish; scales of the pappus numerous and conspicuous, the 2 awns sometimes missing. Pa. to Ill. and S.

B.M. 2381, 2554. Mn. 1:33. Gn. 74, p. 438. R.H. 1903, p. 59.—Perennial.

**latiquama**, Gray. Fig. 589. A handsomer plant, with larger and more showy heads with blue-violet rays: involucre bracts oblong or obovate and obtuse (often bearing a minute point); pappus scales small, the awns present and conspicuous. Kan. and Mo. to Ark. G.F. 5:271 (adapted in Fig. 589). C.L.A. 7:490. Perennial. Var. *nana*, Hort. A dwarf form scarcely 2-3 ft. tall, with pinkish rayed fls. Branches freely from the base.

*B. cantoniensis*, Franch. & Sav., is native to Japan, where the young plants are used for greens. See Georgeson, A.G. 13, p. 8, fig. 4. It is annual. Has not yet appeared in the American trade. Gray restricts *Boltonia* to the U. S., and regards his species as of another genus. *B. laevigata*, Hort. = *B. asteroides* (?).

L. H. B.  
N. TAYLOR.†

**BOLUSANTHUS:** *Lonchocarpus*.

**BOMAREA** (named after the French botanist, J. C. W. de Bomare). *Amaryllidaceæ*. Tender South American plants allied to *Alstrœmeria*, and with similar fls. but a twining habit. Lvs. parallel-veined, usually borne on short, twisted petioles: fls. in pendulous umbels, variously colored and spotted, borne in early spring and summer; perianth funnel-shaped; tube none.

The most beautiful species now grown is probably *B. Carderi*. It has large terminal cymes of rose-colored flowers, about 2 inches long, with dark purple spots and blotches. Another valuable form is *B. Shurtleworthii* with pale yellow flowers, spotted with green.

Bomareas delight in a rich, fibrous soil, and require plenty of water during the growing season, which begins early in the spring. A little well-decayed cow-manure mixed with the soil improves the growth and results in larger clusters of flowers, as does also manure watering during the growing season. Late in fall the stems are cut down to the ground and the roots are kept in the soil in a dry state. While they often make satisfactory pot-plants, they do best when planted out in an open sunny position in a cool conservatory where they have plenty of air in summer. In the south, bomareas may be grown in the open air on trellises in half-shady places. All are woodland plants and cannot be successfully grown in the glaring heat of the sun.

Propagation is by fresh seeds, which germinate readily if sown in shallow pans in a warm propagating-house; also, and more rapidly, by careful division of the rhizome, to which some of the roots should be attached.



590. *Bomarea Salsilla*.  
( $\times \frac{1}{4}$ )

A. *Perianth-segms. equal.*

B. *Umbel simple; fls. medium-sized.*

**oligantha**, Baker. Lvs. 3-4 in. long, oblong, acute, lax, thin, densely pubescent beneath: fls. 6-8 in an umbel; bracts large, lf.-like; segms.  $1\frac{1}{4}$  in. long, outer dull red, inner bright yellow with reddish brown spots. Peruvian Andes.



## BB. Umbel compound.

## c Fls. small.

**Salsilla**, Herb. (*B. oculata*, M. J. Roem. *Alstræmeria oculata*, Lodd.). Fig. 590. Lvs. 2-4 in. long,  $\frac{1}{2}$  in. broad, lanceolate or oblong-lanceolate, moderately firm, glabrous beneath: umbel 4-15-rayed; rays 1-3 in.

long, 1-3-fld.; bracts small; fls. pink or red, marked with blue and dark purple within. Chile. L. B. C. 19: 1851. B.M. 3344.

## cc. Fls. large.

## Cárderi, Mast.

Lvs. 4-6 in. long,  $1\frac{1}{2}$ -3 in. broad, oblong, acute: umbel 1 ft. long, 6-9-rayed; rays 1-4-fld.; bracts large, leafy; perianth-segms. 2 in. long, outer pale pink, spotted brown near the top, inner greenish white, much spotted. F. M. 1876: 239. G.C. II. 5:793.

## chontalénsis, Seem. Lvs. 6-8 in.

long, broadly lanceolate: umbel very large; rays 4-6-fld.; fls. numerous,  $2\frac{1}{2}$  in. long; outer segms. waxy, wavy margined, rosy red or pink with brown spots, inner ones thinner, pale greenish yellow, spotted.—The largest-fld. species; very effective when well grown.

**Shuttleworthii**, Mast. Lvs. 5-6 in. long, oblong, acute, glabrous: umbel 1 ft. long, 5-10-rayed; rays usually 3-fld.; perianth-segms. 2 in. long, outer reddish, inner greenish yellow. Colombian Andes. G.C. II. 17:77, 85.—The curious egg-shaped tubers terminate unbranched roots, which spring from a rhizome about 1 in. wide. Having no eyes or buds, they cannot be used for propagating.

## AA. Perianth-segms. not equal, the inner longer.

## B. Umbel simple.

**patacocénsis**, Herb. (*B. conferta*, Benth.). Sts. purple-tinted, pubescent: lvs. 5-6 in. long, oblong-lanceolate, pubescent beneath: fls. 20-30; outer segms.  $1\frac{1}{2}$  in. long, bright red; inner ones  $2\frac{1}{2}$  in. long, bright red, yellow-keeled, with a few spots. Andes of Ecuador and Colombia. G.C. II. 17:187. B.M. 6692.—When well grown, the umbel is very dense and many-fld.

**Caldasiána**, Herb. Lvs. thin, spreading, oblong, acute, distinctly petioled, 3-6 in. long, glaucous, puberulent beneath: umbel 6-30-fld.; bracts many, oblong-lanceolate; pedicels 1-2 in. long, pilose; outer segms. reddish brown, about 1 in. long, inner  $\frac{1}{2}$  in. longer, bright yellow. B.M. 5442 (as *Alstrænesia Caldasi*).

## BB. Umbel compound.

**vitellina**, Mast. Lvs. 3-4 in. long, ovate-oblong: umbel about 12-rayed; perianth-segms. bright yellow, outer  $1\frac{1}{2}$  in. long, inner 2 in. long; bracts large, leafy. Peruvian Andes. G.C. II. 17:151.

*B. Wrecklei*, Lemoine. Lvs. lanceolate, acuminate, bright green: fls. about 12 in a terminal umbel, vermilion—orange with orange-yellow inside. Costa Rica.

N. J. ROSE.†

**BÓMBAX** (a Greek name for *raw silk*, alluding to the cottony contents of the pods). *Bombacææ*. SILK COTTON TREE. A genus of 50 species of tropical shrubs and trees, with digitate 5-9-foliolate lvs., 1-fld. axillary

or clustered peduncles, and usually large white or scarlet fls. Specimens are rarely seen in cult. in fine glasshouses, and only 1 of the species appears to be in the American trade. The bark of some species produces commercial fiber such as the Kapok fiber.

**malabàricum**, DC. (*B. Ceiba*, Burme.). Fig. 591. Large deciduous tree, the branches in whorls, the trunk



591. *Bombax malabaricum*. ( $\times \frac{1}{6}$ )



592. Borage—*Borago officinalis*. ( $\times \frac{1}{3}$ )

and branches spiny: lvs. 5-7-foliolate, palmate, the lfts. entire, cuspidate: fls. 6-7 in. long, clustered near the ends of the branches, red or scarlet, sometimes white. fr. a 5-valved caps., silky. India.—A very showy plant, excellent for warmhouse, but tender. Intro. in U. S. by Royal Palm Nurseries in 1912. N. TAYLOR.

**BONESET**: *Eupatorium perfoliatum*.

**BOOKS**: Literature.

**BORAGE** (*Borago officinalis*, Linn.). Fig. 592. *Boraginææ*. A coarse annual plant grown for culinary use in some parts of Eu., as in Germany. Used as a pot-herb and sometimes with salads. Only the young lvs. are palatable. Mostly known in this country as a bee-plant and for its handsome blue or purplish racemed fls. It is a hairy plant,  $1\frac{1}{2}$ -2 ft. high, with oval or oblong lvs. Eu., N. Afr. Eng. Bot. 1:36. *Borago laxiflora* DC., is a small, decumbent alpine, but of easy cult., offered in the trade. It has alternate, ovate lvs., hairy throughout, and pretty, long-peduncled, purple or violet fls. Corsica. B.M. 1798.—Little known in Amer. N. TAYLOR.†

**BORASSUS** (an old name, of no significance here). *Palmææ*, tribe *Borassinæ*. Tall unarmed palms, with ringed trunks.

Leaves large, palmately flabelliform; plicate sheath short; petiole spiny; ligule short rigid: fls. small, densely packed in pits on the catkin-like branches of a spathe which comes out between the lvs.; stamens 6: fr. large, subglobose, brown.—Species 1. Trop. Afr. For cult., see *Latania*. The seeds are



593. *Borassus flabellifer*.

very hard and do not germinate readily unless given strong bottom heat and abundant moisture.

**flabellifer**, Linn. (*B. flabelliformis*, Murr. *B. æthiopicum*, Mart.). MEELALLA, a native name for young plants; called also PALMYRA PALM by the Hindoos. Fig. 593. St. 60–70 ft. high; lvs. 8–10 ft. long, broader than long; lf-segms. bifid at the apex, lanceolate or sword-shaped in outline.—Widely cult. One of the most useful palms of India. The frs. are very large. Many parts of the plant are utilized by the natives as food and in the arts. Wood black, very hard. This plant requires rich soil and strong heat for its best development, and is rather slow-growing under cult., especially while young.

N. TAYLOR.†

**BORDER.** In gardening practice, the term "border" is employed to designate definite strip-planting on the margins. The margin may be along the boundary of a yard, park or other area; close about a residence or other building; or a parallel of walks and drives. In all these positions, the border becomes a part of the artistic landscape plan. In some cases borders are designed separately as flower-garden or ornamental features, as margins or boundaries of an avenue of sold

### The hardy border.

The hardy border has assumed a new relation to ornamental planting within recent years in America. Once only occasional, it now forms a dominant part of many gardens previously given up almost entirely to the display of greenhouse plants or tender annuals. Properly designed for a specific purpose, it is capable of giving a maximum of pleasure for a minimum of effort and expense. Now that plants, especially American native plants, are coming to be valued for their intrinsic beauty and interest rather than for their rarity and cost, the hardy border is a more personal and individual expression than some other forms of garden effort.

The informal hardy border is often the most charming, and nature has provided us with many roadside or meadow-corner examples of exquisite beauty. Such a border may change not only with the day but almost from morning until afternoon during the luxuriant June weeks. It may follow the chromatic balance of the season from the brightness of spring hues through the cooler tones of summer until the rich tints of the autumn asters and goldenrods blend into the warmer colors of the aftermath that remains to enhance the effectiveness of the winter's snow in making the border a continuous pleasure. This informal planting can be handled with individuality and changed to suit knowledge, circumstance and surroundings without destroying its charm. The wild things that are picked up—let us hope without ever exterminating a plant colony anywhere—in a day's woodland ramble, belong in this informal border. Often the border is built around or with reference to some essential tree or larger shrub, as a rugged old pine, or a picturesque clump of lilac, or a mass of rhododendrons. It may combine shrubby, herbaceous and bulbous plants to advantage.

The formal hardy border has been exemplified in some notable New England gardens. It is usually formed with masses of similar plants—as a long strip of delphiniums, a great body of aquilegias, serried rows of phloxes, or lupines,—and at times is effectively combined with architectural adjuncts in the so-called "Italian" style, or with evergreen trees of formal or clipped outline. But the "barbered" formal border is passing, and even in the best American example of a formal hardy garden, made up of various borders, the edging of the daintily informal evergreen *pachysandra* gives a note of variation that is significant and pleasing. The hollyhocks, foxgloves and similar treasures of all gardens are indispensable in the formal border to carry line and give contour and mass. In one notable example, the background of a succession of fine hardy borders is a clambering mass of Crimson Rambler roses hanging over a great wall.

In the conventional hardy border, the shrubby plants are used less freely than the herbaceous perennials, and the bulbs still less freely, as yet. The shrubs, if selected properly as to character, eventual height, color, time of bloom and effect of foliage, may well form a framework in which to set the higher colors of the composition supplied by the herbaceous plants—the peonies, iris, gaillardias, veronicas, and the like. Or it is practicable to build the border entirely without shrubs, depending only on the masses and forms available in the plants that die to the ground each winter. With the increase in variety of herbaceous plants now commercially available everywhere, a very delightful and continuous succession of bloom may be had.

The bulbous plants—of course as fully herbaceous as any, but distinguished in trade parlance by their "onions" instead of roots, and their different dormant conditions—should come to more importance in the hardy border. They give colors, forms, fragrance and effects unique to the class. The popular conception of "bulbs" has centered around tulips and hyacinths, the so-called "Dutch" bulbs, but the various narcissi, the



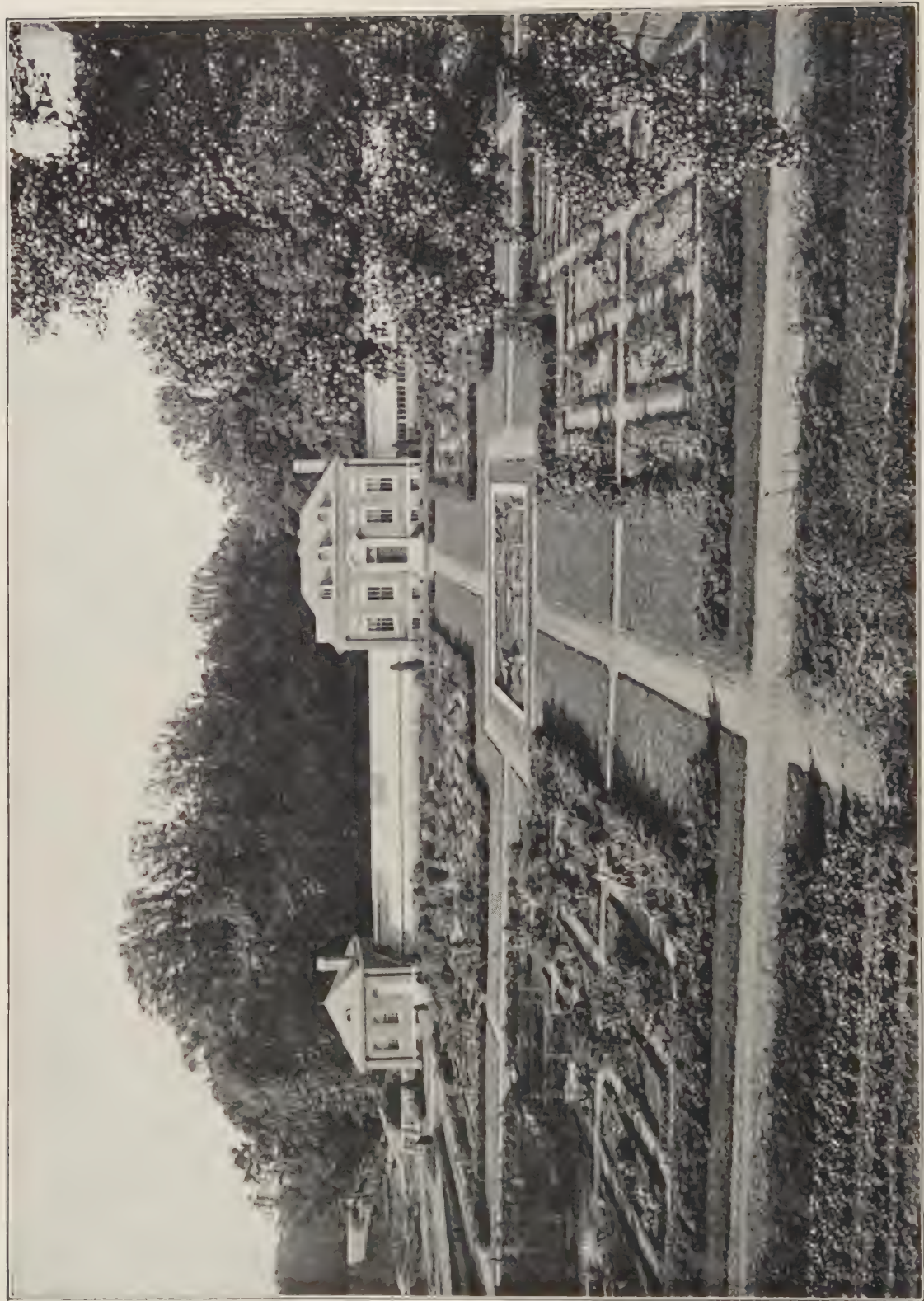
594. Border planting about a residence.

or of a formal walk. The border derives its value from its relationship as well as from its intrinsic character. It is a conception of boundaries and inclosures, and consequently is part in a design of open centers and good lawns. It develops mass effects rather than the detached and spot effects of lawn beds and of single planting; and it derives much of its pleasing result from its length, distance and perspective. The border may be permanent, comprised of hardy plants; or it may be a bedding form of gardening, using temporary subjects; or it may have a framework of hardy material, with inter-planting of bulbs and annuals and greenhouse plants. Borders are often designed to carry and emphasize one idea,—the idea of larkspurs or of hollyhocks, for example; and in such cases the dominance is secured by similarity, and repetition of one plant-form. These borders, when well made, are most effective; but they do not cover the entire season unless expensive efforts are made to replant with other things as soon as the desired effects are passed. Figs. 594–596 show the placing of borders in recognized landscape plans; and Fig. 597 suggests how a mixed hardy border works itself out. Fig. 598 shows the emphasis of a single strong plant-form set against a border rather than to be placed alone in the lawn without background or support.

L. H. B.







XVI. Botanic garden.—The formal garden of Johns Hopkins University



scillas, snowdrops, anemones, and especially the lilies, are more adapted to the permanent border than these. The narcissus, for instance, in several largely grown forms, adapts itself to both the informal and formal border plantings. Combined with iris and lilies, and using certain of the late-flowering tulips, effects as permanent as they are pleasing are now produced, and at little expense. The fancier of rare things may indulge



595. Border inclosure of a city square.

himself according to his resources with the newer and more unusual forms; there are narcissi in commerce at \$60 each and \$5 is cheerfully paid for a gladiolus bulb.

While the nature of hardy garden flowers, with the relief of varied green foliage, seems to make agreeable a heterogeneous color-combination, yet more pleasing pictures are painted in harmonizing or properly contrasting hues. The raw scarlet of the oriental poppy or the kniphofia, for example, does not "go" or compose agreeably with pink or magenta phlox. It is well to keep tiger lilies and certain pink hibiscus colors from fighting each other, as another example. Indeed, a fascination of the hardy border is this opportunity to select and combine hues that shall match and succeed each other agreeably. A border is in mind that blended insensibly from deep crimson at one end through white to pink and white to yellow along to orange and scarlet at the other end. There was no clash. It must be said, however, that if the larger and more vividly colored flowers are judiciously placed, the general mixture of blooming plants in a border is wholly agreeable, even as an oriental rug including many hues in small masses is agreeable.

Fragrance, also, is a quality to plan for in hardy borders,—here a bit of bergamot in a half-shady corner; there the stateliness and the sweetness of many lilies. The funkia scents the evening air, and the wild rose is as fragrant in foliage as in flower. There is added delight in the odorous quality of certain shrubs.

An interesting feature of the border is the seasonal succession of its bloom. It may begin before spring is more than an atmospheric hint, with its hepaticas, certain violets, and the snowdrops and crocuses. After that there need be no flowerless moment until a freeze—not a mere frost—stops the glow of the chrysanthemum and finishes the dainty display of the monkshood. The garden may also continue to please through ex-

tended weeks by changing foliage and by bared twigs of bright colors, as well as by glowing fruits that hang, like the barberries, until the next spring signals retirement.

A pleasing way of creating hardy borders is by the segregation of genera and families. Iris will cover four months with varied flowers of as varied heights. All the columbines may cover many weeks in time of beauty. A collection of viburnums makes a shrub border of long showiness. Lilies are gorgeous, or dainty; they are short or stately, and they include months of bloom-time as a family. There is great delight in studying plant families grouped in neighborly fashion.

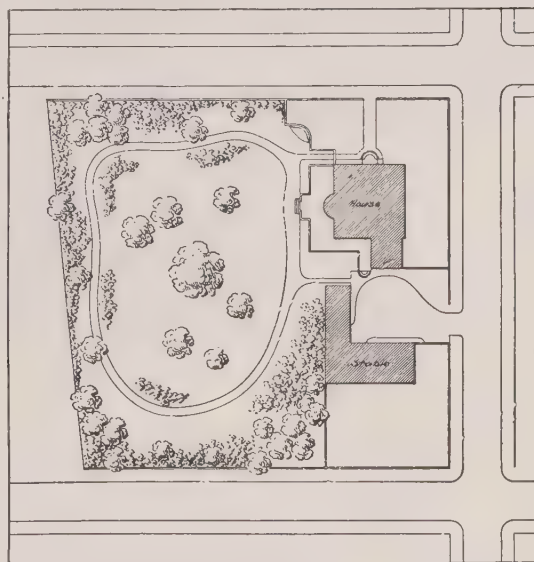
The hardy border may endure full sun or deep shade, with all variations between, if its citizens are selected for their adaptability. Some plants of the border need wet feet; others are best, like the moss pink, on a dry and sterile sunny bank. It is this great range that makes the good border so very good, for it reflects the adaptability of nature for thousands of years.

The plants for a border are now legion. The nurserymen in these days have considered the needs of the planter, and there is little difficulty in securing what is wanted. Certain tradesmen grow perennials in small pots, available nearly all the growing season. But a personal hardy border can be made with little aid from the nurseryman. The man—or woman—who loves them can transplant hardy plants with success at any time of the year when the ground is not frozen deeply, and such persons find plants in the wild that may be separated without destroying colonies of a kind. There is also the fascinating and inexpensive method of growing the perennials from seed, resulting in more knowledge gained through failures; and in enough successes to furnish plenty of plants to the grower and his friends. The hardy border of the personal sort is a great educator in patience, perseverance and knowledge of plant life.

J. HORACE MCFARLAND.

### The making of the border.

Perennial herbaceous plants should form the major part of the planting in most borders, as these are permanent and eliminate the necessity of replanting the whole each year. Biennials, such as the Canterbury bells and foxglove,—for these are best treated as such,—



596. Border inclosing the back area of a city place, the central area being planted for shade.



hollyhocks and sweet williams are an essential that should be provided for in a reserve garden, and moved to the place in which they are desired to bloom as gaps occur. Annuals are necessary, such as mignonette, larkspur, candytuft, asters, stocks and other favorites to help out the display during July and August, for this is a period when perennials in bloom are scarce. There should be a background of shrubs with a group or individual dwarf shrub here and there to break up the flatness, especially in winter and early spring.

It is a question whether spring-flowering bulbs are admissible in this type of permanent border. It is better to keep them in a place by themselves for the reason that it is difficult to make changes when the ground is planted with bulbs, and to lift these at stated periods necessitates disturbing all the other occupants. A group of Darwin tulips here and there is much admired and in keeping, but a general planting is better made elsewhere, as under trees and among ferns.

A border being permanent, no effort should be spared to prepare thoroughly in the beginning. Deep-rooting plants, as peonies, hemerocallis, delphiniums and columbines, require deep preparation of the soil and liberal enrichment, double-digging or trenching being essential. It is better, if possible, to prepare and plant a portion at a time rather than to plant in a hurry and go over it all again later. If the soil is heavy, add sand and coal-ashes, so that it may be easier to work at all times. If the soil is inclined to be wet, it must be drained to take care of surplus water. A dry soil can be improved by the addition of leaf-mold, and provision

spaces, ample groups of each plant are necessary to secure the desired effect and to avoid "spottiness." Large-growing permanent plants, as peonies, boltonias, heleniums, rudbeckias and even silphiums and late-flowering asters should be planted at the back; in front of these, the phlox in separate colors, or at most two colors together that will harmonize, German iris in masses of one or more colors, bleeding heart, campanulas, *Veronica subsessilis*, monarda, oriental poppy, columbines, pyrethrums, perennial candytuft, and, in front of these, the usual dwarf edging plants, as arabis, alyssum, the Carpathian harebell, shooting-star, erysimum, *Tunica saxifraga*, geum, *Heuchera sanguinea* and others. If the border is narrow, individual treatment must be followed to secure a greater variety, and it is always permissible to add the old favorite sweet-smelling plants and herbs, such as balm, thyme, lemon verbena, southernwood, rosemary, rue, marjoram, borage and fennel, and some sweet geranium. All these give interest when flowers are waning, and call up associations helping to take the memory back to old friendships.

A border of this kind will need the addition of annuals to take the place of the earlier flowering plants that are past. Seeds of mignonette may be sown in the place where they are to flower; snapdragons may be raised in frames or hotbeds and set out among other plants that are passing; the scarlet salvia may be put where its color will not clash when in flower; gladiolus may be set out in groups of one color; *Hyacinthus candicans* looks well in fall when planted at the back; in fact, the mixed border of today should contain every desirable

plant that has either sentiment or blossoms — possibly both — to recommend it.

Lilies often do well in partially shaded situations in which moisture is sure and leaf-mold has been added. They should never be treated to manure. They are best seen when planted in masses sufficient to make a display in their season. *L. auratum* never lives long but is good for a year or two; *L. speciosum* is a better lily to keep; the tiger lily always remains with us as do also *L. umbellatum*, *L. Hansoni*, *L. Thunbergianum* or *L. elegans*; and great results are expected from the new Chinese *L. myriophyllum* and others of recent introduction. The flower-stalks of lilies should never be pulled up in fall, but cut off at the ground. It is a protection to the



597. A good mixed border, with many attractive plant forms.

must be made for watering in dry seasons. It is not necessary to lay the pipes deep if there is a natural pitch to the land, the water then being turned off late in the year and the pipes drained for safety. Faucets should be so placed that 50 feet of hose will water any part that needs it; thus the outlets may be 100 feet apart.

The grouping of plants in a mixed border is governed by the width and extent of this border. In large, wide

heart of the bulb to let the stem remain.

Perhaps the most important detail of the management of the border is that of protection in winter. The border should be protected and nourished at the same time; this is possible when a quantity of well-decayed manure and leaf-mold is available for a top-dressing, preferably after a little frost has penetrated the soil. This can be lightly forked into the soil in spring, but a spade should never be used except when making



changes. The great charm of this form of gardening is, after all, the necessity of change from year to year. It must not in any sense be considered changeless. Some plants will outgrow their allotted space and must be restricted, biennials will die out and need replanting, some color scheme may be wrong and need alteration, other really good things will need to be divided and replanted, and in this way the interest is kept up by the taking of notes through the season for reference at

is no more interesting phase of gardening than this, because it calls for care and study all the time, year by year, and our failures of this season are with us to profit by during the next.

E. O. ORPET.

BORECOLE: *Kale*.

BORÉTTA: *Dabæcia*.

**BORÒNIA** (after Francis Borone, an Italian who lost his life at Athens in the service of Dr. Sibthorp). *Rutææ*. Greenhouse shrubs, interesting, and very fragrant.

Boronia is a genus of Australian shrubs with numerous fls., having a rue-like fragrance: lvs. opposite, odd-pinnate, or simple: fls. axillary and terminal, red, rarely white or purplish, on the plan of 4, bearing a thick entire disk: fr. 2-4 carpels, each 1- or 2-seeded. *B. megastigma* and its allies, *B. elatior* and *B. heterophylla*, are remarkable for their very large stigma (which is 4-lobed at the base), and their curious stamens, 4 of which are small, yellow, pollen-bearing, and hidden under the stigma, while the 4 large, conspicuous ones are dark purple or black, and bear no pollen.—About 60 species, in Australia.

The chief value of boronias is their delicious fragrance. A small specimen will perfume a whole house for two or three weeks. Boronias are cultivated like Cape heaths in a cool greenhouse. After flowering they should be cut back, in order to make compact, bushy specimens. The leading shoots may be frequently pinched, to prevent a straggling growth. As most of them are native of barren sandy places, not bogs, good drainage is necessary. "Sour" soil is very disastrous to them. The English florists set their young plants in the open ground during summer, being careful to shade them with lath frames. Plants that have flowered two seasons are thrown away and replaced by younger specimens. They are propagated by cuttings from half-ripened wood inserted in 4-inch pots, which are filled to within an inch of the top with a compost of finely sifted loam, peat and sand, over which is spread a layer of sharp sand. After a thorough watering, they may be placed under a bell-glass in a greenhouse in which the temperature ranges from 45° to 50° F., and shaded from bright sunshine. Seeds germinate readily in the same temperature, and make good flowering plants in one season. Seeds can be obtained from German or Australian dealers, large quantities being collected in the wild. Boronias belong to a large class of hard-wooded Australian plants that were popular along with the Cape heaths in the early part of the nineteenth century. These were largely replaced by quicker-growing, soft-wooded plants. The renewed interest in boronias is largely due to the more recently introduced species, of which the first three described below are the best. American florists have lately grown them somewhat for Easter, especially *B. heterophylla*. Many species are likely to be introduced, as these shrubs are very brilliant in Australia, blooming when very young, and remaining attractive for two or three months.



599. *Boronia megastigma*. (× 1/2)



598. The single specimen set against a border planting.

the planting-time; and this is best done after the fall rains in September and early October before the soil loses its warmth, root-action being rapid then, and the roots soon become established before winter. There is always enough to do in spring, and changes in the borders left for that time are often made at the sacrifice of the display due in summer-time. Much misconception was the result of the term "perennial border." The plants were not all permanent, and the display was not continuous. Out of it has been evolved a much more satisfactory thing in that it calls for endless study, a greater variety containing all the good things, and the possibility of change each season as fancy dictates.

In wide borders especially, it adds greatly to the effect to plant some dwarf-growing shrubs near the path, such as Lemoine's deutzia and philadelphus, some specimens of the new choice lilacs (double and single), *Daphne Cneorum*, the dwarf flowering crabs like *Malus Torringo* and *M. Ringo*. These are all very beautiful and stand close inspection. The shrubs may be so arranged as to form bays for groups of plants, either for certain seasons or color effects, and if there is a tendency to outgrow the situation, pruning judiciously will help if done directly after the flowering season is past, with no sacrifice of bloom, always taking care to keep the individual shape of each shrub. Shears must never be used on shrubs, but shorten-in the longer shoots with a knife.

The Japanese iris, if used in the border, must be planted near water so they can be frequently irrigated in dry times or failure is sure to ensue. They are semi-aquatic and will take much nourishment also. The German kinds require a warm sandy soil, and a dry time in late summer suits them well. They are also best transplanted in September before the heavy rains, as root-action begins at this time and they become reestablished before the winter sets in.

Borders need constant care in summer to keep them trim and clean. All seed-stems and dead flowers should be removed, tall-growing plants staked up with neat stakes, and, above all, plants grown in reserve to take the place of such as are dying out after blooming. There

A. *Stigmas large*.

B. *Lvs. less than 1 in. long; lfts. in 1 or 2 pairs, plus an odd one.*

C. *Fls. borne singly.*

**megastigma**, Nees. Fig. 599. Height about 2 ft.: lvs. very sparse,  $\frac{1}{8}$ – $\frac{2}{3}$  in. long, sessile, the upper with 1 pair, the lower with 2 pairs of lfts. beside the end one; lfts. narrowly linear: fls. maroon-purple outside, yellow within, borne less densely than in *B. elatior*. At times some fls. are chiefly brown, others chiefly purple. B.M. 6046.—Var. *aurea*, Hort., has pale creamy yellow fls.

cc. *Fls. borne in whorls of 4 or 6.*

**heterophylla**, F. Muell. Height 5–6 ft. in Austra.: lvs. 1–1½ in. long, sometimes simple, usually with 1 pair, rarely 2 pairs, of lfts.: fls. bright scarlet, but usually pictured as purplish crimson. Differs from *B. elatior* and *B. megastigma* in its larger lvs., fewer lfts., more brilliant fls. and longer filaments. Cult. only in its var. *brévipes*, Hook. f., which differs merely in the shorter peduncles. B.M. 6845. Gn 32:442.—Of late years it has been grown for Easter by florists to a considerable extent.

bb. *Lvs. more than 1 in. long; lfts. in 2–6 pairs, plus an odd one.*

**elatior**, Bartl. Height about 4 ft.: pubescence variable: lvs. close-set, 1–2 in. long,  $\frac{1}{2}$ – $\frac{3}{4}$  in. broad, petioled, with lfts. in 2–6 pairs; lfts. broader and shorter-acuminate than in *B. megastigma*: fls. dark red-brown, or rosy red, or purple, sometimes showing groups of widely different colors on the same branch, and borne so densely as to hide one side of the branch. B.M. 6285. Gn. 10:312. F.E. 9:491.

AA. *Stigmas small.*

**pinnata**, Smith. Lfts. in 2–4 pairs, very smooth, acute: peduncles dichotomous, 5–7-fld.; stamens 8. B.M. 1763. L.B.C. 5:473.

**tetrandra**, Labill. Lfts. in 4–5 pairs, obtuse, glabrous; branches pilose: pedicels short, 1-fld.: stamens 4.

*B. denticulata*, Smith. 2–6 ft.: lvs. mucronate, denticulate: fls. in pencedunced corymbs, rose-purple.—*B. Fraseri*, Hook. (*B. anemonifolia*, Paxt.). 1–3 ft.: lvs. trifid, the wedge-shaped segms. entire or 2–3-toothed: fls. axillary, solitary, pink. New Holland. P.M. 9:123.—*B. pulchella*, Turcz. (*B. Drummondii*, Planch.). 2 ft.: lvs. pinnatifid: fls. rose-pink, freely produced in spring and summer. Var. *alba*. A white-fld. form is known. F. S. 9:881.

WILHELM MILLER.  
N. TAYLOR.†

**BORZICÁCTUS**: *Cereus*.

**BÔSEA** (after Kaspar Bose, German amateur of plants, at Leipzig, about 1700). *Amarantaceæ*. Syn., *Bosia*. Woody plants, rarely cultivated for their ornamental crimson berries.

Upright shrub: lvs. petioled, alternate, ovate to ovate-lanceolate, entire: fls. small, with 2–4 bracts at the base, in terminal spikes or racemes; sepals and stamens 5; petals wanting; ovary with 3 subulate stigmas: fr a 1-seeded berry.—Three species in the Canary Isls., Cyprus and Himalayas. They can be cult. only in warmer temperate regions. Prop. by seeds and probably by cuttings of young wood.

**Amherstiana**, Hook. (*Rodètia Amherstiana*, Moq.). Glabrous shrub: lvs. ovate, acute or acuminate, 3–6 in. long, narrowed at the base into a petiole  $\frac{1}{4}$ – $\frac{1}{2}$  in. long: fls. perfect, greenish,  $\frac{1}{2}$  in. across, sessile, with 2–4 bracts at the base, in terminal panicles: berries globose,  $\frac{1}{6}$  in. across, crimson. W. Himalayas.—Adv. as *Bohea Amherstiana*. The closely related *B. yervamdra*, Linn., from the Canary Isls., is sometimes cult. in Old World botanic gardens; it differs chiefly in its short-stalked, polygamous fls., with only 2 bracts at the base.

ALFRED REHDER.

**BOSTON FERN**: *Nephrolepis*.

**BOTANIC GARDEN**. A collection of growing plants, the primary purpose of which is the advancement and diffusion of botanical knowledge.

This purpose may be accomplished in a number of different ways, and by placing emphasis on different departments of the science. Some gardens, for example, are preëminently centers of systematic botany, or taxonomy; others of plant physiology and morphology; while in two or three cases, more than special emphasis is placed on botanical education, or formal instruction, as distinguished from, or in close connection with, research. But whatever the method, or wherever the emphasis, the aim is the advancement of botany as distinguished from horticulture or agriculture. Some of the ideas embodied in botanic gardens are displayed in Figs. 600–603.

All the scientific and educational work of a botanic garden centers around the one important and essential problem of maintaining a collection of living plants, both native and exotic. The extent to which this may be done depends largely on the local climate, and extremes are found in such gardens as Christiana, Norway, where the glasshouse is of prime importance, and Havana, Cuba, or Buitenzorg, Java, where the tropical climate renders a conservatory superfluous. At Buitenzorg there are coolhouses instead of hothouses.

Many ancient gardens were little more than olive orchards, and one of the earliest of these of which there is any authentic record is the temple garden of Karnak. There was recently discovered at Thebes the tomb of Nekht, the head gardener of this place, who is believed to have designed it during the reign of Thotmes III, about 1500 B. C.

While the early gardens



600. Entrance to botanic garden, Roseau, Dominica, B. W. Indies.

were cultivated largely for economic rather than ornamental purposes, yet the Greeks, as may well be expected, developed ornamental flower-gardens, and this idea, with so many others of Greek origin, was borrowed by the Romans. Among the best known of the Roman ornamental gardens were those of Lucullus, and of Pliny the younger.

We learn from Pliny that during the first century of the Christian era, Antonius Castor maintained in Rome a garden of medicinal plants. Four hundred years previous to this however, or about 350 B. C., a botanic garden was established in Athens by Aristotle. The first director of this garden was Theophrastus, a pupil of Aristotle, who fell heir to it on the death of the latter, and was able to improve it by means of funds supplied by a philanthropic citizen of Athens.

The gap between these more ancient gardens and those of today is, however, a wide one, and the modern botanic garden may be considered as more immediately derived from the private gardens of the herbalists in the sixteenth and seventeenth centuries. One of the best known of these was the garden of John Gerard, in Holborn. The plants here grown were chiefly medicinal herbs, and the study of these collections, together with the attempts to describe the plants accurately, gradually developed into modern systematic botany.



The organization of all modern botanic gardens is very similar in broad outline. There is usually a director, with a scientific staff, and a head gardener, with assistants. Some gardens are purely scientific institutions. Such were the early gardens of Michaux, in Charleston, South Carolina, of Darlington, in Chester, Pennsylvania, of Bartram, in Philadelphia, and of Hosack, in New York City, all long since extinct, and the Cambridge (England) Physic Garden. A large number of "botanical stations" and "acclimatization gardens" in the various colonies of European countries, the Desert Botanical Laboratory of the Carnegie Institution of Washington, at Tucson, Arizona, and the Acclimatization Garden of the same Institution at Carmel, California, all devoted entirely to scientific research, are often classed as botanic gardens, although not such in a strict sense of the term.

Many of the more purely scientific gardens are connected with universities, or other institutions of learning, or closely affiliated with them. This, for example, is true of the Hortus Botanicus at Amsterdam, where

universities of Bonn, Breslau, Göttingen, Halle, Munich, Strassburg, and Würzburg, in Germany; of Athens, in Greece; of Groningen, Leiden, and Utrecht, in Holland; of Genoa and Modena, in Italy; of Kiev, Odessa, and St. Petersburg, in Russia; of Basel, in Switzerland; of Nikko and Tokyo, Japan; and in the United States, those of the University of California (Berkeley), Harvard University (Cambridge, Massachusetts), Smith College (Northampton, Massachusetts), Mt. Holyoke College (South Hadley, Massachusetts), Michigan Agricultural College (Lansing), the University of Michigan (Ann Arbor), the University of Minnesota (Minneapolis), the University of Pennsylvania (Philadelphia), and Johns Hopkins University (Baltimore).

It is not uncommon in European countries to find botanic gardens in connection with gymnasia (high schools), and normal schools, but the only instance of this kind in the United States, known to the writer, is the botanic garden of the Michigan State Normal School, at Ypsilanti. This garden, with an area of 3 acres, serves only the purpose of supplying study-



601. View in a botanic garden, showing related plants in groups.

were conducted the epoch-making experiments of De Vries with the evening primrose, *Enothera Lamarckiana*, and other species, culminating in the elaboration of the mutation theory, giving a new stimulus to studies in experimental evolution and plant-breeding, and incidentally illustrating now studies in pure botanical science, made primarily for their own sake, and seeming, at first thought, ever so academic or impractical, may be of inestimable value to such applied sciences as horticulture and agriculture.

Among other botanic gardens forming an integral part of the organization of collegiate or university departments of botany may be mentioned those of Aberdeen, Dundee and St. Andrews universities in Scotland; those of Birmingham, Cambridge and Oxford universities, and of the Royal Agricultural College at Cirencester (Gloucester), in England; that of Trinity College (Dublin), in Ireland; those of the universities at Budapest, Czernowitz, Krakau, Lemberg, Prag, and Vienna, in Austria-Hungary; of Ghent and Liege, in Belgium; of Copenhagen, in Denmark; of the Catholic university, in Lille; and the medical college and the veterinary college in Lyons, France; those of the uni-

versities of Bonn, Breslau, Göttingen, Halle, Munich, Strassburg, and Würzburg, in Germany; of Athens, in Greece; of Groningen, Leiden, and Utrecht, in Holland; of Genoa and Modena, in Italy; of Kiev, Odessa, and St. Petersburg, in Russia; of Basel, in Switzerland; of Nikko and Tokyo, Japan; and in the United States, those of the University of California (Berkeley), Harvard University (Cambridge, Massachusetts), Smith College (Northampton, Massachusetts), Mt. Holyoke College (South Hadley, Massachusetts), Michigan Agricultural College (Lansing), the University of Michigan (Ann Arbor), the University of Minnesota (Minneapolis), the University of Pennsylvania (Philadelphia), and Johns Hopkins University (Baltimore).

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Other so-called botanic gardens are little more than public pleasure parks. Golden Gate Park, the municipal park of San Francisco, and primarily a pleasure park, is administered with some regard to scientific ideas, and is sometimes referred to as a botanical garden. Here, also, for example, may be classed Prospect Park, in Brooklyn, in which the labeling of the trees gives a somewhat botanical aspect to the place. This park is said to contain more different species of trees, both native and foreign, than can be found elsewhere in America outside of a true botanic garden or arboretum.

A third type of garden combines the features of a scientific institution for research and education with those of a public park. Of this nature are the Kew



Gardens, near London, the Jardin des Plantes, Paris, the Berlin Botanic Garden, at Dahlem, the New York Botanical Garden, in Bronx Park, the Missouri Botanical Garden, St. Louis, the Botanic Garden of the Imperial University, at Tokyo, Japan, and the new Brooklyn Botanic Garden.

It has already been implied above that the early study of botany was closely connected with the use of plants for medicine, gardens being largely, or even exclusively, devoted to growing medicinal herbs. In this connection it is interesting to note that while the staple food, fodder, and fiber plants are grown as crops, pharmacists and physicians have, with few exceptions, such as the opium-poppy and the ginseng, always depended upon wild plants. This practice of gathering only wild herbs doubtless accounts in large part for the well-known and, until recent date, quite general adulteration of drugs.

The total number of botanic gardens outside the United States is approximately 325. In our own country there are about sixteen, eleven of which are college and university gardens. The following foreign gardens are referred to in the order of their establishment.

#### *Foreign gardens.*

1. Pisa, Italy, founded in 1543, by order of the Grand Duke Cosmo de Medici I. The second director of this garden was Cæsalpino, after whom the leguminous genus *Cæsalpinia*, was named. This was one of the earliest gardens devoted to the public study of botany.

2. Muséum d'Histoire Naturelle, Paris, founded in 1635 by Guy de la Brosse, physician to the king. Its first name was Jardin Royal des Plantes Medicinales, which was changed to the present name in 1790. The gardens proper occupy 14 hectares out of a total of 23.

3. Chelsea Physic Garden, London. Established by the Society of Apothecaries, in 1673, for the stated purpose of furthering the teaching of botany, and of providing material and opportunity for botanical research. The educational and scientific influence of this garden can hardly be overestimated. It was founded by the Society of Apothecaries of London, in 1606, and originally comprised the Grocers' Company, an ancient guild. In 1617 a new charter was granted by James I, and the Society of Apothecaries became separate from the Grocers' Company. From the start the Society was active in advancing botanical knowledge, and soon after its incorporation, field trips, called "herbarizings," were held at irregular intervals, and to these irregular trips a regular annual one was added about 1633. The botanical interests and activities of the Society found natural expression in 1673 in the establishment of the Physic Garden. At first the ground was utilized not only for growing specimens for scientific study, but also for growing crops of medicinal plants sufficient to furnish crude drugs for the commercial use of the Society. However, when Sir Hans Sloan, in 1722, deeded to the Society additional ground, adjacent to the original 4 acres of the garden, in the terms of the deed was a prohibition of this practice, and the garden became from thenceforth devoted to investigation and instruction.

The garden entered upon a new epoch with the appointment, as "gardener," of Philip Miller, well known as the author of the classic "Dictionary of Gardening." The title of "gardener" was subsequently changed to "curator." In 1681 steps were taken toward the development of a botanical library, which, by 1769, contained about 300 bound and unbound books, dealing chiefly with botany. In 1835 John Lindley was appointed Director of the Garden.

It was in connection with the Society's endeavor to grow successfully plants that could be grown only with difficulty or not at all in the smoky atmosphere of London that the well-known "Wardian case" was devised, by Nathaniel Bagshaw Ward, Fellow of the Royal

Society, and a friend and patron of the Physic Garden. These "closely-glazed cases" were first described by Ward in a letter to Sir William Hooker, dated 1834, and published in the "Companion to the Botanical Magazine," in May, 1836. It was also found possible, by employing these cases, to ship living plants across the tropics from the southern to the northern hemisphere with the loss of scarcely a plant, whereas, under former methods of shipment many more plants perished than survived.

Among many important publications growing out of the work of the Chelsea Physic Garden or produced by members of its staff, may be mentioned Curtis's "Linnaeus's System of Botany," and his "Botanical Magazine," and "Flora Londonensis;" Lindley's "Flora Medica," and Lindley and Moore's "Treasury of Botany;" Miller's "Gardeners' Dictionary," mentioned above; and Hudson's "Flora Anglica." In 1902 a well-appointed laboratory building was opened in the garden. In this building are two small rooms which contain the private library of Charles Darwin. The library equipment is used by students of the Royal College of Science, and the Professor of Botany of the college is Scientific Advisor to the Committee of Management. The garden is used freely and largely by teachers with classes, and living material for class study is supplied in quantity to the University of London, the Royal College of Science, and other local schools.

4. Royal Botanic Gardens, Kew, London (1759). The present gardens resulted from the fusion of two royal estates, the Richmond Gardens and the original Kew Gardens. Richmond Gardens, composing the western portion of modern Kew, were the grounds of the royal residence of Edward I. The second half was the private grounds of Kew House. Lord Capel, who, by marriage, came into possession of Kew House in 1696, was greatly interested in the cultivation of plants, and his collections formed the nucleus of the modern Kew plantations. The property was leased to Frederick, Prince of Wales, about 1730, and after his death, his widow, Princess Augusta of Saxe Gotha engaged, in 1759, William Aiton, a former pupil at the Chelsea garden, to establish a physic garden; its rank as a true botanic garden may be considered to date from this year. The union of Richmond and Kew was effected in 1802.

Under Aiton was inaugurated the plan of sending out expeditions for botanical exploration in foreign countries, a practice which has greatly enriched the herbarium and living collections, and which has been carried out on a large scale and with similar results in America by the New York Botanical Garden. Perrédès states that the specimen on which L'Héritier founded the genus *Eucalyptus* was collected on one of these expeditions to the Cape in 1772. In 1789 Aiton published his now classic "Hortus Kewensis." He was succeeded in the directorship by his son William T. Aiton, and the latter, in 1841, by Sir William J. Hooker, although Aiton retained directorship of the pleasure-grounds until 1845.

Hooker's aims were to make Kew so attractive as to create in the general public an interest in plants, to advance pure and applied botany, and to train collectors and gardeners. The area of the garden has increased from 15 acres, when Sir William Hooker became director, to about 95 acres at the present time. The former pleasure-grounds are now developed and known as the Arboretum. In 1875, on the retirement of Sir J. D. Hooker, who succeeded his father in 1865, Sir William Turner Thistle-Dyer was appointed director. The present director is Lieut.-Col. Sir David Prain.

In scientific matters the power of the Director of Kew is absolute, but in matters of administration, he is under the governmental Board of Agriculture. The library consists of about 20,000 volumes, over one-half



of which are set apart, primarily in the office of the Keeper of the museums.

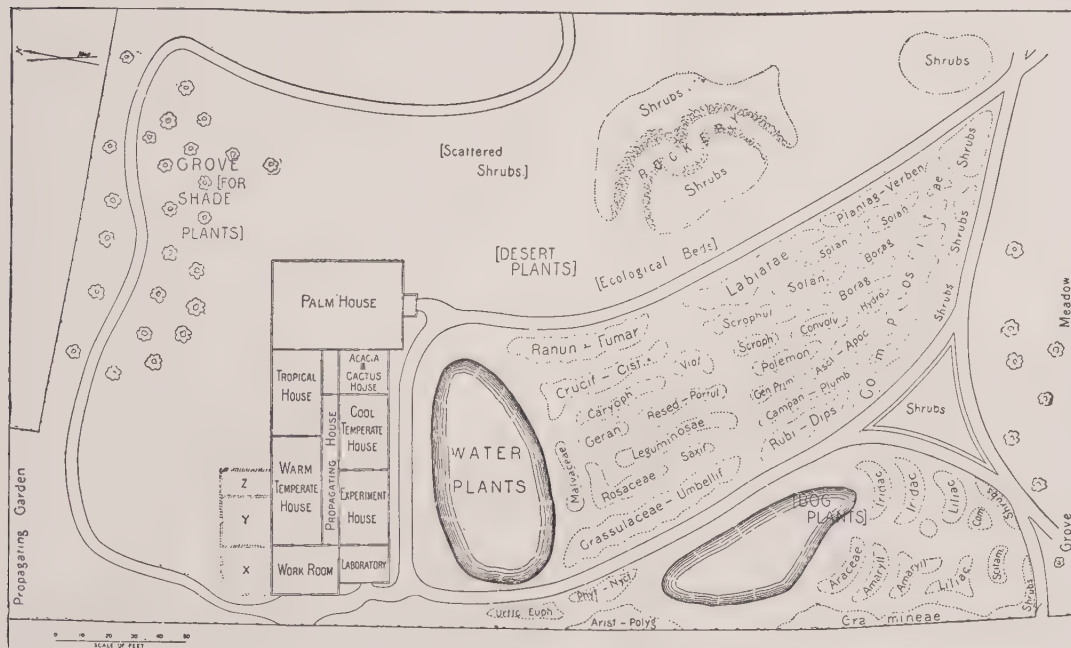
Kew has throughout exerted a profound influence on the development of botanical science, and by the training of gardeners, and in numerous other ways, has forwarded and really made possible the development and work of the numerous colonial gardens and botanic stations. The latter are in reality experiment stations, and while administered by the colonial office, depend upon Kew for scientific advice and for much economic plant material. Consult *Arboretum*.

5. Royal Botanic Society's Gardens (1740). Special mention should be made of the Royal Botanic Society's Gardens at Regent's Park, London, since so much attention has been given there to the various aspects of horticulture. Prior to being taken over by the Royal Botanic Society, about 1840, the area of the garden was occupied by a nursery. Originally flat and circular in outline, it has been given, by artificial treatment, a diversified topography, and the plantations include an

A practical gardening school was established in 1897, and in 1902 a laboratory building was erected for the use of the school. A portion of the grounds is also set aside for this school, and the head of the gardening staff is the chief instructor in the gardening school. Occasional exhibitions are given to illustrate the nature-study work of local schools.

The work of the garden in supplying study-material for schools is unusually extensive, from 50,000 to 60,000 specimens of living plants being supplied annually to students. Several hundred students' tickets are issued each year by teachers in various schools. These tickets admit the bearer daily until three o'clock, after which hour the garden is closed to all except Fellows and other visitors.

The grounds are leased from the Crown, and the money for this and other purposes is derived entirely from private subscriptions by Fellows of the Royal Botanic Society. On this account provision is made to provide attractions for those not primarily or entirely



602. Plan of a small botanic garden.—Smith College, Northampton, Mass. Early plan.

American garden (which is said to be now restricted to a planting of rhododendrons), an herbaceous garden, and an economic garden. Much attention is given to the growing of medicinal plants. An arboretum was started, but eventually abandoned on account of the small area.

The arrangement of plants in the herbaceous garden is that devised by Marnock, the first curator, and the one who planned the entire garden. Each of the different-shaped beds is devoted to one family of plants, so that the relative size of the families is seen at a glance, and beds of nearly related families are grouped together. The economic division comprises trees and shrubs, but the economic herbaceous plants are included in the general herbaceous garden. This is the most extensive exhibit of economic plants grown in London, and it is said that the first banana ever tasted by the late Queen Victoria came from a plant in this garden.

The main part of the conservatory, built in 1845, was the first large plant-house of glass and iron to be erected in England. The system of heating is that of hot water, and the pipes are underground, but this arrangement has not proved to be economical.

interested in botany. The attractions include a tennis-court, croquet-ground, flower-shows, garden fêtes, and a club-house.

There is a set of meteorological instruments in the garden, and records of barometer, wet- and dry-bulb thermometers, temperature of the soil at depths of 1 foot and 4 feet, maximum temperatures in sun and shade, minimum temperatures in shade and "on grass," precipitation, wind direction (but not velocity), duration of sunshine, and general remarks are published in the Botanical Journal of the Society. This journal, issued quarterly, is now (1912) in its second volume.

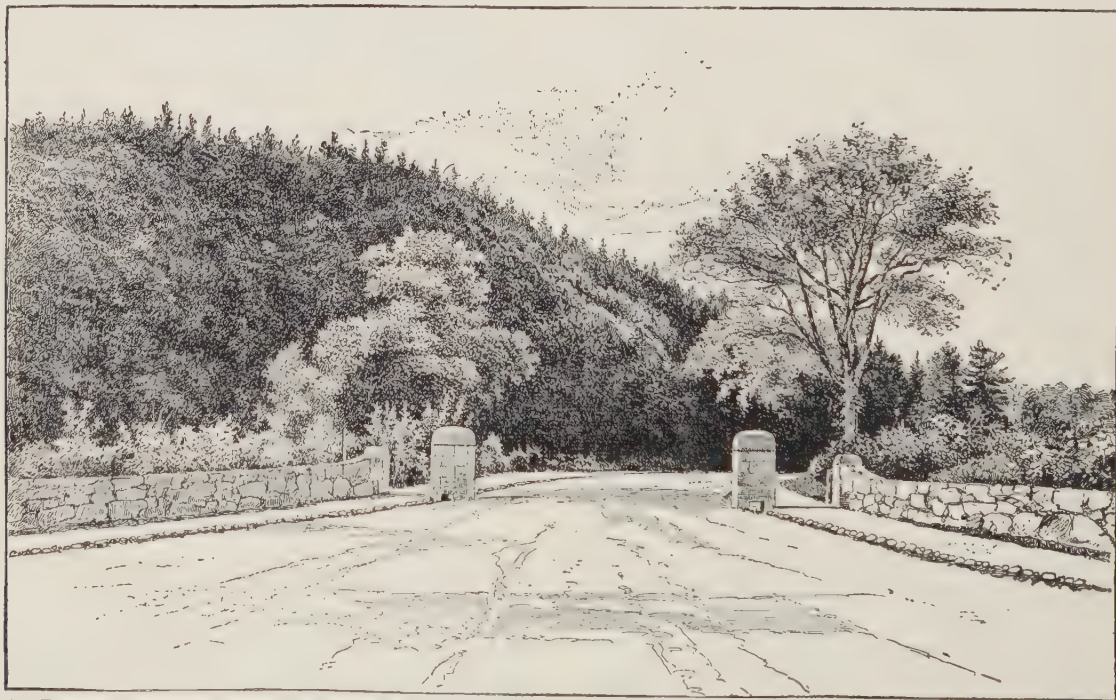
6. Buitenzorg (1817). The botanic garden at Buitenzorg is known officially as 's Lands Plantentuin (Botanic Garden of the State). Its Latin name, "Hortus Bogorensis," is derived from Bogor, the native name of Buitenzorg. The garden is a division of the governmental Department of Agriculture of the Dutch East Indies, and has been described as the most beautiful botanic garden in the world. It was established in 1817 by Reinwardt, and is located 36 miles from Batavia. This location was fortunate for climatic rea-

sons, for while on the Java east coast there is a drought season of three to four months, there is no drought season at Buitenzorg. The total annual precipitation is between 180 and 200 inches, or approximately five times that of New York State. The incessant rains are accompanied by a general lowering of the temperature, and this makes possible the cultivation of plants from the higher altitudes. The altitude of Buitenzorg is 900 feet. There are in reality three gardens: First, the botanic garden proper, in the center of the city, with an area of 89 acres. Each division of this garden has a blanket label, giving a list of the genera it contains, and each species is represented by two specimens, one of which bears a label, giving the scientific name, the common name, if there is one, and usually the economic products of the plant. The climbing plants are arranged systematically in a group by themselves. The vast majority of plants are arborescent, and there are about 10,000 species cultivated. The garden is open day and night. The second division is the agricultural garden, about a league from the center of Buitenzorg, and having 173 acres. Only plants of economic importance, including medicinal plants, are grown here. The third division or garden is some distance from Buitenzorg, on the slopes of the volcano of Gede. Its area is 74 acres, and its altitude is 5,000 feet, thus making possible the cultivation of plants that cannot be grown in the other two gardens. There is a museum building in connection with the garden proper at Buitenzorg.

"The Annals," the well-known publication, was founded by the third director, Scheffer.

#### *American gardens.*

1. Bartram's Garden (1728). The first botanic garden in America was that of John Bartram, established in 1728, and still existing, although in a greatly modified form. At about the same date (1725), Robert Prince, one of the early settlers on Long Island, began to raise a variety of trees for the purpose of ornamenting his own grounds, and this activity soon developed into a nursery, ultimately well known, not only in America, but throughout Europe. Such a venture was favored by a growing interest in ornamental and edible plants resulting from the importation of various French fruits by the Huguenots, who settled at New Rochelle, New York, and along the north shore of Long Island. This nursery continued under the supervision of the same family for five generations (130 years). For a number of years the proprietors confined their attention to fruit trees. The institution was visited by President Washington, and on August 29, 1796, after the battle of Long Island, the British General Howe placed a guard around the garden to protect the trees and plants until all danger was passed. In many old English gardens today are numerous native American plants derived from the Prince nurseries. In 1793 the nursery was christened the Linnæan Botanic Garden, and a catalogue of plants here grown passed through more than twenty editions. The mahonias,



603. Entrance to a botanic garden (or arboretum), showing the utilization of natural features and woods as well as planted specimens.

Under the directorship of M. Treub, the garden became a mecca for investigators from all over the world. One large laboratory is reserved entirely for the use of visiting botanists. In the herbarium the sheets are not kept in folios as ordinarily, but in tin boxes, a necessary protection against insects and excessive moisture. There is a library of several thousand volumes. The director distributes annually, under the authority of the government, and free of charge, seeds and plants of useful vegetables.

described in some of the earlier manuals as "from Oregon," are said to have been first grown in the Linnæan garden, being one of the many novelties received from the Lewis and Clark expedition. One of the plant-houses was devoted to camellias, one to azaleas, one to oranges and lemons, one to African and Asiatic plants, and two to miscellaneous collections. The proprietors were ever alert for novelties, and at the time of the potato famine in Ireland, Prince paid \$600 for less than a pint of bulbs of *Dioscorea Batatas*, for the pur-



pose of testing them as a possible substitute for the Irish potato. At one time there were over 100 varieties of strawberries under cultivation here, including the once famous Isabella, which originated as a chance seedling or mutant in the garden of Isabella Graham, in Brooklyn. While not a botanic garden in the modern or scientific sense, the Linnaean garden exerted such a profound influence on American horticulture and arboriculture that it should not be entirely passed over in this place.

2. Evans's Garden (1828). The garden of John Evans is located along Ithan Creek, near Philadelphia, within walking distance from Rosemont Station, on the Pennsylvania Railroad. It was established about 1828, and was one of the fruits of Bartram's garden. Evans frequently visited the Bartram garden and other gardens in Philadelphia and vicinity, and became greatly interested in plants. His father was a miller, and the vicinity of the mill, with the creek and mill-pond, and the diversified land adjacent, afforded a wide range of habitat conditions. Evans corresponded with Sir William Hooker and exchanged seeds with him, as well as with the son, Sir Joseph Hooker, including material collected by the latter in the Himalayas. He also had a correspondent in Germany. In Evans's garden the plants were arranged almost entirely on an ecological basis, in "the order of nature," and in this respect it differed materially from most other gardens before or since. Mr. Evans was his own director, curator, and head gardener, doing most of the manual labor in the garden himself. It is of interest to note here that he used sawdust from his father's mill to kill the weeds around the cultivated plants, and this, on decaying, made a rich fertilizer, which was spaded under. The garden is said to have been, in its prime, practically unrivaled in shrubs and trees, and to have had few equals in the richness of its herbaceous material. Many of the trees and shrubs were labeled with lead labels, but no catalogue of the collections was ever published.

3. The Missouri Botanical Garden (1859). The Missouri Botanical Garden, at St. Louis, was established by a gift of money and land from Henry Shaw. It is popularly known in St. Louis as "Shaw's Gardens." On November 6, 1885, Mr. Shaw established the Henry Shaw School of Botany as a department of Washington University, at St. Louis, and the garden and school became closely affiliated. The professor or one of the professors in the school shall be director or director's assistant, or both. The grounds were formerly closed to the public on Sundays, except the first Sunday of June and September, but since 1912 they have been open every Sunday afternoon from April to December. Each year there is preached in a local church a sermon on "the wisdom and goodness of God as shown in the growth of flowers, fruits, and other products of the vegetable kingdom." The first director of this garden was William Trelease, who resigned in 1912, and was succeeded by George T. Moore. The grounds comprise about 45 acres, the herbarium about 800,000 sheets, and the library about 50,000 books and pamphlets. One of the features of the garden is a vegetable-garden, which gives pupils practice in the growing of vegetables, and, by means of a forcing house, this work is continued throughout the year. The best-known publication is the Annual Report. "The Missouri Botanical Garden Bulletin," established in January, 1913, will hereafter contain the annual reports of the officers of the board and the director, while the volume hitherto known as the "Annual Report" will in the future be devoted exclusively to the results of scientific research carried on at the gardens.

4. Elgin Botanic Garden (1801). The first botanic garden in New York City was located on Murray Hill, about 1656, and was the precursor of the Elgin Botanic Garden, established in 1801, by David

Hosack, on 20 acres of ground, located at what is now the northwest corner of Fifth Avenue and 47th Street. This garden was transferred to New York State in 1810, and became known as The Botanic Garden of the State of New York. It was later transferred to Columbia University, but finally abandoned for lack of funds. In the spring of 1913 the area was sold by the university for \$3,000,000.

5. New York Botanical Garden (1894). The present New York Botanical Garden, established in 1894, is located at Bronx Park, in the Borough of the Bronx, New York City. It comprises an area of approximately 250 acres, and besides two extensive ranges of plant-houses, a range of six propagating-houses and the plantations, includes the largest purely botanical museum in the country, if not in the world. On the third floor of the museum building are located the herbarium, library and laboratories. The grounds, conservatories, and museum are open daily without charge. The present Director-in-Chief, N. L. Britton, is also Professor of Botany in Columbia University, and has served since the foundation of the institution. Under the auspices of this garden, the director and members of the staff have conducted a systematic exploration of continental and insular America, the results of which are being embodied in the "North American Flora," the most extensive botanical work ever undertaken in America, appearing at intervals in fascicles or parts. The herbarium, composed of the herbariums of Columbia University, the Torrey Botanical Club, and that of the garden proper, contains over 1,500,000 specimens, and the library has over 40,000 volumes and pamphlets. The scientific policy of the institution is directed by a Board of Scientific Directors, and the financial administration by the Board of Managers of the Trustees. The scientific staff comprises (1912), besides the director-in-chief, an assistant director, a head curator, four curators, two assistant curators, head gardener, director of the laboratories, bibliographer, librarian, and other officers. Free public lectures on botanical and closely related subjects are given on successive Saturday afternoons, and the following publications are issued: "Journal" (monthly), "Mycologia" (bi-monthly), "Bulletin" (irregularly, and containing the Annual Report), "North American Flora," Memoirs, and Contributions. The Garden is supported by municipal and by private funds.

6. Brooklyn Botanic Garden. The Brooklyn Botanic Garden, established in 1910, is a department of The Brooklyn Institute of Arts and Sciences, and an outgrowth of the work of the Department of Botany of the Institute. It was the wish of the founders to develop an institution that, in connection with research, would place more than usual emphasis upon formal instruction in botany. It is also the intention to emphasize chiefly departments of botany other than taxonomy, such as plant physiology and ecology, morphology, and pathology, experimental evolution, and plant-breeding. The first and present director is C. Stuart Gager. The new laboratory and instruction building, in process of erection (1912), will contain offices of administration, several large laboratories, a small herbarium room, a library, physiological and photographic darkrooms, and twelve private research rooms. A range of plant-houses is also under construction. The grounds comprise about 43 acres, located in the heart of the borough of Brooklyn. Through the center runs an artificial brook, with swamp. The plantations are classified under ten heads, as follows: (1) Systematic Section, comprising hardy herbaceous plants, chiefly perennials, not native within 100 miles of the Garden, and arranged in beds according to their natural affinities. (2) Local Flora Section (Native Wild-flower Garden), containing herbaceous and woody plants growing without cultivation within a radius of 100 miles of the Garden (the Torrey Botanical Club Range). The strictly native

sorts are designated by labels of different color from those of introduced species. (3) Morphological Section, with divisions of (a) External Anatomy and (b) Comparative Morphology. (4) Ecological Section, adjacent to and including the swamp section of the brook and extending back to include a dry knoll. Here is illustrated the adjustment of plants to environmental influences. (5) Evolution Section, illustrating such subjects as variation, inheritance, artificial and natural selection (including the origin of horticultural forms), struggle for existence, and survival of the fittest. (6) Economic Section with divisions of (a) Foods and Condiments, (b) Medicinal and Poisonous Plants, and (c) Fiber Plants. (7) Weed Section, to show the botanical characteristics of weeds, as bearing on their economic significance. (8) Formal Garden Section, in front of the laboratory building and greenhouses, and serving to illustrate the uses of plants, chiefly horticultural, for purely ornamental purposes. (9) Arboretum, a collection of trees, chiefly native. (10) Fruticetum, a collection of shrubs, both native and exotic. The arboretum and fruticetum features are developed in close connection with the other sections, and in the systematic garden the aim has been to group the shrubs and trees as near as practicable to the herbaceous material with which they are most closely related. The willows and alders are grown along the brook.

The Garden issues an administrative quarterly, "The Brooklyn Botanic Garden Record" (the April number of which contains the Annual Report), Contributions, and Guides. A series of Memoirs and of Educational Leaflets is also projected. Admission to the grounds is free daily, including Sundays and holidays, from 8 A.M. until sunset. The Garden is supported by annual municipal appropriations, by the income from an endowment, amounting at present to over \$50,000, and by gifts.

#### *Suggestions from the foregoing.*

As may be inferred from what has preceded, the history of botanical gardens has shown a steady progressive development from collections of medicinal herbs, gathered and studied with reference to their economic uses, to institutions endeavoring to maintain collections of all kinds of plants, both herbaceous and woody, some ornamental and useful, but perhaps most of them collected and studied for their own sake, from the standpoint of pure science, with an endeavor to understand the nature as well as the uses of plants. The Chelsea Garden affords a concrete illustration of this, for while the collections here were at first almost entirely confined to medicinal plants, these now form only a comparatively small portion of the collections. In this way, and in this way only, may botanical science be most rapidly and most surely advanced, to the advantage not only of pure science itself, but of horticulture, agriculture, forestry, pharmacology, and all phases of applied botanical science.

It was one of the marks of greatness and of sound judgment of Sir William Hooker, that he aimed definitely to make Kew Gardens not only a scientific institution of the first rank, but to make them beautiful,—attractive to the general public. This latter aim has been too often neglected or minimized, on the theory that a botanic garden is a scientific institution, and should, therefore, be developed with little regard for the non-scientific public. This is an unfortunate and unfair attitude, unfair to the general public, especially in those gardens which are supported in part by public money, and unfortunate for botanical science because it not only neglects a very important aspect of botany—applied botany,—but loses the opportunity of enlisting the intelligent sympathy of the community with botanical endeavor. Many persons who might otherwise remain quite indifferent to botanical work in general, or even to the work of a given garden in particular, may, through being attracted primarily by

the beauty of the collections and grounds, be led to give generous support to such work, or even to discover that their own main interest is botany, and ultimately to advance the science by their own studies.

It is unfortunate that the United States government has no national garden to do for our own country what Kew has done for England. The climate and location of Washington combine to make the capital city an admirable place for the development of a botanic garden, and two or three branch gardens could be established to advantage in parts of the country, giving wide diversity of climatic conditions, such as one of the extreme southern states, the great American desert, and one of the most northern states.

With only very little additional expense, many city parks could be made more interesting and instructive, and none the less beautiful and attractive, by giving portions of them more the character of a botanic garden, at least by suitably labeling the trees and shrubs and growing them with some regard to botanical affinities.

With the exception of the Missouri Botanical Garden, there is nowhere offered in the United States a thorough course of study for the purpose of training gardeners to take charge of botanic gardens. The training received in a few months' experience with a commercial florist or seedsman is not sufficient, nor do horticultural courses in our agricultural colleges answer the purpose. Botanic gardens need for gardeners, and especially for head-gardeners, men whose training has included not only instruction in the care and management of greenhouses, and in plant-propagation and cultivation, but also a thorough laboratory course in the elementary principles of botany, a course in systematic botany, including the collection and identification of a minimum number of wild plants, an elementary course in plant pathology, with emphasis on methods of treatment, a course in the physics and biology of soils, and also in such specialized work as accessioning and labeling. The general education of men for these positions ought also to be such as to enable them to express themselves well in writing, and to give courses of instruction to others in the various practical phases of their work, such as greenhouse economy, plant-propagation, and the care of herbaceous and woody plants out-of-doors. The recent success of a number of popular books on gardening indicates a rather widespread demand for such information on the part of amateurs and people of comparative leisure, as well as others. It is much better to get this information in connection with the actual operations of a scientifically administered botanic garden, rather than by the wholly inadequate method of reading a book on the subject.

C. STUART GAGER.

**BOTANY.** The science that treats of plants; plant-knowledge. In its widest sense, and properly, it includes much that, by common consent, is usually included in



604. *Botrychium obliquum*. ( $\times \frac{1}{2}$ )



horticulture,—as amelioration of plants by domestication, hybridizing, and the like. Horticulture is a part of the large conception of botany, so far as its scientific aspects are concerned.

**BOTRÝCHUM** (Greek, in allusion to the grape-like sporangia). *Ophioglossaceæ*. A genus of mostly temperate plants allied to ferns, with fleshy roots, short underground sts., each of which bears a single free-veined lf., consisting of a short petiole, a usually triangular, divided blade, and a single erect panicle bearing the fleshy sporangia.

These plants may be grown in the hardy border, or against a building on the shady side. They require no special treatment. They are little cultivated, but are of interest to the collector or fancier.

A. *Petiole as long as the fertile portion.*

**virginiánum**, Swartz. **MOONWORT**. Six in. to 2 ft. high, with a broad, triangular blade, with 3 main triquadri-pinnatifid divisions: fertile portion long-stalked. E. U. S.—The only species large enough to make a display.

AA. *Petiole much shorter than fertile portion.*

**obliquum**, Muhl. Fig. 604. Plant, 6–15 in. high, with a ternate blade 2–6 in. wide: segms. obliquely ovate or oblong,  $\frac{1}{2}$ – $\frac{3}{4}$  in. long: fertile part long-stalked. (*B. ternatum*, Authors, not Swartz, which latter is a different Japanese species.) E. U. S.

**disséctum**, Spreng. Plant, 6–18 in. high, with a ternate, finely dissected blade, 3–8 in. wide, the ultimate divisions  $\frac{1}{10}$  in. or less wide. E. U. S.—Evergreen; delicate and graceful. Grows in woods and meadows.

R. C. BENEDICT.

**BOTTLE-BRUSH**: *Metrosideros*; also *Callistemon* and *Melaleuca*.

**BOTTOM HEAT**. Soil temperature that is higher than that of the superincumbent air. Most tender plants require to have the roots warmer than the tops, particularly when grown under glass.

**BOUGAINVILLEA** (De Bougainville, 1729–1811, a French navigator). *Nyctaginaceæ*. South American shrubs, often climbers, with very gaudy large bracts, grown under glass, and as arbor plants South.

Leaves alternate, petioled, entire: fls. small and inconspicuous, tubular, the margin 5–6-lobed; stamens, 7–8, on unequal capillary filaments; ovary stipitate. The small and inconspicuous fls. are inclosed with large and showy magenta-purple or red bracts that constitute the decorative value of the plants. Two more or less scandent species are chiefly known in cult. Less than a dozen recognized species.

The bougainvilleas have been much grown of late as pot-plants. The young stock (started from cuttings) may be grown in the field and be lifted in early autumn; this will produce plants for spring bloom but not for early flowering. For earlier bloom, the plants may be carried through the summer in pots. Half-ripened or old wood, in 6- to 12-inch lengths, may be used for cuttings in April to June. The subsequent culture is simple. For glasshouse work the plants may be kept cut back and the branches trained. In California, Florida, and other southern regions, bougainvilleas are plentifully used as porch-covers, where they make a most brilliant show. Not hardy.

The cultural requirements of the bougainvilleas are of the easiest. They thrive in almost any kind of soil and should be grown in full sunshine. *B. glabra* and its varieties are the best for ordinary purposes, as they bloom when small, and thrive readily in a cool greenhouse or in the open where free from frost. *B. spectabilis* and its var. *lateritia* require more tropical conditions and reach large dimensions. All are readily propagated, and will root in a few weeks from cuttings of

the young shoots a few inches in length and placed in sandy soil in bottom heat and moisture at a temperature of 65° or 70° F. *B. glabra* and its varieties make most excellent pot-plants, either as large or small specimens. They are also valuable for summer bedding. All the kinds make very desirable subjects for clothing verandas, arches and pergolas or for planting at the base



605. *Bougainvillea glabra*. ( $\times \frac{1}{2}$ )

of trees (where the climate is suitable for outdoor culture), which they will rapidly clothe in a mass of most beautiful and highly colored flower-bracts. Another and most effective purpose to which these plants can be put is that of hedge or fence plants in tropical and subtropical countries. They stand drought exceedingly well and may be pruned with impunity. (C. P. Raffill.)

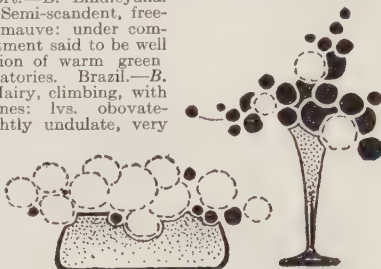
**glabra**, Choisy. Fig. 605. Grows 10 and more ft. high and wide, when planted in the ground and allowed to have its way; glabrous: lvs. ovate and acuminate, glabrous and bright green; bracts cordate-ovate, bright rosy red, distinctly veined. Brazil. G.C. III. 23:168; 30:265. Gn. 54, p. 257; 64, p. 353. R.H. 1889:276. A.G. 16:15. A.F. 11:1371. F.E. 10:106.—Free-flowering and handsome; often grown in pots and kept dwarf. Var. **Sanderiana**, Hort. Very floriferous, blooming even in very small pots. Gn. 45:418. A.F. 10:307; 11:977; 12:1185. Gng. 4:281; 5:345. G. 27:457.—A very worthy plant both for pot culture or as a shrub or climber. Often blooms when 1 ft. high, but reaches a height of 10–20 ft. Var. **Cypheri**, Hort. A much larger and finer plant than the type; the large and bright-colored deep rose bracts are freely produced in long plumose clusters on all the principal growths, and are more highly colored than those of the var. *Sanderiana*. It may be treated the same as var. *Sanderiana* as to cult. It is an acquisition as a decorative plant. Var. **variegata**, Hort. Lvs. prettily variegated with creamy white; useful as a neat and quick-growing foliage plant for summer bedding.

**spectabilis**, Willd. (*B. speciosa*, Lindl. *B. splendens*, Hort.). Taller and stricter, with larger and thicker lvs., hairy: fls. in large panicles; bracts larger, deep rose-color, but varying to purple and greenish. Brazil. B.M. 4810, 4811. P.M. 12:51. I.H. 42:30.—An immense and strong-growing climber, rising by means of numerous stout hooked spines. Variable; known also as *B.*

*brasiliensis*, *B. bracteata* and *B. peruviana*. Var. *lateritia*, Lem. (*B. lateritia*, Hort.), has brick-red bracts. I.H. 13:466. More showy than the last when in full bloom; perhaps distinct; said to be more difficult to start from cuttings than the type, at least without bottom heat.

*B. aurantiaca*, Hort. = *B. Lindleyana*. — *B. formosa*, Bull. Semi-scandent, free-flowering; purplish mauve; under comparatively cool treatment said to be well adapted for decoration of warm green houses and conservatories. Brazil. — *B. Lindleyana*, Hort. Hairy, climbing, with strong curved spines; lvs. obovate-rounded, acute, slightly undulate, very hirsute; bracts elliptic, short-acuminate, cinnabar-color. — *B. refulgens*, Bull. Lvs. pubescent; racemes long and drooping, and bracts purple. Brazil. Apparently a less valuable and shy-flowering form of *B. spectabilis*.

L. H. B.



606, 607. Flower theme (at the left) and foliage theme (at the right). In Figs. 606-616, the outline circles represent flower masses, and the black circles foliage masses.

**BOUQUETS.** The aim in flower-arrangement is beauty: (1) A display of the natural beauty of the plant, or (2) the creation of a beautiful group of floral material.

(1) Plant beauty combines two chief elements: color and form. In such plants as the pansy, the peony, and the full-blown rose, color is the dominant element. In such plants as the calla, the Easter lily, and many of the orchids, form is the dominant element. In some flowers, as rosebuds, nasturtiums, and chrysanthemums, the two elements are so nearly balanced that either one may be selected for special display. In any case, one element, color or form, should predominate in the arrangement. Plate XVIII shows at *a*, the yellow-centered daisy massed to emphasize its beauty of color; *b* shows the same flower arranged to display its beauty of form. A single clump of the plant has been transplanted to a bowl, that its wayward natural growth in the midst of the grasses may be enjoyed.

In some cases the flowers may be the theme. The arrangement then becomes similar to Fig. 606. (In all the figures the dotted circles indicate flower masses, and the solid black circles, leaf masses.) In others the foliage may be worthy to become the theme, or may be used as a foil to bring out more clearly the exquisite grace or hue of a few flowers. In such a case Fig. 607 represents the type of arrangement. Foliage and flowers should never vie with one another for first place.

Color flowers may be massed. The bigger the bunch of peonies, the more impressive and splendid is the color. Form flowers should not be massed. A single stalk of Easter lilies is enough. When massed, the marvelously graceful lines of leaves and flowers are lost.



608. Harmony in vase and bouquet.



609. Harmony in vase and bouquet.

Receptacles should always be less attractive than that which they hold. Brilliant colored vases, those with gilding, cut glass, vases decorated with pictures, or with flowers modeled in high relief or represented in color, are all to be avoided. They are too obtrusive. They force the flowers to take second place. Receptacles of clear glass which take on the color of the stems put into them, of dull soft colors, of unpolished metal, are likely to be most serviceable in displaying the natural beauties of flowers.

The receptacle should be of the shape best adapted to holding the flowers as nearly as possible in the position in which they grew. In Plate XVII at *d*, the broad bowl (full of pebbles to steady the stems) makes possible such an arrangement for the apple blossoms. The tall vase with the narrow neck, at *c*, insures the right position for the spray of bayberry.

Of course the natural beauty of a plant cannot be displayed to advantage when confused with other plants. This is the reason for the general rule: Use in a bouquet only flowers of one kind, with their own foliage.

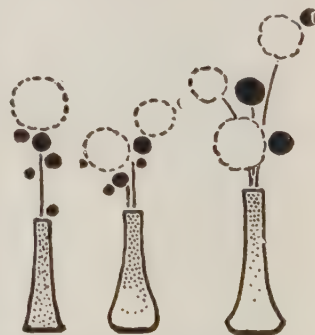
(2) Beautiful groups of plant forms present, (*a*) unity, (*b*) rhythm, and (*c*) balance.

(*a*) An arrangement has *unity* when all the parts of which it is composed are so related that the whole makes its appeal to the eye first. All the parts must have something at least in common to bind them together. In nature the common element may be *texture*, as in the snakeroot; *color* as in the mullein; *line* as in the goldenrod. In flower-arrangement the receptacle must have some element in common with the plant; in *a* (Plate XVIII) the color of the jar echoes the color of the flowers; in *b* both the color and the ornament of the bowl echo the character of the sod; in *d*, the shape of the bowl echoes the shape of the apple blossom and its color echoes their color. In *c*, the shape of the vase echoes the shape of a bayberry leaf; its contours echo the lines of the stems; its pattern echoes the speckle of the bayberries; and the dark stand gives the receptacle a color repeating the dark color of the leaves. The receptacle must have something at least in common with the plant, but must never vie with it in any way. If the bouquet is tall and slim, the vase may have similar form (Fig. 608); if it is short and broad, the vase may repeat that shape (Fig. 609). In Fig. 610, the sprays have one line in common, a simple forceful curve repeated in the vase. In Fig. 611, the sprays have the reversed curve in common, echoed softly in the vase.

(*b*) *Rhythm* means orderly variety of some kind. Fig. 612 exhibits orderly variety in the sizes of leaves, all subordinate to the one flower. Such an effect can always



610, 611. Simple and reversed curves.

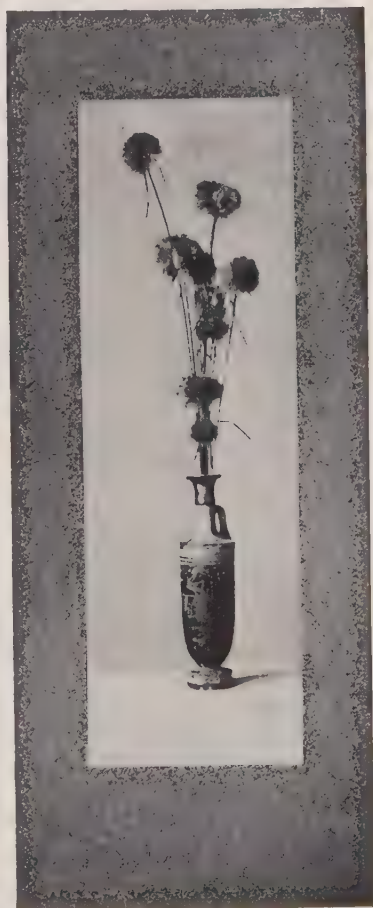


612, 613, 614, respectively, showing simple rhythm forms.





H  
T  
B  
..



XVII. The arrangement of bouquets.





be produced by pruning the spray. Fig. 613 shows an orderly variety in sizes in both leaves and flowers. The parts are in pairs, a larger and a smaller composing each pair like march time in music. Fig. 614 shows an orderly variety in which each set is composed of a series of three, large, smaller, smallest,—something like a three-part measure, waltz time, in music. Figs. 610 and 611 show rhythm of measure in the lengths of the sprays and rhythm of line in their curves. In each case there are three similar curves, but three which form a series from least bent to most bent. Fig. 608 presents a rhythm of measure in the sizes of the flowers, another in the sizes of the leaves, and another in the lengths of the stems. Fig. 615 shows a rhythm of color. When flowers of one kind present a wide range of tone,—pinks, for example, running from white to red through various tones of pink, they may be arranged agreeably by making evident the rhythm of color from lightest to darkest. When the flowers vary in hue as nasturtiums do, from yellow through orange to red, a rhythm of hue may be established in a similar way. Such sequences of color (unless too formal) are always more pleasing than haphazard spottings of color. All these arrangements show rhythms of mass. Fig. 608, 610, and 611 show a triple subdivision, large, smaller, smallest, but not so disconnected as to destroy the unity of the whole in any case. Figs. 609, 615, and 616, show more complex rhythms of mass, but in a general way they present a simple movement from the diffuse to the compact. This the eye can take in at a glance. Each review of this rhythm gives additional pleasure to the sense of sight. A rhythm, an orderly sequence of some kind, for the eye to follow, is essential in floral arrangement.

615. A color rhythm.

(c) *Balance*.—A flower-arrangement must not be too formal. It must present something of the freedom of wild nature but it must appear to be in stable equilibrium. Every spot, every color, every stem line, every space between these elements, presents an attraction for the eye. All these attractions must be adjusted to one another so that the whole appears to stand securely. This means that the parts must be disposed with reference to the vertical center line of the vase. The principle is that of the steelyard. A large, a brilliant, a solid mass, near the center line, may be balanced by a small, a dull, or a diffuse mass, farther removed from the center line. To appear free, like nature, the attractions on one side must not duplicate, in form, size or position, the masses on the other. Such an arrangement is formal, and belongs in the realm of structural and conventional art; but, however varied the elements may be, they must be so disposed as to counterbalance each other, and maintain the balance of the whole. Compare the illustrations with this principle in mind.

Lovers of natural beauty do not overlook the possibilities of winter bouquets. Sprays of seed packs, withered leaves, and the like often present soft dull colors in such harmonious groups of tones that they may serve as models for color schemes for cos-

tumes and the interior decoration of rooms. They often present exquisite rhythms of measure, subtle refinements of line, charming combinations of erratic curves, and surprising oppositions of harmoniously related details, unrivaled in the growing period of the plant's life. Plate XVIII shows at *e* a picturesque spray of white oak with "oak apples."

More than one kind of plant may be used in an arrangement, provided the beauty of one enhances the beauty of the other, like day and night, like a handsome man and a beautiful woman side by side. But even then the two must have something in common. The Japanese often combine a round-leaved plant with a linear-leaved plant. While presenting a contrast in form the two have green in common. Nature often combines strong contrasts, as in the dark green holly with its bright red berries. While the colors are complementary, the textures are alike. Both present smooth surfaces with glints of light in common. Moreover the red never vies with the green in mass. It is a green spray, with a few precious red dots.

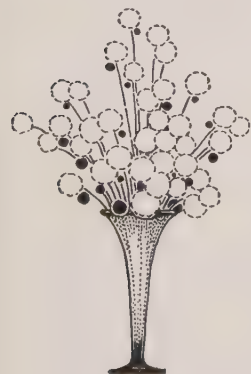
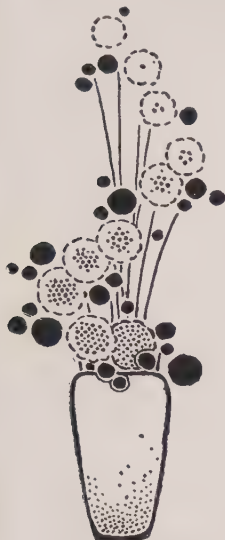
In a word, in good flower-arrangement either beauty of color or beauty of form is the dominant element. The whole arrangement presents a unity within which play rhythms of measure, of line and of tone, all related to a principal mass, the supreme center of interest, and all so disposed as to constitute a balanced whole.

HENRY TURNER BAILEY.

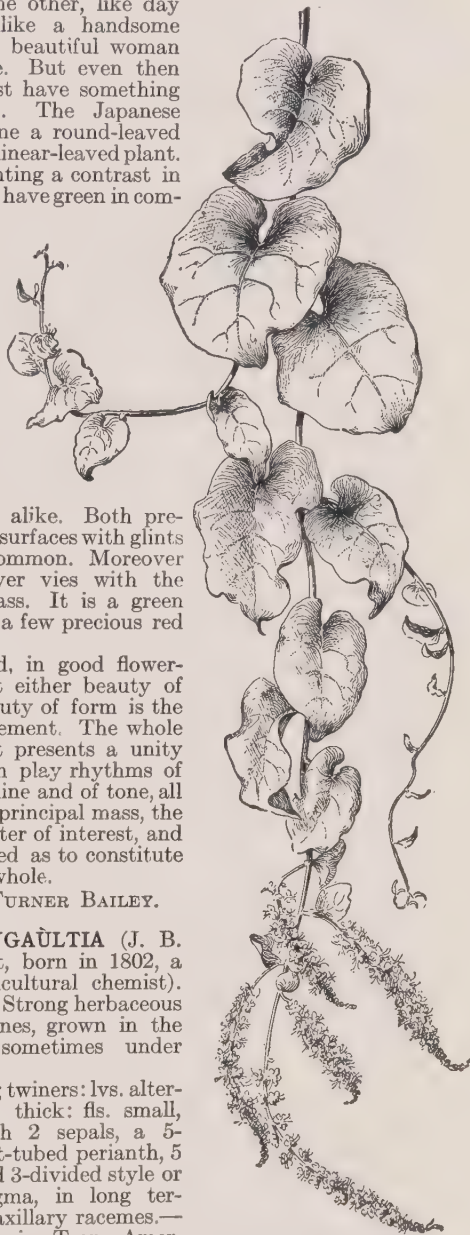
**BOUSSINGAULTIA** (J. B. Boussingault, born in 1802, a famous agricultural chemist). *Bassellacææ*. Strong herbaceous perennial vines, grown in the open and sometimes under glass.

Branching twiners: lvs. alternate, entire, thick; fls. small, perfect, with 2 sepals, a 5-parted, short-tubed perianth, 5 stamens, and 3-divided style or 3-lobed stigma, in long terminal and axillary racemes.—Ten species in Trop. Amer. *Anredera* is a related genus.

**baselloides**, HBK. MADEIRA VINE. MIGNONETTE VINE. Fig. 617. Perennial, root tuberous: sts. smooth, reaching 10–20 ft. in a season, and in late summer or fall bearing profusely of the fragrant white fls. (which become nearly black with age), and producing little tubercles by means of which the plant is prop. Ecuador. B.M. 3620.—A common



616. Complex rhythm of mass.



617. *Boussingaultia baselloides*. ( $\times \frac{1}{2}$ )

vine, prized for porches and arbors. The roots are stored in the winter, and planted out after danger of frost is past. The plant will not endure frost. Sometimes grown in the conservatory and window-garden. It has run wild in Fla. and Texas. L. H. B.

**BOUVÁRDIA** (Charles Bouvard, 1572–1658, physician to Louis XIII, and Superintendent of Royal Gardens in Paris). *Rubiaceæ*. Handsome greenhouse



618. The common garden form of *Bouvardia*. Cluster from a side growth.

flowering shrubs, once popular as florists' plants.

Small shrubs (rarely perennial herbs), with simple, sometimes verticillate, lvs. and subulate stipules: fls. in terminal cymes, showy, in red, yellow and white; calyx 4-lobed, the lobes persistent; corolla long-tubular or salver form, with 4 spreading lobes; stamens 4, alternate with corolla-lobes and attached in the tube or throat; styles inserted or exserted in different fls., the stigmas 2; ovary 2-celled: fr. a loculicidal caps.—About 30 species, from Texas and Ariz. to Colombia and southward, chiefly in Mex. and Cent. Amer.

Bouvardias were once very important florists' flowers, but they have now given place, along with camellias and others, to chrysanthemums, carnations and other plants. The plants have such merit in themselves, however, and are so likely to return to favor in this country, that a rather full cultural treatment is here given. The bouvardias of florists do not represent any of the type species. They are sports, hybrids, and other types of variations. The Latin-form names in American trade catalogues nearly all belong to these garden forms. The species which are of most importance to the horticulturist are mentioned below:

A. Fls. in shades of red.

B. Lvs. normally in 3's (except, perhaps, on the branchlets).

**triphylla**, Salisb. (*B. Jacquinii*, HBK.). Small pubescent shrub, 2–6 ft. high: lvs. in 3's or 4's (or opposite on the branchlets), lanceolate to lance-ovate, glabrous above: fls. an inch long, pubescent, bright scarlet. Mex. and reaching north to Ariz. B.M. 1854; 3781 (as *B. splendens*, Graham).—The genus *Bouvardia* was founded upon this species, which was intro. into England more than 100 years ago. It is evidently the most important parent strain, although it is probably not in cult. in its original form. Figs. 618 and 619 partake very strongly of this species. In fact, Fig. 618 compares well in botanical characters (except less long-pointed lvs.) with the early pictures of *B. triphylla*.

**leiántha**, Benth. Much like *B. triphylla*; more bushy and better grower: sts. hairy: lvs. hairy above: fls. glabrous. Mex. R.H. 1851:81.—Perhaps only a form of the preceding. It is said that the first recorded hybrid bouvardia appeared about 1857, with Mr. Parsons' nurseries at Brighton, England, being between *B. leiántha* and *B. longiflora*. Many secondary forms have come from this cross, some of them being white, as *B. Davidsnii* or *B. Vreelandii* (G. 27:632).

Other red-fl. 3-lvd. species are: *B. angustifolia*, HBK. Lvs. lanceolate, revolute, glabrous above and fine-pubescent below: branches nearly glabrous. Mex. *B. hirtella*, HBK. Very similar: lvs. pubescent on both

surfaces. Mex. *B. scabra*, Hook. & Arn. Lvs. ovate, short-stalked: fls. large in dense clusters, pink: st. hairy. Mex.

BB. Lvs. opposite.

**Cavanillesii**, DC. (*B. multiflora*, Schult.). Hairy: lvs. ovate-acuminate, broad at base, short-stalked, edges hairy: fls.  $1\frac{1}{2}$  in. long, very slender, glabrous. Mex.

AA. Fls. yellow.

**flava**, Decne. Lvs. opposite, ovate-lanceolate or lance-elliptic, very short-stalked, ciliate: fls. very long drooping, in 3–5-fl. racemes, bright yellow. Mex. F.S. 1:43.

AAA. Fls. white.

**longiflora**, HBK. Glabrous, branching shrub: lvs. opposite, ovate-acuminate, stalked: fls.  $1\frac{1}{2}$ –2 in. long, with a very slender tube and a wide-spreading, large limb, 2 or 3 together and aggregated into a terminal cyme. Mex. B.M. 4223. F.S. 2:123.

**Humboldtii**, Hort. Lvs. opposite, ovate-acuminate: fls. very large, fragrant, in a large, terminal cluster. G.C. 1873:717. G. 27:331 (var. *grandiflora*).—This is a choice conservatory plant. It is usually catalogued as *B. Humboldtii corymbiflora*. Blooms from summer to winter. Probably a derivative of *B. longiflora*. *B. candidissima*, Hort., white-fl., is said to be a hybrid, with *B. Humboldtii* as one of its parents.

**jasminiflora**, Hort. Compact and dwarf, very floriferous, the fls. in close, terminal clusters. G.C. 1872:215.—Probably a derivative of *B. longiflora*. L. H. B.

All the cultivated species and varieties of bouvardia are evergreen greenhouse plants. They thrive best in a mixture of equal parts of rich turfy loam, leaf-mold and sand, which should be rammed moderately firm but not too hard. They require an abundance of water during the growing season, and, once they have started into growth in the spring, should never be allowed to suffer for the want of water at the roots. A house in which the temperature can be maintained at 55° F. with fire-heat, suits them best, but the temperature may, with advantage, be allowed to run up to 80° or



619. The double-flowered form of the garden *Bouvardia*. Terminal truss.

90° F. with sunheat, providing they are given an abundance of ventilation at the same time. The plants should be frequently syringed during the growing season to keep down insect pests and to help to maintain a healthful growing atmosphere. All the bouvardias revel in a fair amount of sunshine, and may be described as sun-loving plants, but under glass during the hottest part of the day, it is an advantage to shade them lightly to break the direct rays of the sun. Under this



treatment growth is rapid, and the plants require to be frequently pinched back at the points in order to induce sturdy, well-balanced specimens. If this pinching-back is neglected, the plants will become ill-balanced and few flowers will be the result. The time of flowering can be readily regulated by the time of the last pinching back, and a succession of flowering plants may be maintained practically throughout the whole year. Amongst market-growers, the aim should be to secure the bulk of the flowers in the winter period, for which purpose very little pinching of the shoots should be practised after September, and the plants should then be allowed to grow on until the flowers appear. When in flower, the plants should be removed to a somewhat drier house, and they last much longer if kept in a temperature of about 50° F.

Many growers plant out strong healthy plants upon benches under glass, or in favored situations outdoors. Under these conditions growth is rapid, and if carefully watered and attention is paid to pinching-back the leading growths, fine flowering specimens are quickly secured. For the cut-flower trade, this method has a considerable advantage over pot culture. All through the growing period, it is absolutely essential that the plants should never be allowed to suffer for the want of water and, when well established, they should be fed liberally with manure.

Specimens planted out in the open, should be lifted with a good ball in early autumn, potted up and placed in a close shaded house until the roots again become active. These plants will furnish a large supply of flowers during the winter months.

After the flowering period is over, bouvardias should be kept somewhat cooler and drier at the roots for a few weeks, after which they should be cut back and started again in heat and moisture. If kept frequently syringed, they will soon break freely and furnish a good supply of cuttings. These are best removed with a heel when about 2 inches long, and placed in 4- or 5-inch pots in an open compost of equal parts sand and peat or fine leaf-mold, and placed in a moist and close frame with a brisk bottom heat. Roots are soon emitted, when the plants should be potted up singly and moved on into larger-sized pots as required. Most of the garden varieties are also readily propagated from pieces of the larger and thicker parts of the roots in spring. These may be cut into lengths of about 2 inches and planted the same as cuttings, leaving a small piece exposed above the soil. Adventitious shoots are soon formed on these and soon make good serviceable plants.

The numerous garden forms are all so distinct in habit, shape and poise of the flowers from all the known species, that it is difficult to identify any of them as varieties of any one species. It is probable that they are complex hybrids of *B. triphylla*, *B. leiantha*, *B. Cavanillesii*, *B. scabra* and possibly *B. flava*, all of which species are more or less villose and scentless. The garden forms are extremely handsome, and useful as cut-flowers, for indoor decoration, also for button-holes and for making up into ladies' sprays, wreaths and so on. Other purposes for which they are largely

grown, are the decoration of the greenhouse or conservatory, and, in warm localities, as bedding plants. A selection of some of best varieties is given herewith:

*Alfred Neuner*. Double, pure white fls.; an old variety of great merit; of good constitution. *Bridal Wreath*. White, free-flowering, with large loose trusses; one of the best for cut-fls. *Bridesmaid*. Double, pink fls., brighter than President Garfield. *Brilliant*. Bright crimson, floriferous, and of easy cult. *B. candidissima*. White; an improvement on *B. jasminoides*. *Dazzler*. Rich scarlet; free and compact-growing. *B. elegans*. Scarlet; large truss of loose habit. *B. flavescens*. Light yellow; distinct; bad habit. *B. flavescens flore-pleno*. Double form of last-named. *Hogarth*. Brilliant scarlet; large truss; a well-known variety. *Hogarth flore-pleno*. Double, scarlet. *B. jasminoides*. White; a free-flowering dwarf form, of easy cult. *King of the Scarlet*. Light-scarlet; large truss of very fine large fls.; a new variety of great merit. *Maiden's Blush*. Light rose; floriferous. *Mrs. Robert Green*. A fine salmon-pink sport from President Cleveland; distinct and beautiful. *President Cleveland*. Brilliant scarlet, with crimson tube; the richest and best of its color, floriferous and of easy cult. *President Garfield*. Double, pink; floriferous; large truss. *Priory Beauty*. Delicate rose or deep pink; one of the most beautiful; elegant habit; medium and compact truss. *Purity*. White; fragrant, free, large fls.; loose truss. *Sang Lorraine*. Bright vermilion-scarlet; double. *The Bride*. White, tinted with pink; one of the best for bouquets, etc. *Thomas Meehan*. Double, bright scarlet, with pale rose-scarlet tube; floriferous. *Triomphe de Nancy*. Double bright orange-red; large truss; distinct. *Victor Lemoine*. Large, very double fls.; brilliant scarlet. *B. vreelandtii* (*B. Davidsonii*). Pure white; extremely floriferous; a favorite variety in gardens, and of very easy cult. *Vulcan*. Scarlet; medium-sized truss. *White Bouquet*. Pure white; exceedingly dwarf and compact.

C. P. RAFFILL.



620. *Bowiea volubilis*.

**BOWENIA** (bears the name of Sir Geo. F. Bowen, once Governor of Queensland). *Cycadaceæ*. Zamia-like plant, grown to some extent in Florida and hardy in the central part.

*Bowiea*, a monotypic genus, differs from *Macrozamia* in foliage characters and in the absence of a point on the cone-scales; and from *Zamia* largely in its bipinnate lvs. *B. spectabilis*, Hook. Trunk thick, scarcely rising above ground, plant glabrous: lvs. 3-4 ft. long, loosely bipinnate, each pinna or lft. 1 ft. or more long, the 9-20 segms. ovate or ovate-lanceolate, oblique or falcate, acuminate: cones short-peduncled, the sterile ones 1½-2 in. long and half as thick, the fertile ones 3-4 in. diam., and the scales expanded between the seeds into a broad and thick truncate apex. Queensland, Austral. There is a var. *serrulata*. B.M. 5398, 6008.—This charming little cycad makes beautiful

clumps, thriving well under lath houses in Fla., when given proper shade, good supply of moisture and soil rich in humus; the lvs. are easily broken if the plant is roughly handled.

L. H. B.

**BOWIEA** (after J. Bowie, collector for Kew). *Liliacæ*. A monotypic genus containing one of the most curious plants in the vegetable kingdom, sometimes grown under glass as an oddity, and as an illustration to students of botany.

A round, green bulb 4-5 in. thick throws up yearly a very slender, twining fl.-st. 6-8 ft. high, with many compound, forked, curving branches below, and numerous small green fls. above. This branched fl.-stalk is green and performs the function of the usually absent lvs.; somewhat asparagus-like. There are no lvs. except 2 small, linear, erect scales at the apex of the bulb, which quickly vanish. The lvs. show its relation to *Drimys* and *Scilla*.

*volubilis*, Harv. Fig. 620. Perianth 6-cleft to the base, persistent, green or greenish white, the segms. incurved at the tips, ultimately reflexed. S. Afr. B.M. 5619.—Sold by dealers now and then, and cult. in botanic gardens with cactus-like euphorbias and other curiosities. *B. volubilis* is a remarkable bulbous-rooted twining greenhouse climber. The bulbs grow to be very large, sometimes becoming 19 in. circum. and some 6 or 7 in. deep. The slender, twining vine seems out of proportion to the size of bulb. It does not produce lvs., but the lower part of the vine is furnished with pendulous, abortive panicles which seem to perform the function of lvs. The small insignificant greenish white fls. are borne at the upper end of the vine. This is a useful plant for twining on the supports of a moderately warm greenhouse, and is of the easiest possible cult. Prop. is effected by seeds, or occasionally by the natural division of the bulbs. The season of growth usually begins about the first of Oct., when the bulbs should be repotted in any light, rich soil, and kept well watered until the sts. begin to mature, which usually occurs in May, when water should be gradually withheld, and the plants stored away in some shaded part of the greenhouse and kept quite dry until the season of growth begins again.

WILHELM MILLER.  
E. J. CANNING.

**BOWKÈRIA** (Henry Bowker and sister, botanists in S. Afr.). *Scrophulariaceæ*. South African shrubs of 5 species, one of which is rare in cult. in south of England, and likely to be intro. into this country. Allied to *Scrophularia*, differing in being ligneous and in technical floral characters. *B. Gerrardiana*, Harv. (*B. triphylla*, Hort.). Erect-branched shrub, 8–10 ft., with gray hairs: lvs. in 3's, sessile, elliptic or oblong-lanceolate, 4–6 in. long: fls. in small axillary cymes, 1 in. across, satiny white, calceolaria-like, red-dotted inside, the upper lip flat, lower lip shorter and ventricose and 3-lobed. B.M. 8021. G.C. III. 36, Suppl. Dec. 10.—Hardy in the Isle of Wight.

BOX: *Buzus*.

**BOX ELDER** (*Acer Negundo*, which see). A very popular small native tree for planting on the prairies and in trying climates. It propagates most readily from seeds. It is an excellent nurse tree for other species. The wood is of inferior quality. It grows with great rapidity for a few years.



621. *Brachycome iberidifolia*.

**BOYKÍNIA** (named after Doctor Boykin, of Georgia). *Thérofon*, Raf. *Saxifragaceæ*. Glandular-pubescent perennial herbs, 7 species, of which one is Japanese and the others in the S. Alleghany region and Calif., two of which have been offered for wild gardens. Lvs. alternate, but mostly radical, stalked, blade orbicular

or very broad and lobed or cleft: fls. white, small, in terminal clusters; petals 5, entire or nearly so; stamens 5; styles 2–3: fr. an urn-shaped or globose caps., erect or pendulous. Mostly mountain plants. *B. rotundifolia*, Parry. Villous-pubescent, 2–3 ft., leafy: lvs. 2–4 in. across, orbicular or broadly ovate, crenately cut and toothed: fls. short-pedicelled, on one side of the branches; petals little surpassing the acute calyx-lobes. Water-courses, San Bernardino Mts. *B. aconitifolia*, Nutt. Erect, 1–3 ft.: lvs. 2–6 in. across, nearly orbicular or reniform, palmately 5–7-lobed: fls. in a glandular-pubescent corymb; petals eroded; sepals triangular-ovate. Mt. slopes, Va. to Ga.—A pretty foliage plant for wild gardens and borders.

L. H. B.

**BRACHYCHÆTA** (Greek, *short bristle*). *Compositæ*. A monotypic genus, growing in open woods from Ky. to N. C. and Ga. Closely allied to *Solidago*, from which it differs in the very short pappus (the bristles shorter than the achene), and the lower lvs. cordate. *B. cordata*, Torr. & Gray (*B. sphacelata*, Brit.), which has been intro. by dealers in native plants, is 2–3 ft. high, soft-pubescent, with thin, serrate, ovate to orbicular-ovate lvs.: fls. golden yellow, in small heads, which are borne on the thyrsoid, secund branchlets; disk-fls. perfect.—Recommended for the native border, particularly in half shade.

**BRACHYCHILUS** (*short lip*, the labellum being suppressed). Spelled also *Brachychilum*, from the name as a subgenus of *Hedychium*. *Zingiberaceæ*. Herbaceous plants of two species, one or both of which have been cultivated abroad, in warmhouses. Closely allied to *Hedychium*. The species are *B. Horsfieldii*, Peters (*Hedychium Horsfieldii*, Wall.), from Java; and *B. tenellum*, Schum., from Moluccas. The former has been cultivated as *Alpinia calcarata*.

**BRACHYCHITON** (name referring to the short imbricated hairs and scales). *Sterculiaceæ*. Australian trees (about eleven species), grown to some extent in Florida and perhaps elsewhere South, often included with *Sterculia*, from which they differ (when the genera are distinguished) by bearing the radicle next the hilum in the seed, having the seeds and inside of carpels villous, and other technical characters.

Leaves entire or rarely lobed: fls. unisexual or polygamous, in panicles or racemes; calyx with 5 or 4 spreading lobes; petals wanting; stamens 10–15 in a column united with the pistils; ovary with 5 nearly or quite distinct carpels, the styles united under the pelate or lobed stigma.—Two showy-fl. species are reported in this country. *B. acerifolium*, Muell. (*Sterculia acerifolia*, Cunn.). Large timber tree in its native country: lvs. long-stalked, 5- or 7-lobed, 8–10 in. across, the lobes oblong-lanceolate or almost rhomboid: fls. rich red, in loose racemes or small panicles; calyx  $\frac{3}{4}$  in. long, glabrous, broad-lobed; ovary borne on a short stalk or column: fr. large follicles, long-stalked, glabrous. *B. diversifolium* may be either *B. diversifolium*, R. Br. = *Sterculia caudata*, Heward; or *B. populneum*, R. Br. = *S. diversifolia*, Don, probably the latter and here described: tree, 20–60 ft., glabrous except the blossoms: lvs. long-stalked, ovate to ovate-lanceolate and entire, or more or less deeply 3- or 5-lobed: fls. yellowish white, reddish within, in axillary panicles that rarely exceed the lvs.; calyx broadly campanulate, about  $\frac{3}{4}$  in. diam., acutely lobed to middle: follicles nearly ovoid, sometimes 3 in. long, on stalks 1–2 in. long. Both species are reported as growing vigorously in high pine-land garden in Fla.; trunk unusually thick near the ground; characteristic in the open cone-like tops.

L. H. B.

**BRACHYCÔME** (*short hair*, from the Greek, alluding to the pappus). *Compositæ*. About 40 species of Australian herbs, with membranaceous involucrel



bracts, naked pitted receptacle, very short pappus bristles, and diffuse leafy growth, one of which is cult. as a garden annual; of very simple cult.

**iberidifolia**, Benth. SWAN RIVER DAISY. Figs. 621, 622. A very graceful little annual (6-16 in. high), suited to borders, and also attractive in pots; seeds may be sown in the open or under glass: fls. blue, rose or white, an inch across: lvs. small, pinnate, with narrow divisions. H.F. 4:96. J.H. III. 54:461. V. 3:170. A good winter-bloomer 4 or 5 mos. after sowing.

L. H. B.

**BRACHYSÈMA** (short standard, referring to the flower). *Leguminosæ*. Shrubs or undershrubs, Australian, making good pillar or climbing plants for greenhouse; allied to Baptisia and Thermopsis.

Evergreen: lvs. opposite or alternate, simple, sometimes reduced to scales: fls. red or yellowish or almost black, solitary or several together or sometimes crowded on short radical scapes, the keel turned upward by the curving of the pedicels; stamens not united with each other: fr. ovoid or elongated, turgid.—About 14 species, a few of which are known in gardening literature. **B. acuminatum**, Truff. (*B. speciosum*, Hort.), is now offered as a good red-fl. pillar plant: sub-frutescent: lvs. opposite, oval-elliptic, entire, more or less narrowed to base and short-petioled, the older ones long-acuminate: fls. deep carmine-red to nearly purple, in short axillary clusters, the corolla much exceeding the yellow-green calyx, the standard very small. R.H. 1866:413.—An attractive free-flowering species.

L. H. B.

**BRACHYSPÀTHA**: *Amorphophallus variabilis*, *A. Titanum*, and others.

**BRADLÈIA**: *Phyllanthus* and *Wisteria*.

**BRÀHEA** (Tycho Brahe, the Danish astronomer). *Palmaceæ*, tribe *Corypheæ*. Medium-sized, usually spineless palms except on the leaf-stalks, with ringed trunks, the upper part of which is usually clothed with the persistent leaf-bases.

Leaves usually numerous, nearly round and somewhat peltate, the many lfts. plicate and deeply 2-parted, sometimes slightly spiny on the margin, more often filamentous; petioles flattened, dentate or rarely spiny along the margins, very fibrous at the sheathing base: spathes usually linear, firm, almost woody, frequently perfectly glabrous; spadix much branched, sometimes twice or thrice paniculate and bearing among the dense white wool 1 or many sessile fls. in each cluster; fls. hermaphrodite, sometimes with inconspicuous bracts, 3 nearly round sepals, 3 valvate petals and 6 stamens: fr. small, ovoid, sometimes pubescent. Beccari admits only 4 species, all Mexican except *B. salvadorensis*. From its nearest horticultural relative, Sabal, Brahea is distinguished by the purely technical character of having 3 free carpels.

In a moderately warm house, the cultivated braheas

will thrive very well. A mixture of sand, rich loam and well-rotted horse- or cow-manure is best. They require plenty of water. They are not very common in the trade but two species are grown outdoors in southern California. Propagation is by seeds, which are rare.

*A. Fls. solitary on the spadix.*

**dúlcis**, Mart. PALMA DULCE. Sts. several in a cluster, 10-20 ft., 6-8 in. thick, cylindrical: lvs. 4-5 ft. long; petiole plano-convex, green, with pale margins; ligule short, nearly triangular, green, the scarious villous margin at length deciduous; lfts. 36-50, linear, acuminate: spadix 6-8 ft., pendulous from among the lowest lvs., much branched: fr. edible. Mex. I.H. 10:379.

**calcàrea**, Liebm. (*B. nitida*, André). Trunk 8-15 ft. high, covered with the woody persistent lf.-bases: lvs. usually 20-30 in a dense bushy crown, unarmed, membranaceous, covered below with a brownish powder: spadix long, more or less erect and considerably longer than the lvs., after flowering more or less pendulous; fls. solitary, with a single bract: fr. ovoid. Mex. R.H. 1887, p. 344. Gn. 35, p. 285.—Offered by Montarioso Nursery.

*AA. Fls. in more or less dense, though small, clusters on the spadix.*

**Pimo**, Becc. St. 8-12 ft.: much the same as the last in general appearance and vegetative characters: spadix 3-4-branched, the finer ramifications very slender and bearing small clusters of whitish yellow fls.; stamens 6, forming by union a 6-lobed ring: fr. unknown.—A rare Mexican species, known in the trade only at Santa Barbara, Calif.

*B. edulis*, Wendl., sometimes offered in Amer., is *Erythea edulis*, Wats.—*B. filamentosa*, Hort.=*Washingtonia filifera*, Wendl.—*B. filifera*, Hort.=*W. filifera*.—*B. glauca*, Hort.=*Erythea armata*, Wats.—*B. robusta*, Hort.=*Washingtonia*.—*B. Roëzlii*, Lindl.=*Erythea armata*, Wats.

N. TAYLOR.

**BRÀINEA** (C. J. Braine, Hongkong). *Polypodiaceæ*. One species related to Woodwardia. Lvs. in a crown, 1-pinnate, the venation as in Woodwardia, consisting of a single row of areoles along each midvein with free simple veins extending to the margins: sporangia along the free veins, not reaching the margin, without indusium.

**insígnis**, J. Smith. A beautiful small tree fern from S. E. Asia. Requires rich soil, moisture and shade.

R. C. BENEDICT.

**BRAKE**. A name applied to various coarse ferns, particularly to *Pteris aquilina*.

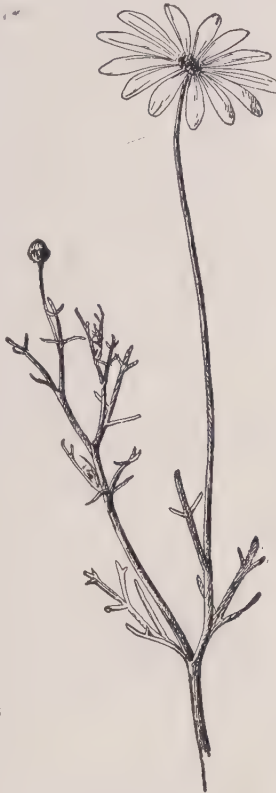
**BRAMBLE**. Thorny plants of the genus *Rubus*,—raspberries, blackberries, dewberries.

**BRASÈNIA** (meaning unexplained). *Nymphaeaceæ*. WATER-SHIELD or -TARGET. One species of aquatic plant widely distributed (in N. Amer., Asia, Afr., Austral.). Lvs. oval, entire, floating, centrally peltate; submerged parts coated with thick transparent jelly: fls. axillary near the summit of the st., small ( $\frac{1}{2}$  in.), purple; sepals 3 or 4; petals 3 or 4, linear; stamens 12-18, on filiform filaments; carpels 4-18, separate, forming indehiscent 1-2-seeded pods. **B. Schrèberi**, Gmel. (*B. peltata*, Pursh. *B. purpurea*, Casp.), is not a showy plant but is interesting and suitable for edgings of small aquatic gardens. Grows in 1-6 f. of water. Easily prop. by division of roots or by seed.

H. S. CONARD.

**BRASSÁVOLA** (A. M. Brassavola, Venetian botanist). *Orchidaceæ*. About twenty tropical American epiphytes, closely allied to *Lælia*, and demanding similar treatment.

The fls. are large, solitary or racemose, the sepals and petals narrow and greenish, the lip white: lvs. thick, solitary. For the cultivator, the treatment of *Brassavola* is identical with that of the Mexican *Lælias*. Plenty of sun to mature the young growths, and water



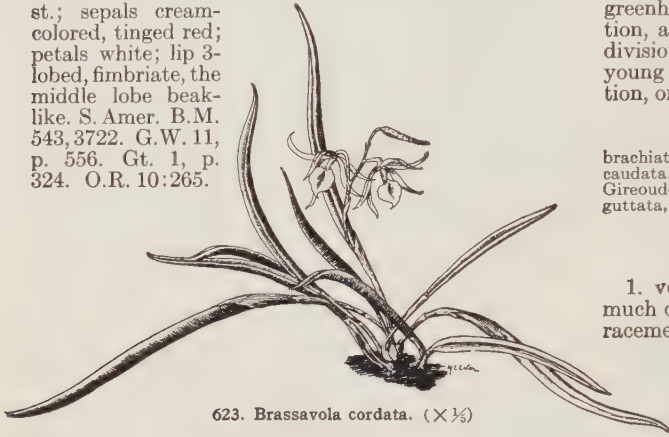
622. *Brachycome iberidifolia*.  
(Natural size.)

when growing, with a somewhat drier atmosphere when resting, will be found to suit them. Suspend on blocks. *B. Digbyana*, Lindl., is *Lælia Digbyana*; *B. glauca*, Lindl., is *Lælia glauca*.

A. *Fls. solitary.*

B. *Lvs. long and narrow: lip fimbriate-toothed.*

**cucullata**, R. Br. (*B. cuspidata*, Hook.). Lf. terete and subulate, grooved above: scape very short but bearing a very long-tubed fl., so that the blossom seems to be elevated on a st.; sepals cream-colored, tinged red; petals white; lip 3-lobed, fimbriate, the middle lobe beak-like. S. Amer. B.M. 543, 3722. G.W. 11, p. 556. Gt. 1, p. 324. O.R. 10:265.



623. *Brassavola cordata*. ( $\times \frac{1}{2}$ )

BB. *Lvs. short: lip entire.*

**acaulis**, Lindl. & Paxt. Low: lvs. very narrow: fls. large, greenish white; lip cordate; tube red-spotted at base. Cent. Amer.

AA. *Fls. in racemes.*

B. *Blade of lip not longer than claw.*

**cordata**, Lindl. Fig. 623. Lvs. linear, rigid, recurved: fls. corymbose; sepals and petals lance-linear, acuminate, pale green; lip roundish-cordate, cuspidate, entire, scarcely as long as the claw. Jamaica, Brazil. B.M. 3782.

BB. *Blade of lip longer than claw.*

c. *Claw  $\frac{3}{4}$ -1 in. long.*

**nodosa**, Lindl. (*B. grandiflora*, Lindl.). Lvs. lanceolate, acuminate, channeled above: fls. few and large, corymbose; sepals and petals linear-acuminate; lip round-ovate, long-cuspidate, entire, longer than the claw. Jamaica, Mex., S. B.M. 3229, of this name, is *B. subulifolia*.

CC. *Claw very short.*

**fragrans**, Rod. Lvs. up to 16 in. long, terete, deeply furrowed above: raceme of 4-12 large fls.; sepals linear-lanceolate, yellowish white and faintly purple-spotted; petals linear, yellowish white; lip obovate, with a very short claw, a yellowish green spot at the base. Brazil. I.H. 5:180.

GEORGE V. NASH.†

**BRASSIA** (named in honor of William Brass, a botanical collector of the last century). *Orchidaceæ*. Epiphytic orchids, thriving in intermediate temperatures.

Pseudobulbs bearing 1 or 2 terminal lvs., and lateral or axillary racemes: sepals narrow, acuminate, or sometimes tailed, spreading, equal or the lateral longer; petals similar to the dorsal sepal or smaller; lip sessile on the foot of the column, spreading, flat, entire, shorter than the sepals; pollinia 2, waxy.—A genus of about 30 species extending from Mex. to Brazil and the W. Indies.

The brassias are plants of easy culture and add considerable interest to collections. They have little value as florists' flower since the colors are not suitable, but a well-grown specimen, such as is often seen in old gar-

dens, makes a most attractive object. The long-tailed sepals and petals are a characteristic of the brassias, and some have an agreeable odor. Pot culture is best, with the usual peat fiber as a rooting medium. In winter-time much less water is necessary than in the growing time, although the plants must never be dried off completely or the flowering will be interfered with. One often sees plants of *B. maculata* brought here by visitors to Jamaica, and other species are now introduced there from the mainland of South America, and thrive well. These may all be grown in an ordinary greenhouse with other plants, in fact a mixed collection, and give satisfaction. Propagation is effected by division only. Green-fly is often troublesome on the young flower-spikes and must be kept down by fumigation, or sponge dipped in soapy water. (Orpet.)

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<i>guttata</i> , 3.		

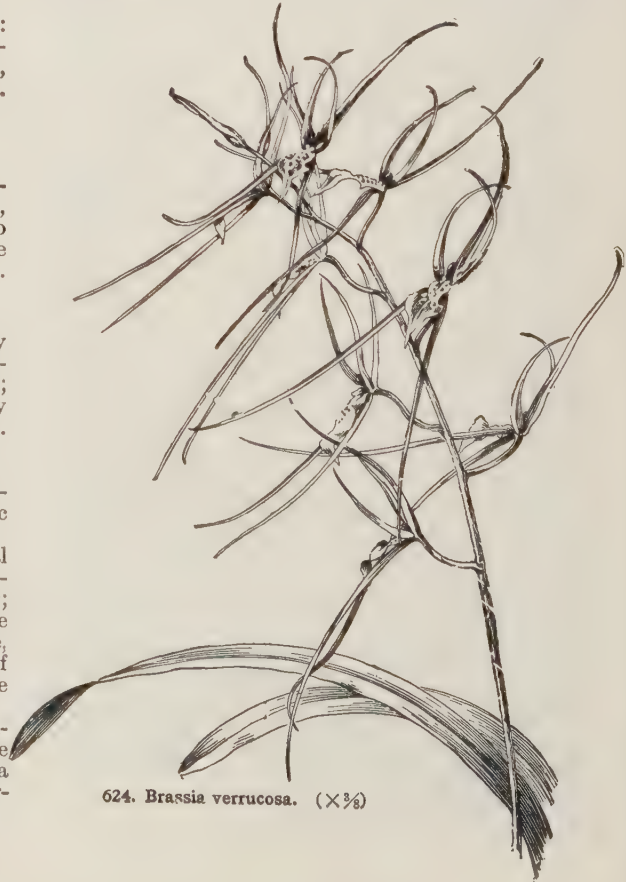
A. *Lip with flat green warts.*

B. *Sepals 3-4 in. long: lip white.*

1. **verrucosa**, Batem. Fig. 624. Pseudobulbs ovoid, much compressed, up to 4 in. long; lvs. up to 1 ft. long: racemes 8-15-flid.; sepals and petals light yellowish green, spotted at base, the sepals 3-4 in. long, the petals about half as long; lip white, with numerous dark green warts, with a broad dilated claw, the upper part nearly orbicular, abruptly acuminate. Guatemala.

BB. *Sepals 6 in. long: lip light yellow.*

2. **brachiata**, Lindl. Pseudobulbs 3-5 in. long, oblong, compressed: lvs. up to 1 ft. long: racemes 6-12-flid.; sepals and petals light yellowish green, with a few purple basal spots, the petals about two-thirds as long



624. *Brassia verrucosa*. ( $\times \frac{3}{8}$ )



as sepals; lip light yellow, with dark green warts, constricted at the middle, the basal part nearly orbicular, the upper portions broadly triangular-ovate, acuminate. Guatemala. B.R. 33:29.

AA. *Lip without warts.*

B. *The lip with a broad claw, broadly obovate or nearly orbicular above.*

c. *Lateral sepals lanceolate, about 3 in. long.*

3. *maculata*, R. Br. Pseudobulbs 3-4 in. long, 1-lvd.: lvs. up to 9 in. long; racemes of 5-10 fls.; sepals and petals yellowish green, brown-spotted on the lower part, the sepals about 3 in. long, the petals two-thirds as long; lip cream-white, purple-dotted, with broad claw, the upper part broadly ovate, acute. Jamaica. B.M. 1691. P.M. 6:5. Var. *guttata*, Lindl. (*B. Wrayæ*, Skinner). Fls. smaller and greener. Guatemala. B.M. 4003.

cc. *Lateral sepals narrowly linear, 4-5 in. long.*

4. *Gireoudeana*, Reichb. Pseudobulbs 1-lvd., 3-4 in. long and about half as broad, much compressed: lvs. up to 1 ft. long; racemes with 6-12 fls.; sepals yellowish green, the base brown-spotted, the lateral sepals up to 5 in. long, the dorsal a little shorter; petals about half as long as dorsal sepal, the base brown, the remainder yellowish green; lip yellow, brown-spotted, with a broad claw, the upper part nearly orbicular, acute. Costa Rica.

BB. *The lip not clawed.*

c. *Lateral sepals 6-8 in. long.*

d. *Sepals greenish yellow; lip ovate.*

5. *caudata*, Lindl. Pseudobulbs up to 5 in. long: lvs. up to 10 in. long; racemes with 6-12 fls.; sepals and petals greenish yellow, brown-spotted at base; dorsal sepal about 3 in. long, the lateral 6 in.; petals about 1 in. long; lip without a claw, ovate, acuminate, light yellow with brown spots. W. Indies. B.R. 832. B.M. 3451. A.F. 6:609.

DD. *Sepals deep orange-yellow; lip oblong-lanceolate.*

6. *longissima*, Nash (*B. Lawrenceana*, Lindl., var. *longissima*, Reichb.). Pseudobulbs 2-3 in. long, compressed, 1-lvd.: lvs. up to 9 in. long; racemes of numerous fls.; sepals and petals deep orange-yellow, with a few large basal blotches; the dorsal sepal about half as long as the lateral which are 7-8 in. long and about  $\frac{1}{4}$  in. wide at base; the petals 2-3 in. long; lip oblong-lanceolate, about 3 in. long, pale yellow, acuminate, purple-spotted at base. Costa Rica. B.M. 5748.

cc. *Lateral sepals 2½-3 in. long.*

d. *Crest 2-lobed; lip oblong.*

7. *Lanceana*, Lindl. Pseudobulbs 2-lvd., 3-5 in. long, much compressed and ribbed: lvs. up to 1 ft. long; racemes of 7-12 fls.; sepals and petals light yellow, brown-spotted below, the sepals 2½-3 in. long, the petals about half as long; lip oblong, yellow, unspotted or with a few basal brown spots, undulate, acute. B.R. 1754. B.M. 3577.



625. Flower of mustard. (×2)

1-1¼ in. long. Guiana.

DD. *Crest truncate in front; lip oblong-lanceolate.*

8. *Lawrenceana*, Lindl. Pseudobulbs 2-lvd., 3-5 in. long, ribbed and much compressed: lvs. up to 1 ft. long; racemes of 7-12 fls.; sepals and petals light yellow, brown-spotted below, the sepals about 3 in. long, the petals about 1½ in. long; lip oblong-lanceolate, light yellow, about 1½ in. long, acute, undulate. Brazil. B.R. 27:18. J.H. III. 30:275.

*B. Forgetiana*, Hort. Fls. whitish with chocolate markings, the crest of the lip orange. Related to *B. maculata*. G.C. III. 48:471. —*B. Josstiana*, Reichb. f. Brazil. Gt. 3:308.

GEORGE V. NASH.

**BRÁSSICA** (old classical name). Including *Sināpis*. *Cruciferae*. Annual and biennial herbs, including cabbage and turnip, and their allies, and also the mustards.



626. Pod or silique of mustard. — *Brassica juncea*. (×1½)

Leaves various, the lower ones mostly lyrate or pinnatifid: fls. yellow, mostly in erect racemes; petals and stamens 4: pod long and slender, compressed-cylindrical or 4-sided, beaked; seeds not winged, the cotyledons conduplicate (Figs. 625, 626).—Nearly or quite 100 species in Eu., Asia, Afr., and many of them widely naturalized. The brassicas possess a remarkable natural tendency toward the thickening of parts under cult., as of root, st., axillary buds, lf.-rosettes, midribs and even of fl.-clusters. Oil is extracted from the seeds of several species, and the ground mustard of commerce is made from the seeds of *B. nigra* and others.

The brassicas are botanically much confused, particularly in the groups containing cultivated species. The manuals probably contain too few rather than too many species of Brassica; at least, the miscellaneous throwing of rutabagas, turnips, rape and other plants into *Brassica campestris* is unnatural, and, therefore, unfortunate. One of the best presentations of the true brassicas is that of De Candolle's Prodrômus, as long ago as 1824 (also in Trans. Lond. Hort. Soc., Vol. V, and in Systema, 2:582-607), and the present treatment follows that outline in general. Some of the forms that are here kept separate as species may be derived from their fellows, but the evidence of such origin is lost, and perspicuity demands that they be kept distinct in a horticultural treatise. The taxonomic arrangement here presented can be regarded as only tentative, however, and new systematic studies should be made of the entire group.

The confusion into which our brassicas have fallen is in some measure due to the various vernacular names in the different countries. The French use the word chou generically to include all forms of *B. oleracea* and the rutabaga—that is, all the blue thick-leaved brassicas; while in England the rutabaga is called the Swedish turnip. A tabular view of the different vernaculars may be useful:

French.	English.	American.
Chou cabus	Cabbage	Cabbage
Chou de Milan	Savoy cabbage	Savoy cabbage
Chou de Bruxelles	Brussels Sprouts	Brussels sprouts
Choux-verts	Borecole or Kale	Borecole or Kale
Chou-rave	Kohlrabi	Kohlrabi
	{ Swede, or Swedish turnip	} Rutabaga
Chou-nave	Turnip-rooted cabbage	
Chou-fleur	Cauliflower	} Cauliflower
Navet	Turnip.	

The Latin names in Brassica, particularly in the oleracea-campestris group, have been so variously used that it is practically impossible to place some of them accurately.

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<i>gemmifera</i> , 1.		

- A. Whole plant glaucous-blue when in fl.: lvs. of the fl.-sts. clasping; fls. various. (Mostly *Brassica* proper.)  
 B. Lvs. from the first more or less fleshy throughout, and glaucous-blue even when young; fls. large and creamy yellow, the petals conspicuously long-clawed, and the sepals usually erect.

1. *oleracea*, Linn. CABBAGE, CAULIFLOWER, BRUSSELS SPROUTS, KALE. Fig. 627.



627. Flowers of cabbage.—*Brassica oleracea*. ( $\times \frac{1}{2}$ )

tion, or perhaps sometimes a biennial, with a very tough and woody root, a diffuse habit, and large thick deep-lobed lvs. in various shades of green and reddish, and more or less glaucous. The lvs. of this plant were probably eaten by the barbarous or half-civilized peoples; and, when history begins, the plant had been transferred to cult. grounds and had begun to produce dense rosettes or heads of lvs. It appears to have been in general use before the Aryan migrations to the westward. There were several distinct types or races of the cabbage in cult. in Pliny's time. From the one original stock have apparently sprung all the forms of cabbages, cauliflowers, brussels sprouts and kales. For this family or group of plants the English language has no generic name. The French include them all under the term *Chou*, and the Germans treat them under *Kohl*. These various tribes may be classified as follows:

Var. *acéphala*, DC. Fig. 706. The various headless cabbages, comprising kales or borecoles, in many types and

varieties, as the tall or tree kales, curled or Scotch kales, and collards. Its likeness may be found wild on the cliffs of the south-eastern coast of England today. The thick, tender lvs. of the kales are used as "greens." See *Collards* and *Kale*. It is not certain that all the kales and collards belong here; some of them may be *B. campestris*.



628. Wild cabbage on the cliffs of the English Channel.

Var. *Caùlo-Ràpa*, DC. KOHLRABI (which see). St. tuberous above the roots, the tuber bearing the lvs.

Var. *gemmifera*, DC. The bud-bearing cabbage, or brussels sprouts (see Fig. 672). In this group, the main st. or axis is tall and erect, and axillary buds are developed into little heads. See *Brussels sprouts*.

Var. *capitata*, Linn. The head-bearing, or true cabbages, kraut of the Germans. In this group, the main axis is short and thick, and the lvs. are densely packed into a gigantic bud or head (Figs. 701-705). The varieties of cabbage are very numerous and various. See *Cabbage*. A serviceable classification of them might follow this order:



629. Flowers of rutabaga—*Brassica campestris*. ( $\times \frac{1}{2}$ )

- A. Lvs. plain (not blistered).  
 B. Head oblong or conical (Fig. 701).  
     c. Green.  
     cc. Red.  
 BB. Head oblate or flattened (Fig. 702), including c and cc, as above.  
 AA. Lvs. blistered or puckered. The Savoy cabbages, Fig. 703 (*B. oleracea* var. *bullata*, DC., or var. *sabauda*, Linn.), to be further divided, as in A.

Var. *botrytis*, Linn. Cauliflower and broccoli, in which the head is formed of the condensed and thickened fl.-cluster. Broccoli produces its heads later in the season than cauliflower, and in mild climates it is allowed to remain and make its heads in spring. See *Cauliflower*.

2. *Napus*, Linn. RAPE. Lvs. smooth from the first: differs from *B. oleracea* chiefly in habit and more deeply scalloped lvs. There are oil-producing forms (var. *oleifera*, DC.). The botanical position of the rapes is doubtful.

3. *campéstris*, Linn. First lvs. hairy; all lvs. glaucous and thickish or somewhat fleshy, the lower ones lyrate and toothed, the st.-lvs. cordate-amplexicaul and



630. Pak-choi.—*Brassica chinensis*.

acuminate; fls. shorter and also smaller than in the *B. oleracea* series (Fig. 629). A weed in waste places, in its run-wild form, but rarely persisting long or becoming troublesome. There are oil-bearing forms (var. *oleifera*, DC.).

Var. *Nàpo-Bràssica*, DC. (*B. oleracea* var. *Nàpo-Bràssica*, Linn.), is the rutabaga evolution of the plant. The rutabaga tuber is either white-fleshed or yellow-fleshed, but the preference in this country seems to be for the yellow kinds. For contrasts with turnips, see No. 4; also *Turnip* in Vol. VI.



BB. Lvs. (except upon the fl.-st.) thin and green: fls. smaller and bright yellow, less prominently clawed.

C. Plant potentially biennial (that is, the root hard and thickened, often distinctly tuberous): foliage firm in texture.

D. Foliage distinctly hairy.

4. *Râpa*, Linn. COMMON TURNIP. Lvs. prominently lyrate or interrupted below, the root tuberous.—Whatever the origin of the rutabaga and turnip may be, the two plants show good botanical characters. The tubers of the two are different in season, texture and flavor. In the rutabaga, the small lvs. immediately following the seed-lvs. are sparsely hairy, but all subsequent lvs. are entirely smooth, densely glaucous blue, thick and cabbage-like, with a fleshy petiole and midrib. In the turnip, the radical lvs. are always more or less hairy, and they are green and radish-like, thin, with slender petiole, and the lvs. are much more lyrate, with interrupted lfts. on the petiole; the small lvs. following the seed-lvs. are also thinner and narrower and more deeply scalloped. In the rutabaga, the fls. are large and creamy-yellow, whereas in the turnip



631. Tuberous root of pak-choi.—*Brassica chinensis*.

they are small, yellow and mustard-like, with shorter claws and more spreading calyx. The turnips vary in hairiness, but the cone of expanding lvs., or the "heart-lvs.," always shows the hairs distinctly, while the heart-lvs. of the rutabagas are normally entirely glabrous, fleshy, and remind one of the young shoots of sea-kale. The turnip usually produces seed freely if the bottoms are left in the ground over winter; and thereby the plant spreads, becoming a true annual and a bad weed, with a slender hard root. Oil-producing forms are var. *oleifera*, DC.

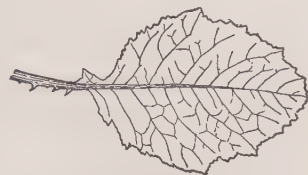
DD. Foliage not hairy.

5. *chinensis*, Linn. PAK-CHOI CABBAGE. Fig. 630. Radical lvs. broad and ample, glossy green, obovate or round-obovate in general outline, either entire or obscurely wavy or even crenate, tapering to a distinct and thick strong petiole, which is usually not prominently margined: pod large and tapering into a beak half an inch long: root sometimes tuberous (Fig. 631).—This plant is grown by the American Chinese, and is occasionally seen in other gardens (see Bailey, Bull. No. 67, Cornell Exp. Sta.). It is impossible to determine whether this particular plant is the one that Linnaeus meant to distinguish by his *Brassica chinensis*, but it best answers the description in his *Amœnitates* (Vol. IV). In Linnaeus' herbarium is a *Brassica* marked "chinensis" in his own handwriting, but it shows purple fls. and has lyrate-lobed lvs., whereas Linnaeus described his plant as having yellow fls. and cynoglossum-like lvs.; probably not the original.

6. *napiformis*, Bailey (*Sinapis juncea* var. *napiformis*, Paill. & Bois). TUBEROUS-ROOTED CHINESE

MUSTARD. Fig. 632. Radical lvs. comparatively few, the blade thin and oval in outline, and on long and slender, slightly feathered petioles, sharply and irregularly toothed, with a thin bloom: beak of the pod more abrupt: root distinctly hard and tuberous.

China.—This vegetable appeared in France in 1882 from seeds sent by Bretschneider, of the Russian legation, Pekin. It was offered by American seedsmen as early as 1889. The plant is a biennial, with thin bluish foliage, and a small tuberous root like a conical turnip. These roots reach a diam. of 3 or 4 in., and are scarcely distinguishable from white turnips in appearance, texture and flavor. In China the tubers are used as a winter vegetable, the seeds being sown in summer. The plant does not appear to have been brought to the attention of botanists until Bretschneider published



632. Lower stem leaf of *Brassica napiformis*.

an account of it in a French journal in 1881. Paillieux and Bois (Le Potager d'un Curieux) regard it as a variety of *Brassica juncea*, to which the Chinese mustard belongs, but it is very different from that plant. It is nearly related to pak-choi, and it may have sprung from the same species; but it is clearly distinguished by its sharply toothed lvs., one of which is shown in Fig. 632.

CC. Plant truly annual: foliage profuse, loose and soft.

7. *Pe-tsai*, Bailey PE-TSAI CABBAGE. Fig. 633. Numerous radical lvs., large and light green, oblong or ovate-oblong, crinkled and very veiny, and the margins

wavy, contracted into a flat and ribbed petiole 1-3 in. wide, which is provided with a wide thin notched or wavy wing; st.-lvs. sessile and clasping: pod of medium size, with a short cone-like beak.—The pe-tsai, or Chinese cabbage, is no longer a novelty in American gardens, although it does not appear to be well known, and its merits are not understood. Its cult. and peculi-



633. *Brassica Pe-tsai*.

arities were described in France as long ago as 1840, by Pepin, who says that, while the plant had been known in botanic gardens for 20 years, it was brought to notice as a culinary vegetable only 3 years before he wrote. It appears to have attracted little attention in Eu. until late in the last century, however. It began to attract attention in the U. S. probably about 25 years

ago. The lvs. tend to form an oblong loose head, like cos lettuce. *Cabbage*; also page 3582.

AA. *Whole plant green or but slightly glaucous when in fl.: lvs. on the fl.-sts. not prominently clasping: fls. small and yellow. Annuals. (Sinapis or Mustard.)*

B. Pod long, terete or nearly so: pedicels spreading.

8. *japonica*, Sieb. POT-HERB MUSTARD. Fig. 634. Annual, self-sowing: rather numerous radical lvs., oblong or oblong-obovate, the margins either crisped or cut into many very fine divisions, the petiole distinct at its lower end; st.-lvs. all petioled: pod very small, with a slender beak. —The very soft thin lvs. make excellent "greens." Long known, but with no designative name, in old gardens in this country, and sometimes run wild about premises. Intro. in 1890 by John Lewis Childs as California pepper-grass. A very worthy plant (Bull. 67, Cornell Exp. Sta.).



634. *Brassica japonica*, the radical leaves used for greens.

9. *junceae*, Coss. (*Sinapis juncea*, Linn.). CHINESE MUSTARD. Figs. 626, 635. Rank and coarse grower, in the common forms making great tufts of root-lvs. if sown early: radical lvs. usually abundant and often very large, oval or obovate in outline, the blade angled or toothed, tapering into a narrow petiole, which generally bears leafy appendages; lower st.-lvs. more or less toothed and petiolate, the upper ones oblong or oblong-lanceolate, entire and usually sessile or alternate: flowering sts. and lvs. more or less lightly glaucous: fls. bright yellow: pod slender, of medium size, tapering into a short seedless beak. Asia.—This species is held by Hooker and Thomson (Journ. Linn. Soc. v. 170) to include a great variety of forms, as *Sinapis levigata*, Linn.; *S. integrifolia*, Willd.; *S. ramosa*, *S. rugosa*, *S. patens*, *S. cuneifolia*, Roxbg.; *S. lanceolata*, DC., and others. There are two types of it in cult. in our gardens, one with the radical lvs. somewhat sharply toothed and nearly smooth below (sometimes grown as



635. Broad-leaved Chinese mustard.—Form of *Brassica juncea*.

*Brassica* [or *Sinapis*] *rugosa*), the other with root-lvs obtusely toothed and spinescent on the veins below (comprising Chinese mustard, Chinese broad-leaved mustard, and brown mustard). Linnæus founded his *Sinapis juncea* on a figure in Hermann's *Paradisus* (Hermann, *Paradisus Batavus*, t. 230, 1705), which represents a plant very like the former type mentioned above, and which Hermann described as "lettuce-leaved."

10. *alba*, Boiss. WILD MUSTARD. Tall: lvs. pinnatifid and rough-hairy: pods spreading, hairy, the lower part thick and few-seeded, the beak longer: seeds pale brown, large. Weed, from Eu.

11. *arvensis*, Kuntze (*B. Sinapistrum*, Boiss. *Sinapis arvensis*, Linn. *Sinapistrum arvense*, Spach). CHARLOCK. Tall: lvs. strong-toothed, or sometimes nearly lyrate: pods knotty, glabrous or hairy, the upper third indehiscent and 2-edged, usually 1-seeded. Weed, from Eu.

BB. Pod short, distinctly 4-angled: pedicels and pods appressed.

12. *nigra*, Koch. BLACK MUSTARD. Fig. 636. St. tall and upright, with wide-spreading branches: lvs. pinnatifid, somewhat hairy: pods short and erect, glabrous; seeds small and dark brown, pungent, supplying the mustard of commerce. Cult. in Eu., but a weed in this country.—Commercial mustard is the flour of the seeds of this species chiefly, but the seeds of *B. alba* and probably of *B. juncea* are sometimes used.

*B. adpressa*, Boiss. Annual or biennial, much like *B. nigra* but st. stiffer, lvs. less divided and plant somewhat hoary: pods with a short 1-seeded beak. Occasionally adventive from Eu.—*B. sinensis*, Hort. = *B. chinensis*.

Many forms of *Brassica* have been described that it is not necessary to endeavor to account for here. Studies in crossing may be expected to indicate some of the relationships. The writer has found no difficulty in crossing cabbage-kale-cauliflower and others. See Lund and Kjaerskou, *Landbrügets Kulturplanter* No. 4; and 'Morfologisk-anatomisk beskrivelse af *Brassica oleracea*, *B. campestris* og *B. Napus*.'

L. H. B.

**BRASSOCATTLÆLIA** (compounded from *Brassavola*, *Cattleya* and *Lælia*). *Orchidaceæ*. A small group of trigenic hybrids between the genera *Brassavola*, *Cattleya* and *Lælia*.

*B. balarucensis* (*B. Digbyana* × *L.-C. Schilleriana*).—*B. Fuerstenbergii* (*Brassolælia Gratrixia* × *C. Trianae*).—*B. Máckayi* (*B. Digbyana* × *L.-C. elegans*). See also *Adamara* and *Linneara*.

**BRÁSSOCÁTTLEYA** (compounded from *Brassavola* and *Cattleya*). *Orchidaceæ*. A genus established to include hybrids of the species of the genera *Brassavola* and *Cattleya*.

The following, among others, are offered in the American trade:

*B. Akèbenii* (*B. Digbyana-gigas* × *C. Luddemaneana*).—*B. Alexánderi* (*B. Digbyana* × *C. citrina*).—*B. Chámberlainiæ* (*B. Digbyana* × *C. quadricolor*).—*B. Cliftonii*, Hort. (*B.-C. Digbyana-Massia* × *C. Trianae* var. *Uplands*). G.C. III. 45:34. O.R. 18:48.—var. *Wellesleyæ*, Hort. G.C. III. 51:135.—*B. conspicua* (*B. glauca* × *C. Leopoldii*).—*B. Digbyano-Förbesii* (*B. Digbyana* × *C. Forbesii*).—*B. Digbyano-gigas* (*B. Digbyana* × *C. Gigas*).—*B. Eva* (*C. Lawrenceana* × *B. Digbyana*).—*B. gesneriæflóra* (*B. fragrans* × *C. maxima*).—*B. heatonensis* (*B. Digbyana* × *C. Hardyana*).—*B. Hólfordii* (*C. Forbesii* × *B. Digbyana*).—*B. Hyæz* (*B.*



636. Siliques of *Brassica nigra*. (×1)



Digbyana × C. Harrisoniana).—*B. langleyensis* (B. Digbyana × C. Schroederæ).—*B. Laurentiano-glauca* (B. Laurentiano × C. glauca).—*B. Leemannii* (B. Digbyana × C. Dowiana). O.R. 11:57.—*B. Mariæ* (B. Digbyana × C. Warneri).—*B. Maronæ* (B. Digbyana × C. Warszewiczii).—*B. nivâlis* (B. fragrans × C. intermedia).—*B. Peetersii* (B. glauca × C. Lawrenceana).—*B. Pocahontas* (B. Digbyana × C. Eldorado).—*B. Sânderi* (B. glauca × C. Schroederæ).—*B. sandhaghensis* (B. Digbyana × C. Setulleriana).—*B. striata* (B. fragrans × C. Mossiæ). Fls. rose-colored, fragrant. R.H. 1903:276, desc.—*B. Süssanæ*. (B. Digbyana × C. Thayeriana).—*B. Thônionii* (B. Digbyana × C. Gaskelliana). J.H. III. 61:601.—*B. Veitchii* (B. Digbyana × C. Mossiæ).—*B. Vilmoriniana* (B. Leemannii × C. Mossiæ).—*B. Wellesleyæ* (B. glauca × C. Mossiæ Wageri).

*Brassavola Digbyana*, Lindl., is now considered a *Lælia*, so the above hybrids, under that conception, might be designated *Lælio-Cattleya*.

GEORGE V. NASH.

**BRÁSSO-LÆLIA** (compounded of the genera *Brassavola* and *Lælia*). *Orchidaceæ*. Established to include hybrids between the two genera.

The following are to be found in the American trade:

*B. Canari* (B. Digbyana × L. xanthina).—*B. Digbyano-purpurata* (B. Digbyana × L. purpurata).—*B. fladôsa* (B. nodosa × L. flava).—*B. Helen* (B. Digbyana × L. tenebrosa). O.R. 10:169.—*B. Jéssopii* (B. Digbyana × L.-C. xanthina).—*B. Lellieixii* (B. Digbyana × L. anceps).—*B. Rölfei* (B. Digbyana × L. crispa).—*B. Thwaitesii* (B. Digbyana × L. grandiflora).—*B. Veitchii* (B. Digbyana × L. purpurata).—*B. westfieldensis* (B. glauca × L. flava).

*Brassavola Digbyana*, Lindl., is now considered a *Lælia*, so the above hybrids, under that disposition, might be designated as hybrid *Lælias*.

GEORGE V. NASH.

**BRÁSSO-LÆLIA-CATTLEYA**. *Orchidaceæ*. A trigenic hybrid. *B.-L.-C. Fowléri* (C. Schroederæ aurantiaca × Brasso-Lælia Mrs. M. Gratrix). Fls. yellow, tinged, and veined with salmon-rose. G.C. III. 41:303. *Brassavola Digbyana*, one of the elements, is now considered a *Lælia*, and the plant would then belong to *Lælio-Cattleya*.

GEORGE V. NASH.

**BRAVÔA** (Bravo, Mexican botanist). *Amaryllidaceæ*. A small genus, much resembling in some of its species the tuberose (*Polianthes*), and hardly distinct from it.

Stems slender, from small thickened rootstocks: lvs. mostly basal: infl. a lax spike or raceme; fls. always in pairs, more or less bent or curved; stamens 6, included within the perianth-tube: fr. 3-celled, many-seeded. Native of the mountain and tableland region of Mex.—Five species have been described formerly, but recent explorations have discovered some 5 or 6 additional species.

While the flowers are not so showy as the common tuberose, yet the genus should be found in every choice bulb collection. Only one species has been cultivated to any extent, and even this species is not well known. As the species often grow in the high mountains of Mexico, they ought to be hardy in the southern stretches of the temperate zone.

**geminiflora**, Llav. & Lex. MEXICAN TWIN-FLOWER. Sts. 1-2 ft. high: bulbs small, 1-1½ in. long, the outer scales cut into fine fibers at the top: basal lvs. linear, erect, 6 lines or less broad, smooth: fls. in a slender raceme, reddish or orange-colored; lobes minute, rounded. B.M. 4741.—Handsome, and worthy of more attention.

*B. Bulliana*, Baker. Basal lvs. described as lanceolate, 1-1½ in. broad: fls. in 5 or 6 pairs, white. Seemingly too near the little-known

*Polianthes mexicana*. Not in cult.—*B. sessiliflora*, *B. densiflora*, and *B. singuliflora*, are rare species, only known from herbarium specimens. The latter two, however, should probably be excluded from this group.

J. N. ROSE.

**BRÀYA** (Count de Bray, 1765-1831, German botanist). *Cruciferae*. Small tufted alpine or boreal perennial herbs, sometimes grown in alpine gardening. There are a dozen or more species in Eu., Asia and Amer. Plant glabrous or cano-tomentose: lvs. radical, spatulate or linear, entire or dentate: fls. on scapes that often are naked and sometimes only 1-fl'd. but mostly bearing racemes or corymbs, white or rose-colored or purple. *B. alpina*, Sternb. & Hoppe, is the usual species, with white fls. *B. pinnatifida*, Koch (probably properly *Sisymbrium pinnatifidum*, DC.), has white-lilac fls. Practically unknown in cult. in N. Amer.

**BRAZIL-NUT:** *Bertholletia*.

**BREAD-FRUIT:** *Artocarpus*.

**BREAD-NUT:** *Brosimum Alicastrum*.

**BREEDING OF PLANTS.** The definite producing of kinds of plants adapted to given uses and conditions is known now as plant-breeding. The existing varieties are of course the result of the action of natural tendencies and laws, but the producing of them has not been, for the most part, a conscious, or at least not a regulated, act on the part of man. The laws of variation and inheritance are now beginning to be understood, and the application of this knowledge is to produce orderly and more or less predictable results.

In beginning the artificial cultivation of plants, our early ancestors, even with their crude understanding and methods, probably selected seed for planting from the best wild individuals of any plant. The selection of seed from the best individuals has thus been continuing for thousands of years, ever since the dawn of civilization. While this is a crude method of breeding, if long continued on an extensive scale, it could not, as is now recognized, fail to have results. The greatness of the changes produced is shown by the fact that some of the most extensively cultivated crops, such as wheat and maize, have been so modified that the wild types from which they sprang cannot now be recognized, although the original wild ancestors probably still exist.

Breeding did not become established as an art until comparatively recently. The sexuality of plants was not established until it was proved experimentally by Camerarius in 1691; and the first hybrid of which there is record was made in 1719 by Thomas Fairchild, an English gardener, who crossed the carnation with the sweet william. The first exact knowledge of hybridization dates from about 1761 when Koelreuter began publishing the results of his observations, but even his work had little bearing on practical plant-breeding. The systematic breeding of plants may be said to have begun with the work of Knight and Von Mons about the beginning of the nineteenth century.

Knight worked mainly in hybridization and in 1806 said: "New varieties of every species of fruit will generally be better produced by introducing the farina of one variety of pollen into the blossoms of another than by propagating from a single bud." Von Mons worked mainly in selection and it is interesting to note that his experiments were made primarily with pears. He emphasized continuous selection and produced very many valuable varieties. It is probable that a large part of the success of Von Mons' work was due to the fact that pears are normally sterile to their own pollen, requiring cross-fertilization, and, therefore, many of his new varieties were probably hybrids. He was not aware of this fact, however, and it made no great difference in the establishment of the principle which has since proved to be so important.

A most important stimulus to the development of

plant-breeding was given by the publication of Darwin's famous works, particularly his "Animals and Plants under Domestication," in 1868. His extensive researches, masterful compilation and systematization of the existing knowledge may be said to have established breeding on a systematic basis.

Following Darwin, little advance was made in the knowledge of the principles of breeding until in 1900, when Mendel's papers on plant hybridization, describing his now famous principles or laws of inheritance, were rediscovered independently and brought to attention by DeVries, Correns and Tschermak. The discovery of these laws and the publication of DeVries' "Mutation Theory" in the same year, marked the beginning of a new era in plant-breeding. No matter what the final conclusions may be regarding Mendel's principles and the mutation theory, the stimulation which these two theories have given to breeding has already served greatly to modify and extend knowledge, both in scientific and practical directions.

The great advance that has been made in the discovery of the underlying principles of breeding puts experimentation in this field on a much surer basis and the breeder can now approach his subject with definite understanding.



637. Variations in size of wheat plants grown side by side in field.

#### Classification of varieties.

To understand clearly the character of organisms with which breeding deals, careful definitions of the different groups of cultivated plants which are ordinarily known as varieties are needed. One speaks of varieties of wheat, corn, apples and pears, yet it is known that these varieties differ from each other as natural groups. In order to distinguish clearly these differences, the following classification of varieties into races, strains and clons has been proposed:

**Races** are groups of cultivated plants that have well-marked differentiating characters, and propagate true to seed except for simple fluctuating variations. The different groups of beans, peas, wheat, oats, corn, cotton, and the like, referred to commonly as varieties, are thus in a more restricted sense races. Boone County White, Leaming, Golden Bantam, and so on, would be recognized as races of corn, and Turkey Red, Fulcaster, Fultz, as races of wheat, and Early Paris, Dwarf Erfurt and Snowball as races of cauliflower.

**Strains** are groups of cultivated plants derived from a race, which do not differ from the original of the race in visible taxonomic characters. When the breeder, by a careful selection of Blue Stem wheat, produces a sort of Blue Stem that differs from the original race only in the quality of yielding heavily, it would be called a strain of Blue Stem.

**Clons** are groups of cultivated plants the different individuals of which are simply transplanted parts of the same individual, the reproduction being by the use of vegetative parts such as bulbs, tubers, buds, grafts, cuttings, runners, and the like. The various sorts of apples, potatoes, strawberries, chrysanthemums, and so on, commonly denominated varieties, in a more restricted sense would be clons. Clons of apples, pears, strawberries, potatoes, and the like, do not propagate true to seed, while this is one of the most important characters of races and strains of wheat, corn, and others. The term variety would thus be used in a general sense, and would include races, strains and clons.

#### Heredity.

The laws of heredity are of primary importance to the breeder. It is a general principle that like begets like, but it is also true that like frequently gives rise to

unlike. In general, by heredity is meant the tendency which an organism manifests to develop in the form and likeness of its progenitors, and the study of heredity includes thus the inheritance of characters. It is of the utmost importance that organisms in general reproduce their kind, as otherwise the breeder would be confronted with confusion, but it is of equal importance that the offspring does not always reproduce the parental characters. There are thus apparently two conflicting principles in plant-breeding. On the one hand, the breeder seeks to produce variations in order to get new types as the foundations for improvement. On the other hand, when such a variation from or improvement on the normal type is secured, he reverses the process and tries to establish heredity and reduce the amount of variation, so that the aphorism, "like begets like," will hold true.

In pedigree- or grade-breeding, and in breeding to produce new varieties, the importance of hereditary strength cannot be overestimated, as it is only by rendering this power very great that any new form can be brought to what is called a fixed type.

In recent years, the ideas of fixity of type have been greatly modified, and it is now held that fixity of type is secured by purifying a race from all admixtures so that any character represented in a race will be pure.

#### Unit-characters.

The modern studies of heredity have led to a new conception of organic characters that should be clearly understood by the breeder. A careful study of species or varieties of plants or animals focuses the attention not on the generality of the differences existing but rather on the differences in certain characters; one observes whether a plant is smooth or hairy, cut-leaved or entire-leaved, much branched or simply branched, erect or procumbent, tall or short, and the like. This leads to the conception that a plant is not of simple organization but is comprised of a combination of characters. These characters or the physiological units which cause them are now thought of as in considerable measure independent of each other and as representing distinct organic units. The classical studies of Grego



638. Red cedar: a, Columnar form; b, Spreading form.

Mendel on the hybridization of races of peas that exhibited different characters established the fact that at least certain characters are inherited separately and may form permanent new combinations.

A unit-character, then, may be defined as any characteristic quality or set of qualities or expression of character in an organism that is inherited as a whole and independent of any other quality or set of qualities. They are the organic units of inheritance. The units that are considered in hybridization are not the species or varieties themselves, but the unit-characters of which they are composed. The origin of a new



variety would then consist in the acquirement of a new character by the organism or the loss of an old character or of the production through hybridization of new combinations of characters that already existed but in different combinations.

#### Nature of variation.

While, as indicated in the discussion of heredity, organisms are usually reproduced in the likeness of their parents, nevertheless it is well known that all plants vary. Individual plants differ from one another just as do men. The fact that plants can be improved by selection depends upon the occurrence of these so-called variations. One is accustomed to think of plants as very stable and uniform. Casually looking over a field of ox-eye daisies and admiring their beauty, one distinguishes no apparent variability; all seem to be alike. Nevertheless, if the plants are examined carefully and the different individuals studied, it is found that each one possesses certain peculiarities. Some have large flower-heads, others small flower-heads; some have very many rays or petals, others comparatively few; some have broad rays, others narrow rays. Some plants are tall, others short. No two plants can be found which do not differ from each other in some noticeable character. They present different facial expressions, the same as do people or cattle, so that different individuals may be recognized after one has studied them and made their acquaintance. This is one of the interesting studies which the breeder pursues. Careful gardeners learn to recognize the individual plants that they handle day after day as the shepherd recognizes the different members of his flock.

The inheritance of a character ordinarily does not mean its exact expression in the offspring as in the parent. In considering variations from the standpoint of the conception of unit-characters, it must be remembered that only the determiners of a character are inherited and the expression of the character in the new individual is influenced by the environment under which the individual develops. It must also be remembered that in the higher plants and animals with which the breeder ordinarily has to deal, an individual results from a fertilized egg-cell which contains the heritage determiners of two parents and, as there are a very large number of characters making up any individual and as different individuals possess different determiners which are brought together in fertilization, rarely or never can one individual be conceived to be an exact counterpart of another.

*Variations* are of very great difference in magnitude and kind; and while many different names have been given to the different types of variation, the most generally accepted usage at present is to classify all variations either as fluctuations or mutations.

*Fluctuations* are those variations that are supposed to be due to the direct action of environment and that are not inherited. The variation in size as a result of richness of soil, is such a fluctuating variation and, as well recognized, is not a heritable character. A similar illustration of such a variation is the difference in size of oat or wheat plants due to crowding in the field (Fig. 637). It is known that if a pole bean be transferred to the North, it tends to produce a bush type, and if a cowpea be transferred to the North, it tends to shorten up its vine and assume a bush habit. An interesting illustration of such modifications is shown in the ordinary red cedar, *Juniperus virginiana* (Fig. 638). In the rich, moist soils of Pennsylvania, Maryland and Virginia, this tree forms a beautiful tall columnar top with dense foliage (Fig. 638 *a*). On the dry, sterile, limestone hills of Kansas, Nebraska, and Kentucky, and in the sandy soil of Florida, the same tree produces a spreading, scraggly top of entirely different character (Fig. 638 *b*). If one of these trees is trans-

planted while young, from sterile barren soil to moist rich land, it assumes the tall columnar habit as a result of the environment.

Plant-breeders have sometimes assumed that such modifications, which are the result of environment (Fig. 639), are of great importance to them. This matter, however, is in grave doubt. The information at command indicates that these characters, which are physiological adaptations, are not hereditary, and are lost as soon as the plant is transferred again to its normal environment. If, for example, it is desired to produce a bush cowpea and the selection is undertaken in the South with a viny variety, a search should be made among the plants for the individual that approaches most nearly to the bush type, and it is probable that this plant would be as likely to transmit this character to its progeny as a similar bushy type selected under northern conditions. As a matter of fact, it may be that this tendency could be recognized much more



639. Variation in size of dandelion caused by growing at different altitudes. *a*, Plant grown in valley at low altitude; *b*, plant grown on mountain at high altitude. (From Bonnier.)

clearly in a southern location, where the plants normally produce vines, than in a northern location.

*Mutations*, on the other hand, are changes that are more profound and effect the germinal cells of the organism in such a way that the changes are inherited. The most typical illustrations of mutations are the striking large type-variations that are known to gardeners as sports, and which ordinarily reproduce true to seed. It must not be understood, however, that all mutations are large type-variations. This, it is true, was in large measure the meaning given to mutations by DeVries in his development of the mutation theory of evolution, but the more general interpretation of biologists at present is to consider any type of variation that is inherited as a mutation. Many small variations, such as a slight difference in height of ear in corn, may be regularly inherited, and in some instances differences that are so slight as to be distinguished only by careful biometrical analysis are regularly inherited, generation after generation, even under very different conditions. Recent scientific studies have emphasized

the great importance of such variations in the production of cultivated varieties and the evolution of species. As is well known to gardeners, these sports or mutations appear suddenly without warning or reason, so far as is known. They cannot be produced, and one must simply wait until they appear and then be prepared to recognize and propagate them. Mutations usually reproduce their characters without much reversion to the parental type except such as is caused by cross-pollination. Mutations of self-fertilized plants thus usually come true to type, while in cross-fertilized plants the mutation must usually be cultivated in an isolated place and carefully selected to weed out the effect of such crossing as has occurred. Many seedsmen examine their trial-grounds regularly for sports or mutations, and many of the best varieties have resulted from the selection of such sports. Livingston, of Ohio, who during his life was famous for the number of new varieties of tomatoes which he produced, made it a practice to search regularly the fields of tomatoes, which he grew for seed purposes, for such sports, and almost all of his numerous varieties were produced by the discovery of such striking variations.

A very interesting case of a variety that originated as a seedling sport or mutation is the now familiar case of the Cupid sweet pea. Until about fifteen years ago the only sweet peas known were the ordinary tall twining sorts which grow to a height of 3 to 6 feet, depending upon the richness of the soil. At this time there was found in California, a small dwarf sweet pea plant only about 6 or 8 inches high. This was growing in a row of the Emily Henderson variety, one of the ordinary tall sorts from which it evidently had sprung. Seed of this

different sorts, until now there are varieties of Cupids representing almost all variations of color and shape of flower known in the sweet pea family.

#### *Causes of variation.*

Understanding of the causes of variation is as yet very imperfect. Fluctuations are in general interpreted as the direct physiological action of environment on the plant, or, in other words, environmental reactions. There would seem to be no doubt of the correctness of this view for the cause of ordinary fluctuations, and it may be accepted as the cause of such fluctuating variations as the breeder will commonly meet. Such reactions as the changes in structure and form of the entire air-leaves and finely divided water-leaves of certain buttercups (*Ranunculus*) and the floating and submerged leaves of pondweeds or *Potamogeton* (Fig. 640), and the loss of knees on the bald cypress when cultivated on high land where the soil is well aerated, may be interpreted merely as extreme environmental reactions. Even these extreme changes are not inherited other than that the ability to react in this way under different environments is inherited.

To account for mutations is, however, a much more difficult matter and no definite conclusion as to their cause has yet been reached. Lamarck and his followers have strongly maintained the hypothesis that changed environment would stimulate the production of variations that would permanently effect the organism and its progeny in the direction of better adapting them to their environment. Many scientists, even today, believe in the effectiveness of environment in developing adaptive changes. Weisman and his followers, however, appear to have shown that characters acquired through external influences, the so-called acquired characters, do not affect the germ-cells, which are early differentiated in the development of the organism, and are thus not inherited.

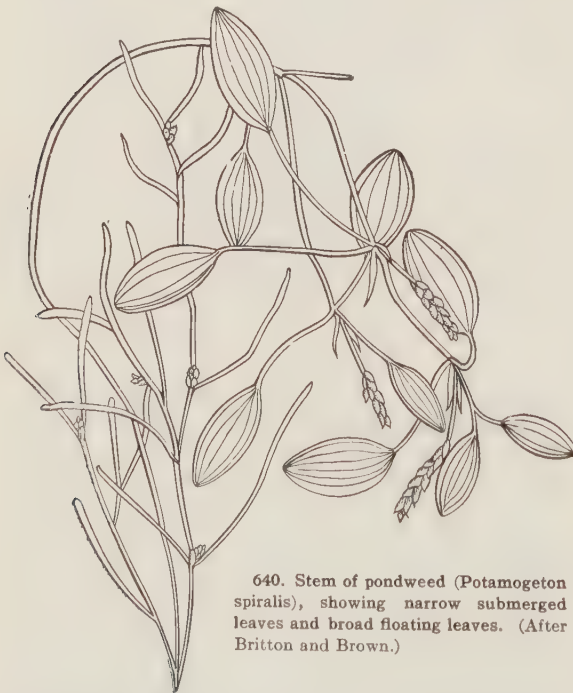
While, in general, it is certain that the ordinary environmental reactions are not inherited, it is known that plants long grown under a certain environment become modified to suit that environment, and that such adaptive changes have in some way so modified the organism that the adaptive changes are rendered heritable. Thus the conclusion follows that in some way environment by its stimulation does occasionally affect the germ-cells and produce changes that are inherited. Plants that have long been cultivated under widely varying conditions almost invariably develop numerous heritable variations that would be classed as mutations. The older breeders strongly held to the belief that such conditions as change of food-supply, change of altitude, artificial cultivation, budding, and grafting, indeed the ordinary manipulation of agricultural cultivation, lead plants to vary in directions of importance to the breeder. Clearly, no problem is of more importance to the breeder than to be able to produce or cause such new characters to appear.

It is only very recently that the idea has developed that one can go farther than possibly to change the environment. With the publication of MacDougal's researches in 1906, describing mutations that were apparently caused by injecting the capsules of plants with certain solutions, such as zinc sulfate and magnesium chloride, a possible new method of forcing variations was introduced. MacDougal apparently obtained marked variations as a result of his treatment, that were inherited in succeeding generations.

Tower, by subjecting potato beetles during the formation of the germ-cells to extremely hot and dry or hot and humid conditions with changes of atmospheric pressure, was able to cause the development of marked changes or mutations that were found to transmit their characters true through several generations and which segregated as unit-characters following hybridization. He concludes from his experiments "that heritable variations are produced as the direct response to external stimuli."

Gager has produced similar changes in plants by subjecting the developing ovaries to the action of radium rays, and a number of similar studies by Hertwig and others indicate that radium emanations have a very active effect on both plants and animals.

While the evidence favoring the value of such external stimuli as the above in producing new heritable characters is apparently definite and positive, the extent to which the method can be used in



dwarf plant was saved and grown, and it was found to reproduce plants of the same dwarf character. The variety was designated the Cupid, under which name it was introduced to the seed trade and distributed over the world. The Cupid differed from other sweet peas not only in height but in its closely set leaves and general habit of growth. Indeed it is as distinct from other sweet peas as are distinct species of plants in nature. From the original Cupid, there have sprung many



practical breeding has not been determined, and indeed further experience must be awaited before the evidence, or the interpretation of the evidence presented in these very valuable and suggestive researches, can finally be accepted. Humbert has made experiments in which the capsules of a pure line of a wild plant (*Silene noctiflora*) were injected with the solutions used by MacDougal, and although the number of plants handled (about 15,000) was apparently as great or greater than was used in MacDougal's experiments, no mutations were found in the treated plants that were not also found in the untreated or check plants.

Some observations and experiments are recorded in literature which indicate that mutilations or severe injury may induce the development of mutations. Most noteworthy among such observations are those of Blaringhem, who by mutilating corn plants in various ways, such as splitting or twisting the stalks, apparently produced variations that bred true without regression and which he described as mutations. Observations on the great frequency of striking bud-variations on recovering trunks of old citrus trees in Florida, following the severe freeze of 1894-5, also furnished evidence in support of this theory.

While the evidence at command regarding the artificial production of mutations is not yet sufficiently exact and trustworthy to enable one to draw definite conclusions and formulate recommendations for practical breeders, it may be stated that this is apparently one of the most profitable lines of experimentation for the immediate future.

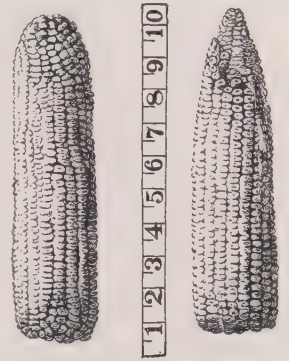
### Principles of selection.

Selection is the principal factor of breeding, both in the improvement of races and in the production of new races and varieties (Fig. 641). The keynote of selection is the choice of the best, and a factor of the highest importance in finding the best is the examination of very large numbers.

In evolutionary studies, it has long been recognized that variation is the foundation of evolution and that no evolution is possible without variation; but, to selection has been assigned an all-important part as guiding and even stimulating the variation in a certain direction. Darwin, and particularly some of his more radical followers, have assigned to selection a creative force, in that it has been assumed that when nature by a slight variation gave the hint of a possible change in a certain direction, natural or artificial selection, by choosing this variation and selecting from among its progeny the most markedly similar variants, could force the advance in the direction indicated. Since Darwin's time, this cumulative action of selection had been emphasized so forcibly that selection had come to be recognized as an active force in creation rather than merely as a determinative agency.

It is certain, of course, that, by careful observation and selection from any particular race, ultimately a new race may be produced. The question is whether the individual or individuals selected in producing the new race have not varied by mutation or seed-sporting rather than being merely representative of the cumulative result of the selection of slight individual variations. The sugar-beet furnishes an interesting illustration in this direction. It will be remembered that Louis Vilmorin started the selection of sugar-beets for richness in sugar between 1830 and 1840, selecting first by means of specific gravity, the method being to throw the beets into solutions of brine strong enough so that the great majority of them would float, the few that sank being of greater specific gravity and presumably of greater sugar-content. Considerable improvement was produced by this method. About 1851, the method of chemical analysis was introduced to determine the exact sugar-content. At this time, the sugar-content was found to vary from 7 to 14 per cent, and in the second generation of selection individuals with 21 per cent of sugar were found. The selection based on percentage of sugar, using the beets highest in sugar as mothers, has been continued regularly since that time, and the industry has come to rely entirely on careful selection for high sugar-content. It would be expected that under these conditions, the percentage of sugar would have increased sufficiently so that the selected plants could be considered a different race or strain. Yet, after fifty years of selection, the highest sugar-content found is only about 26 per cent, and this in a very few

instances, seldom over 21 per cent being found. At the present time, many thousand analyses are made every year, so that abundant opportunity is afforded to find individuals producing a high sugar-content. On the contrary, when Vilmorin's work was started, the determination of sugar-content was made by very laborious methods, and was limited to comparatively few individuals. It is not improbable that if Vilmorin had been able to make analyses of the sugar-content in many thousands of roots, he would have found certain individuals producing as high as 26 per cent. The inference from this illustration would be that the limitations of the variation within the race have not been surpassed as a result of selection.



641. Improvement of corn by selection. Boone County White corn on left, and original type from which it was developed by selection on right.

Of recent studies favoring the active influence of selection in creating or strengthening characters, the most noteworthy are those of Castle and Smith.

Castle and his assistants made an extensive series of experiments with hooded rats to increase the black-colored dorsal band on the one hand and to decrease or obliterate it, on the other. He appears to have obtained very positive evidence favoring the gradual cumulative action of the selection, as he succeeded in markedly increasing the amount of black in one strain until the rats were almost wholly black and in the other strain almost wholly obliterating the black. Castle has also obtained similar results in producing a four-toed race, and a change of coloring in guinea-pigs. His view may be summarized in the following quotation: "In Johannsen's view, selection can do nothing but sort out variations already existing in a race. I prefer to think with Darwin that selection can do more than this; that it can heap up quantitative variations until they reach a sum total otherwise unattainable, and that it thus becomes creative."

The experiments conducted by Smith and others at the Illinois Experiment Station on selecting high and low strains of corn with reference to oil- and protein-content, have resulted in markedly distinct strains possessing these qualities. Experiments have also been made in cultivating these varieties without selection and the new characters have been maintained for several years without marked regression.

The standard researches of DeVries, now familiar to all, challenged the correctness of the selection theory and sought to show that species originated by sudden jumps or mutations. It may be admitted that DeVries proved that species or new characters were formed suddenly as mutations, but this would not prove that they might not also be formed or actually induced to mutate by a continuous process of selection. Indeed, in his experiments on the production of a double-flowered variety of *Chrysanthemum segetum* ("Mutationstheorie," Vol. I, p. 523), a few generations of selection led to increasing markedly the number of ray-florets before the ligulate corollas appeared among the disk-florets, the change that he interpreted as the mutation that gave him the double variety.

Tower's experiments with the potato beetle in attempting to create by selection large and small races, albinic and melanic races, and races with changed color-pattern, although conducted carefully from ten to twelve generations, failed to give any evidence of producing permanently changed types. While strains of plus and minus varieties gave populations with a range of variation apparently markedly restricted to their respective sides of the normal variation range, still these selected strains did not greatly exceed the normal range of variation in either direction, and when the selection was discontinued, in two or three generations, again populations exhibiting the normal range of variation were produced. Jennings, in a series of selection experiments with *paramecium* extending over twenty generations, and Pearl, in an extensive experiment in the selection of chickens in an attempt to produce a breed of high egg-laying capacity, failed to secure any evidence favoring an accumulative effect of selection.

No series of experiments have had a more profound influence on the conception of selection than those of Johannsen, the Danish investigator. In studying commercial varieties of beans, he found that such characters as weight and size of seed fluctuated around a certain average, and when large seed or small seed was chosen, the progeny showed the influence of the selection, being smaller or larger in accordance with the direction of the selection. The progeny, however, did not exhibit the extreme sizes of the selected parents, there being a certain regression toward mediocrity. In investigating this matter, Johannsen was led to use the ordinary pedigree method of cultivating the progeny of different individuals separately and inbreeding or selfing all seed used to prevent the

crossing of different strains. By this method, he found that the progeny of each individual fluctuated around an average or typical size, as had the commercial varieties, but that while some strains were exactly the same in average size as the commercial variety, others fluctuated around a larger mean or a smaller mean than the commercial variety. He tried the experiment of selecting from these large and small strains extreme variants, and found that no advance was made as a result of the selection. He was thus led to conclude that in a pure self-fertilized strain from a single plant—what he called a pure line—no advance could be made by selection and that the commercial variety with which he first experimented was a mixed race. In the course of his experiments with pure lines, several variations were obtained which reproduced true to type, but these were interpreted by him as changes of type by mutation.

While, before the publication of Johannsen's results, breeders clearly recognized the importance of determining individual performance and using pedigree methods, still his pure-line conception was a distinct advance and forcibly brought to attention the fact that most commercial varieties and races consist of a number of distinct types—biotypes, as he called them,—and that much of our work of selection consists merely in isolating and purifying these types.

Is one, then, to conclude that the practice of breeders in continually selecting from the best for propagation is useless, and must one advise practical breeders to discontinue their selection? There can be no doubt that the practical breeders have made advances by selecting from the best individuals. No scientific breeder will deny this. It is simply the question of the interpretation of how the results were secured that is in doubt and whether these results can be considered as permanent new unit-characters.

It appears that one is dealing in breeding with two markedly distinct types of selection, based on different principles and arriving at different results, both correct in principle and productive of equally valuable practical results, but of very different value when considered from a strictly evolutionary standpoint. The first of these types would be that in which mutations are selected and new races established, while the second would be illustrated by that type of selection which is intended merely to maintain a maximum strain of the race.

It would seem that such cases of improvement as are illustrated by the sugar-beet indicate that the continuous selection, generation after generation, of maximum fluctuations shown by a character, will result in maintaining a strain at nearly the maximum of efficiency; and that within a pure race the progeny of a maximum variate which would probably be classed as a fluctuation, does not regress entirely to the mean of the race in the first generation succeeding the selection, but that there is only a certain percentage of regression similar to the regression determined by Galton.

These races or selected strains maintain themselves as long as the selection is continued, and when the selection is discontinued rapidly regress to the mean of the species.

The practical breeder should clearly recognize that the act of selection, the choice of the best, remains just as important whether it has a cumulative effect, thereby augmenting the character, or whether he is merely purifying an already existing superior race. The final result remains the same.

#### Methods of selection, or pedigree breeding.

By methods of selection is meant those practices that the breeder uses to find promising variations, determine their value, and purify or develop them into fixed races coming true to seed.

##### *Choosing superior plants.*

The first concern of the breeder is to find the valuable variations. How he had best do this will depend largely upon the plant with which he is working. In all cases, it is of the greatest importance to find the best possible plants and this is likely to require the examination of a very large number of individuals. This factor cannot be too strongly emphasized. If, for example, one attempted to find a man 7 feet high, one would probably

have to examine, or pass over, a million individuals to find him. The superior individuals fitted to be the progenitors of a new or improved race are very few. Certain individuals far above the average may be found by examining a comparatively limited number, but the very best possible individual is but rarely produced.

The plants from which selections are to be made should be grown under as uniform conditions as possible, so that the experimenter may have opportunity to examine and select the best. Two methods of growing plants for selection are in general use, and may be termed the nursery method and the field method.

*The nursery method*, which was first used by Hallett about 1868, consists in cultivating each plant under the most favorable conditions possible for its best development. By this method with wheat, for example, Hallett pursued the policy of planting the individuals in squares a foot apart, which would give each plant abundant opportunity for stooling, and also the investigator an opportunity clearly to distinguish each individual plant and determine its characteristics, total yield, and so on. In recent years, this method of growing the individual plants at a standard distance from each other, in order to test their yielding capacities and the like, has been used very extensively.

*The field method* was used by Rimpau about 1867, and probably by many others before that time. By this method, the selections are made from plants grown under normal field conditions. The advantages of this method are that it can be judged only what a plant will do in the field under ordinary conditions of field culture, by growing and selecting it under these conditions. In the large majority of cases, the first selections are probably made from plants grown in the field in the regular course of crop-production, which thus were not specially grown for the purpose.

If one is to use the nursery method, the plants must be especially planted. While the nursery method certainly allows the breeder to distinguish the individual plants more clearly, in wheat, oats, and other crops that are sown broadcast or drilled, it entails very much extra work and is probably to be recommended only for the use of experimenters who are giving their entire time to the work. In the greater number of horticultural crops, the individuals are normally cultivated one in a place, as in the case of tomatoes, cabbages, strawberries, currants and the like, and the examination of individuals in the field thus satisfies the requirements of both the above methods.

The breeder may have in mind either of two purposes in his work: (1) On the one hand, he may desire to secure an improved strain of a certain race, that is, by selection to keep his seed up to the maximum of efficiency. This may be called strain breeding. (2) On the other hand, he may desire to produce an entirely new race with different characters, and this may be called race-breeding.

He should clearly recognize which of these types of breeding he is following. As an illustration, suppose that the breeder is growing the Stone tomato and desires to maintain the best-yielding strain possible of this race. He would then attempt to choose from a very large number of plants of the Stone variety, the best-yielding plants having the largest number of perfect fruits and typical of the variety in habit of growth, quality, character of fruit, and the like, and would hope by a process of continuous selection to maintain his selected strain in a state of high productivity. This is the type of selection pursued by the sugar-beet breeders described earlier in this article.

On the other hand, if he desires to produce an improved new race, he would search among large numbers of tomato plants of any or all varieties for the appearance of mutations or sports, or plants of new type differing from any known variety. As a matter of experience,



it should be stated that it is very easy to find types of plants differing from the varieties or races ordinarily grown, but far the larger part of such variations are worthless types. Good new types, the superior or even the equal of the known varieties, are of very rare occurrence.

If the general improvement of a variety is the breeder's purpose, he should choose a considerable number of apparently superior plants of good type, which will form the basis of his selection work. Breeders who are conducting careful experiments will find it necessary and desirable to use careful methods of judging their plants. While one is breeding possibly for one primary improvement, as, for example, increased yield, it is necessary, at the same time, that one should keep the product up to the standard in other characteristics, namely, quality, disease-resistance, drought-resistance, and the like, and that one sees that all of the good qualities of the variety are retained. To do this properly necessitates the use of a score-card, on which each character of the plant that is important is given its relative weight or grade. By the use of such a score-card, the breeder can judge each character separately, and by the adding up of the score-card get the rank of different plants in a comparative way.

*Inheritance test.*—When a number of plants have been chosen, the next important factor is to test each individual as to its inheritance. It must be continuously remembered that a plant is valuable only as it produces good progeny. To determine the inheritance, the usual method is to plant the seed from each individual selected in a row by itself, or in a marked part of a row. This is the so-called "plant-to-row" method, and brings the offspring of a single individual together so that they may be readily compared with each other and their qualities carefully judged. These progeny rows should be grown in a special breeding-patch in which the soil is as uniform as can be secured.

It is frequently found that two select plants that are equally good so far as their yield is concerned will give progeny that, as a whole, differ greatly in this respect. In the progeny of one, almost every plant may have inherited the desired quality, while in the progeny of the other only a few of the plants may show, in any noticeable degree, the inheritance of the quality. To determine the degree of inheritance, it is necessary to grade carefully the progeny of each individual.

Finally, with the use of his best judgment, the breeder determines the superior progenies, and these would be the ones which have most nearly given the ideal type and produced the best yield of the highest quality. This would end the work of the first generation of the selection as the breeder now has the data which shows him which of the original plants selected was the superior one. It will be seen that this is a method of judging the individual by its progeny.

#### *Continuation of the selection the second year.*

Having determined the superior progeny or progenies at the end of the first year, the breeder then makes his selections of seed-plants from these best progenies for continuing the breeding. While one progeny may be and usually is superior to all others, this may be due to the season or other accidental conditions and for a few generations it is usually the best policy to make selections from several of the best progenies. Select from each of the superior progenies several of the best plants, using the same care in selecting these plants as was used in choosing the first plants. Preserve the seed from each of these plants separately and keep it carefully labeled so that its origin may be known.

The further work with these plants consists in planting each individual by the plant-to-row method, testing the inheritance as described in the first generation, and finally selecting again the best progenies. This would be followed by again selecting from the best pro-

genies a number of superior individuals to continue the selections in the third year.

The third and succeeding years of the selection would be conducted in the same way as long as it was thought necessary or desirable to continue the work.

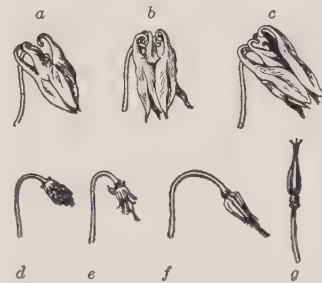
#### *Securing general stock seed of the improved strain.*

In carrying out selection work as outlined in the preceding section, it is ordinarily the object of the breeder to secure an improved strain of the race with which he is working, and usually he desires to utilize such improvements as he can make at the earliest possible time. With ordinary annual crops such as beans, peas, tomatoes, corn, and cotton, it will be found a good policy at the end of the second year of the selection, after taking the seed from the few special plants used in continuing the pedigree breeding, to harvest the seed from a number of the best plants remaining in the chosen progenies and using this seed to plant a multiplication plat from which stock seed may be secured to plant a fairly large crop. Each year following this, seed may be taken in the same way from the best progenies in the breeding patch to plant a multiplication plat. By this method, seed of a gradually improving grade may be secured for planting a general crop.

#### *Control of parentage.*

In plant-breeding, as in animal-breeding, the isolation of the parents is a very important consideration. It is necessary that the character of both parents should be known whenever this is possible. In breeding plants, more attention is given ordinarily to the mother parent,

and in very many instances the characters of the father parent are entirely neglected. Animal-breeders, on the contrary, give more attention to the characters of the male parent, and much improvement in ordinary herds has been accomplished by the introduction of improved heritage through the male. In plant-breeding, it is desirable that the seed of the select individuals be planted in a field by themselves. This insures that only progeny of carefully selected individuals will be planted near together, and thus no ordinary stock will



642. *Aquilegia* flowers, illustrating the process of emasculation.

a, mature bud showing stage which should be chosen for emasculation; b, similar bud with the tips of the corolla pruned apart and the stamens removed; c, a bud opened naturally, too old to operate on; d, a bud of the stage shown in a and b, with corolla removed to show the internal organs; e, a bud the same as in d, but with the stamens removed; f, the same as e, but older, at the age when pollination normally takes place; g, pistil shortly after fecundation, the remnants of the stamens having fallen away.

enter as a contamination. One can be certain that each plant of the progeny is fertilized with pollen from another similarly good plant, or at least from a plant derived from good parentage. One difficulty, however, has been experienced by plant-breeders in planting continuously their selected stock in such isolated plats. If this method is continued year after year, it results in fairly close inbreeding, which, in the case of plants, frequently results in loss of vitality and vigor. In animals there is frequently no noticeable effect from close inbreeding, and many of the most famous animals have been produced as a result of the closest in-and-inbreeding. In plants, however, it is possible to secure much closer inbreeding than in animals, as in many cases a plant can be fertilized with its own pollen.

Within recent years, much activity has been shown

in the careful breeding and improvement of corn. The corn plant has been shown, as a result of experiments made by various investigators, as, for example, the Illinois Experiment Station and the United States Department of Agriculture, to lose vitality very rapidly when self-fertilized. Within three or four generations, by the most careful inbreeding, it is possible to reduce corn almost to total sterility. The



643. Plant of aquilegia with flowers covered with bags in hybridization work.

general practice of corn-breeders who have been giving attention to the production of pedigree strains is to plant the rows of corn from different select ears side by side, giving a row to each select ear, and each year selecting, from the progeny of those rows that give the largest yield, plants to continue further the selection. Planting these select ears together every year, therefore, means that they are more or less inbred, as the closest relatives are planted together in the same row. While in following this practice at first no effect was visible, corn-breeders are now finding in some cases an apparent decrease in yield, which seems

to be traceable to the effect of inbreeding. It seems necessary, therefore, in corn and in other plants that are affected by inbreeding, to use methods that will avoid close inbreeding. The detrimental effect of inbreeding is largely limited to those plants that are normally cross-fertilized, this fact being strikingly brought out in Darwin's "Effects of Cross and Self Fertilization in the Vegetable Kingdom." Tobacco, wheat, and some other plants that are normally self-fertilized do not show this decrease in vigor as a result of inbreeding.

Considerable effort has been made within recent years, in the selection of certain crops, particularly corn, to follow both parents, choosing good males and good females of known parentage and crossing these by artificial means. There can be no doubt but that by the use of such methods more rapid progress could be made, but in the greater number of cases the methods thus far devised require so much work as to be almost prohibitive.

A method of breeding has recently been devised by J. B. Norton in the improvement of asparagus, which is worthy of careful consideration and may be applicable, at least in modified form, to use in the improvement of various crops. Asparagus is dioecious, the male and female flowers being borne on different plants. The first part of the process consists in selecting a number of superior plants of both sexes, attention being given to all important characters such as yield, quality, rust-resistance, and the like. This having been done, the next process consists in crossing each female with each selected male plant and testing the progeny produced by the cross. If, for example, ten superior females and ten superior males were chosen, a sufficient number of flowers on female No. 1 would be crossed with pollen of each of the ten males to obtain sufficient seed to test the comparative value of the progeny of female No. 1 with each of the ten males. The ten lots of seed from the crosses on female No. 1 would be grown separately and the comparative value of the different progenies determined by careful observations on vigor, rust-resistance, quality of product, yield, and the like. In this way, it would ultimately be determined which of the ten male plants was the superior one to use in crossing with

female No. 1. In like manner, female No. 2 would be crossed with each male and the progenies tested to determine the superior male in this combination. Finally the combination of each female with each male can be compared and if the work has been conducted with sufficient care and for a long enough period, it can be determined which combination has uniformly given the best results.

Asparagus is perennial and is easily propagated vegetatively by separation of the roots, so that when once the superior male and female combination has been determined, these may be propagated vegetatively as clons, in alternate rows in an isolated place so that all seeds developed will be of the desired combination. Asparagus produces numerous seeds and by such a method an indefinite quantity of seed of the desired combination can be produced. It would doubtless be possible in a few years, if desired, to have all of the seed used commercially grown from a single superior combination.

If experiments of this nature could be made on an extensive scale so that the males and females of the highest or maximum grade could be discovered, they would be of almost fabulous value. The importance of this method of breeding may be better appreciated by imagining the value of the best bull and the best cow in the world if they would live indefinitely and if it were possible for them to reproduce rapidly enough to supply all of the individuals desired.

The direct application of this method is possible only with perennial dioecious plants that can be propagated as clons and that develop numerous seeds. The hop is another plant to which this method of improvement could be applied.

### Hybridization.

Aside from selection, hybridization has played the most important rôle in the formation of the varieties and races of our cultivated plants; but the results obtained are in many cases closely connected with selection. Ever since the time of Knight, hybridization has been used extensively in plant-breeding, and it seems that this is the only sure means that the breeder can use in producing new and desirable combinations of characters. In hybridization, as generally used, the breeder does not expect to cause or produce new unit-characters, although such changes may occasionally occur under the stimulus of hybridization. What he can do with certainty is to secure hybrids combining the different characters of two distinct sorts. The extent to which such recombination of characters can be carried is almost unlimited. In many cases, two or three or even four distinct species and the characters represented in their various varieties have been recombined in hybrids.

In older literature, the term hybrid was restricted to crosses resulting from the combination of distinct species, while combinations of different races of the same species were known as crosses or mongrels. The term hybrid is here used as designating any product of a cross when the parents were noticeably distinct from each other, whether the parents belonged to different clons, races or species. This broader use of the term hybrid has become almost universal in recent years. If, in discussion, it is necessary to refer to the degrees or grades of difference in the parents, the hybrids may be characterized as species hybrids, racial hybrids, clonal hybrids and the like.

### Choosing varieties to hybridize.

In starting any work in hybridization, the first important step is the choice of the varieties to be hybridized. It is interesting to make crosses of any two plants with distinct characters and observe the recombinations of characters which result, but this haphazard work takes too much time and is not to be recom-



mended. The breeder, in general, should hybridize with some definite aim in view and use systematic methods in attempting to accomplish that aim. One cannot ordinarily expect to obtain in hybrids of any two varieties any characters which are not present in the parents. The unit-character conception explained in the beginning of this article is of fundamental importance in understanding hybrids. The breeder, by a careful study of varieties, determines the good characters and the poor or weak characters of each variety. He may, as an illustration, if working with tomatoes, find all of the varieties with yellow pear-shaped fruits to be large bushy plants, the so-called standards, and he may desire a dwarf type of plant and red fruits. By examining the different races of tomatoes, he would soon find a variety, such as the Quarter Century, which possesses the characters of dwarf plant and red fruit. By crossing these two varieties, he would obtain new combinations of the characters of the two sorts, and if he grew a sufficient number of the second generation of these hybrids, he would be certain to find some plants in which the pear-shape had been combined with the red color and dwarf habit of the Quarter Century variety.

The study of the varieties of any crop thus gives the breeder an idea of the characters available, and he must then use his originality and judgment in determining what combinations of these characters would form the best commercial variety. If this combination does not already exist, he may start out with considerable confidence that it is possible for him to obtain such a combination and thus a valuable new variety. Plants, however, are not simple in their organization and the reaction of different characters on one another in different combinations may not always be what one expects. Again, in no plant has a complete analysis been made of all characters, and it may be impossible for us ever to reduce all the characters of a plant to a unit-character basis; thus there is always an element of doubt as to the value of any new combination of characters until this combination has been produced and tested.

#### *Methods of crossing plants.*

Plants, like animals, bear male and female organs, and an act of fecundation is necessary in all ordinary cases to insure the development of seeds. In probably the larger number of plants, the male and female organs or the stamens and pistils are borne in the same flowers on one plant. In some cases, as in the castor bean, corn, and the like, both sexes are borne on the same plant but in different flowers. In still other cases, as in the date palm, asparagus, hop and hemp, the sexes are on different plants.

In hybridizing plants, it is necessary to insure that the plants are not fertilized with their own pollen or with pollen from any other source than that desired. If, therefore, the plant to be operated on has the stamens and pistils in the same flower, the stamens must be removed from the buds before they burst and discharge the pollen. This act of removing the stamens, or emasculation, as the process is called, is necessary in order to prevent self-fertilization. In some plants, it is necessary to emasculate the buds very early, as the pollen develops considerably in advance of the pistils. In other cases, the pistils reach maturity or a receptive condition before the pollen is shed. In this latter case, the emasculation may be delayed until a time just previous to the normal opening of the flower.

The process of emasculation may be illustrated by the columbine. Here large-sized buds are chosen just before they open normally (Fig. 642). The tips of the petals can then be easily pried apart so that the stamens may be pulled off with small forceps. This process should be performed carefully to avoid crushing or injuring the pistil. The bud should then be inclosed in a small light paper bag in order to prevent pollen from any foreign source being brought to the pistil by insects or wind (Fig. 643). The bud should remain covered until sufficient time has elapsed to allow the pistil to reach normal maturity, when the bag should be removed and the pollen from the desired variety dusted over the pistil. After this act of pollination, the bud should again be covered with the paper bag, which should not be finally removed until several days later, after fecundation has taken place. As soon as a flower is pollinated, it should be labeled with a small tag of some sort which may remain attached to the flower-stem until the fruit is ripe. In some cases, the pollen may be placed on the immature pistil without injury, when the flower is emasculated, and this is a great saving of time when it can be done. However, in most cases, premature pollination is liable to injure the pistil and prevent the setting of seed. One should ordinarily attempt to pollinate the pistil at as nearly the normal time as possible. Many

plants are difficult to hybridize and every process must be as natural as possible to insure results.

Many handy methods have been devised to use in pollination work and are described in breeding literature. In all work fine copper wire is better to attach bags and labels than is string. In emasculation work also, it will often be found convenient when some pollen has accidentally fallen on the pistil to wash it off with water by means of a small dental syringe. In many cases, such as apples, pears and cotton, the best means of emasculation is to remove the outer floral envelopes by cutting them off, using a sharp scalpel. With a little practice this can be done quickly and with minimum injury to the essential organs (Fig. 644).

Difficulty is frequently experienced when hybridizing different varieties, in getting plants of each variety to bloom at the same time. This difficulty may be overcome in many cases by keeping the pollen, which can be done for a limited period by slightly drying the pollen without allowing it to become desiccated, and preserving it in a tightly corked bottle.

After the pollen has been placed on the stigma of the pistil by the act of pollination, each pollen-grain develops a small tube which grows down through the pistil to the ovary. Through this tube, the male germ-cells pass down and finally a male germ-cell comes in contact with each egg-cell of the different ovules in the ovary (in most plants there are several ovules in each ovary) and fuses with them. This constitutes the act of fecundation or fertilization. This fecundated egg-cell is then the beginning of the hybrid and from the seed containing it, when grown, there develops the hybrid plant. The plant developed directly from this hybrid egg-cell is known as the first-generation hybrid ( $F_1$ ). Seeds from this first-generation hybrid, when grown, give second-generation hybrids ( $F_2$ ). The expressions  $F_1$ ,  $F_2$ , and  $F_3$ , meaning first, second and third filial generations, are used very commonly to designate the first, second and third generations of hybrids.

#### *Laws of inheritance in hybrids.*

When plants of different pure races are crossed, as, for example, different races of wheat, corn or cotton, the hybrids are usually all very similar to each other in the first generation, exhibiting in general the same characters. And this is the case also when different fixed species are crossed. If, however, individuals belonging to unfixed races are crossed, there is usually a considerable variation in the first generation. This is well illustrated by the crossing of different clones of apples, pears, oranges, and the like, when the different so-called varieties are merely transplanted parts of the same individual seedlings which have not been bred to a purity of type. It is well known that if seeds of an apple variety be planted, the resulting plants exhibit many different variations in the first generation. The parents, themselves, therefore, not being of pure type, when they are hybridized produce progeny which in the first generation is variable. In the crossing of races which have been bred true to type, whether of the same or of different species, the first-generation hybrids, however,



644. Cotton flowers, illustrating the process of emasculation.

a, mature bud showing the stage which should be chosen for emasculation; b, a similar bud with the corolla cut off ready to emasculate; c, a similar bud with the stamens removed,—emasculated.

are nearly uniform in the characters presented, and in such instances it is necessary to secure a second generation of the hybrids in order to accomplish the segregation of the characters and the production of a large number of variations. Ordinarily, therefore, desirable variations are looked for in the second generation. This, as has been explained above, is true only in the case of hybrids of species and races that are fixed in type.

*Mendel's law of hybrids.*

The preceding discussion represents fairly well the general understanding of hybrids until about 1900, when DeVries and Correns rediscovered what is now termed "Mendel's law of hybrids." These laws or principles are of great value from an economic standpoint, and are, furthermore, of the greatest scientific interest. They should thus be thoroughly understood by every practical breeder of plants. It has been known for many years that a splitting-up and redistribution of parental characters occur in hybrids, and it is on this fact largely that the practical application of hybridization in plant-breeding depended. Until Mendel's law was discovered, however, there was no understanding of why or how such a recombination could be made, and it was necessary to experiment extensively in order to determine what could be accomplished.

If one carefully studies a number of first-generation hybrids with special reference to the characters of the parents exhibited in the hybrids, it will be found that certain characters possessed by the male parent are plainly represented in the hybrid, while other characters possessed by the female parent are also represented in the hybrid. Many characters of the parents are thus plainly represented in the hybrid, but it is probable that other characters will be blends of the similar parental characters, or possibly differ from any definite characters distinguishable in the parents. Attention has already been called to the complexity of organisms in general and the difficulty of recognizing all of the unit-characters. Thus far it has been possible only to follow carefully certain plainly marked characters. This commingling of the different characters of each parent gives the hybrid a mosaic appearance, as if certain characters had been taken from each parent and thrown together to make up a hybrid individual.

*Character-pairs.*—To understand this commingling of characters in the first-generation hybrids, it is necessary to know that the parents used in the hybridization differed from each other in certain characters. One parent may have had red fruits, hairy stems, and dwarf habit, while the other may have had yellow fruits, smooth stems, and tall habit. Such characters are opposed to each other, and such opposed qualities or characters are termed "character-pairs." A plant may have red fruits and smooth stems, but it could not have red fruits and yellow fruits at the same time. As an illustration of such character-pairs, may be cited, scarlet and yellow fruits of peppers, reversed or erect fruits of peppers (Fig. 645), starchy and sweet kernels of corn, standard and dwarf size in tomatoes, stringy and stringless pods of beans, and the like. Such pairs of characters have been termed by Bateson "allelomorphic pairs of characters," and this terminology is commonly used in the literature on hybrids. When parents possessing opposed or contrasted characters are crossed, the hybrid egg-cell receives, through the male and female germ-cells uniting in the fecundation, the determiners which represent the different contrasted pairs of characters, and all cells making up the first-generation hybrid will contain in like manner the determiners representing these characters, and are thus hybrid in nature. This

being the case, it might be expected that all characters in the hybrid would show as blends of the parental characters or exhibit some stage of intermediacy between the characters of the parents. This is indeed frequently the case, but more commonly one of the characters is very strong, or "dominant," as Mendel expressed it, and only this character will show in the first-generation hybrid, the other character remaining recessive or masked, although present. As an illustration, in the character-pairs mentioned above, scarlet fruits of pepper, reversed fruits of pepper (this is true only in certain varieties), starchy kernels of corn and standard size of tomato plants, are dominant over their corresponding contrasted characters. Illustrations of blended or intermediate characters are found, for example, in first-generation hybrids of round with pear-shaped tomatoes, and large with small fruits of tomatoes or peppers.

*The law of segregation and purity of the germ-cells.*—The second important principle of Mendel's law is what is termed the law of segregation and purity of the germ-cells. It seems certain from the researches that have been conducted that, when the germ-cells of the first-generation hybrids are formed, the determiners which represent the two different characters under consideration, and which were united by the hybridization, ordinarily segregate again in the cell-divisions, which lead to the formation of the germ-cells, so that certain germ-cells include the determiner of one only of the two characters. There are thus two kinds of germ-cells formed with respect to this one character-pair. Choosing as an illustration a hybrid of a pepper having scarlet fruits with one having yellow fruits (Fig. 645), when the germ-cells were formed a segregation of the determiners representing the two opposed characters would take place and there would be germ-cells of one kind, both male and female, containing the scarlet fruit determiners and of a second kind, both male and female, containing the yellow fruit determiners. This segregation takes place in the formation of both the egg-cells and the sperm-cells or pollen-grains. It is thus seen that the first-generation hybrid, when two such allelomorphous characters are combined, forms two kinds of egg-cells and two kinds of sperm-cells, so far as this one character-pair is concerned. This segregation of characters, which has been termed the law of segregation, is one of the most important facts of inheritance and, in enabling us to get recombinations of characters, is of the highest importance in breeding.

*The law of probability in recombination of characters.*—The third important principle of Mendel's law is what is termed the law of probability, and explains what may be expected in plants of the second generation of such a hybrid. Remembering that there are formed in the first-generation hybrid, as explained above, two kinds of egg-cells and two kinds of sperm-cells with reference to the opposed characters, what would happen if the hybrid were bred with its own pollen; or, in the case of an animal, if it were bred with another hybrid of the same parentage? For the purpose of illustration, suppose that a hybrid of a scarlet-fruited pepper with a yellow-fruited pepper be fertilized with its own pollen, and that 100 egg-cells be fertilized with 100 pollen-grains of the same hybrid. There are two kinds of egg-cells produced, some carrying determiners of the scarlet fruit, and others determiners of the yellow fruit, and the same is true of the pollen-grains. Taking the egg-cells and pollen-grains without choice, as equal numbers are produced of each kind, one would expect to have of the egg-cells fifty with scarlet determiners and fifty with yellow determiners. In the pollen-grains, also, one would expect to have fifty with scarlet determiners and fifty with yellow determiners. If, then, the 100 egg-cells and 100 pollen-grains are brought together in fertilization by chance, as would occur in nature, according to the law of probability, there would be twenty-five scarlet uniting with twenty-five scarlet; twenty-five scarlet uniting with twenty-five yellow; twenty-five yellow uniting with twenty-five scarlet; and twenty-five yellow uniting with twenty-five yellow. Representing scarlet determiners by the capital letter S because scarlet is the dominant character, and the yellow determiners by the small letter y, as yellow is recessive, the unions may be represented as follows:

## ONE HUNDRED EGG-CELLS BY 100 SPERM-CELLS.

Female Cells	Male Cells	Composition of hybrids	
25 S	× 25 S	= 25 SS	These do not contain determiners of y and will reproduce true.
25 S	× 25 y	= 25 Sy	
25 y	× 25 S	= 25 yS	These are hybrids so far as this character-pair is concerned,—exactly the same as in the first generation and contain determiners of both S and y. These will not reproduce true to type and will break up like second-generation hybrids.
25 y	× 25 y	= 25 yy	
			These do not contain the determiners of S, and will reproduce true.

The above illustration explains the law of segregation, and the probable ratio of recombination when hybrids are inbred with their own pollen, and when only one pair of characters is considered. When an egg-cell with scarlet determiners unites with a sperm-cell with scarlet determiners, this gives rise to a pure germ-cell, or zygote, containing only scarlet determiners, and the progeny in subsequent generations will breed true so far as this character is concerned. Also, when an egg-cell with yellow determiners unites with a sperm-cell containing only yellow determiners the result is a pure germ-cell, containing only yellow determiners and the progeny would reproduce true, so far as this character is concerned, in subsequent generations. In the other two cases, when in fecundation

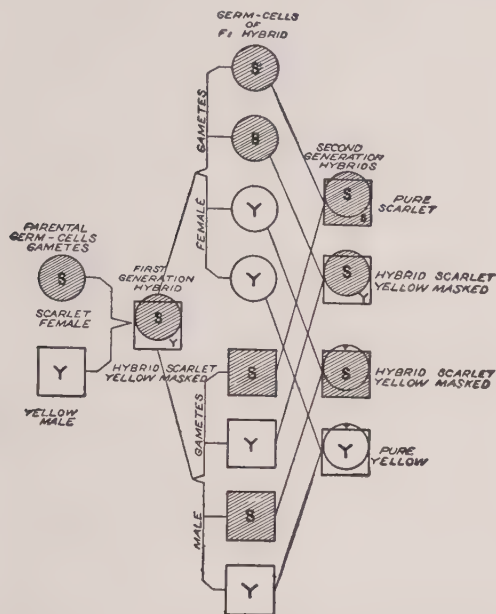


645. Pepper plants: *a*, with scarlet-colored reversed fruits; *b*, with yellow-colored erect fruits. The number and form of branches are also markedly different.



gametes with scarlet determiners unite with gametes with yellow determiners giving the combinations Sy and yS, which amount to the same thing, there result in reality, hybrids exactly the same as in the first generation and the progeny from these in the next generation behave exactly the same as did the first-generation hybrids in the second generation.

In such a case as the one under consideration, in which the scarlet is a strong dominant character, all combinations that contain the determiners of this character, whether pure or of hybrid nature, show this character only. Thus in the above 100 combinations the twenty-five yy would come with yellow fruits while the seventy-



646. Representing Mendelian inheritance of scarlet S, and yellow Y, color of fruits in pepper hybrids.

five other combinations would have scarlet fruits, although fifty of these would be of hybrid nature. To determine which of these seventy-five scarlet-fruited plants are the combination Sy, that is, scarlet with yellow, and which are SS, that is, scarlet with scarlet, requires the growing of self-fertilized progeny from them to determine which are reproduced true to type, as these would be the pure scarlet. The progenies of any of these plants that produced both scarlet- and yellow-fruited plants would show that the parent of such progeny was a hybrid.

In the hundred combinations there is thus produced a ratio of one pure scarlet to two hybrid scarlet and yellow to one pure yellow, 1 SS:2 Sy:1 yy, or three scarlets to one yellow and this is the famous 3:1 Mendelian formula.

This process of union of an allelomorph pair of characters in hybridization, the formation of four kinds of germ-cells, both male and female, by the hybrid, and their four different unions, is graphically illustrated in Fig. 646.

While in certain hybrids of parents possessing two opposed parental characters, this ratio of probabilities is not produced, if large numbers are used the ratio will be found in many cases with little deviation. A sufficiently large number of cases have now been studied with various plants and animals to place this conclusion beyond question. It is not known, however, how many characters follow Mendel's law, nor is it yet entirely certain whether those character-pairs that sometimes follow the law of segregation always follow it.

The individuals of the second generation which contain the determiners of both characters of the pair, if self-fertilized or bred with similar individuals containing the determiners of both characters, exhibit in the third generation exactly the same nature that first-generation hybrids exhibit in the second generation. The two determiners are commingled in their cells, and to all intents and purposes they are exactly the same as first-generation hybrids. When such self-fertilized hybrids are grown they give again, in the third generation, the regular Mendelian proportion of 1 SS:2 Sy:1 yy. Here the individuals containing only determiners of one character, that is, SS and yy, would come true to these characters in succeeding generations, while those individuals containing the determiners of both characters, S and y, would be expected to segregate again in the fourth generation in similar proportions.

When dealing with more than one character-pair, ratios of segregation become complicated but are easily understood. If the character of reversed fruits (R) and erect fruits (e), two plainly marked characters of ordinary garden peppers, caused by the pedicel of the fruit curving backward in one case and remaining straight in the other, are combined with the above allelomorph

characters, it can be foretold exactly what combinations will occur and the relative number of each. This is a second allelomorph pair of characters that behaves in inheritance the same way as did the two colors of fruit. In this case, the reversed pedicel is the dominant character, as in the F<sub>1</sub> hybrids of reversed with erect sorts the pedicels are always or very generally recurved. These characters would thus be represented by R for the recurved or dominant character and e for the erect or recessive character. In this character-pair one would expect a splitting and segregation to have occurred in the formation of the germ-cells of the first generation so that the hybrid plants of the second generation would exhibit these characters in Mendelian proportions as in the character-pair first described. The progeny in the second generation would thus exhibit these characters in the following combinations and proportions: 1 RR:2 Re:1 ee. This theoretical proportion should hold rather constantly, either in small or large numbers of hybrids, though in large numbers it would be more nearly realized. The determiners of the four characters, or two character-pairs, are commingled in the cells of the first-generation hybrid. When the egg-cells and pollen-grains are formed, however, a segregation of the determiners of the two character-pairs occurs, but independent of each other. Each egg-cell or pollen-grain will receive only the determiner of one character of a certain character-pair but will, at the same time, receive determiners of other characters belonging to other character-pairs. Considering the two character-pairs described in peppers, an egg-cell receiving the determiner of the scarlet color of fruit S, might also receive the determiners for either R or e representing the characters of recurved or erect fruits. These two character-pairs would thus give egg-cells of four combinations, SR, Se, yR, and ye.

In the formation of the pollen-grains, the same combination occurs, so that with reference to the two character-pairs described, the pollen-grains that would be formed have the same combinations of determiners as the egg-cells, namely, SR, Se, yR, and ye. There would thus be four kinds of egg-cells and four kinds of pollen grains so far as these two character-pairs are concerned. If these are brought together, sixteen combinations are possible as follows:

SRSR	SeSR	yRSR	yeSR
SRSy	SeSy	yRSy	yeSy
SySR	SySe	SyRS	SySe
SySy	SySe	SyRS	SySe

Examining these combinations carefully, and placing together those combinations that contain the same character-determiners as indicated by the letters, and this can properly be done as it does not matter in the fecundated egg whether a certain determiner is furnished by the egg-cell or the pollen-grain, there result the following nine combinations, all of which are different in germinal constitution with reference to these two character-pairs:

TABLE SHOWING NUMBER OF GERMINAL COMBINATIONS AND CHARACTER OF F<sub>2</sub> PEPPER HYBRIDS WITH TWO ALLELOMORPHS.

No. of combinations	Germinal constitution	Visual characters of hybrid	Nature of hybrid
1	SRSR	Scarlet recurved	Pure scarlet and recurved
1	SeSe	Scarlet erect	Pure scarlet and erect
1	yRyR	Yellow recurved	Pure yellow and recurved
1	yeyy	Yellow erect	Pure yellow and erect
2	SRSy	Scarlet recurved	Pure scarlet and hybrid recurved x erect
2	SySR	Scarlet recurved	Hybrid scarlet x yellow and pure recurved
2	SySe	Scarlet erect	Hybrid scarlet x yellow and pure erect
2	yRyS	Yellow recurved	Pure yellow and hybrid recurved x erect
4	SySe	Scarlet recurved	Hybrid scarlet x yellow and hybrid recurved x erect

An examination of the preceding table, in which are grouped the sixteen possible combinations when two allelomorph pairs are concerned in the hybridization will show that among these sixteen there are nine groups with different germinal constitutions. The visual character of the hybrid plants of these nine different groups is given in the third column and is easily understood by examining the germinal constitution and remembering that scarlet S, and reversed R, are the dominant characters in the two allelomorphs and that the presence of one determiner of either of these characters will cause the appearance of that character in the hybrid plant. It will be observed that by grouping the hybrid plants according to the characters they show, there will be nine scarlet and reversed, three scarlet and erect, three yellow and reversed, and one yellow and erect. This is the Mendelian formula: 9:3:3:1. The nature of the nine different groups of hybrid plants with different germinal constitution is given in the fourth column of the table. When a character is pure, it may be expected to reproduce true in succeeding generations but in those cases in which both determiners of a character-pair are present, the character is of hybrid nature and will segregate in succeeding generations.

In the illustration of the character-pair, scarlet and yellow fruits and the probable ratio of number of unions in F<sub>2</sub> hybrids, it was shown that out of 100 unions one should expect 25 SS:50 Sy:25 yy. If now the second character-pair recurved and erect fruits is con-

sidered in connection with these same 100 unions, there would occur the following combinations, according to the law of chance:

25 SS	50 Sy	25 yy
$6\frac{1}{4}$ SRSR	$12\frac{1}{2}$ SRyR	$6\frac{1}{4}$ yRyR
$12\frac{1}{2}$ SRSe	25 SRye	$12\frac{1}{2}$ yRye
$6\frac{1}{4}$ SeSe	$12\frac{1}{2}$ Seye	$6\frac{1}{4}$ yeye

These nine combinations are the same as given above, but the percentage of each combination out of the 100 unions is shown.

If a third character were considered, the proportions of the combinations can be determined in exactly the same way. Each one of the above nine possible combinations would be again divided into three different unions in the same way as the three combinations of the one character-pair gave nine different combinations with the second character-pair. In the consideration of the three character-pairs, there would thus be twenty-seven different combinations of parental characters. And again in each ovary fecundated, when only one determinant of each character-pair occurred, the opposing character-determiner being in each case eliminated, such a cell should give a plant that would reproduce its character true to type. It is well known that almost any two different races or species that may be chosen for hybridization will ordinarily differ from each other in numerous characters. When there are a



647. Pepper hybrids distinct from parental types, formed by recombination of characters; *a*, dwarf type with few small horizontal branches; *b*, giant type with many large erect branches.

number of these opposing characters which form Mendelian character-pairs, the determination of the possible combinations by Mendel's formulae becomes very complex and difficult to understand. It is only by taking a few well-marked character-pairs and carefully studying them that the segregation and new combinations according to Mendelian proportions can be followed and understood.

Any character-pairs following Mendel's law would segregate as indicated above, in the case of scarlet and yellow fruits and reversed or erect fruits of the pepper. A very large number of characters of various plants and animals are now known to be Mendelian and while many modifications of the principles have been necessary to harmonize them with special cases, still it may be said that there is no other general law of heredity and Mendel's law has thus furnished us with a working basis of great value.

The study of hybrids has been resolved into a study of unit-characters and their relation to each other. By hybridizing related types having opposed characters and observing the segregations which occur in the later generations, the characters of each type are analyzed and it is determined when a character-pair occurs. The researches on this subject by Mendel, Bateson, Davenport, Castle, Punnett, Shull, Hurst, Correns, Tschermak, East and dozens of other now well-known investigators, have developed a science of heredity of which there was no conception a few years ago.

The characters presented by the different varieties of a plant or of different species, which can be crossed with it, can now be studied, and one can definitely plan the combination of characters desired in an ideal type, and can with considerable confidence estimate the number of plants it will be necessary to grow to get this combination. It is now known in general how characters behave in segregation and inheritance, so that one can go about the fixation of a desired type, when one is secured, in an orderly and intelligent way.

The further the study of characters is carried, the more it is coming to be realized that the appearance of apparently new types following hybridization is due to recombinations of different units which in their reactions give apparently new characters. As an illustration, in a study of pepper hybrids, which has been conducted during the past four years, it has become evident that the form of plant and branching is due to three pairs of characters or allelomorphs; namely, first, erect or horizontal branches; second, large or small branches; and third, many or few branches. In crossing two medium-sized races, one with large horizontal and few branches, and the other with small erect and numerous branches, there result many new combinations of characters, among which appear some with small horizontal and few branches, which gives a dwarf plant, and others will have a combination of large erect and numerous branches, which gives a giant plant (Fig. 647). These dwarfs on the one hand and giants on the other appear as distinct, new creations, though they are very evidently merely the recombinations of already existing unit characters, and dwarfness and giantness are the results of the reaction of the different units combined.

When the large number of distinct characters that are presented by the very numerous varieties of any of our cultivated plants is remembered, an understanding is secured of the possibilities of improvement which the field of hybridization affords.

### The development of hybrids into pure races.

When hybrids have been produced between species or varieties possessing certain characters that it is desired to unite in a variety, the recombinations of characters as explained in the preceding section become visible in the second generation, and it is thus among the plants of this generation of the hybrid that one should expect to find the combination of characters desired. The breeder would thus very carefully examine a large number of second-generation plants and choose for further experimentation those plants that were found to have inherited the characters which he desired to combine. The entire batch of  $F_2$  plants should be carefully examined to determine what characters behave as character-pairs and also the dominant or recessive nature of each character. This knowledge is necessary in order to determine the practice to be pursued in choosing plants in which the characters desired will be pure with reference to these characters. If, for example, the breeder is working to get a combination of two characters only, such for instance as a yellow- and erect-fruited pepper, from the combination of character-pairs discussed above in explaining Mendel's law he would discover that both of these characters are recessive, and thus when a hybrid was found in which these two characters were united, he could be sure that by self-fertilizing such an individual it would reproduce true with reference to both of these characters in the next and succeeding generations. He would know furthermore in dealing with only two pairs of characters that he should, according to the law of chance, secure on an average about one such combination in sixteen hybrids.

If, however, the combination desired was a scarlet reversed fruit, both dominant characters, the process would be much more difficult. As shown in the preceding section describing the segregation and recombination of characters, nine plants out of the sixteen possible combinations would have red, reversed fruits, while only one of the nine would be pure with reference to both of these characters. The breeder would thus be compelled to self-fertilize a number of the plants having red and reversed fruits and grow a number of plants from each in order to determine which one, if any, was pure with reference to both characters. If, then, the progeny from any one of the plants chosen and self-fertilized came true to type with reference to both characters, he would be certain of its purity and would again self-fertilize some of the best plants of this progeny, which should give him a pure type.

If a combination of a dominant and recessive character is desired, the examination of the  $F_2$  hybrids would enable the breeder to choose a pure plant so far as the recessive character is concerned, but he could not determine the purity of the dominant character and would be compelled to self a number of plants exhibiting the two characters and grow progenies in the third



generation, when he should be able to select a pure type with reference to both characters.

If, as frequently occurs, neither character of an allelomorph pair is dominant, but gives in the hybrid an intermediate form, the fixation becomes simple, as in such cases those hybrids in which either character is pure can be recognized.

While these methods appear very complex at first, they will be easily understood with careful study, and are far simpler than the methods breeders were compelled to employ in fixing hybrids before they had an understanding of Mendel's law.

When more than two characters are concerned in the recombination, the process becomes more difficult, and indeed one cannot limit one's consideration to two characters in practical breeding unless one is combining standard varieties where all characters are good. As in simple selection work, one must necessarily consider all important characters that go to make up a good variety, and usually one will be able to recognize Mendelian segregation only in a few prominent differential characters. The breeder should use the knowledge of inheritance that he possesses with all characters which he can recognize, but at the same time the plants which he inbreeds to secure purity of type should be perfect plants of all-round good type, and in every generation of the hybrids grown he should exercise his best judgment in selecting the best plants for seed-bearers.

In the fixation of cotton hybrids, the policy was pursued of selecting for inbreeding the most fruitful and best-shaped plants of those hybrids having the desired characters, using very large numbers of hybrids from which to choose. The self-fertilized seed of a certain type was then planted by the plant-to-row selection method in an isolated plat, in order to give an opportunity to select not only the pure combination of the desired characters but the best all-round plants. As soon as the plants in such an isolated plat were sufficiently developed to show their characters and it could be recognized that certain ones had inherited the desired qualities, the fields were carefully searched and all plants not true to type were pulled up, leaving only a few good plants of the correct type. This process of roguing, as the seedsmen call it, insures that at least the greater part of the seed developed would be fertilized with pollen of similar plants of good type. This sort of selection and purification of type will probably in most cases be found necessary even after such Mendelian characters as can be recognized have been secured in a pure state.

The inheritance of many fundamental characters will doubtless remain obscure for many years.

#### The use of impure first-generation hybrids.

In the case of very many of the most important horticultural crops, fortunately, it is possible to use hybrids without the necessity of purifying or fixing them as described in the last section. Plants such as apples, pears, oranges, grapes, roses and strawberries, which are grown as clonal varieties, being propagated by buds, grafts or slips, are merely parts of one individual and it does not matter whether they are germinally

pure, as seeds are not needed. This makes it possible to use  $F_1$  hybrids and, as hybrids are notoriously vigorous, this is a factor of very great importance. Again, characters which blend and give intermediates in the  $F_1$  generation may, in such cases, prove very valuable.

The work that has been carried out by the Department of Agriculture in the breeding of citrus fruits very clearly indicates that valuable intermediates may sometimes be secured. The writer, in conjunction with Walter T. Swingle, hybridized the hardy cold-resistant trifoliolate orange (*Poncirus trifoliata*) with several varieties of the tender sweet orange, and as a result at least five different varieties of hardy oranges or citranges have been produced. These hybrids are nearly intermediate between the two parents, having the characters in the first generation nearly blended.

The leaves are trifoliolate, but are much larger than the leaves of the ordinary trifoliolate orange tree, and show a tendency to drop off, the lateral leaflets producing an unifoliolate leaf. The trifoliolate orange is deciduous, while the sweet orange is evergreen. The hybrids are semi-deciduous, holding a large share of their leaves through the winter. In hardness they also seem to be intermediate, being much more cold-resistant than the ordinary orange, but not so hardy as the trifoliolate orange. They are sufficiently hardy so that they doubtless may be grown with safety as far north as South Carolina, or 300 to 400 miles north of the present orange region. Some of the

fruits produced are as large as the ordinary orange, but most of them are very nearly intermediate in size. They are very variable, however, in the first generation. At least five of the fruits that have been produced are juicy and valuable. It is not probable that they would be reproduced true to seed, but orange varieties are clonal, and the different types will, of course, be normally reproduced by buds or grafts, so that from a practical standpoint it does not matter whether or not they would reproduce true through the seed. In the second generation it is probable that these different characters would split up, possibly according to Mendel's law, and it is likely that still more valuable varieties will be secured when a second generation has been grown. See *Citranges*.

Similar groups of valuable intermediate types of fruits have been produced by Wm. Saunders, until recently the Director of the Canadian Experimental Farms, by crossing varieties of the ordinary apple, such as the Pewaukee and Wealthy, with a very hardy cold-resistant crab (*Pyrus baccata*). Saunders has produced already numerous hardy intermediate types which bid fair to be of very great economic value, particularly in the cold regions of Manitoba and Saskatchewan (Fig. 648). Second generation seedlings of these valuable types may be expected to yield still more important improvements.

The reproduction of such unfixed hybrids may be said to form the basis of fruit-culture, as all of the apple, peach, pear, plum, orange, lemon and grape varieties, as well as the varieties of small fruits, are of mixed parentage and do not reproduce true to seed. Most of the varieties of these fruits are either known to be hybrids or are superior seedlings that have been selected and propagated. These latter, doubtless, in the



648. *Pyrus baccata* above, and three named crosses with forms of *P. Malus*.—Alberta, Columbia and Robin respectively from top to bottom. ( $\times \frac{3}{4}$ )

greater number of cases were of hybrid nature as all of these fruits are normally cross-fertilized and natural hybridization is exceedingly common.

The same may be said of most flowers, such as carnations and roses, that are cultivated extensively for the cut-flower trade. Practically all of the varieties are unfixed hybrids.

#### The selection of bud-variations.

No consideration of the methods of plant-breeding would be complete without a mention of the improvements that can be produced by what may be termed the selection of bud-variations.

While, in general, all buds of a plant are practically the same, as is shown by the fact that buds taken from the Baldwin apple almost uniformly produce Baldwin apples, yet there is considerable variation frequently in the product from different buds, and it is evident that bud-variations may be classified like seedling-variations, into fluctuations and mutations or the so-called bud-sports (Fig. 649).



649. Bud sport of *Cupressus* to fastigiate type, with branch of similar fastigiate variety on right.

Hybrid plants also frequently, for some cause, show segregations of characters in different buds similar to the segregations shown in  $F_2$  hybrid seedlings. It would thus seem natural to suppose that these variations could be utilized in producing new varieties much as the similar types of seedling-variations are used.

In violets, for example, the propagation is normally by slips that are developed from different buds. These slips when grown into plants frequently show considerable difference, and B. T. Galloway and P. H. Dorsett, of the national Department of Agriculture, have demonstrated that by the selection of slips from plants which are very productive the yield in the number of flowers to the plant can be increased considerably. In the case of the orange, seedling trees are almost always very thorny, yet certain branches may show a tendency to be more nearly thornless, and by the selection of buds from such branches the thorny character of almost all the standard varieties has been reduced. By the systematic selection of vegetative parts, such as buds, slips, suckers, and the like, in many cases very important improvements could doubtless be secured, and the plant-breeder should have a thorough understanding of this method of improvement. In hybrids of mixed parentage, frequently a bud on one side of a plant will sport, showing different tendencies, and many of our new varieties of roses, chrysanthemums and carnations have been produced by the selection of such bud-sports. Many standard varieties of carnations have produced bud-variations that have proved valuable; the Lawson has given rise to the Red Lawson and White Lawson; the Enchantress has produced the Pink Enchantress and White Enchantress. The practice of exercising care in choice of chrysanthemum or carnation cuttings and of

cions for fruit trees is, therefore, seen to rest on rational reasons.

Variations in the character of the seed from different bolls, in the case of hybrid cottons, are frequently found and may be of value to the breeder even in cotton that is propagated by seed. In the study of cotton, similar bud-variations have been found, showing in the lint characters of hybrids. In a number of instances, certain bolls have been found which produced much longer lint than other bolls on the same plant, and similar variations in strength and uniformity of length have been observed. Experiments indicate that such variations, which are doubtless to be classed as bud-variations, are inherited in considerable degree. This being the case even in seed-propagated plants, it becomes desirable to observe and search for bud-variations.

The importance of bud-selection in oranges and lemons has recently been called to attention by the investigations of A. D. Shamel, of the United States Department of Agriculture. It has been found that groves planted with the Bahia or Washington Navel, which is grown extensively in California, frequently show a number of different types with reference to productiveness and form of fruit and that these conditions remain the same from year to year. The same has been found to be the case also in lemon groves, several distinct types not infrequently being produced on the same tree (Fig. 650). These barren trees, and trees producing poor fruit, greatly reduce the production of the grove and in many cases are a serious handicap. Evidence has been collected showing that when buds are taken from productive trees of good type they may ordinarily be expected to produce good types.

In experiments which have been conducted during the last six years in the selection of potatoes, it has been clearly demonstrated that, in a family of potatoes developed from a single tuber and thus positively known to be pure, low- and high-yielding strains can be produced by selecting from low- and high-yielding hills (Fig. 651). Such low- and high-yielding strains have now maintained themselves for three years in over thirty different cases representing work with eighteen different varieties.

The importance of bud-selection is only beginning to be realized and further data is necessary before it can be determined how important this is in different cases. The evidence now at hand, however, clearly indicates that this method of improving plants should be given careful consideration.

H. J. WEBBER.

**BREVOÛRTIA** (J. Carson Breevoort, naturalist, Regent N. Y. State University). *Liliaceæ*. Differs from *Brodiaea* in the long-tubular and 6-saccate corolla: stamens 3, with 3 broad and truncate staminodia: caps. stalked.—One species.



650. Two types of fruit, good and poor, borne on same tree of the Eureka lemon.

**Ida-Mäia**, Wood (*B. coccinea*, Wats. *Brodiaea coccinea*, Gray). **FLORAL FIRE-CRACKER**. Lvs. slender, grassy: scapes slender, 1-3 ft. high, with 3-6 pendulous tubular-saccate fls. 1-2 in. long, which are brilliant crimson-red, tipped with pea-green. N. Calif. to Ore. in wooded foothills. B.M. 5857. G.C. III. 20:687. Gn. 46, p. 503.—The fls. are very lasting and beautiful.



Half-hardy. Needs partial shade and a deep, loose soil, thoroughly drained, and with some leaf-mold. Corm the size of a nutmeg.

CARL PURDY.

**BREWÈRIA** (Samuel Brewer was an English botanist of 18th century). *Convolvulacæ*. Perennial herbs, rarely somewhat woody: fls. much like those of *Convolvulus* but the styles distinct or partly so, the corolla



651. Low- and high-yielding strains of Rural New Yorker potato developed by hill-selection within the progeny of a single tuber.

pubescent outside in the bud: lvs. simple, entire.—Trailing plants of 30 or more species in warm climates.

**grandiflora**, Gray. Root tuberous: st. pubescent: lvs. broad-ovate or oblong-ovate and very short-stalked: peduncles 1-fl'd.; fl. very large (3 in. long), bright blue and showy, funnel-shaped: caps. large and globose-ovoid or ovoid. Fla.—Intro. by Reasoner Bros. One species of *Breweria* (*B. Pickeringii*, Gray) occurs from N. J. and Ill. south, and a few other species are also native farther south in the U. S.

N. TAYLOR.†

**BREYNIA** (for J. P. Breyn, a German botanist of 17th century). *Euphorbiacæ*. Tropical shrubs or trees, rarely cult. Lvs. alternate, simple: fls. small, in short axillary clusters, monœcious, apetalous; calyx imbricate; styles 2-parted: fr. a red berry. Related to *Phyllanthus*: about 15 species in Trop. Asia and Pacific Isls. *B. turbinata* (*Phyllanthus turbinatus*, Sims). B.M. 1862. L.B.C. 8:731, may be the same as *Andrachne fruticosa*.

J. B. S. NORION.

**BRICKÉLLIA** (Dr. John Brickell, an early American naturalist). *Coleosanthus*, Cass. *Compositæ*. About 40 species of herbs or small shrubs in the warmer parts of the U. S. and Mex., only one of which seems to be in the trade. Somewhat allied to *Eupatorium*, from which it differs in having 10-ribbed achenes. Lvs. veiny, either opposite or alternate: fls. white, cream-colored or flesh-colored, small, with pappus either scale-like or somewhat plumose, involucre bracts striate-nerved: achenes striate. Prop. by cuttings under a bell-jar.

**grandiflora**, Nutt. TASSEL FLOWER. Nearly glabrous, 2-3 ft., branchy above: lvs. triangular-cordate or triangular-lanceolate above, coarsely toothed: heads about 40-fl'd., drooping, in large panicles, tassel-shaped and yellowish white. Rocky Mts.—Recommended for moist shady borders, and best grown in a mixture of leaf-mold, loam and sand.

N. TAYLOR.†

**BRIDAL WREATH:** *Spiræa prunifolia*.

**BRIER.** In America, commonly applied to brambles or thorny plants of the genus *Rubus*, especially blackberries. In the Old World, it is applied to large wild-growing roses.

**BRITISH NORTH AMERICA, Horticulture in.** The vast territory of British North America, as understood in this article, comprises the Colony of Newfoundland and the Dominion of Canada. Much of the territory is so little developed horticulturally, and most of the provinces are so very large, that rather extended attention is given here to the adaptabilities of the different political divisions. The map (Fig. 652, page 560) shows the outlines of the territory under consideration, and its relation to the northernmost part of the U. S.

Horticulture in Newfoundland has so far not developed to a great extent and the island is not thought of as a horticultural region; but the colony has great possibilities in this direction. The winter temperatures are not so low as in some parts of Canada where apple trees grow well; and with care and protection from wind the hardiest summer and autumn varieties can be grown. The Canada plum (*Prunus nigra*) is a native of the southern part of the island and no doubt good varieties of this could be produced. The European or domestic plums can also be grown successfully near the coast where protected from the high winds, but owing to the moist air they are very liable to become covered with moss and lichens. Bush-fruits thrive, and strawberries and gooseberries succeed particularly well, and English varieties of both these fruits, which do so poorly in Canada on account of the hot, dry summers, are giving admirable results. In winter the plants are well protected by a deep covering of snow. The hardier vegetables flourish, and large quantities of potatoes are grown by the settlers.

Owing to the relatively moist summer, annuals and herbaceous perennials do particularly well, it being possible to have almost or quite as beautiful a garden there as in eastern Canada.

In the Dominion of Canada, horticulture has become one of the most important industries. In fruit-growing, in floriculture, in vegetable-culture and in the beautifying of cities, towns, and private grounds, Canadians are fully alive to the possibilities of their country; and the rapid development of horticulture in all its branches is an indication of the success that has attended those engaged in its pursuits.

The history of horticulture in Canada dates from the early settlement at Annapolis Royal in Acadia, now Nova Scotia, in 1605, and from the founding of the city of Quebec, now in the province of Quebec, in 1608. There is a definite statement as early as 1663 that apple trees were growing near the banks of some of the rivers in Acadia. There are also records of trees growing in the province of Quebec about that time. In the province of Ontario, it was about the beginning of the eighteenth century before horticulture began appreciably to develop, while in British Columbia, which has made such rapid advances in recent years, fruit trees were not planted until about the middle of the nineteenth century. Owing to inadequate means of transportation, the development of fruit-culture was not rapid in any part of Canada until within the past half-century, but now the extension of orchards, small fruit-plantations, glasshouses, and truck-farms is very marked every year.

The census of Canada for 1911 gives the following figures: Total number of fruit trees in Canada, 20,812, 556; area occupied by fruit trees in Canada, 376,322 acres; estimated capital value of fruit trees in Canada, \$127,000,000. The quantity of fruit grown in Canada is not known, but the Trade and Navigation Returns for the year ending March 31, 1912, show the exports of fruit from all ports to be:

	Value
Dried apples, 3,149,620 pounds....	\$248,035
Fresh apples, 1,664,165 barrels....	5,104,107
Berries.....	106,486
All other fruits.....	159,293
Canned and preserved fruits.....	257,590



652. British North America, showing Newfoundland, the nine Canadian provinces, and the vast territory beyond.



The larger proportion of this fruit is produced in the provinces of Ontario and Nova Scotia, but rapidly increasing quantities are grown in British Columbia.

The fruit areas of Canada are large enough to supply Canada and a large part of the world with some kinds of fruit, and particularly with the apple, for many years to come. In the great province of Ontario, 220,000 square miles in area, larger than the states of New York, Ohio, Illinois and Michigan together, there are large districts in which apples, pears, peaches, plums, cherries, grapes and the small fruits can be grown to perfection. The province of Quebec is considerably larger than Ontario, and while the tender fruits do not succeed except in the most favored parts, apples are grown in large quantities yearly. From east to west in the provinces of Quebec and Ontario there is a belt of about 700 miles in length in which apples and other hardy fruits can be grown; while in the province of Ontario alone the best winter apples, pears, and plums can be grown successfully over an area about 350 miles long and 30 to 150 miles in width. The successful cultivation of peaches in Ontario is confined to the Niagara district and to points along Lake Erie and Lake Huron, but the area suitable for this fruit is extensive enough to supply a large population.

Nova Scotia has long been noted for its apples. The most favored districts are the Annapolis and Cornwallis valleys, where apples, pears, plums and cherries can be grown and where even peaches can be successfully raised. These valleys have a total length of about 100 miles and vary in width from 6 to 11 miles. Fruit-culture is not confined to this district, as over most of the province the harder fruits can be grown successfully. New Brunswick has not yet developed a fruit industry to any great extent, but in some of the valleys apples and other hardy fruits of the finest appearance and best quality can be produced. In recent years there has been a marked awakening in this province and, owing to the cheapness of land and the beauty and quality of the fruits that can be produced, there would seem to be a good future for horticulture.

Prince Edward Island, the smallest province of the Dominion, produces excellent tree fruits, and, owing to the late season, the apples keep better than in any other part of the Dominion. Means of transportation are not yet good, but it is hoped that this will soon be much improved.

British Columbia, the area of which is about 370,000 square miles, or more than twice the size of California, has large sections admirably adapted to fruits. Like the states of Oregon and Washington, with which its natural conditions may be compared, British Columbia has a number of districts with special conditions. Three of these are, (1) that in the damp coast climate of Vancouver Island and the Lower Mainland; (2) in the dry interior country where irrigation is, as a rule, necessary; (3) in the Kootenays, east and west, where irrigation is necessary only in places. In these districts all the best fruits, including peaches in some places, can be grown to great advantage. There are, however, many valleys that are being found suitable for fruit-culture, varying much in climate and extending from the American boundary far north.

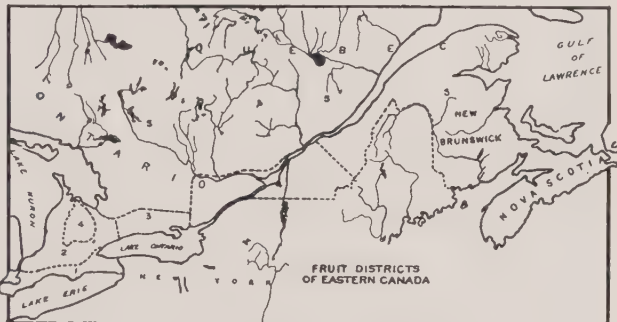
British Columbia is expending its efforts mainly to supplying the prairie provinces of Canada; and it has been very successful in placing fruits on these markets in good condition. The trade abroad is growing also. Ontario is a close competitor of British Columbia for the prairie trade, but the increase in population is so rapid that it will require both provinces to supply the demands for a long time to come.

The prairie provinces of Manitoba, Saskatchewan and Alberta and the great territories to the north pro-

duce excellent bush fruits, but the tree fruits have for the most part not done well up to the present, although the hardiest varieties of apples succeed in some of the more favored localities and plums are native to Manitoba and the early varieties can be grown successfully over a wide area.

Some of the influences affecting Canadian horticulture may be mentioned. The Dominion Experimental Farms, now sixteen in number, work upon which was begun twenty-five years ago, have played an important part. There are six Provincial Agricultural Colleges, all of which have Experiment Stations that disseminate information both through the students and by literature. The Provincial Experiment Stations and demonstration orchards are also doing much to explain the possibilities of fruit-culture in their several districts. Seven Provincial Fruit Growers' Associations lend their aid in spreading a knowledge of the best methods of fruit-culture and of uniting the growers in coöperation and legislation. The horticultural periodical literature of Canada, although represented by few papers, has done much to aid fruit-, flower- and vegetable-growers.

The Farmers' Institute and orchard meetings organized by the Provincial Governments and assisted by the Dominion Government, are very practical and helpful. In the province of Ontario, a large proportion of the



653. The fruit regions in eastern Canada.

counties have the District Representative, a Government official whose duty it is to instruct the people by word, by experiment and by demonstration.

The horticultural societies assisted by the Provincial Government, of which there are seventy-five in Ontario, are doing excellent work in awakening a greater interest in horticulture and in spreading information, especially in regard to ornamental plants.

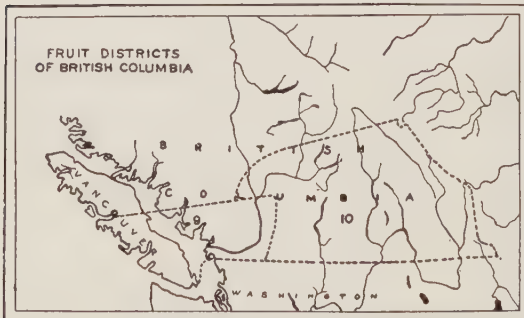
The apples originated by Wm. Saunders in crossing the wild Siberian crab-apple, *Pyrus baccata*, and the varieties of the apple, have enabled the settlers in the prairie provinces to grow at least small apples where larger ones do not succeed; and the larger-fruited varieties obtained by Saunders, by introducing more of the blood of the apple into the first crosses, are now being tested for hardiness, and, if found worthy, will mark a step in advance.

All these factors affecting horticultural conditions and progress have been made still more effective by the coöperative movement that has in recent years made much progress in Canada. In the provinces of Ontario and Nova Scotia are many coöperative associations that now have central organizations where plans affecting the welfare of all the associations are discussed. These associations are doing much to make the fruit marketed of more uniform character and to bring better returns to the producer. One of the best influences in the improvement of horticultural products in Canada is the Fruit Marks Act (now the Inspection and Sales Act) passed in 1901, and operative over the whole of Canada. By this Act, growers are compelled to pack

their fruit according to certain standards and are liable to fine if they do not do so. Inspectors are stationed at packing-houses, on the markets, and at the ports of export, who examine the fruit to determine whether it is packed according to law. A marked improvement has been noticed in the Canadian fruit exported since this law went into effect. There are also standard barrels, boxes and baskets for the whole of Canada.

While floriculture is growing very rapidly, the area under glass in Canada is not very large yet, it being estimated at about 120 acres or 6,000,000 square feet in 1912. The estimated capital invested is \$1,500,000 and the value of the output \$1,800,000. The flowers most grown under glass in Canada are carnations and roses, although many other kinds are also raised. Some of the Canadian growers have an international reputation for the quality of the flowers they produce. The official organ of the florists in Canada is "The Canadian Florist," a trade paper published every two weeks.

Many kinds of vegetables succeed admirably in Canada and there are a large number of skillful growers. Owing to the rapid development of the larger cities and the many new towns in the newly settled parts, there are many openings for market-gardeners. Large quantities of vegetables, including particularly tomatoes and corn, are grown for the canning factories in southwestern Ontario where the season is earlier than in any other part of eastern Canada. Early vegetables are



654. The fruit region (within dotted lines) in British Columbia.

grown on a large scale, and have proved very profitable to those engaged in the business. Perhaps the most noted vegetable grown in Canada is the Montreal muskmelon, which is well known for its high quality in many cities of the United States. The production of such a high-class melon is a good indication of the summer climate of Canada, which in many parts is hot enough to mature melons well. The market-gardeners are represented in Ontario by the Provincial Vegetable Growers' Association, branches of which are to be found in a number of the cities and towns. This organization has done much to assist market-gardeners and to make them feel that their calling is as important as any other branch of agriculture. W. T. MACOUN.

#### Nova Scotia.

Nova Scotia (Fig. 655) is a peninsula on the extreme eastern side of Canada. It extends in a northeasterly and southwesterly direction and is crossed by the forty-fifth parallel of north latitude. No part of the interior is more than 30 miles from the sea. The surface is gently undulating, with no high mountain ranges. The principal farming and fruit-growing sections are mainly in the valleys through which the rivers run and around the headwaters of the Bay of Fundy, where the high tides have left extensive deposits of rich alluvial soil. The annual rainfall is about 42 inches.

The French Acadians early made plantings of the apple in this province. When the New England settlers

came, in 1761, to occupy the lands of the deported French, they found apple trees in bearing, many of which lived and continued to bear fruit well along into the last century. The leading horticultural industry is fruit-growing. Its most important division is apple-culture, although pears, plums, cherries and small fruits are successfully grown. These soft fruits are necessarily sold in the local markets, which, though steadily growing in size, are as yet of too limited capacity to justify an extensive development of the culture of such perishable products. Apples, on the other hand, are shipped to the British and other foreign markets where, in their season, they successfully compete with those from other parts of the northern hemisphere.

The strictly horticultural region of Nova Scotia is a small section of the western part of the province generally called the Annapolis Valley. This region, except in its extreme eastern part, is separated from the Bay of Fundy and protected from the direct force of the northerly and westerly winds by a range of hills, some 400 to 500 feet in height, known as the North Mountain. It includes the valley of the Annapolis River, which flows southwesterly to the Annapolis Basin, and the valleys of the Pereaux, Habitant, Canard, Cornwallis, Gaspereau and Avon Rivers, which flow into Minas Basin on the east. It is a narrow strip of country 6 to 10 miles wide and less than 100 miles long.

Here apple-culture, from being a side line to general farming down to about forty years ago, has grown to be the leading branch of agriculture. The yield of apples in this district, packed and sold in 1911, was 1,734,000 barrels. The yield for 1912 is estimated at 1,100,000 barrels. These figures do not include, in either case, those that were used by the canneries, evaporators and vinegar factories, or that were consumed in the district in which grown. About one-tenth of the output finds a market in the towns and the villages of the non-fruit-growing sections of the maritime provinces, the remainder being exported to Great Britain, Germany and other European countries, and to Newfoundland, the Canadian West, the West Indies and South Africa. The varieties of apples grown have been selected chiefly with reference to the English market. The leading commercial sorts are Gravenstein, Blenheim, Ribston, King, Yellow Bellflower, Cox Orange, Wagener, Baldwin, Stark, Spy, Golden Russet, Fallawater, Roxbury Russet and Ben Davis. Some of these have long been known in England and were introduced from that country. The Gravenstein, especially, reaches a high quality here. The winter varieties also do well and mature just as the cool weather of autumn comes on.

As a rule, orchards are carefully cultivated, fertilized, pruned and sprayed. A large quantity of commercial fertilizer is used every year, as the area in orchards has outgrown the supply of stable manure. Cover-crops are grown to furnish humus, the clovers, vetches and buckwheat being the crops chiefly used for this purpose. The practice of thinning apples has lately been adopted by many of the best growers and is likely to become more general as competition in fruit-raising increases.

A system of frost-proof apple warehouses, that has come into existence during the last sixteen years, is an important element in the carrying-on of the fruit business in Nova Scotia. These—numbering one hundred in all—are found at the railway stations throughout the fruit district. The usual width is about 40 feet, the length from 80 to 120 feet, affording room for packing and storage for 5,000 to 10,000 barrels. Formerly, the fruit-grower packed his apples at home, or in his barn. Then, when a steamer was ready to load at Halifax, the apples had to be hauled to the railroad station, often several miles distant, and loaded into the waiting cars. Now the apples are generally taken in barrels directly from the orchard to the warehouse where they are stored until ready to be packed out for shipment.





XVIII. Canadian orchard development.—The tidewater country in Nova Scotia.





Under this system, it is possible with very little delay to pack and place on cars a steamer-load of apples. A railway haul of four or five hours brings the cars to the side of the steamer so that the danger from frost, even in zero weather, is largely avoided.

A further advance was made in the business of packing and marketing apples when coöperative fruit companies were formed. The first company of this kind was organized in Berwick in 1907. During the next five years, more than thirty similar companies were formed. Under provincial legislation enacted in 1912, these were organized into a central association known as the United Fruit Companies of Nova Scotia, Limited. All the apples of the companies affiliated in this central association are sold through its agency. It controls the sale of fully one-half of the apple crop of the province. A uniform standard of grading is maintained, an official of the central association inspecting the packing in all the warehouses of the affiliated companies. Coöperation in the marketing of apples was quickly followed by the coöperative manufacture of barrels and purchase of fertilizers, feeds and seeds, greatly to the convenience and financial advantage of the members of the companies. In the near future, all farmers' supplies will probably be purchased coöperatively.

The establishment of evaporators, canneries and vinegar factories throughout the fruit district, some of them owned by coöperative companies, furnishes a market for defective fruit and has also the effect of improving the grade of apples packed. There are now eight evaporators, two canneries and four vinegar factories in operation.

Local nurseries, chiefly for the propagation of apple trees, are to be found at Annapolis, Berwick, Waterville and Wolfville. While these have received good patronage in the past, the larger quantity of nursery stock in recent years has been imported, chiefly from Ontario. With a view to avoiding the danger of introducing noxious insects and plant diseases, the provincial department of agriculture has lately passed strict regulations governing the importation of nursery stock. The effect of this has been to stimulate the home nursery industry.

Pears, plums and cherries are grown for home use and the local markets. Bartlett and Clapp Favorite are the varieties of pears most largely grown. Moore Arctic, Lombard, Yellow Egg, the Gages, Damsons and Burbank are the chief plums. The cherries are the Morello and other varieties of the sour type. Peaches are grown to some extent in the western part of the province, Alexander, Early Canada and Fitzgerald proving hardy.

Cranberries constitute an important part of the fruit crop of Nova Scotia. They are grown on reclaimed bog lands that would be unsuitable for any other farm crop. There is much land of this kind in the province still unused. In 1908, the cranberry crop in the vicinity of one railway station, Auburn, amounted to nearly 5,000 barrels and netted the growers \$25,000. A good market for Nova Scotia berries is found in Montreal and the Canadian West.

Truck-gardening is conducted to some extent on the light sandy soil of the central part of the Annapolis Valley. In the vicinity of Berwick, Aylesford, and Kingston, such crops as strawberries, raspberries, tomatoes, green beans, asparagus and rhubarb, are grown for the local markets. Some of the tomatoes go to the cannery.

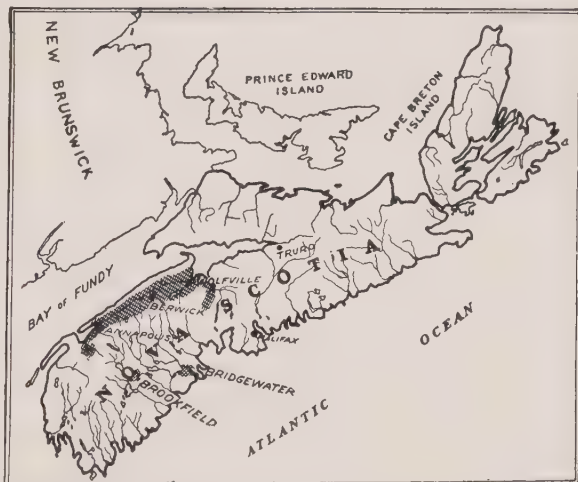
Only one important variety of apple originated in Nova Scotia, the Banks Red, a bud-sport of the Gravenstein. John Burbidge, who settled in the Cornwallis Valley in 1764 introduced the Nonpareil (Roxbury Russet). Charles Inglis, first Bishop of Nova Scotia, who received a grant of land in Aylesford Township, in 1790, introduced the Yellow Bellflower, which

thence came to be known here as Bishop Pippin. Charles R. Prescott introduced Ribston in 1814, Blenheim in 1829, Gravenstein and Alexander in 1835, Baldwin and Greening in 1820 and Northern Spy shortly after 1852.

The Nova Scotia Fruit-Growers' Association, founded in 1863, is the oldest in the Dominion, and receives an annual grant from the provincial government. For several years it assisted in maintaining a school of horticulture at Wolfville. In 1905, this school was merged into the College of Agriculture at Truro.

In 1911, a fruit experiment station was established at Kentville. This is maintained by the federal government at Ottawa. The provincial government has established thirty-five demonstration orchards in parts of the province outside the fruit district proper. The purpose of these orchards is to discover the fruit-growing possibilities of the different sections of the province, to find out the varieties best suited to these sections, and to give a demonstration of what orchard practice is considered most effective in such localities. Horticulture is taught at the Agricultural College which was established at Truro in 1905.

PERCY J. SHAW.



655. Nova Scotia, showing the present fruit district and two centers (Bridgewater and Brookfield), where the industry is beginning to develop.

#### Prince Edward Island.

In the Gulf of St. Lawrence, and separated from the continent by the Northumberland Strait, lies the province of Prince Edward Island (Fig. 656), the "low and beautiful land" that Cartier saw on the afternoon of June 30, 1534. It is situated between  $46^{\circ}$  and  $47^{\circ} 7'$  north latitude and east of  $64^{\circ} 27'$  west longitude, and is distant from New Brunswick 9 miles, from Nova Scotia 15 miles and from Cape Breton 30 miles. In form, it is an irregular crescent, concaved toward the north with such an exceedingly indented coastline that no part of the country is far distant from the sea. Sand-dunes extend along the north shore for a distance of 50 miles. The surface is gently undulating. Ranges of low hills traverse the island from New London to Hampton, from Brooklyn to Wood Islands, and from Red Point to Rollo Bay. The highest elevation is less than 300 feet. Small flat areas occur in the western part of Prince Co.

The climate is temperate and not subject to rapid changes. For the past five years, the average temperature during the winter months was  $36.6^{\circ}$ , the lowest registered being  $-19.5^{\circ}$ , and during the summer months  $70^{\circ}$ , with  $86.5^{\circ}$  the highest. The yearly precipitation varies from 38 to 42 inches, a little less than half falling during the months May to October in light showers at more or less regular intervals.

The whole population is engaged in agriculture and fishing and in the merchandise connected therewith. Horticulture is yet in its infancy and only very few of the inhabitants have begun to realize its possibilities.

Nearly every farmer has a few trees producing sufficient apples for his own family. But few have seriously



656. Prince Edward Island. The shaded parts are horticultural sections.

considered apple-growing as a revenue-producing branch of agriculture. The first trees were planted shortly after the English occupation in 1763. The stock was brought out from the Old Country and was nearly all of the cider varieties. On this account it was generally believed that good apples could not be grown in this province. For over a century very little improvement was made.

The development of the apple industry in Nova Scotia stimulated the planting of more trees in Prince Edward Island and led to the setting out of nurseries in 1886 by William Taylor at Lower Freetown and by Condon at Kensington. They received a great many orders for trees but the orders were so small (very few people wanting more than half a dozen) that there was not much profit in the business and it was not continued.

A few men, however, were enthusiastic over the possibilities of fruit-growing and at the call of Lieutenant-Governor Howlan met in Charlottetown on March 30, 1896, and formed the Fruit-Growers' Association of Prince Edward Island. It received the encouragement of the Department of Agriculture and was given an annual grant of \$100, for the purpose of holding a fruit show.

This again gave a further stimulus to tree-planting, and nurseries were set out by D. A. Sharp at Summerside, Thomas Moyses at Central Bedeque and John Robertson at New Perth. Many trees were sold but the business does not seem to have been very profitable, and at the present time all the stock is imported. A few men, however, set out commercial orchards and between the years 1897 to 1900 some shipments of apples were made to the British market. It was very difficult, however, to find more than a few barrels of one variety in a district. This added very much to the expense of packing and shipping, and as the business was at best very uncertain, it was soon given up.

In 1909 the Coöperative Fruit Company was formed. The purpose was to provide proper packages and to get together sufficient quantities of apples of one variety to make a profitable shipment. The Department of Agriculture provides the Company with a secretary and makes a small annual grant, sufficient to cover truckage expenses.

In 1909, eighty-four barrels were shipped; in 1910, some 350 barrels. The expenses of getting their apples together, graded, properly packed and marketed were too great and in 1911 each grower shipped his own. This, however, proved even less satisfactory and the Company is preparing to pack again this autumn. They hope, however, to get a number of barrels of apples together at certain centers, and with this end in view, all the orchards in these vicinities are being sprayed.

For a number of years the question of varieties has been taken up by the Fruit-Growers' Association. The following are now recommended: For home orchard—Yellow Transparent, Crimson Beauty, Duchess of Oldenburg, Wealthy, Wagener, King, Northern Spy, McIntosh Red, and Stark. For commercial orchard—

Wealthy, Alexander or Wolf River, McIntosh Red, Ribston Pippin and Ben Davis.

The feeling is general that the next few years will witness a great development of the apple industry in Prince Edward Island.

Very few pear trees have been planted, but when given good cultivation and properly sprayed, they have done well. The most popular varieties are Clapp Favorite, Bartlett, Vermont Beauty, Flemish Beauty, Howell and Anjou.

The cool, moist climate of Prince Edward Island favors the growing of plums of the very finest quality, and of late years quite a number of trees have been set out. Among the varieties best suited to Island conditions are Glass Seedling, Moore Arctic, Quackenboss, Yellow Egg, Victoria, Bradshaw, Prince Englebert and Blue Damson.

Cherry trees were introduced by the early French settlers and, as they were able to take care of themselves, met with great success. Nearly every farmstead has a few trees. The crop is, however, very uncertain, as a late frost catches the blossoms about every third year. They are nearly all sour cherries of the Richmond and Montmorency varieties. In a few orchards sweet cherries are being tried with indifferent success. They bloom too early and are caught by the frost.

Grass lands that have not been manured with mussel mud invariably grow a crop of strawberries in every part of the province. The increased cost of labor has made the picking of the wild ones unprofitable and for the last few years the cultivated varieties have taken their place on the market. From 8,000 to 10,000 boxes to the acre is considered an average crop. Some progressive farmers have had very large returns from strawberry-growing, with the result that prospects are very bright for a large industry. The chief varieties grown at the present time are Splendid, Glen Mary, Senator Dunlap, Williams and Wilson.

Among the bush fruits, raspberries and blackberries are being cultivated but not to the same extent as gooseberries and currants, which are in greater demand. All, however, are being grown very successfully. Dewberries are not grown to any extent. They have been introduced at the Experimental Farm and their cultivation will likely be extended.

As wild strawberries are found in the higher grasslands, wild cranberries are found in the bog-lands and marshes. In a few districts they are being cultivated and giving very large returns. When the plantation can be flooded, the crop is fairly sure, but when it cannot be flooded the frost frequently does much damage. The average crop is about eighty bushels to the acre.

There are several thousand acres of blueberry barrens in the province, from which about twenty carloads of berries are shipped annually. They do not, however, seem to improve by cultivation and the increasing cost of labor will likely lessen the amount marketed. Now and again the crop is a comparative failure, due to frost or to severe drought.

Prince Edward Island is peculiarly adapted to the growing of fruit. The reason that more progress has not been made is the inadequate transportation facilities. Last year, however, arrangements were made for three calls of an ocean steamship at Charlottetown on the way from Montreal to Manchester. The car ferry, also, that is about to be built between Carleton and Cape Tormentine will further help to overcome this difficulty, and it is expected that the next few years will witness a great development in horticulture in this



province. The census returns for 1911 give the following figures of the industry:

	No.	Product
Apple trees .....	205,979	160,124 bushels
Peach trees .....	546	13 bushels
Pear trees .....	2,439	773 bushels
Plum trees .....	20,625	27,480 bushels
Cherry trees .....	53,094	7,576 bushels
Other fruit trees .	9,998	1,479 bushels
Grapes .....		1,641 pounds
Strawberries .....		186,692 boxes
Currants and gooseberries .....		48,429 quarts
Other small fruits .....		1,860 boxes

THEODORE ROSS.

#### New Brunswick.

The province of New Brunswick (Fig. 657) lies mainly between 45° and 48° north latitude, and 64° and 68° west longitude. Its boundaries are: On the south the Bay of Fundy, on the east the Strait of Northumberland and the Gulf of St. Lawrence, on the north the Bay of Chaleur and the province of Quebec, on the west the state of Maine. The greatest length of the province from north to south is 230 miles, and its greatest breadth is 190 miles. It has an area of 27,985 square miles and about 600 miles of seacoast. It is a rolling country of no great elevations with the more hilly sections formed by an extension of the Appalachian Mountains in the northern and northwestern parts of the province. Few countries are so well watered as New Brunswick. Lakes and small streams are numerous all over the country. The St. John River, which flows into the Bay of Fundy, is 450 miles long. The Miramichi and Restigouche Rivers, both of which are over 200 miles long, drain into the Gulf of St. Lawrence. The Petitcodiac and St. Croix are important rivers situated respectively in the eastern and western ends of the province and flowing into the Bay of Fundy. The yearly record for continuous sunshine is excelled by only one other province in the Dominion. The average hours of sunshine recorded yearly at Fredericton is 1,983. The average annual precipitation for the last thirty-eight years at Fredericton is 45.6 inches.

The province contains 17,393,000 acres, of which 7,750,000 are Crown land, 5,000,000 acres are settlement land and 4,643,000 acres are private timber land. According to the report of the Agricultural Commission, which investigated farming conditions all over the province in 1908, there were at that time 32,480 farms, and 1,474,076 acres of cleared land.

Potato-growing is the leading horticultural industry. The province is particularly adapted for the production of this crop, as the comparatively cool moist climate enables the potatoes to grow for a long period of time, and they are green and vigorous until the frost comes, hence their firmness, full starch content, good keeping quality and pleasant flavor. An additional advantage is the ease and cheapness with which the potato can be shipped to tide-water, since the St. John River and its tributaries water an area of 2,000 square miles. Carried in scows, potatoes are delivered in St. John from York County for 5 cents the barrel. Carleton County on the western border, watered by the upper reaches of the St. John River, has long been the banner county for potato-growing. In 1910, it had 8,786 acres under cultivation, with a production of 1,127,680 bushels, or 128.3 bushels to the acre. In 1909, from 8,940 acres, it derived 1,800,676 bushels, or 201.4 bushels to the acre. The same year the province averaged 187.4 bushels to the acre. Victoria County, to the north of Carleton County and immediately adjoining Aroostook

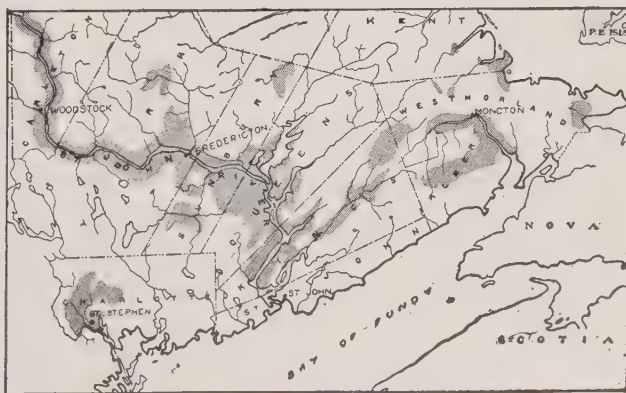
County, Maine, affords considerable excellent potato-raising land. In fact, the entire valley of the St. John River is well suited for this purpose and potatoes are also grown extensively in the eastern counties of Kent and Westmoreland.

The entire acreage under potatoes in the province in 1910 was 47,744 and the yield 6,067,276 bushels. In 1909 it was 47,853 acres and the yield was nearly 9,000,000 bushels. In 1911, the acreage was 47,304 and the yield 8,493,212 bushels. Large quantities of potatoes are now being shipped annually to Ontario, the West Indies and Cuba. Experiments conducted during the past few years by experimental stations and practical farmers in Ontario show that potatoes produced in the maritime provinces gave a much larger yield than those from Ontario-grown seed. This has led to an increasing demand from Ontario for New Brunswick potatoes for seed purposes.

Apples were undoubtedly grown in the province in the early part of the nineteenth century, but it remained for Francis Peabody Sharp, New Brunswick's pioneer horticulturist, to demonstrate the possibilities of commercial apple-growing in this northern climate. His operations were conducted at Upper Woodstock on the St. John River, and there, in 1844, he set out his first trees. Sharp planted many large orchards, did extensive work in hybridizing and introduced many of the standard varieties into New Brunswick from the United States and elsewhere. His death occurred at Upper Woodstock in December, 1903. From that time an impression that apple-growing could not be made a success seemed to gain ground, but of late years this has been swept away and the outlook for the future of the industry is now very bright.

The list of apples recommended for New Brunswick covers the season and provides a class well suited for export shipment, as well as for supplying the local markets. With cheap and rapid transportation by water, with an over-seas market close at hand, with plenty of suitable land at a moderate cost, with the knowledge that has been secured as to the proper varieties to plant, and with the active coöperation of the government, the success of New Brunswick as a fruit-producing area seems assured.

Many commercial orchards are now being planted, chiefly in the St. John River valley and in the eastern part of the province, and apple-growing bids fair in the near future to take first place in the horticultural crops of the province. The provincial Department of Agriculture established a horticultural division in 1910 and there are now a provincial horticulturist and three assistants actively engaged in promoting the fruit-growing industry. Preparations for an export trade are being made by experimental shipments of apples



657. New Brunswick. The shaded parts represent the chief fruit-growing and horticultural areas of the province.

to the European markets and the placing of exhibits in the principal cities of the United Kingdom and Canada. The following varieties of apples are grown very successfully: Crimson Beauty, Red Astrachan, Duchess, Sharp New Brunswick, Yellow Transparent, Wealthy, Dudley, Alexander, Wolf River, Fameuse, McIntosh Red, Bishop Pippin, Golden Russet and Bethel. Northern Spy, King of Tompkins and Rhode Island Greening are grown to a limited extent. The Moore Arctic, Lombard and Yellow Egg plums and Flemish Beauty and Clapp's Favorite pears are grown successfully.

Wild raspberries, strawberries, blueberries and cranberries grow in abundance. Strawberry-culture was first introduced into New Brunswick at Kingston, Kings County, about 1862, by the late D. P. Wetmore, Inspector of Schools. Large quantities are now produced, and as the season of maturity is comparatively late, many shipments are made to Boston and Montreal, where they are much in demand, as the strawberry crop is then finished in other sections. Blueberries grow wild in enormous profusion and are canned in large quantities.

Truck-gardening is practised extensively on the

but in the extreme north arctic conditions prevail and the country is sparsely inhabited. The greater part of the province, however, is well suited to agriculture, and the returns per acre compare favorably with other agricultural areas of Canada. The rainfall, although quite scanty at certain seasons, is usually sufficient. Irrigation is seldom or never practised and is usually unnecessary.

When horticulture began in Quebec is not known, as it is older than the oldest records. When the country was first explored by the French, the Indians knew the melon and cultivated it with some success, as well as a number of other crops of interest to horticulturists. Father Charlevoix (S.J.), the historian, is very plain on this latter point. In a letter dated Chambly, April 1, 1721, while referring to Montreal, he asserts that "The Indians, before our arrival in Canada, were familiar with both ordinary melons and watermelons." He said, "The former are as good as any in France, especially those raised on the island of Montreal, where they grow in rich profusion" (Vol. III, Journ. d'un Voyage, etc., p. 164).

That melons in ordinary seasons were common enough in Montreal may be gleaned from the appended

quotations from a letter of Father Claude Chauchetiere (S.F.), dated Montreal, August 7, 1694: "We have had no melons to speak of this year; we shall barely have enough for seed. This is something I have never yet seen before in Montreal, and every one is surprised at it."

The "Relation par lettres," 1709, attributed to Father Antoine Tiley (S.J.), is authority for the statement, "The savage had the small squash, the watermelon, the gourd and the sunflower before the French came to the country." Although horticulture is old in Quebec, it has never been extensively practised, and the industry is expanding slowly. In the vicinity of Montreal, vegetables are

extensively cultivated for the home market, but the home market is not nearly supplied by native-grown produce and will not be for some time to come.

The present fruit areas are indicated on the map by parallel lines, while those partly in fruit are dotted. The areas in which fruit might be grown are inclosed by a dark line surrounding the section. It will be seen that the total area is not large. Much of the province south of the St. Lawrence possesses great horticultural possibilities and expansion may there be looked for. Rouville, Chateauguay, Hochelaga, Jacques Cartier, Two Mountains, Stanstead, L'Assomption are regarded as fruit counties; Huntingdon, Argenteuil, Vaudeuil, Soulange, La Prairie, Napierville, Kamouraska, L'Islet, Montmagny and Bellechasse are partly in fruit; while Compton, Missisquoi, Brome, Beauce, Shefford, Bagot and counties on the St. Lawrence to Champlain County may be regarded as possible fruit areas, but are not as yet extensively planted.

The present status of horticulture may be gleaned by a study of the census of 1911 so far as the fruit industry is concerned. It would seem that many of the old trees have fallen victims to the ravages of time; but that young trees are being set in larger numbers. Better methods and a more thorough dissemination of knowledge are constantly crowding out the old, so that there



658. Horticultural regions of Old Quebec.

northeastern bank of the St. John River, in the vicinity of Maugerville and Sheffield. The soil there is a dark loam, several feet deep and exceedingly fertile, being the old river-bed, and large quantities of cabbages, cauliflowers, tomatoes, cucumbers, and the like, are grown and shipped to Fredericton and St. John.

A. G. TURNEY.

#### Quebec.

Old Quebec (Fig. 658) occupies a unique position in the Dominion of Canada because it is the oldest province, the largest province and the province in which the English-speaking people are in the great minority. Although not regarded as maritime, yet it possesses considerable coast; and the mighty St. Lawrence takes on the character of an open sea. The St. Lawrence and the numerous rivers and lakes that feed it are the principal physical features of the province, and these features have made of Montreal, Quebec's chief city, the importing, exporting and distributing center of Canada. The Appalachian Mountains extend into Quebec under the name of Notre Dame, but in no place do they reach any great height. The greater part of the country is decidedly level, while some sections are gently undulating.

South of the St. Lawrence the climate is not severe;



is no doubt that a few years hence the number of bearing trees will be much increased. The census figures are as follows:

	1901	1911	Increase or decrease	Per cent of Increase or decrease
Orchard and nursery (acres)	34,289	34,376	Inc. 87	Inc. 0.2
Vineyard (acres)	119	641	Inc. 522	Inc. 438.6
Small fruits				
(acres).....	not given	1,669		
Apple trees (no.)	2,256,752	2,158,589	Dec. 98,163	Dec. 4.3
Bearing (no.)..	1,476,727	1,295,992	Dec. 180,735	Dec. 12.2
Non-bearing (no.).....	780,025	862,597	Inc. 82,572	Inc. 10.5
Product (bus.)	2,025,113	1,401,109		
Peach trees (no.)	332	2,244	Inc. 1,912	Inc. 575.9
Bearing (no.)..	68	1,641	Inc. 1,573	Inc. 2,313.2
Non-bearing (no.).....	264	603	Inc. 339	Inc. 128.4
Product (bus.)	17	987		
Pear trees (no.)	11,823	7,534	Dec. 4,289	Dec. 36.2
Bearing (no.)..	5,191	3,807	Dec. 1,384	Dec. 26.6
Non-bearing (no.).....	6,632	3,727	Dec. 2,905	Dec. 43.8
Product (bus.)	3,275	4,967		
Plum trees (no.)	364,280	260,077	Dec. 104,204	Dec. 28.6
Bearing (no.)..	245,370	133,567	Dec. 111,803	Dec. 45.5
Non-bearing (no.).....	118,910	126,509	Inc. 7,599	Inc. 6.3
Product (bus.)	122,648	51,045		
Cherry trees (no.)	394,090	167,275	Dec. 226,815	Dec. 57.5
Bearing (no.)..	317,762	111,267	Dec. 206,495	Dec. 64.9
Non-bearing (no.).....	76,328	56,008	Dec. 20,320	Dec. 26.6
Product (bus.)	150,690	44,705		
Other fruit trees				
(no.).....	28,528	42,687	Inc. 14,159	Inc. 49.6
Bearing (no.)..	23,711	33,073	Inc. 9,362	Inc. 39.4
Non-bearing (no.).....	4,817	9,614	Inc. 4,797	Inc. 99.5
Product (bus.)	21,386	10,764		
Total fruit trees				
(no.).....	3,055,805	2,638,405	Dec. 417,400	Dec. 13.6
Bearing (no.)..	2,068,829	1,579,347	Dec. 489,482	Dec. 23.6
Non-bearing (no.).....	986,976	1,059,058	Inc. 72,082	Inc. 7.3
Grapes (lbs.)	995,849	310,826	Dec. 685,023	Dec. 68.7
Strawberries (qts.)....		1,955,749		
Currents and Gooseberries (qts.)....	842,968	661,101	Dec. 181,867	Dec. 21.5
Other small fruits....		194,901		

The nursery business is popular in the province. Considering the size of the horticultural areas, the number of nursery firms doing business is large. Under the name of "northern-grown stock" the sale has been pushed. All nursery produce is carefully inspected by government officials, and all imported stock must be inspected before planting may be made.

Many varieties have originated in Quebec. The most of these are of minor importance, but the Montreal melon and the Fameuse apple have done more to advertise horticulture in Quebec than all other causes combined. The Montreal muskmelon is a melon of great size, often weighing nineteen and a half pounds. There are many cases on record in which they became much heavier, but these exceptionally large ones are not sought after. It has been stated that early French Jesuits brought melon seed to Quebec and that the present Montreal melon evolved from this source, but there is no such record. If this ever happened, the event was deemed of so little importance as to be unworthy of record. There can be no doubt, however, that the Indians were cultivating the melon in Quebec when first explored by the French in 1645 to 1649. Father Bressani (S.F.) mentions a plant he had seen in the country of the Hurons, now Simcoe County, which he says was similar to the melon of India (Bresse Relation, Martin's translation, p. 68). The Journal of a "person of merit," name not given, 1663, who was sent out expressly to report on the resources of Canada, and

who spent one year in the colony, has this to say on the matter in question: "Thence we proceeded up the river to Montreal. Its latitude is that of Bordeaux, its climate most agreeable, its soil excellent; a gardener here has but to cast his melon seeds into a little patch of loosened earth among the stones and they do not fail to thrive without further care on the part of the man" (Relations 1663, quib, ed. p. 28, 2 col.; Chiv. ed., Vol. 48, p. 169). He adds, "Squashes are raised there with still less labor, but differ much from ours [in France] for some have the flavor of apples and pears when cooked." The Montreal melon has not been an equal success in other sections. The peculiar soil-formation and climatic conditions on the island of Montreal combine to give the fruit a flavor which is not equaled elsewhere. At the beginning of the melon season moderate-sized specimens bring on the Montreal market \$18 per dozen and retail at \$2.25 each. The Fameuse apple is now commonly spoken of as the national apple of Quebec. No definite records exist concerning the exact origin of the Fameuse. There can be no doubt, however, that the Fameuse is a seedling arising from seed brought from France by early French priests. The Fameuse in Quebec is a very striking apple; in form, color and flavor it is par excellence. No province to the west can compete with Quebec's Fameuse. Specimens are produced here as nearly ideal as may be found, as comparative exhibitions have shown. Fameuse apples from this province are easy winners.

The local government grants \$12,600 as an aid to horticulture. From this sum \$7 a month is allowed all students from Quebec attending the regular agricultural courses at the colleges; \$1,500 is granted to three pomological societies. Aid is also given to horticultural extension work, such as demonstration trains, demonstration orchards and various forms of institute work. Horticulture is taught in three colleges, Macdonald College, Oka, and St. Anne de la Pocatiere, which deserve special mention. Macdonald College is unique in agricultural development along educational lines. It sprang into being fully equipped and ready for efficient service at once. This was made possible by the munificence of Sir William Macdonald, a public-spirited capitalist of Montreal. It was Macdonald who financed the undertaking; but it was James W. Robertson, a man of great vision, who, by means of lectures, literature and personal persuasion, aroused widespread interest in agriculture; and who, by his work and ideals was able to attract the attention of Sir William and to gain his financial support. The college property comprises 561 acres, and boasts the largest horticultural department in similar institutions in America. The courses run over four years, leading to the degree of B. S. A. The agricultural school conducted by the Trappist fathers is of great interest to visitors. These Trappist monks, by their industry and skill in agriculture, have changed the face of the countryside in the region of the Lake of the Two Mountains since 1880. The scientific and practical training at the college is given by twelve to fifteen fathers and lay teachers. The average number of pupils at present is about one hundred, who come largely from the province of Quebec. Students who have passed all examinations successfully obtain the degree of B. S. A. from Laval University. The agricultural school of St. Anne de la Pocatiere teaches horticulture as well as allied agricultural subjects. A limited number of students are in attendance, who secure diplomas upon completing the courses.

E. M. STRAIGHT.

#### Ontario.

The horticulture of Ontario is undergoing very rapid evolution. The province is so situated geographically and topographically as to enjoy a climate much milder than that of most parts of Canada. Within the prov-

ince, towns and cities are growing very rapidly, and markets are thus being provided for high-class products of all kinds. The Canadian Northwest, also, is rapidly becoming an important market and is attracting every year a large volume of trade that formerly went to Great Britain and western Europe.

Ontario (Fig. 659) includes a vast extent of country, being over 700 miles from extreme north to extreme south and approximately 1,000 miles from east to west. The outline of the province is very irregular. The most noticeable feature is the vast extent of boundary line which borders on the Great Lakes. The altitude of the lakes varies from 250 to about 600 feet and inland Ontario ranges from lake-level to 1,700 or 1,800 feet. Practically all of the fruit-growing districts lie below 1,000 feet and all the important fruit districts border the Great Lakes.

The early settlers paid less attention to horticulture than to other branches of rural activity, but of late years very rapid development has begun, especially in connection with fruit-growing, although commercial vegetable-growing and commercial floriculture are becoming increasingly important. Landscape art is newer and less developed than are the commercial branches of horticulture, but many of the towns and cities possess active horticultural societies, part of the work of which is a propaganda looking toward the beautifying of home surroundings. Ontario, as a province, possesses great natural beauty. Few sections are entirely level and the general character is undulating or more or less rolling. There are many beautiful homes in towns and cities and many also throughout the countryside.

The many local horticultural societies and the provincial federation of them are exerting profound influence

Old Ontario lies farther south than any other part of Canada, the most southerly part, as a matter of fact, lying in the same latitude as Boston, Mass., and on a level with the northern boundary of the State of California. In this southern district, the production of early vegetables, both under glass and out-of-doors, has become an important industry. In the vicinity of many towns and of the large cities, such as Hamilton, Brantford, London, Toronto and Ottawa, there have also grown up important local industries in the production of vegetables. The extensive production of such truck-crops as onions, cabbage, and celery is conducted in a few small districts only, but with the rapid development of markets this phase of vegetable-growing is taking on increased importance. In certain sections, such as Prince Edward County, the vegetable industry takes the form of production for canning factories. In that county, there are some sixteen large commercial canning plants, and many additional factories are located in other sections and devote themselves to the canning of full lines of vegetables and fruits. The industry is growing.

The apple is by far the most important fruit produced within the province, but certain sections have for years been producing peaches in a large way. The Niagara Peninsula has long been famed as an important fruit center, and many fine commercial plantations of peach and other fruits are found there. Peaches from this locality are being successfully shipped to Winnipeg and northwestern markets, and a few shipments have also been landed in Great Britain in excellent condition. On the accompanying map, the three districts marked No. 1 produce peaches successfully in a commercial way. The peach section bordering on Lake Huron is of comparatively recent development, but the climate and soil

are perfectly adapted to this fruit, and a great extension of acreage has taken place in that locality within recent years. That part of district No. 1 which lies to the north of Lake Erie does not produce peaches as extensively as its area would indicate, but there are numerous localities that can and do grow large quantities of this tender fruit. The section marked No. 1 which lies south of the west end of Lake Ontario is the Niagara district of Canada, and is world-famous.

The sweet cherry as a commercial crop is found only in very few localities, and these are practically all in district No. 1. This district is also the only part of the province that grows grapes extensively, as the more northerly sections have not sufficient length of season to ripen



659. Fruit-regions (numbered) in lower Ontario.

throughout the country on all kinds of amateur horticultural work, and floriculture especially is a feature of very many home gardens and of many school and public grounds as well. In commercial floriculture, the Dale greenhouses in Brampton were until recently said to be the largest range of houses in America, and there are many other up-to-date glasshouse plants in various parts of the province.

the crop. District No. 2 produces most of the plums and pears grown commercially in the province, but the Niagara section of district No. 1 also grows these two fruits extensively. The part of district No. 2 bordering on Georgian Bay was formerly one of the most important plum districts. The only district in the province that produces pears extensively is the Burlington section, lying at the west end of Lake Ontario.



The commercial cultivation of strawberries, raspberries, gooseberries, blackberries, and of sour cherries, is extensive in many districts of the province. Local conditions, such as the presence of urban markets or of canneries, together with the availability of labor, seem to determine the localities which can engage profitably in the production of these fruits. Large quantities of even the most tender fruits, such as strawberries, are shipped west to points in the prairie provinces, and eastward in some cases to Quebec, New Brunswick and Nova Scotia.

The most important apple districts of the province are all included in districts Nos. 2 and 3. The northern, or, more correctly, the upper limit of district No. 2, forms approximately the limit of the commercial cultivation of the Baldwin apple. Other important varieties grown in district No. 2 are Northern Spy, Greening and King. That part of district No. 2 lying to the north of Lake Ontario produces few Baldwins and some Greenings, but the leading variety is probably Northern Spy. District No. 3 grows winter varieties for storage purposes and Northern Spy grown here keeps well until March or April. The counties north of Lake Ontario also produce large quantities of Ben Davis, Gano and Stark. These varieties have been exported in large quantities for many years to European markets.

The area marked district No. 4 in western Ontario lies at a much higher altitude than the surrounding districts and is consequently much colder. There are few apples grown commercially, but the climate corresponds very closely to that of the St. Lawrence River Valley, part of which on the map is also marked district No. 4. The St. Lawrence River Valley has long been noted for its McIntosh Red and Fameuse. The McIntosh Red, by the way, had its origin in Dundas County, not far from the St. Lawrence River, about 1790. (See page 317.)

District No. 5 and the large extent of country lying to the north of Lake Huron and Lake Superior, and extending to James Bay, is comparatively new and untried with regard to its possibilities in fruit-growing. In one or two districts of the great northland, apples are grown successfully in a commercial way. This is true of St. Joseph's Island, Algoma, and of the mainland of Algoma District bordering on the north shore of Lake Huron.

One of the most interesting features of Ontario horticulture is the existence within the province of a large number of very successful fruit-growers' selling organizations. The story of the work done by some of these organizations in reviving the fruit industry in certain previously neglected counties reads like romance. In Norfolk County, on the north shore of Lake Erie, the production of apples increased in ten years from nothing to approximately 50,000 barrels, and this tremendous development came about simply through the care given to the old orchards, many of which had been standing uncared for and idle thirty or forty years previous to the organization of the fruit-growers' association. There are some forty of these associations now doing business within the province, and by their aid Ontario expects in the future to be able to dispose of her fruit successfully in the face of all competition.

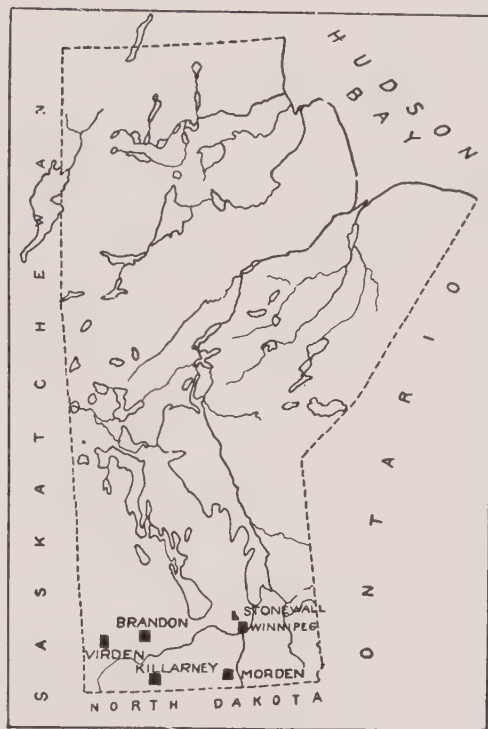
J. W. CROW.

#### Manitoba.

In considering the agricultural possibilities of the province of Manitoba (Fig. 660), the subject of horticulture is too frequently overlooked or given scant consideration. The fact that cereals can be grown with great success has been very clearly demonstrated, but up to the present time comparatively few of the persons residing in western Canada have had sufficient confidence in the fruit-growing possibilities of the country to enter the industry on a very extensive scale. However, a few pioneers have opened the way, and to the results of their work one looks for encouragement and guidance.

Geographically, Manitoba lies just north of the international boundary line, extending from longitude 95° W. to 101½° W., or about 276 miles. Since the extension of the boundary, the northern limits are on the shores of the Hudson Bay. The altitude varies from 760 to 1,500 feet above sea-level.

The annual precipitation in the Red River Valley varies from 20 to 25 inches, and in the western part of



660. Manitoba.

the province from 15 to 20 inches. The average rainfall for the growing season—May, June, July and August—varies from 8 to 11 inches.

The annual sunshine is 47 per cent of the possible, and during the growing season is 56 per cent, making an average of 8.5 hours of bright sunshine a day, which accounts for the phenomenal growth which is made by most plants.

The average monthly temperature in degrees Fahrenheit is as follows: January, 1.9; February, .5; March, 14.4; April, 38.2; May, 50.4; June, 60.6; July, 64.6; Aug, 62.1; September, 52.8; October, 40.7; November, 20.7; December, 7.5. Average temperature for the growing season from the first of May to the first of September is 59.2° F.

In a country of such rich agricultural resources as Manitoba, in which excellent crops of cereals can be produced on an extensive scale with a minimum of labor, one would naturally expect that the people would turn rather slowly to the production of fruits, which require much greater care and a much more intensive and exact system of cultivation. The growing of this finer class of agricultural products is usually delayed until the country has become thickly populated and the land has been brought into a fairly good state of cultivation. Making an allowance for the difficulties that must be overcome in the production of fruits, some excellent work has been done and substantial progress made.

Among the valuable introductions is the *Pyrus baccata*, or Siberian crab-apple, which was first planted on the experimental farm at Brandon, in the year 1890,

the trees having been grown at the Central Experimental Farm, Ottawa, from especially selected seed that had been imported from Russia. The introduction of this hardy Russian apple has done much for the advancement of apple-growing in Manitoba. It furnishes a hardy stock on which the tenderer standard varieties may be grafted and their hardiness very much increased. An effort has also been made to increase the hardiness of some of the standard varieties by hybridizing them with *Pyrus baccata*. Several promising hybrids have been produced in this way and are now being grown to some extent in the province. (See page 557).

Among the earliest attempts in fruit-growing in the district of Winnipeg, may be mentioned those of the late W. B. Hall, of Headingly. In the early sixties, some not unsuccessful experiments were conducted by him with currants, tomatoes, gooseberries, Siberian crab-apples and rhubarb. The results were indeed so satisfactory that he and others in the neighborhood were induced to undertake fruit-growing on a limited scale. Among other pioneers whose experiments on fruit-growing have been of value, may be mentioned the late Thomas Frankland, of Stonewall, A. P. Stevenson, of Dunstan, and D. W. Buchanan, of St. Charles. Mr. Stevenson has experimented with apples, plums, cherries, grapes, gooseberries, currants, raspberries and strawberries, and his untiring efforts have been a great incentive to others. He has been very successful in growing apples, particularly the hardy Russian sorts. He has at the present time a number of the better varieties of this class growing in his orchard, practically all of which are yielding good returns, his annual crop being usually over one hundred barrels. The various hardy crab apples also yield good returns. Mr. Stevenson is convinced that apples can be successfully grown in Manitoba if the proper varieties are chosen and the proper conditions provided.

The experimental farm at Brandon has accomplished much for Manitoba horticulture. Hundreds of varieties of the various classes of fruits from different parts of America and Europe have been tested there and the results published. In the month of April, 1899, about 500 fruit trees, consisting of apples, crab-apples, plums and cherries, were placed under test at the experimental farm. These included many of the large standard varieties together with a number of hardy imported kinds. Numerous varieties of grapes, currants, gooseberries, raspberries, blackberries and strawberries were also tested. Many of these plants did not survive the first winter and in a few years only the hardiest sorts were found to be alive. Since the first planting, many other varieties of fruits have been introduced and experimented with and much valuable information has been gained. Among the numerous introductions made was the Russian berry-crab, *Pyrus baccata*. Its extreme hardiness makes it eminently well suited to this country, where it is used as stock on which the less hardy sorts are grafted for the purpose of increasing their hardiness and thereby adapting them to an environment that would otherwise be uncongenial to them.

Small-fruit culture in the province of Manitoba has always been attended with a fair degree of success. Currants, gooseberries, red and black raspberries, and strawberries have been grown since the early settlement of the country. They yield profitable returns when intelligently cultivated. They apparently possess an inherent hardiness not shared by many tree fruits, which renders them much more suitable for the severe climate. It is only a matter of a few years until these smaller fruits will be grown in all parts of the province, in sufficient quantities to supply the local demand.

Another phase of horticultural work to which considerable attention is being given, is the decoration of home- and school-grounds by the planting of ornamental trees, shrubs and flowers. The prairie is bare and unattractive and around many prairie homes there has been

a lack of trees and shrubs. The work of beautifying the surroundings of residences is one of the most necessary steps in the horticultural work of Manitoba. Much has already been done in the cities, towns and rural districts by horticultural organizations to increase their attractiveness by ornamental planting.

Practically all garden vegetables, with the exception of a few that require a long season, may be grown to a high state of perfection. The richness of the soil and the shortness of the seasons tend to give a flavor and tender crispness to the vegetables not attainable elsewhere. The heavy yields that may be obtained from these gardens make vegetable-growing a very profitable branch of horticulture, as there is an abundant demand for vegetables in the home market.

The work of fostering horticulture within the province is borne largely by the Agricultural College and certain societies; among the latter are the Manitoba Horticultural and Forestry Association, the Brandon Horticultural and Forestry Society, and others of a more or less local character. The objects of these societies are to bring together those persons interested in horticulture, to assemble horticultural literature, and to stimulate in every possible way a greater interest in horticultural pursuits. Much good work has been accomplished by these societies and to their efforts is largely due the increasing interest that is being taken in the various lines of horticultural work within the province.

There are several directions in which progress may be made in Manitoba horticulture; for example, a better selection of varieties; an improvement by breeding and selection of wild and native fruits and varieties grown in the country; and improved systems of culture. Much is being done in plant-improvement in other parts of the country, and Manitoba also offers an excellent field for the improvement of native fruits. Various wild fruits grow very abundantly in many parts of the province, and if a combination could be effected whereby the hardiness and productiveness of these could be combined with the larger size and better quality of the cultivated fruit, a great step in advance would be achieved.

F. W. BRODRICK.

### Saskatchewan.

In the map (Fig. 661), all that part of Saskatchewan that need be considered here is shown in the numbered districts, the remainder farther north being still beyond the reach of settlement, although many parts of it will no doubt be found, amidst its lakes and forests, eminently suited to the growing of farm and garden products, where now the lonely trapper and the mink and marten roam. Districts Nos. 2, 3, 5 and 6 are mostly bare prairie, being slightly wooded about some of the hills, river-banks and coulees; district No. 1 has also considerable prairie, but about the center is situated the Moose Mountain Forest Reserve, while mixed prairie and scattered groves of poplar extend over the northeastern part and through districts Nos. 4, 5 and 9, with heavier timber towards the northeast in district No. 7.

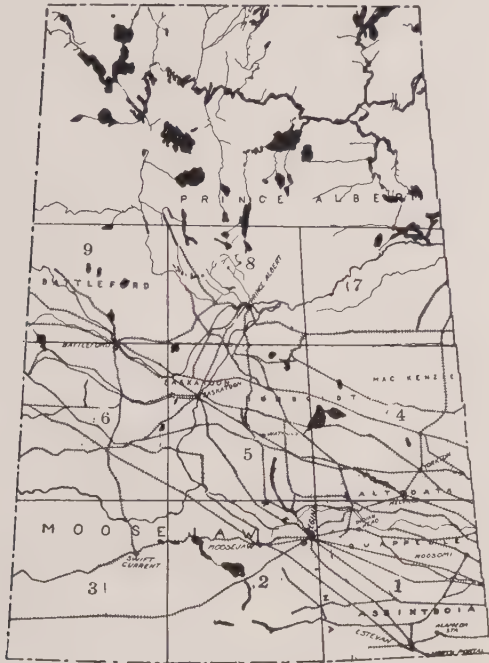
The average annual precipitation has been about 17 inches, but hardly more than 15 inches in districts Nos. 2, 3 and 6. Over 12 inches of this occurs from April to September. The elevation is also greater in this southwestern portion of the province, being 2,439 feet above sea-level at Swift Current, 1,884 feet at Moosomin near the eastern boundary, and 1,432 feet at Prince Albert on the Saskatchewan River in the north.

The average mean temperature of Saskatchewan for ten years has been: January, 2.9°; February, 3.8°; March, 14.5°; April, 37.4°; May, 50.2°; June, 57.5°; July, 63.3°; August, 60.5°; September, 50.1°; October, 40.9°; November, 25.0°; December, 10.4° F.

Horticultural industries have not yet been developed



to any extent, and consequently imports of canned fruits and vegetables, fresh fruits and flowers, have been very heavy in proportion to the population, and of exports there have been none. A rapidly increasing resident and floating population, combined with the attractions of grain-farming, to some extent account for this. There is no adequate reason why vegetables, small fruits and flowers should not be grown in quantity sufficient at least to meet the demand of the home market. There is ample evidence at any of the fairs held in the various parts of the province that the soil and climate are suitable for the production of a large variety of vegetables of unexcelled quality. It has been proved that vegetables and flowers can be grown profitably under glass during the coldest winters. The most important points to consider in locating such industries are access to market and cheap fuel. A glance at the map will show many favorably situated distributing points on the network of railway lines, while the lignite of the Souris Valley in the south and the wood of the northland, readily



661. Saskatchewan.

solve the fuel problem without considering the possibilities that lie hidden in the straw piles that accumulate or are burned on the millions of acres of grain fields each season.

Small conservatories and nurseries located at Prince Albert, Moose Jaw and possibly other points, are devoting their attention mostly to winter vegetables, while at Saskatoon 25,000 feet of glass is used in the production of pot- and cut-flowers. There is also a large demand for shrubs and ornamental trees for the beautifying of the homes so rapidly growing in numbers in village, town and city, but few nurseries are specializing in that line. The abundance of native small fruits such as the currant, gooseberry, raspberry, Saskatoon, blueberry, cranberry, cherry and strawberry, has to some extent delayed the introduction of cultivated varieties into the gardens of the residents in those portions of the province most suitable for successful fruit-growing, and, on the other hand, those living on the open prairie have first to grow shelter-belts before they can hope for good gardens. When shelter is provided, the hardier varieties of small fruits and crab-apples may be grown

without difficulty. There are, however, peculiar weather conditions that should be considered before anything of this kind be attempted on a commercial scale. Bright warm days and cold nights in April, and frosts in May, determine the extent of the fruit crop. It is true, however, that some of the evil effects of freezing and thawing can be avoided by protection of the stems from the direct rays of the sun.

In isolated instances, in sheltered gardens, some of the hardiest varieties of standard apples, such as Hibernian, Anisette and Blushed Calville, are growing and some are producing fruit, but the day is yet distant when it can be said that apples are commonly grown here. The late Director of the Dominion Experimental Farms, Wm. Saunders, since the beginning of these farms, took a keen interest in the finding of suitable fruits for the prairie provinces and in the encouragement of horticulture, and has been ably assisted in this by Angus Mackay, Superintendent of the Indian Head Farm, where the Siberian crab has been found hardy enough to withstand the most severe climatic vicissitudes. This hardy crab has been used in the production of most promising hybrids and as stock on which to root-graft hardy cross-breeds. At the same station varieties of the native Manitoba plum of good quality have been developed. Work of this kind is also being undertaken at the more recently established experimental stations at Rosthern and Scott. Another institution that, under the superintendence of Norman M. Ross, has aided greatly in demonstrating to the people the possibilities in the way of landscape gardening and floral beautification of home surroundings, is the Dominion Forestry Farm at Indian Head, from which many millions of trees are distributed yearly to the farmers on the open plains to be planted, as windbreaks and shelter-belts, under expert supervision. Much encouragement was given to the horticulture of the Northwest Territories, and Saskatchewan especially, by the interest displayed by A. E. Forget, recently Lieutenant-Governor, and the skill and success of his popular gardener, George Watt, who was ever ready to advise and assist the inquiring amateur. Probably no farm in the province could boast of so attractive a garden as that of Gerald Spring-Rice near Pense, where in typical Old Country fashion its labyrinth of walks mid the choicest of flowers and shrubs, was centered by a sun-dial. Another farm on which the possibilities in the way of garden and fruit-culture have been demonstrated is that of George Harvey in the Indian Head district, where shelter-belts, shade trees and hedges provide the protection so necessary for success in horticulture and nesting-places for the birds that are of so much assistance in controlling insect form. Personal mention should also be made of John Ashworth, a member of the legal fraternity, who, from love of flowers and the pleasure of overcoming obstacles, established the Saskatoon Nursery Company, which is now a profitable industry.

So closely is bee-keeping associated with successful fruit-growing, that it may not be out of place to say that very few in this province have yet turned their attention to the production of honey, although it has been amply demonstrated that bees make honey of excellent flavor from the abundance of wild flowers on the prairie; and bees may be safely wintered notwithstanding the severity of the frost at times.

There are now only two horticultural societies in the province, one being located at Regina and in receipt of an annual civic grant, the other having been just started at Saskatoon. No direct aid to horticulture is given by the provincial government, but through the Extension Department of the University of Saskatchewan, the agricultural societies and the homemakers' clubs may draw grants founded on their prize lists, in which horticultural competitions may assume a prominent place and expert judges are furnished when required. There is no

horticultural school at present in the province, but a department of horticulture is planned for the College of Agriculture and will no doubt be equipped in the near future, but at present the only instruction given is through qualified practical horticulturists sent out by the Extension Department to address meetings throughout the province.

T. N. WILLING.

#### Alberta.

Alberta (Fig. 662), is the farthest west of the three prairie provinces of Canada. Its eastern boundary is the 110th parallel of longitude, and its western boundary for about 500 miles north is the summit of the Rocky Mountains; and beyond this point, its western boundary is the 120th parallel.



662. Alberta.

From a climatic point of view, the province naturally divides itself into four principal regions,—southern Alberta, central Alberta, northern Alberta, and the foothills or highlands district. The latitude of the northern part of the province is offset to a great degree by its lesser elevation.

Northern Alberta may be said to be that part of the province lying north of a line drawn east and west through Athabasca Landing. The whole of this district is still practically unsettled, although people are going in; a few small older settlements are scattered here and there about the fur-trading posts, and all the common garden vegetables, as well as farm crops, are grown at these places, as far north as 400 miles beyond Edmonton. Wild currants, gooseberries, strawberries, raspberries, and saskatoons or Juneberries are plentiful throughout the region. The country is more or less bush-covered or park-like, and is, in this way, protected from the winds that sweep over the open country in the

south. In view of what has been accomplished in fruit-growing in the south, at a higher altitude and under wind-swept conditions, it is reasonable to expect that at least some of the hardier apples and crabs will in time be grown successfully in the far north. The soil of northern Alberta is a deep black humous loam, and its very richness constitutes a danger from a horticultural point of view. There is usually an abundance of rainfall, and the difficulty with fruit trees under such conditions is to get them matured-up before winter. No reports are at hand as to attempts at growing fruit in northern Alberta. The distance from the railways is so great that plants are usually dried out before reaching their destination, but as railways are now being pushed north, it will doubtless not be long before promising results will be secured.

Central Alberta may be said to comprise the region lying south of northern Alberta as far as a line drawn through Red Deer to Provost near the Saskatchewan border. Its soil, climate, and other features are similar to those of northern Alberta, although the altitude in the central part of the district is greater, rising at Lacombe to over 2,900 feet. It is the oldest settled part of Alberta, and is covered with well-handled farms, whose owners, having been some years in the country, have had time to make experiments in fruit-growing. Apples have been produced near Edmonton, Ponoka and Red Deer, and crabs have been grown at the Dominion Experimental Farm at Lacombe and also at Calgary. Small fruits are grown successfully all over the district. The influence of the difference in altitude is very marked in this territory, as ornamental trees, such as the soft maple (*Acer saccharinum*) and the American basswood (*Tilia americana*) are hardy in Edmonton, while they are a failure farther south at higher altitudes, and with similar soils, shelter, and rainfall.

The Highlands of Alberta may be described as the country south of the Red Deer River, east as far as a line drawn north of the main line of the Canadian Pacific Railway, and thence running southwest to Stavely on the Calgary and Macleod line, and from that point south to a point north of Cardston, and thence east through Spring Coulee. Its western boundary is the boundary of the province. This is the highest part of the cultivable land of Alberta, rising to a height of over 4,000 feet. A very small area of the northern part of this region is wooded, the remainder being open and often wind-swept prairie, with the additional harassment in the south of the warm chinook winds. In appearance, this southern section is not unlike the country east of it, while it is still in the "dry" belt, with a rainfall reaching in certain places at times over 20 inches. It has a little more precipitation than southern Alberta to the east of it. This increased precipitation causes longer and thicker grass, and this growing and dying down for generations has left a richer soil, which in turn encourages late growth in trees. This, coupled with the often shorter season between frosts, incident to its higher altitude, will probably preclude the possibility of apple-growing becoming general in the higher districts unless in favored spots. The hardier varieties of small fruits do well in this region, and at Cardston, 12 miles from the United States boundary line, at an altitude of approximately 4,000 feet, apples have been grown by a number of persons. At Joe McFarlane's ranch about 6 miles from the Livingstone Range of the Rocky Mountains, at an altitude of over 4,000 feet, Hyslop crabs have been ripened. These successes were in sheltered situations; and while this district may never become known as apple-producing, still these cases serve to show what may be done in isolated instances in which conditions are favorable, and may be accepted as an indication of what may become more general in years to come.



Southern Alberta proper is the district lying east of the foothills, and south of central Alberta. It also has conditions peculiarly its own. The prairie is bare of trees, and while the soil is of excellent quality, it is not the black, deep, vegetable mold of the other parts of the province. It is what may be classified as a friable clay loam, that is, a rich clay loam containing enough sand to enable it to be worked easily. It is in the dry belt, and the rainfall ranges from 12 to 15 inches per annum. Being bare, it is often windswept, and gardening without shelter-belts will never be successful. It is the home of the warm chinook winds, and these may come at any time, and often in a few hours, or even minutes, a rise of temperature from 30° below zero to 8° or 10° above freezing will take place. This is an extreme change in temperature, and if the warm wave is followed, after a few days or weeks, by a cold spell, it cannot fail to be a severe trial to growing trees. These rapid changes in winter have been declared by many of the old settlers to be the cause of the scarcity of trees on the prairie. This, however, is to a large extent a fallacy, as is being now proved constantly by the successful growth of shelter-belts of suitable species all over the country, and exposed in the fullest degree to the influences of the chinooks. The lack of rainfall, however, does constitute a menace to successful fruit-growing, for if there is a scarcity of moisture in the soil in the fall, there is invariably greater risk of dead trees in the spring. Snow cannot be depended on to preserve the moisture, or to supply it, as only about twice in thirty-eight years has it lain steadily the whole winter. The dry winds drift the snow off, and the chinooks melt it, so that in winter for weeks at a time the ground may be bare of snow. Cultivation to preserve the moisture is a necessity, though irrigation in the fall, in some districts in which it can be done, is of great assistance in carrying the trees over winter. Notwithstanding all these untoward circumstances, a number of apple trees are growing and producing fruit in southern Alberta. Settlement has been general only in the last ten years, and yet in that time many successful experiments in fruit-growing have been made, possibly more in the same time than in the history of any of the other prairie provinces. Apples, crabs and plums have been growing in several gardens for the last seven or eight years in Medicine Hat, Irvine, Lethbridge, Magrath, Calgary and Macleod, and they also have been grown in several instances at Stirling and Raymond. Thus, although southern Alberta would appear at first sight to have natural conditions unfavorable to large-fruit-growing, experience shows that, in spite of these, it is possible to do so. It would seem as if the dryness of the country, intensified perhaps by the influence of the chinook, tends to ripen the annual growth before frost comes in the fall, so that the trees do not winterkill. There is no doubt, also, that the nature of the soil has much to do with this early ripening, lacking as it does the stimulating effect of the more vegetable soils of the north. Experience in grain crops and forest trees serves to bear this out. However, it is still doubtful whether southern Alberta will ever become a fruit country. The high winds that occur at any time in the spring and fall may interfere greatly with the setting or maturing of the fruit, and, as a consequence, the regularity of the supply. There is no doubt, however, about the farmer in time being able to grow fruit enough for his own use, with the help of shelter-belts. When fruit is grown under irrigation in Alberta, care must be taken to avoid irrigating after the last of June. If water is applied after that time, there is usually grave risk of winterkill, or rather fallkill, as the trees continue growing late into the fall and are not mature when the first frost comes. Even cultivation to preserve the moisture should not be carried on later than July 15.

There is no provincial horticultural society, and no state aid devoted purely to horticulture, although much

good work is being done by the experimental farms, maintained by the Dominion government. These, however, have not been able to do much as yet, having been established only six years. The chain of demonstration farms which is being established by the provincial government will probably be of some assistance in this direction. There are two fairly strong local horticultural societies at Edmonton and Calgary.

ARCH. MITCHELL.

### British Columbia.

In the time since the *Cyclopedia of American Horticulture* was published, horticulture in British Columbia (Fig. 663) has passed through the experimental stage. Although the province is one of the largest in area in Canada, its population in 1891 was only 98,000; in ten years it had almost doubled; and in twenty years the census of 1911 shows a population of 362,000, of which over half is urban in character, and located on the coast. While practical experiment has shown that different forms of horticulture can be most successfully conducted commercially under the widely diversified conditions existing throughout southern British Columbia, development has been so recent that only the fringe of its possibilities has been touched. Yet, even now the province has gained such a reputation as a fruit-growing country as to warrant a rather full description here.

Fruit-growing in British Columbia has been inspired by the success that the industry has attained in the states of Oregon and Washington directly to the south, in which conditions of climate and soil are not dissimilar, and by the rapidly increasing demand for fruit, not only by the growing population of the province, but by the phenomenal increase in demand from the Canadian prairie provinces, which cannot possibly produce all their own fruit. Early dreams of possible markets for all the horticultural products of the province have been far surpassed by the actual development of the market. The population of western Canada was in 1911 over three times as great as in 1901. On the other hand, fruit-growing is now firmly established as one of the commercial industries of the province and though lumbering, manufacturing and mining surpass agriculture in the amount of wealth now being produced, fruit-growing will in a few years aid in bringing the returns from agriculture well to the front.

In general physical features British Columbia is mountainous, the greater part of the area being covered by the Rocky, Selkirk, Cascade and Coast ranges, between which lie the valleys of the rivers and lakes in which agriculture is being practised. It is probable that about one-twentieth or one-thirtieth of the entire land is cultivable. The land is, therefore, usually fertile, and in many districts unusually so. The climate is remarkably varied. The greater part of the cultivated area of British Columbia lies within the upper austral and transition zones. On the coast the atmosphere is humid, the rainfall copious and the annual temperature has a very limited range. In the interior, continental temperature conditions prevail, and in most of the interior valleys it ranges from zero to 90° or 100° as the extremes. Some of the interior valleys have a total precipitation of only 8 or 9 inches, while others run from 35 to 40 inches. Irrigation is essential in the first-mentioned, not in the latter. A large percentage of British Columbia horticulture is conducted under irrigation. The altitude of the horticultural districts on the coast varies from a few feet above sea-level to 400 or 500 feet above. In the interior valleys the altitude runs from 800 to 2,800 feet, and even to 3,300 feet, above sea-level.

Among the tree fruits grown in the province, the apple holds preëminence, and especially is this true in the arid and humid valleys of the interior, in which many varieties of apples reach a degree of perfection

not excelled elsewhere. The interior valleys now ship about 600 carloads of apples to prairie and coast markets, and to Australia, China, Japan and England. Pears are largely planted, not only in the interior, but also on the coast where they are relatively more successful than are apples, the principal varieties being Bartlett, Clairegeau, Anjou and Flemish Beauty. Plums and prunes are also of considerable commercial importance, the Pond Seedling or Hungarian being the principal plum, although the Italian prune is more largely grown commercially than any other variety of either plum or prune. Peaches are practically confined to the Lower Okanagan valley, and the Triumph, Early Crawford, Yellow St. John and Elberta are most largely grown commercially. The total shipments probably aggregate about 100 carloads. Cherry trees are planted throughout the province on a commercial scale, the hardier sweet cherries, especially the Bing, Lambert and Royal Anne throughout the interior, while on the coast the Olivet and English Morello, both preserving cherries, meet with particular success, the growers obtaining an average of 11 cents a pound for a period of years. Not the least important among the tree fruits are the crab-apples, particularly Transcendent and Hyslop, grown most largely in the Okanagan Valley. The Transcendent is thought to be the most profitable apple for a period of years in the province. Prairie markets have recognized the superiority of the British Columbia crab-apple and are paying prices extremely satisfactory to the fruit-grower. The apricot is grown to some extent in the warmer interior valleys. Nut trees are being experimented with throughout the province and indications are that some varieties of walnuts will prove commercially profitable on the coast.

In small-fruits British Columbia has some areas, especially those contiguous to the delta of the Fraser River, that are preëminently adapted to the strawberry and raspberry; the loganberry also flourishes in the coast regions and is proving profitable. Blackberries are grown to some extent on the coast, as are currants and gooseberries, although the latter are inclined to mildew, with the exception of the Oregon Champion, a western variety now grown almost exclusively. The interior valleys, especially those having a more humid climate, are growing strawberries and raspberries commercially to an increased extent. Taken as a whole, however, the acreage in small fruits is only a small fraction of that devoted to tree fruits, and this is quite likely to be the case indefinitely.

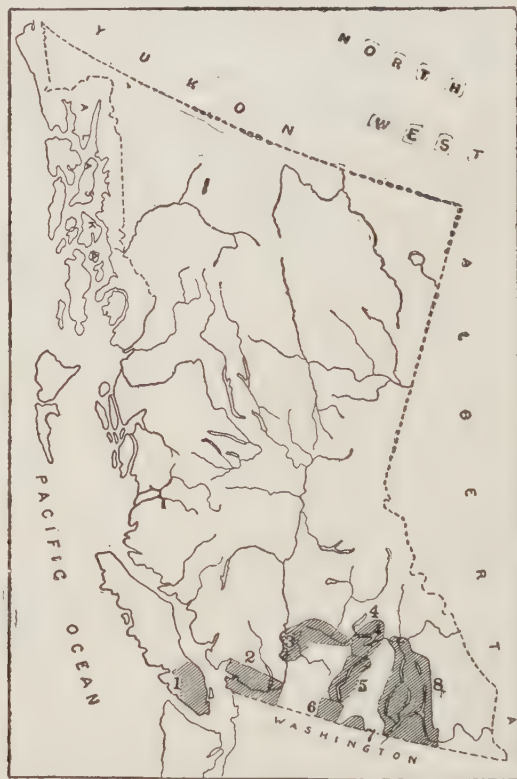
Vegetable-growing is practised throughout the province, the white potato, onions, tomatoes, cabbage, and celery being the principal crops in the order named. The potato is grown as a field crop in practically all districts and the average yield an acre in 1911 was 230 bushels. British Columbia potatoes won the Stillwell trophy at the National Land and Irrigation Exposition, New York, 1911, which proves the general excellence of the soil and climate of the province for the crop. The potato-beetle is unknown and blight is not usually serious enough to warrant preventive measures. Potatoes are shipped in commercial quantities to the Yukon, to northern British Columbia, to the coast cities, to the mining camps and to the prairie provinces. The acreage in 1911 was about 13,000 acres and this was increased in 1912. The onions, of which the Yellow Globe Danvers is grown in the Okanagan Valley to the extent of about 100 carloads a year, are shipped to coast and prairie markets. The summer nights are too cool for the tomato except in the arid interior valleys where they are grown in large quantities both for shipping fresh and for canning purposes. Cabbage, celery and other vegetables are grown on an extensive scale commercially on suitable soils throughout the province, notably at Armstrong.

The greenhouse business surrounding the cities of the

coast, has trebled in volume in three years, and openings still remain for its extension throughout the province. Bulb-culture is making progress in the district surrounding Victoria, and will become an important commercial industry when labor becomes cheaper.

The regions are shown on the map (Fig. 663). Horticulturally British Columbia is as yet almost confined to the southern part, and only the different areas so indicated are here discussed.

Districts Nos. 1 and 2 on the map are distinctly coastal in character. The Japanese current tempers the climate throughout the entire year so that zero weather is very uncommon, and the summer temperature very rarely reaches over 80°. The humidity is high almost throughout the year, and the annual



663. Horticultural Regions of British Columbia.

precipitation (which is nearly always in the form of rain) runs from 30 to 120 inches, the average in the horticultural areas being around 55 inches. This falls largely in the winter months, and July and August are often so very dry as to cause a loss from drought. This area has a remarkably long growing season. Owing to the coolness of the nights, tomatoes, corn, and the like do not ripen. Early apples do well, but winter apples cannot be matured successfully. Fungous diseases also restrict apple-culture to a serious extent. Pears, however, do well; small-fruits do exceptionally well, and preserving cherries are very profitable. District No. 1, being the southeastern part of Vancouver Island, with an annual precipitation of about 40 inches, is rather drier than the lower mainland district No. 2, but this difference has no great influence on the character of its products. In these districts only a small proportion of the land suitable is being made to produce what it is capable of producing. The local markets still import considerable quantities of produce from California, Oregon and Washington.







XIX. Canadian orchard development.—The bench lands of British Columbia.



The second great horticultural region of southern British Columbia is the dry-belt. It lies just east of the Cascade Mountains, is about 200 miles wide and extends northwest from the interior boundary about 250 miles. In it are districts Nos. 3, 5, 6 and 7 as indicated on the map. Its valleys lie at an elevation of 800 to 1,500 feet above sea-level. The annual precipitation totals from 9 to 15 inches, distributed fairly evenly throughout the months of the year. The atmosphere is dry and bracing. Sunshine is plentiful and in the summer months almost constant. The winter extremes of temperature are lower than on the coast, and the summers are very much warmer. It is the great apple-, peach-, tomato- and potato-producing district of the province, all of its products being grown under irrigation, and mostly marketed in carloads on the coast and in the prairies. Of its valleys, the Okanagan (No. 5) is the most advanced and the largest shipper; Thompson River (No. 3) and the Kettle River (No. 7) produce winter apples and potatoes as their staple crop, while the Similkameen Valley (No. 6) produces principally peaches and winter apples.

The third great horticultural region in British Columbia may be called the semi-humid interior belt, embracing districts Nos. 4 and 8. Here irrigation for most crops is not necessary, although for small fruits it is desirable. The annual precipitation runs from 18 to 45 inches, a considerable portion of which falls as snow, while June is a month of considerable rainfall. The air is more humid than in the dry-belt and extremes of temperature of winter and summer are not so great. The humidity makes fungous diseases a problem and spraying for apple-scab is necessary. Unlike the dry-belt, it is a timbered country, and the cost of land-clearing offsets the cost of irrigation systems in the former. District No. 4, in the water-shed of Shuswap Lake, is as well advanced as the Okanagan Valley, the principal shipments from Armstrong and Salmon Arm being apples, potatoes, celery and cabbage. District No. 8, the West Kootenay, has not thus far been a shipping district, the local demand in the mining camps of Rossland, Slocan and the Crow's Nest consuming more than the locality produces.

The following tabular statement indicates the adaptabilities of the different regions:

District	Present greatest production	Best commercial plantings
1. Island.....	Strawberries, King and Wealthy apples, pears, plums, and Italian prunes.	Olivet and English Morello sour cherries, King apple, Bartlett, Clairegeau and Anjou pears.
2. Lower mainland.....	Strawberries, raspberries, plums and prunes.	Strawberries, raspberries, King apple; also the above pears.
3. Thompson Riv.	Various winter apples.	Wealthy, McIntosh, Jonathan and Wagener apples.
4. Shuswap Lake Section.....	Various winter apples.	Jonathan, Wagener, Spy and Grimes apples.
5. Okanagan Val.	Various fall and winter apples, pears, plums, peaches and prunes.	Hyslop and Transcendent crabs, Duchess, Wealthy, McIntosh, Jonathan, Wagener, Y. Newton, Spitzenberg, Northern Spy, and Rome Beauty apples.
6. Similkameen ..	Peaches and winter apples.	Jonathan, Wagener, Y. Newton, Spitzenberg, Winesap, and Rome Beauty apples.
7. Kettle River...	Fall and winter apples.	Wealthy, McIntosh, Jonathan, Wagener, Rome Beauty and King apples.
8. W. Kootenay...	Strawberries, fall and winter apples, plums, prunes and pears.	McIntosh, Gravenstein, Wagener, Jonathan and Northern Spy apples.

The Dominion census of 1891 credited fruit with a total of 6,500 acres. By 1901 this had been increased only to 7,500 acres, but in the decade just passed tree-fruit-planting has had a tremendous impetus and the acreage at the beginning of 1912 was thought to be around 40,000 acres, of which 93 per cent is apples, 4 per cent pears; the remainder, plums, prunes, cherries, apricots and peaches. The report of the provincial statistician shows that in 1911 there were 15,454 acres of vegetables, of which potatoes constitute some 13,000 acres, tomatoes and onions supplying the majority of the balance. Potatoes average 6.9 tons or 230 bushels to the acre, while other truck crops average 11.4 tons to the acre. The value of the fruit and vegetable products of 1911 was \$5,084,241.

In floriculture and in landscape gardening, British Columbia is only making the first steps. In the cities, especially those of the coast, there are many fine gardens and estates, and the coast cities are developing admirable park systems.

The exact records of the first fruit trees imported, it has not been possible to obtain. It has been learned that the Hudson Bay Company was instrumental in bringing the seeds or seedling apples from California to its forts Camosun and Langley sometime previous to 1850. These old orchards are not now in existence. Orchard-planting on the coast during the period 1850 to 1885 was almost altogether of an experimental character, and nothing commercial was expected from it. From that time, and especially after the formation of the British Columbia Fruit-Growers' Association in 1890, experiments in commercial orcharding were begun. Among the first orchards in the interior country might be mentioned those of Thomas G. Earl of Lytton; that of Fred Gartrell at Trout Creek; and that of Frank Richter at Keremeos. Later on came the planting of the Coldstream orchards owned by Lord Aberdeen, under the supervision of John Craig, and T. W. Stirling's orchard at Kelowna. All of these orchards are still in bearing and have produced the wonderful fruit that has done so much to stimulate the large plantings that occurred between 1900 and 1912.

The British Columbia Fruit-Growers' Association, founded in 1890, has been in continuous activity since that time, and has done a great deal to stimulate and encourage the fruit industry and to secure governmental aid and recognition for it. With the British Columbia Fruit-Growers' Association are affiliated all the fruit-shipment and educational fruit-growers' organizations of the province.

The provincial Department of Agriculture has done very much to stimulate interest in the industry, and to protect it from the invasion of insect pests. The Horticultural Board, organized under the auspices of the Department to study the problems connected with the industry, and especially the control of pests, has through its inspectors succeeded in keeping the province free of codlin-moth, San José scale, Colorado potato-beetle, plum curculio and many other insect pests which increase the cost of production in other districts.

Four years ago the Department organized the Horticultural Branch, which is devoted to supplying information on horticultural subjects to the many new settlers embarking in the industry. The Horticultural Branch maintains sufficient assistant horticulturists to forward this work in the various districts. It has inaugurated a series of schools to teach fruit-packing, publishes literature including a list of fruits recommended for planting, and is generally at the service of the fruit industry along these lines. The Department has done much to make the possibilities of the province known by means of advertising and inspection work, British Columbia having won the highest possible awards from the Royal Horticultural Society in London, England, against all the other colonies of the

Empire for six years in succession, fruit being every year exhibited. There are no horticultural schools in British Columbia, the nearest approach to these being the short courses conducted by the Horticultural Branch of the Department. Provision has, however, been made for an agricultural college, which is now being put under way, and in this institution ample provision will be made for investigation and experiment as well as education in horticulture. R. M. WINSLOW.

**BRÏZA** (ancient Greek name for a kind of grain, probably rye). *Graminææ*. **QUAKING GRASS**. Annual or perennial grasses, with open panicles of handsome spikelets; grown in gardens.

Spikelets several-fld., flat, triangular or heart-shaped; glumes strongly concave, these and the lemmas usually horizontally spreading.—Species 12, in temperate regions, 3 intro. into the U. S.

These and one or two others also cult. for ornament, the panicles being suitable for bouquets.

**A. Plants perennial.**

**média**, Linn. **COMMON QUAKING GRASS**. Culms erect or decumbent at base, 1–2 ft.; panicle pyramidal, many-fld., the branches stiffly spreading; spikelets nodding, 3 lines long, triangular-ovate.

**AA. Plants annual.**

**máxima**, Linn. Fig. 664. One to 2 ft.: panicle drooping, few-fld.; spikelets ovate, large,  $\frac{1}{2}$  in. long, 5 lines broad, the pedicels slender, drooping. G.M. 47:175. V. 3:246.

**minor**, Linn. Four to 15 in.: panicle erect, many-fld., the branches stiffly spreading, the branchlets capillary, spreading; spikelet triangular-ovate,  $1\frac{1}{2}$  lines long.—This species is known to gardeners also as *B. gracilis* and *B. minima*.

*B. geniculata*, Thurb. = *Eragrostis obtusa*, Munro.

A. S. HITCHCOCK.

**BRIZOPYRUM**: *Desmazeria*.

**BROCCOLI**: *Cauliflower*.

**BRODIEÆ** (J. J. Brodie, a Scotch botanist). *Liliacææ*. **BRODIEÆ**. West American cormous plants of low growth, a few of which are now becoming popular in some parts of the country for spring bloom.

Flowers several on a scape; pedicels jointed: the perianth mostly funnelliform and non-saccate, not contracted in the throat, ranging from purple to red, white and yellow; stamens 6, 3 of them sometimes reduced to staminodia: lvs. all radical, narrow, usually few, sometimes evanescent. Monographers include under Brodieæ a number of genera erected by other authors, as *Hookera*, *Triteleia*, *Milla*, *Calliprora*, *Hesperoscordum*. (The oldest generic name of the group thus constituted is *Hookera*, but Brodieæ is one of the "nomina conservanda" of the Vienna code, retained because of its general use in the 50 years following its publication and since). For horticultural purposes, it is better and more convenient to merge all into Brodieæ. In this

broad sense Brodieæ includes about 30 species, which must be divided into several groups. Monogr. by Baker, in G.C. III. 20, pp. 213, 238, 459; also Watson, Proc. Amer. Acad. Arts and Sci. 14:236. Closely related genera are *Bloomeria*, *Brevortia* and *Stropholirion*.

The brodieas are valuable for naturalizing in California and the West, as they can be grown very easily. In colder climates they are worthy a trial for the same purposes but probably better for specimen-beds or the coldframe for cutting. They bloom during May, June and early July. *B. capitata* is the earliest to flower. The flowers are very lasting and beautiful for cutting. Unless planted in large numbers they are of little value for color-massing in beds, but most beautiful and dainty when planted in rockwork or with delicate plants such as ferns, heucheras, or columbines. While there is room for much variation in the treatment of the different species, several growing well in very wet soils while others can be grown even in rock fissures or grit, it will be found that the following general treatment will bring success.

On the Pacific slope, brodieas will grow well and can be naturalized in any soil or situation except in heavy shades or generally wet places or in heavily manured or much-watered soils. When the soil is somewhat sandy or gritty, or has been lightened with road grit, spent tan-bark, leaf-mold or any light material, they will usually thrive best. It is questionable whether they are quite hardy east of the Rockies and north of Virginia. The soil should be well drained, and a winter covering of leaves should be given. Plant in the fall before the ground is frozen up, from 2 to 3 inches apart and not deeper than  $2\frac{1}{2}$  inches, water sparingly, and ripen well after flowering. It is unnecessary to lift the bulbs in the summer on the Pacific slope but probably advisable east of the Rockies, unless they are kept dry in summer by placing glass over them.

All brodieas grow readily from seeds, but it requires several years to flower them. Many species produce offsets which, if detached, soon flower. If potted early and placed in coldframes, they can be forced gently.

In the following taxonomy, the species have been thrown into four more or less marked horticultural groups.

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<i>capitata</i> , 21.	<i>ixioides</i> , 1.	<i>peduncularis</i> , 7.
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<i>filifolia</i> , 17.	<i>major</i> , 3.	<i>stellaris</i> , 14.
<i>gracilis</i> , 4.	<i>minor</i> , 1, 13.	<i>terrestris</i> , 10.

**Group 1.**—In this group, which contains some of the best species in cultivation, the plants have a fibrous-coated flattened corm, resembling that of the crocus; not usually bulbiferous. The lvs. are few, all radical and grass-like: scapes slender but stiffly erect, naked except for bracts below the many-fld. umbel; fls. usually broadly tubular, borne on slender pedicels, in purples, white and yellow; anther-bearing stamens 6. All are hardy, but a protection of straw or lvs. is advisable in the colder regions. A light, loose, well-drained, sandy or loamy soil best meets their needs, and an excess of moisture and very rich soils are to be avoided.

A. Segms. equaling or exceeding the perianth-tube.

1. *ixioides*, Wats. Dwarf, 3 in. to 2 ft.: lvs. linear, fleshy; fls. few to many, on pedicels 1–4 in. long, in shades of yellow and often purple-tinged, 1 in. or less long; filaments winged, 2-toothed above. S. Calif. to Ore. B.R. 1590. B.M. 3588 (as *Calliprora lutea*). G.C. III. 20:459.—Many handsome varieties. The best is var. *splendens*, Hort., with large, bright yellow fls..



664. *Briza maxima*. ( $\times \frac{1}{2}$ )



the limb wheel-shaped. Var. *minor*, Hort. Dwarf: fls. yellow, with dark band and blue anthers. Var. *erecta*, Hort. Dwarf.

2. *hyacinthina*, Bailey (*Triteleia hyacinthina*, Greene). From 1–2 ft.: lvs. linear: fls. 10–30, 1 in. or less long, milky white or purplish. Calif.—Perhaps this and *B. lactea* are forms of one species.

3. *lactea*, Wats. (*B. hyacinthina* var. *lactea*, Baker). In the type, has the habit of *B. laxa*, but the fls. have a short tube with a rotate corolla, and are white, with green midvein; filaments deltoid. Calif. to Brit. Col., in many forms. Watson combines the *Hesperoscordum lacteum* and *H. hyacinthinum* of Lindley, B.R. 1639, into this species *B. lactea*, thereby not recognizing a *B. hyacinthina*. Baker, however, unites the *B. lactea* form with *B. hyacinthina*, describing var. *lactea* as “more slender than the type, with white fls. and longer pedicels.” G.C. III. 20:459.—Var. *lilacina*, Wats., is much stronger, very bulbiferous, grows in wet, heavy soils, and has a larger fl., which is usually lilac-colored. Var. *major*, Purdy. Like var. *lilacina*, but fls. white.

4. *gracilis*, Wats. A tiny species, with small yellow fls.: scape 2–4 in. and purplish: lf. 1: fls.  $\frac{1}{2}$  in. long, on pedicels of equal or greater length; filaments elongated and very slender. S. Ore.

AA. Segms. shorter than the tube.

5. *laxa*, Wats. Strong plant, 1–2 ft.: lvs. linear: fls. many, broadly tubular, purple; tube very narrow, and exceeding the segms.; filaments very slender; stamens in 2 rows. N. Calif. B.R. 1685 (as *Triteleia laxa*). G.C. III. 20:241.—Showy, and one of the best. There are many variations.

6. *candida*, Baker (*Triteleia candida*, Greene). Much like *B. laxa* in character of bloom, but fls. only 6–10, and segms. white or bluish with a green vein, and the fls. set at an angle on the pedicel, so that they all face one way: further distinguished by early flowering and the very broad and glossy, scarcely carinate lvs. Calif.

7. *pedunculâris*, Wats. (*Triteleia pedunculâris*, Lindl.). Still stouter (1–2 ft.), with smaller and fewer white fls. on pedicels a few inches to a foot long; filaments short or none. N. Calif. G.C. III. 20:243.—This species grows in wet, heavy ground close to water, and is very cormiferous.

8. *Bridgesii*, Wats. Fig. 665. Similar to *B. laxa*, but stamens in one row, corolla with a spreading limb and sub-cylindrical tube, and color reddish purple; filaments deltoid. Cent. Calif. G.F. 1:126 (adapted in Fig. 665).—Grows a foot or more high.

9. *Hendersonii*, Wats. Resembles *B. Bridgesii*: yellow, banded purple: filaments somewhat winged, but not deltoid: small-flid. S. W. Ore.

Group 2.—Corm not flattened, bearing many strong offsets, the coating hairy and reddish: lvs. linear and grassy: scapes stiff, few-flid.; fls. large, of a thick, waxy opaque texture, funnellform (except *B. Purdyi*), very lasting, usually purple, in an open umbel; perfect anthers 3. These brodieas are native to a heavy soil, in rather moist situations, and are hardy. They will thrive under conditions recommended for Group 1. (*Hookera*).

A. Fls. funnellform, with a prominent tube.

B. Scape not rising above ground.

10. *terrestris*, Kellogg (*H. terrestris*, Brit. & Greene). Scape short or practically none, the umbel sitting on the earth: lvs. nearly terete: fls.  $\frac{3}{4}$ –1 in. long; staminodia emarginate, yellowish; anthers sagittate-oblong. Cent. Calif., along the coast.

BB. Scape evident.

c. Staminodia as long as anthers, or longer.

11. *grandiflora*, Smith (*H. coronaria*, Salisb.). Scape 4–10 in. high: lvs. nearly terete, dying before the fl.-st.

appears: fls. 3–10, bright blue, of good size (1 in. or more long), segms. longer than tube, very lasting; staminodia obtuse; anthers linear. Calif. to Brit. Col. B.R. 1183. B.M. 2877. G.C. III. 20:213.

12. *californica*, Lindl. (*H. californica*, Greene). Much like *B. grandiflora*: scape longer (12–30 in.); fls. 10–25,  $1\frac{1}{2}$ –2 in. long, rose to deep purple; staminodia linear and cuspidate. N. Calif. G.C. III. 20:215.—“The finest species for garden purposes,” according to Baker.

13. *minor*, Wats. (*H. minor*, Greene). Much like a small *B. grandiflora*: scape very slender, 3–6 in.; fls. 2–6 and only  $\frac{1}{2}$ –1 in. long; staminodia broad and usually emarginate; anthers oblong. Calif. to Ore.

14. *stellâris*, Wats. (*H. stellâris*, Greene). Low: scape with long pedicels and 3–6 bright purple fls., with white centers: lvs. nearly terete: anthers winged behind: staminodia white, longer than the stamens, emarginate. N. Calif. G.C. III. 20:213.—Very pretty.

15. *rosea*, Baker (*H. rosea*, Greene). About 3–6 in.: lvs. nearly terete: fls. 5–8, under 1 in. long, rose-red; filaments dilated; staminodia white, obtuse and entire, longer than the anthers. N. Calif. G.C. III. 20:213.—A pretty species.

cc. *Staminodia markedly shorter than anthers.*

16. *Orcuttii*, Bailey (*H. Orcuttii*, Greene). Plant rather stout, a foot or more high: lvs. linear, flat or nearly so: fls. 5–15, less than an inch long, short-tubed, lilac; staminodia a small triangular scale, or none. S. Calif. G.C. III. 20:215.

17. *filifolia*, Wats. (*H. filifolia*, Greene). From 6–12 in.: lvs. slightly flattened: fls. 3–6,  $\frac{3}{4}$  in. or less long, dark-colored; staminodia triangular, twice shorter than the anthers. S. Calif.

AA. Fls. short and flaring.

18. *Purdyi*, Eastw. Different from others in having a short-tubed fl. with broadly spreading, declinate segms., the throat constricted. Cent. Calif., in Sierras.

Group 3.—Corm long and cormiferous: lvs. grassy: scape tall, slender and flexuous; fls. small, in close, head-like umbels, the separate fls. waxy and narrowly tubular; perfect anthers 3, except in *B. capitata*. These species thrive in a loose, perfectly drained, loamy soil, with some humus. Hardy. The species are not readily distinguished. All are from Cent. Calif. to Wash. Known as California hyacinths.

A. Anthers 3.

19. *congêsta*, Smith. Tall (2–3 ft.), with a globular head of purple fls.: lvs. somewhat terete, perishing: fls. 6–12, sessile or nearly so,  $\frac{3}{4}$  in. long; filaments 0,



665. *Brodiea Bridgesii*. (plant  $\times \frac{1}{2}$ )

staminodia purple, 2-toothed. Calif. to Wash. G.C. III. 20:213.—Blossoms late.

20. *multiflora*, Benth. (*B. parviflora*, Torr. & Gray). Similar to *B. congesta*: fls. 6–20, sessile or short-stalked, imbellate,  $\frac{3}{4}$  in. long, blue; staminodia lanceolate, entire. Calif., Ore., Utah. B.M. 5989.

AA. *Anthers 6*.

21. *capitata*, Benth. (*Milla capitata*, Baker. *Dichelostemma capitata*, Wood). Lower (1–2 ft.): lvs. narrow-linear, perishing: fls. many, in a capitate umbel,  $\frac{3}{4}$  in. or less long, lilac (a var. *alba*); three inner anthers winged. Calif., Utah, New Mex. B.M. 5912. G.C. III. 20:238.—Early blooming.

Group 4.—Corm as in Group 1: fls. many, in a dense, or at least a close, umbel, the tube about as long as the segms.; good anthers 6.

A. Fls. essentially capitate.

22. *Douglasii*, Wats. (*Triteleia grandiflora*, Lindl. *Milla grandiflora*, Baker). Lvs. linear: scape  $1\frac{1}{2}$ –2 ft.; fls. few, in a close umbel, saccate as in *Brevoortia coccinea*, blue; segms. as long as the tube, the inner ones wavy; filaments winged. Ore and Wash. B. M. 6907.

23. *Howellii*, Wats. (*Triteleia Howellii*, Greene). Fls. bell-shaped, white: differs from *B. Douglasii* in smaller fls., and segms. not more than half so long as tube. Wash. B.M. 6989.

Var. *lilacina*, Hort. One of the handsomest of all brodieas, and a good grower: fls. porcelain-blue, suggestive of *Brevoortia coccinea*. Wash. G. C. III. 19:767; 20:239. Gn. 46:502.—Large and strong.

AA. Fls. in a close but rather free umbel, the pedicels usually larger than the perianth.

24. *Pálmeri*, Wats. Fig. 666. Lvs. firm and linear: fls. many,  $\frac{1}{2}$  in. long, the segms. about as long as tube, blue. S. Calif. G.F. 2:245 (adapted in Fig. 666).

*B. coccinea*, Wats.=*Brevoortia*.—*B. cracea*, Wats. 1 ft. or more: fls. 6–15, yellow. N. Calif.—*B. insularis*, Greene. Like *B. capitata*, but more robust and larger-fl. Islands off Calif.—*B. Lemmonæ*, Wats. 1 ft.: fls. small, deep orange. N. Ariz.—*B. leptandra*, Baker. 1 ft. or less: fls. 2, purple. Calif.—*B. klacina*, Baker. 1 ft. or less: fls. 10–15, lilac-purple. Calif.—*B. ligens*, Baker. Like *B. ixioides*, but fls. saffron-color within and brown-black on tube and ribs. Calif.—*B. pulchella*, Greene. Probably the same as *B. congesta*.—*B. scabra*, Baker. Like *B. ixioides*, but scabrous: fls. bright yellow. Calif.—*B. volubilis*, Baker=Stropholirion.

CARL PURDY and L. H. B.

**BROMÈLIA** (Bromel, a Swedish botanist). *Bromeliaceæ*. Hothouse plants, grown for the stiff form and clusters of flowers.

About two dozen species of Trop. American herbs, with stiff, pineapple-like lvs., and fls. in heads or panicles; corolla 3-parted; calyx of 3 ovate-oblong sepals. Differs from *Billbergia* and *Ananas* in technical characters, particularly in the deeper-cut calyx. Less popular as stove plants than *Æchmea* and *Billbergia*. *B. bracteata* and *B. macrodonites* of trade-lists belong to *Ananas*. Culture as for *Billbergia*, which see. Monogr. by Mez, in De Candolle's Monogr. Phaner. 9.

**Pínguín**, Linn. PINGUIN of Jamaica. WILD PINE Three to 4 ft. high: lvs. broad-toothed and spiny, bright green, but becoming pink and red with age: fls. reddish, pubescent, in a dense panicle, with a mealy rachis, the sepals acute: fr. as large as plums, acid. W. Indies.—Makes a good hedge in tropical countries, and the fr. yields a cooling juice.

**Binôti**, Morr. Panicle lax; sepals rounded at the top: habit open and spreading. Brazil.

*B. longifolia*, Rudge=Streptocalyx.—*B. tricolor*, Sanders. Lvs.  $1\frac{1}{2}$ –2 ft. long,  $1\frac{1}{2}$ –2 in. wide, the wavy margins creamy yellow except at the rose-red base, the central portion a glossy green. G.C. III. 43:261.

L. H. B.

GEORGE V. NASH.†

**BROMHEADIA** (Sir Edward F. Bromhead, English naturalist). *Orchidaceæ*. Stove orchids, terrestrial or epiphytic, non-bulbous, little known in cult., comprising two species from the East Indian–Malayan region.

Leaves distichous, rigid, often fleshy: fls. showy, white and orange, the parts narrow and pointed; lip 3-lobed, narrow. Prop. by division or offsets after flowering. *B. Finlaysonianæ*, Reichb. (*B. palustris*, Lindl. *Grammatophyllum Finlaysonianum*, Lindl.). Root of stout and fleshy fibers: st. 3–8 ft., with sheathing scales below and a few oblong thick or fleshy lvs. at the middle and elongated scaly peduncle at the top: fls. white, fragrant, the parts  $1\frac{1}{2}$  in. long, oblong-acuminate and nearly equal, spreading; lip oblong, 3-lobed, white outside and purple-lined inside, the middle lobe rounded and yellow at center. B.M. 4001.

**BROMPTON STOCK**: *Matthiola*.

**BRÔMUS** (ancient Greek name for the oat). *Gramineæ*. BROME-GRASS. Annual or perennial grasses with large, usually awned spikelets in panicles.

Spikelets several-fl.; lemmas convex or keeled, 5–9-nerved, usually 2-toothed at apex and awned from between the teeth, sometimes awnless, the awn usually straight.—Species about 100, mostly in the north temperate zone.

The genus contains a few forage grasses and several annual species that have been intro. into the U. S., especially on the Pacific coast, where they have become troublesome weeds. Among the weedy annual species may be mentioned *B. secalinus*, Linn., chess or cheat, with smooth sheaths, drooping panicles of ovate short-awned spikelets, the lemmas convex and smooth; *B. commutatus*, Schrad., resembling the preceding but the sheaths hairy; *B. mollis*, Linn. Resembles chess, from which it differs by its hairiness and more erect panicle; *B. villosus*, Forsk., with large few-fl. spikelets, the awns about 2 in. long; *B. tectorum*, Linn., delicate, slender spikelets in drooping panicles the awns 6–7 lines long; *B. rubens*, Linn., with erect compact panicles of purple spikelets, the awn 9–11 lines long. The last 3 are especially abundant in Calif. Cheat is used for hay in Ore.

A. Plants perennial, producing rootstocks.

**inermis**, Leyss. Awnless BROME-GRASS. Erect, 2–4 ft.: panicle narrow, the branches ascending or spreading in fl.; spikelets about 1 in., the lemmas mucronate or short-awned. Intro. from Eu. Gn. 25, p. 429. Dept. of Agric., Div. of Agrost., 7:298.—Used as a pasture and meadow grass in the northwestern states. Especially valuable in semi-arid regions.



AA. *Plants annual or biennial.*

B. *Spikelets awnless or nearly so.*

**brizæformis**, Fisch. & Mey. One to 2 ft.: panicle 2-6 in., one-sided, nodding; spikelets oblong-ovate, strongly flattened, as much as 1 in. long, 5 lines wide. Eu. Dept. of Agric., Div. of Agrost., 7:298.—A handsome ornamental.

**unioloides**, HBK. (*B. Schraderi*, Kunth). Fig. 667. KESCU-GRASS. SCHRADER'S BROME-GRASS. Two to 3 ft.: sheaths pilose; blades narrow, scabrous: panicle erect, open or narrow, the branches ascending; spikelets 1 in. long, compressed, the lemmas keeled, strongly nerved, acuminate, glabrous or scabrous. Andes. Dept. of Agric., Div. of Agrost., 7:299; *ibid*, Circ. 26:1.—Grown in the southern states as a forage grass.

BB. *Spikelets long-awned.*

**macröstachys**, Linn. One to 2 ft.: panicle narrow, compact, consisting of a few large spikes  $\frac{3}{4}$ -1 in. long; awns spreading or recurved,  $\frac{1}{2}$  in. long. Eu.—Sometimes cult. for ornament.

**madritensis**, Linn. Fig. 668. One to 2 ft., tufted: panicle erect, 2-4 in., oblong-ovoid, contracted; glumes and lemmas narrow, the latter 7-9 lines long; awn straight or somewhat curved, 8-11 lines long. Eu.—Sometimes cult. for ornament.

*B. pratensis*=*Festuca elatior*.

A. S. HITCHCOCK.

667. *Bromus unioloides*.  
( $\times \frac{1}{2}$ )

BROOM: *Cytisus* and *Genista*.

**BROOM-CORN**. Brooms are made of the rays or peduncles of the flower-cluster of *Andropogon Sorghum* (*Sorghum vulgare*), the species which in other forms is known as sorghum, kafir, and Guinea corn. For cultivation of broom-corn, see Cyclo. Amer. Agric., II, 216.

**BRÓSIMUM** (Greek, *edible*). *Moracæ*. A genus of 8 species of large trees of Trop. Amer., yielding edible fr.: fls. monœcious, or rarely dicecious, inside or on the outside of a fig-like receptacle. *B. Alicastrum*, Swartz, is the bread-nut of Jamaica, but it is not grown within the U. S., except in most of the botanic gardens. It bears round yellow fr., about an inch in diam., containing a single large seed, which is edible after roasting. The tree has shining lance-elliptic entire lvs. Prop. by cuttings of young wood in a bell-jar with bottom heat.

**BROUGHTONIA** (named in honor of an English botanist, Arthur Broughton). *Orchidacæ*. Epiphytic orchids, requiring stove conditions.

Pseudobulbs, 1- or 2-lvd., ovoid or globose; infl. terminal, simple or somewhat branched; sepals and

petals similar, somewhat spreading, the latter a little the broader; lip sessile on the base of the column or sometimes a little adnate, lateral lobes inclosing the column, middle lobe spreading; ovary extended into a long cavity; pollina 4, waxy.—A West Indian genus of 2 or 3 species. Sometimes united with *Epidendrum*.

**sanguinea**, R. Br. Pseudobulbs up to 2 in. long, 2-lvd.: lvs. 2-4 in. long, leathery, linear-oblong; racemes of 5-10 fls. about  $1\frac{1}{2}$  in. across and of a crimson-purple; sepals lanceolate, acute; petals oval-oblong; lip nearly orbicular, denticulate on the margin. Jamaica. B.M. 3076, 3536 (as *B. coccinea*).

GEORGE V. NASH.

**BROUSSONETIA** (after T. N. V. Broussonet, a French naturalist). *Moracæ*. Ornamental trees or shrubs, grown chiefly for their large handsome foliage.

Leaves alternate, petioled, serrate, undivided or lobed: fls. dicecious, apetalous, the staminate in cylindrical, nodding catkins, with 4-parted calyx and 4 stamens, the pistillate in globular heads with a tubular perianth including the stalked ovary; stigma filiform: collective fr., a dense globose head consisting of the persistent perianths and bracts with numerous small 1-seeded drupelets protruding at maturity and orange red.—Three species in E. Asia, and there often cult., the bark being used for paper-making.

These are deciduous trees with wide-spreading branches, under culture often shrubby, with rather inconspicuous greenish white flowers. *B. papyrifera*, the hardier of the two species in cultivation, is fairly hardy as far as north New York. It is usually a small tree with a rather low wide-spreading head and may be used in cities in situations in which small shade trees are wanted, as it stands heat and dust well. It is not particular as to the soil.

Propagation is by seeds, sown after maturity or in spring, by greenwood cuttings under glass, or by cuttings of ripened wood, kept in colder climates during the winter in the greenhouse; also by root-cuttings with slight bottom heat and layers. The varieties are also sometimes budded in summer or grafted in early spring on the roots of the type in the greenhouse. Known as paper mulberries.

**papyrifera**, Vent. (*Morus papyrifera*, Linn.). Tree, 30-50 ft., with thick, pubescent branches: lvs. long-petioled, usually cordate-ovate, acuminate, coarsely dentate, often deeply lobed, especially on younger plants, rough above, pubescent beneath, 3-8 in. long: fr.-heads  $\frac{3}{4}$  in. across, red. May. China, Japan. B.M. 2358. S.I.F. 1:38. Var. *cucullata*, Ser. (*B. navicularis*, Lodd.). Lvs. small, concave and curled upward. G. W. 6:601. Var. *laciniata*, Ser. (var. *dissecta*, Hort., var. *Bilardii*, Hemsl.). Lvs. finely dissected into very narrow lobes, often reduced to the nerves and only at the end with a small lanceolate or ovate-lanceolate lft. R.H. 1878, pp. 374, 375. Gn. 15, p. 53.—Very distinct form, low and shrubby, more tender than the type. Var. *macrophylla*, Ser. Lvs. large, usually undivided. Var. *leucocarpa*, Audib. Fr. white.

**Kazinòki**, Sieb. (*B. Sieboldii*, Blume. *B. Kaempferi*, Hort.). Branches slender, glabrous at length: lvs. short-petioled, ovate or ovate-oblong, nearly glabrous, only somewhat rough above, entire or 2-3-lobed, 2-8 in. long: fr.-head less than  $\frac{1}{2}$  in. diam.



668. *Bromus madritensis*.  
( $\times \frac{1}{4}$ )

China, Japan. I. T. 2:45.—This species is more tender than the former. It is cult. sometimes as *B. Kaempferi*, while the true *B. Kaempferi*, Sieb., with the lvs. resembling in shape those of *B. Kazinoki*, but much smaller and pubescent, and with very small fr.-heads, seems not be in cult.

ALFRED REHDER.

**BROWALLIA** (after John Browall, Bishop of Abo, Sweden). *Solanaceæ*. Mostly blue-flowered greenhouse and garden herbs.

A genus of about 6 S. American annuals, with abundant blue, violet or white fls. which are solitary and axillary, or in more or less 1-sided racemes; corolla-tube 15-nerved, straight, which distinguishes it from *Streptosolen*, in which the corolla is twisted.

The seeds may be sown in the open border, but for the sake of the earlier bloom it is better to start them indoors in early spring and transplant into the open about May 15, where they will bloom profusely all through our hot, dry summers, and until frost. They can be grown in poorer soil than most half-hardy annuals, and make excellent bedding-plants. They are also used for winter decoration, the seeds being sown in midsummer, earlier or later according to the size of the specimens desired. They should be placed near the glass and frequently stopped, in order to produce compact plants. Large specimens are excellent for cutting, and small potted plants should be grown more commonly by florists for home decoration at Christmas. It is even possible to lift flowering plants from the open before the first frost of autumn and pot them for con-



669. *Browallia speciosa*, and a flower (at e) of *B. demissa*. ( $\times \frac{1}{2}$ )

servatory decoration, although the flowers are likely to become successively smaller. Blue flowers are rare in winter, and browallias are especially desirable for their profuse bloom all through winter and early spring. The flowers are, however, likely to fade, especially the purple ones. In pots under trees, *B. speciosa* makes an excellent summer plant.

In the names of the early species, Linnæus commemorated the course of his acquaintanceship with Browall: *elata*, reflecting the exalted character of their early intimacy; *demissa*, its rupture; and *alienata*, the permanent estrangement of the two men.

A. Corolla-segms. long, acute or acuminate: corolla-tube at least 1 in. long.

*speciosa*, Hook. Fig. 669. Lvs. sometimes opposite, sometimes alternate: fls. much larger than in *B. grandiflora*, all solitary, axillary; peduncle shorter than the lvs.; corolla-tube thrice as long as the calyx, and abruptly swollen at the top beneath the limb; limb of 5 ovate, striated, dark purple segms., pale lilac beneath. Colombia. B.M. 4339. P.M. 16:290.—There are blue-, violet- and white-fl. varieties. Var. *major*, Hort., has violet fls. 2 in. across. R.B. 20:240. *B. gigantea*, Hort., is a florists' variety, with very deep blue fls. and long-blooming habit. Intro. into American trade in 1899.

AA. Corolla-segms. short, 2-lobed or notched: corolla  $\frac{3}{4}$  in. long or less.

B. Upper lvs. not stalked: fls. all in loose racemes; calyx not hairy.

*grandiflora*, Graham (*B. Roëzlii*, Hort.). St. and lvs. glabrous, or in the upper part of the plant minutely clammy-puberulent: lvs. ovate, the lower petioled: calyx-teeth oblong, somewhat obtuse, equal, scarcely shorter than the tube, spreading: corolla white or pale blue, the limb wider than in *B. demissa*. Peru. B.M. 3069.—In *B. Roëzlii*, said to be from the Rocky Mts., some fls. are white, some pale blue. The name is unknown in N. American botanical literature. No dark blue or violet-colored forms are advertised.

BB. Upper lvs. stalked: fls. solitary and axillary below, racemose above.

c. Calyx hairy.

*demissa*, Linn. (*B. elata*, Linn.). Fig. 669. St. and lvs. pubescent or glabrous: lvs. ovate, with longer stalks than in *B. grandiflora*: calyx-teeth acute, unequal, much shorter than the corolla-tube. The lvs. are variable, cuneate, rotund, or rarely cordate. S. Amer. B.M. 34; 1136. The following are now referred to the above: *B. americana*, *B. elata*, *B. elongata*, *B. nervosa*. This species is the commonest, and is usually known as *B. elata*. Blue, violet, white and dwarf forms are cult.

cc. Calyx sticky or clammy.

*viscosa*, HBK. (*B. pulchella* and *B. Czerniakowskiæna*, Hort.). Plant viscous-pubescent: lvs. short-petioled, ovate, rough-hairy on both sides: pedicels a little shorter than the calyx: calyx-teeth very clammy, oblong, shorter than the corolla-tube. The lvs. are similar to *B. demissa*, but the habit is stiffer and the fls. more numerous. The calyx-teeth spread less than in *B. grandiflora*. S. Amer.

*B. americana*, Linn., is considered by some a separate species from the above, but in Germany, where most seeds of annual fls. are grown, it is used by Siebert & Voss (in Vilmorin's Blumengärtnerei) to include *B. demissa*, *B. elata* and other forms.—*B. Jamesonii*, Benth.—*Streptosolen Jamesonii*.—*B. pulchella*, Hort., is likely to be either *B. grandiflora* or *B. viscosa*.

WILHELM MILLER.  
N. TAYLOR.†

**BROWNEA** (Patrick Browne wrote a history of Jamaica). Sometimes written *Brownæa*. (*Hermesias*, Loeffl.). *Leguminosæ*. A group of 10 small evergreen trees of Trop. Amer., allied to *Amherstia* and *Bauhinia* but little known in the American trade. Lvs. alternate and pinnate: fls. showy, red, in dense terminal or axillary clusters. Cult. in hothouses. *B. Ariza*, Benth. (*B. princeps*, Lind.) has drooping heads of scarlet fls. I.H. 42:38. *B. grândiceps*, Jacq. Fig. 670. Fls. red, in capitate spikes: lfts about 12 pairs, lance-oblong. S. Amer. B.M. 4859. G.M. 31:115. *B. Rôsa-de-Mônte*, Berger. Fls. scarlet, in dense heads: lfts. 2-3 pairs, oval, acuminate. S. Amer.

N. TAYLOR.†



**BRUCKENTHÁLIA** (after S. von Bruckenthal, an Austrian nobleman). *Ericaceæ*. Ornamental shrub, chiefly grown for its profusely produced small spikes of pink flowers.

Leaves linear, whorled; fls. in short racemes; calyx campanulate, 4-lobed; corolla campanulate with 4 triangular lobes; stamens 8, included, connate at the base; disk rudimentary; caps. subglobose, 4-celled, loculicid, many-seeded. — One species in S. E. Eu. and Asia Minor. Very closely related to *Erica*, but differs chiefly in the calyx being lobed only to the middle, not 4-parted, in the rudimentary disk and the connate stamens.



670. *Brownea grandiceps*. (×1-12)

hardy North and requiring the same treatment as hardy ericas; a pretty little plant for rockeries. Propagation is usually by seeds which are freely produced in cultivation and treated like those of *Erica*; also by cuttings.

**spiculifolia**, Reichb. (*Erica spiculifolia*, Salisb. *B. spiculiflora*, Benth.). Tufted shrub, 5-8 in. high; lvs. about  $\frac{1}{2}$  in. long; fls.  $\frac{1}{2}$  in. long; anthers obtuse, 2-lobed at the apex, style exserted. June, July. B.M. 8148.

ALFRED REHDER.

**BRUGMANSIA**: *Datura*.

**BRUNÉLLA** (probably from old German *breune* or *braune*, quinsy, which it was thought to cure). Often written *Prunella*, which was the spelling used by Linnaeus. *Brunella* is pre-Linnaean. *Labiatae*. Low-growing hardy herbaceous perennials.

Flowers usually violet or purple, produced all summer on heads an inch or more high or in bracted spikes; calyx reticulate about 10-nerved and 2-lipped, which distinguishes it from the closely related *Physostegia*, in which the calyx is almost regular.

They are best suited for the rockery and slightly shaded parts of the border, succeeding in almost any soil that is not excessively dry.

**vulgâris**, Linn. SELF-HEAL. HEAL-ALL. Lvs. ovate-oblong, entire or toothed, usually pubescent; corolla violet or purple, rarely white,  $\frac{1}{2}$ - $\frac{3}{4}$  in. long, not twice as long as the purplish calyx. Amer., Eu., Asia.—One of the most cosmopolitan of all plants, being too common in the wild to be cult. A form with variegated lvs. is rarely found wild. Herb considered astringent and vulnerary. Var. *laciniata*, Hort., not Linn. Lvs. much cut and torn; fls. as in the type.

**grandiflora**, Jacq. (*B. pyrenæica*, Phillipe). Lvs. often toothed, especially at the base; corolla over 1 in. long, more than twice as long as the calyx. Eu. B.M. 337.—Perhaps the best of the garden kinds. Var. *alba*, Hort. Fls. pure white.

**Webbiâna**, Hort. Lvs. shorter than in *B. grandiflora*, and not so pointed; fls. very freely produced, more than twice as long as the calyx, bright purple. June-Sept.

N. TAYLOR.†

**BRUNFELSIA** (Otto Brunfels, physician and botanist of the sixteenth century). *Francisceæ*. *Solanaceæ*. Trees and shrubs, a few of which are grown in warm glasshouses.

Leaves entire, oblong, often shining; fls. in terminal cymes or clusters, or solitary, large and showy, sometimes fragrant; corolla with 5 rounded and nearly equal spreading lobes (or 2 of them a little more united); stamens 4, in the throat of the corolla, the anthers all alike: fr. berry-like.—Species above 20, in Cent. and S. Amer. and W. Indies.

Brunfelsias are usually winter-flowering plants. The wood must be well ripened before flowering begins. Grow in a rich open compost, and feed liberally when well rooted. They need a night temperature of 50°. They bloom best when pot-bound. Propagated by cuttings from the new growth in spring, or from pieces of the ripe wood in autumn inserted in very sandy soil and peat and kept close and shaded until rooted. The plants are of easy culture when the simple requirements are understood. Under glass, the bloom begins usually in October and November. They are showy open-air plants in Florida and southern California.

A. Fls. violet or bluish, sometimes fading to white.

**calycina**, Benth. (*Francisceæ calycina*, Hook. *F. pauciflora*, Benth. *F. confertiflora*, Moore. *Besleria inodora*, Vellozi). Habit erect or spreading, branching freely from the base upwards; lvs. shortly petiolate, numerous, glabrous or nearly so, 3-4 in. long, elliptic or elliptic-ovate, acute, rich dark livid green above, pale green below; fls. rich dark purple in dense terminal or axillary cymes; pedicels an inch long; limb salver-shaped, with slightly wavy margins; calyx  $\frac{3}{4}$ -1 in. long, tubular, light green. Brazil. B.M. 4583.—Extremely variable in the size of the fls. and lvs. Some of the most distinct forms have been described as species by various botanists. All have fls. of some shade of purple and are here included as varieties. The following are well-marked forms in cult.:

Var. **eximia** (*Francisceæ eximia*, Scheidw.). A fine free-flowering variety intermediate in size between the type and var. *macrantha* and characterized by the long slender slightly curved and hairy calyx, which is about  $1\frac{1}{4}$  in. long; fls. rich purple on first-opening, but soon fading to almost pure white, about  $1\frac{1}{2}$  in. diam.; calyx rather long for the genus, tube extending to three-fourths its length; whole plant slightly downy. B.M. 4790. F.S. 10:1037.

Var. **floribunda** (*B. floribunda*, Hort.). A dwarf floriferous shrub of free-branching habit and glabrous in all parts: lvs. 2-4 in. long, elliptic, rich dark livid green color, glabrous, and prominently veined on the under sides; fls. rich violet, with small white eye; limb flat or nearly so; calyx  $\frac{5}{8}$  in. long, elliptic in outline; pedicels stout,  $\frac{1}{2}$  in. long.—Largely grown by European nurserymen in recent years. A pretty and desirable form, as it flowers rather early in the year without any extra heat.

Var. **macrantha** (*B. macrantha*, Lem. *B. grandiflora*, Don. *B. Lindeniana*, Nichols.). Fig. 671. A magnificent form of strong and vigorous habit, with rich dark green lvs. often as much as 8 in. long and  $2\frac{1}{2}$  in. broad, glabrous or nearly so in all parts, except the upper part of the corolla-tube: fls. in dense axillary or terminal cymes in the axils of all the upper lvs., rich deep purple in color, with prominent ring of lavender-blue color surrounding the white eye at the mouth of the tube; calyx, 1 in. long, bright green; corolla  $2\frac{1}{2}$ -3 in. diam.—One of the finest and most floriferous shrubs for a warm greenhouse or subtropical country, of

extremely easy cult., and readily trained into fine specimens. Readily conforms to pot culture. Should be kept slightly on the dry side during the winter, but not enough to cause it to lose the lvs.

**ramosissima**, Benth. Lvs. oblong to nearly lanceolate, acuminate or obtuse, glabrous or rarely slightly hairy above and hairy or villous beneath: fls. large, in lax cymes, deep violet-purple, the corolla-tube twice longer than the calyx.—One of the best, with luxuriant foliage; may be grown cooler in winter than the other species. Probably a form of *B. calycina*.

**Hopeana**, Benth. (*Franciscea Hopeana*, Hook. *F. uniflora*, Pohl). A slender twiggy free-branching shrub: lvs. lanceolate-oblong, thin in texture, rich dark green, paler beneath: fls. small but freely produced, solitary or in pairs all along the leafy growths; limb light violet-blue on first opening, fading to almost pure white with age; tube very slender, curved upwards, nearly white, 1 in. long; calyx  $\frac{3}{4}$  in. long, teeth obtuse. Brazil. W. Indies. B.M. 2829. L.B.C. 14:1332.

**latifolia**, Benth. (*Franciscea latifolia*, Hook.). Habit dwarf with slender spreading branches: lvs. elliptic, 2–4 in. long, acute or obtuse, glabrous above, slightly pubescent beneath: fls. in terminal clusters or short axillary, few-fl. cymes; corolla  $1\frac{1}{2}$  in. diam., pale violet, with white center, changing in a day or so to white, sweetly scented; tube  $1\frac{1}{2}$  in. long, slender, slightly curved; calyx erect, campanulate,  $\frac{1}{2}$  in. long, teeth acute. Trop. Amer. B.M. 3907.

AA. Fls. white or yellow.

**americana**, Linn. Habit dwarf, branches slender: lvs. glabrous or nearly so; lamina elliptic-ovate, acute; petiole  $\frac{1}{2}$ –1 in. long, stout: fls. solitary and axillary, or in terminal few-fl. clusters, pure white shading with age to pure yellow and sweetly scented, especially at night; petals obtuse; calyx green, campanulate teeth spreading, nearly equaling the length of the tube. Trop. Amer. B.M. 393.—Of very easy cult., and thriving and seeding freely under the conditions of an ordinary greenhouse. In Fla., grows 4–6 ft. high; the very fragrant fls. are much prized.

Var. **pubescens** (*A. fallax*, Hort.). Resembles the type, but hairy in all its parts, and rather more floriferous.

**undulata**, Swartz. A strong-growing evergreen shrub or small tree, reaching to 20 ft. in its native habitat and flowering freely when quite small: lvs. ovate-lanceolate, margins slightly wavy, light green in color, acute, variable in size up to 7 in. long and 2 in. wide when vigorous; apex acute or obtuse; petiole  $\frac{1}{4}$ – $\frac{1}{2}$

in. long: fls. on the upper parts of the sts. solitary or in pairs in the axils of most of the terminal lvs. forming terminal clusters; calyx cyme green  $\frac{1}{2}$ – $\frac{3}{4}$  in. long, campanulate; corolla white changing to creamy white with age; lobes broadly ovate or orbicular in outline and with beautiful wavy margins. Jamaica. B. M. 8422.—A magnificent free-flowering species and a great acquisition to any garden. Requires subtropical conditions.



67. *Brunfelsia calycina* var. *macrantha*. ( $\times \frac{1}{2}$ )

**jamaicensis**, Griseb. (*B. nitida* var. *jamaicensis*, Hook.). An erect shrub or small tree, sparsely branched in the young state: sts. woody, with the lvs. more or less tufted at the ends of each year's growths: lvs. elliptic or lanceolate, up to 7 in. long, but often small and borne on short lateral tufted growths, glabrous or nearly so; petiole very short: fls. crowded on the apex of the current year's growth, solitary (occasionally in pairs) and axillary; pedicels  $\frac{1}{4}$ – $\frac{1}{2}$  in. long, slender, erect or spreading; calyx erect,  $\frac{1}{2}$  in. long, campanulate teeth spreading, acute; corolla erect, white, changing with age to primrose-yellow. W. Indies. B.M. 4287.—A very fine species for the warmer parts of the S., but a somewhat shy-flowering plant unless the growth is thoroughly well ripened up. There is a general resemblance between this species and *B. nitida* and *B. undulata* and it is possible that they are forms of one polymorphic species.

L. H. B.  
C. P. RAFFILL.

**BRUNSDÓNNA**. A cross between *Brunsvigia* and *Amaryllis Belladonna* has recently been given the garden name *Brunsdonna Sanderæ alba*; it has the umbel resembling typical *A. Belladonna*, and one-sided rather than globular: fls. white. See *Amaryllis Belladonna* var. *Parkeri*, which is a similar cross.

**BRUNSVÍGIA** (after the Duke of Brunswick). *Amaryllidaceæ*. Tender summer- or autumn-flowering bulbs.

Umbels of large numerous brick-red fls.; corolla funnelliformed, 6-parted, deciduous, its segms. nearly equal, recurved at the tip.—Species 9. S. Afr.

The bulbs must be thoroughly rested from the time the leaves fade until the scape appears. *Brunsvigias* are hard to flower. They require rich, sandy soil, plenty of heat and sunlight. When growing, give water and liquid manure freely. They propagate by offsets. For fuller instructions, see *Amaryllis*.

AA. Lvs. strap-shaped.

**Josephinæ**, Ker. Bulb 5–6 in. thick: lvs. 8–10, strap-shaped, glaucous or greenish, thick, closely ribbed, 2–3 ft. long,  $1\frac{1}{2}$ –2 in. broad: scape 1 in. thick,  $1\frac{1}{2}$  ft. long; fls. 20–30, rarely 50–60, in an umbel; pedicels  $\frac{1}{2}$ –1 ft. long: caps. smaller than in *B. gigantea*, less conical and less strongly angled. B.M. 2578. F.S. 4:322.—Named after the Empress Josephine, who purchased the original bulb after it flowered at Malmaison.

AA. Lvs. tongue-shaped.

**gigantæa**, Heist. (*Amaryllis gigantæa*, Van Marum. *A. orientalis*, Ecklon). Bulb very large: lvs. about 4, tongue-shaped, closely ribbed, 3–5 in. broad, usually under 1 ft. long: scape red or green, a finger's thickness; fls. 20–30 in an umbel, paler than in *B. gigantea*, and less numerous; pedicels stout, strongly ribbed, 4–6 in. long. B.M. 1619 (as *B. multiflora*).

*B. falcata*, Ker.—*Ammocharis falcata*.—*B. magnifica*, Lind. Fls. 20–25 in a cluster; corolla short; the segms. white, with medium stripe of red or purplish red: lvs. 1–2 ft. long, 3–3½ in. wide, recumbent.—Thought by Baker to be *Crinum Forbesianum* or near that species.

N. TAYLOR.†

**BRUSSELS SPROUTS**. Fig. 672. A form of the cabbage tribe, grown for the globular buds or "sprouts" produced along the stout upright stem.

The garden varieties of brussels sprouts represent one of the many interesting variations that have taken place in the cabbage family. This plant, while in its seedling stage and during its early life, closely resembles the ordinary cabbage, but later in its development the axillary buds, instead of remaining dormant as is the case with the common cabbage, develop into miniature heads similar in their make-up to an ordinary head of cabbage but very small.

The soil to which the sprout is adapted is, in general, the same as that for late cabbage; in fact, the plant is



always grown in conditions similar to those chosen for late cauliflower or late cabbage, and its range of adaptation is much the same as that of autumn cabbage. The fertilizing of the crop should be the same, in general, as for autumn cabbage. The plants should be set so as to allow them sufficient room for full development, preferably in check-rows 30 to 36 inches apart each way. Young seedlings should be ready for planting in the latitude of New York from June 20 to July 10. The cultivation of the crop, up to the time the sprouts begin to develop, is practically the same as that for cabbage.

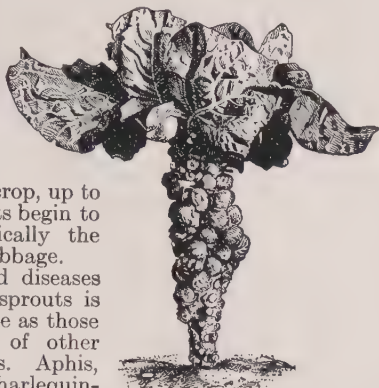
The enemies and diseases to which brussels sprouts is subject are the same as those of the fall crops of other cabbage-like plants. Aphis, green-worm, the harlequin-bug and the cutworm are probably the most annoying of the insect pests, while the rots, damping-off fungus and the mildew are more or less troublesome.

Before the sprouts are ready for harvest, the lower leaves of the plants are broken away in order to facilitate the cutting of the miniature heads or sprouts; this is done by means of a sharp short-bladed knife, used to separate them from the stalk of the plant. In sections in which the plant can remain in the open during the winter, two or three cuttings are made. The first sprouts develop in the axils of the leaves nearest the ground, and as the stalk of the plant elongates and more leaves are added, a succession of sprouts develop. The first cutting is confined, therefore, to the older and more fully developed sprouts. When the miniature heads have attained the size of  $\frac{1}{2}$  to 1 inch in diameter, the cutting begins and is repeated at intervals depending upon the development of the sprouts. In regions in which it is not safe to allow the plants to remain in the open during the winter, a small supply for home use or for local market may be stored in a vegetable-cellar or storage-pit, the plants being lifted with earth adhering to the roots and planted in sand that is kept somewhat moist during the storage period. Under these conditions, the sprouts will remain in good condition for several weeks and successive harvests can be made the same as when the plants are standing in the open.

The hand labor involved in gathering the sprouts and preparing them for market is the chief deterrent to the extensive cultivation of this crop. It is only in regions in which mild winter conditions prevail and in which labor is available to harvest and assort the sprouts that the industry thrives on a commercial scale. After the sprouts have been cut and placed in suitable receptacles, they are carried to a packing-house where each head is trimmed by removing the outer leaves. The trimmed heads are then placed in berry boxes holding one quart, those for the top layer being selected for uniformity in size and arranged so as to give a finished appearance to the receptacle.

Several varieties of brussels sprouts are offered by the trade, but there is only one general type, the chief difference being in the length of the stalk of the plant itself and the manner in which the sprouts are distributed along the stalk. This plant, although a popular vegetable in England and on the Continent, is sparingly cultivated in the United States, a few centers only giving attention to it as a commercial crop. Parts of Long Island, in New York, are well known for brussels sprouts production.

L. C. CORBETT.



672. Brussels Sprouts.

**BRYÁNTHUS** (Greek, *bryon*, moss, and *anithos*, flower: growing among mosses). *Ericaceæ*. Heath-like low shrub with pretty pink flowers, suitable for rockeries, but not yet in cultivation.

Leaves evergreen, linear, remotely denticulate: calyx 4-parted; corolla rotate, 4-parted; stamens 8: caps. subglobose, 4-valved.—One species on Kamtchatka and Behrings Isls. The genus *Phyllodoce* has been referred by several botanists to *Bryanthus*, but it differs considerably in its urceolate or campanulate 5-lobed corolla, 10 stamens, 5-valved caps. and solitary or umbellate fls.

This prostrate evergreen shrub has small needle-shaped leaves and small rosy pink flowers in peduncled, slender, 3-10-flowered racemes. *Bryanthus* will probably require the same treatment as *Chiogenes*, *Loiseluria* and *Phyllodoce*. The only species is *B. Gmelinii*, Don. For illustration, see Pallas, Fl. Ross. 2:74 (as *Andromeda Bryanthus*).

*B. Brèweri*, Gray=*Phyllodoce Brèweri*.—*B. empetriformis*, Gray=*Phyllodoce empetriformis*.—*B. erectus*, Lindl.=*Phyllodoce erecta*.—*B. glanduliflorus*, Gray=*Phyllodoce glanduliflorus*.—*B. taxifolia*, Gray=*Phyllodoce taxifolia*.

ALFRED REHDER.

**BRYÒNIA** (Greek, *to sprout*, referring to the annual growth from the tuber). *Cucurbitaceæ*. Herbaceous perennial climbers.

A genus of 12 species of perennial cucurbits, native of Eu. and W. Asia. They are herbaceous from a tuberous root, with staminate fls. in racemes, while *Bryonopsis* is an annual plant, with the staminate fls. in fascicles. All species of *Bryonia* are dioecious except *B. alba*. *Bryonopsis* is monoecious. See Cogniaux, in DC. Mon. Phan. 2:469.

A. Fls. *diæcios*; *stigmas rough*: fr. red.

**diðica**, Jacq. **BRYONY**. Height 6-12 ft.: root long, fleshy, branching, white, a finger's thickness: lvs. ovate or roundish in outline, 5-lobed, margin wavy-toothed, rough with callous points, paler beneath: pistillate fls. greenish white, corymbose, short-peduncled.—Common in England and in Cent. and S. Eu., rarer in W. Asia and N. Afr. Not usually sold in Amer., but a common plant along English highways and cult. in American botanic gardens. It grows rapidly over hedges and fences. Root of this and of *B. alba* are employed principally as a hydragogue-cathartic. The fresh, bruised root applied to the skin causes vesication.

AA. Fls. *monæcios*; *stigmas smooth*: fr. black.

**álba**, Linn. Height 6-12 ft.: roots thick, tuberculate, yellowish outside, white within: lvs. long-petioled: pistillate fls. in long-peduncled racemose corymbs. Eu., Caucasus, Persia.

*B. laciniosa*, Linn.=*Bryonopsis laciniosa*.

WILHELM MILLER.

**BRYONÓPSIS** (Greek, *Bryony-like*). *Cucurbitaceæ*. A genus of two species of annual climbers. Consult *Bryonia* for generic differences.

**laciniosa**, Naudin (*Bryonia laciniosa*, Linn.). Lvs. deeply 5-lobed, rough, light green above, paler beneath; segms. oblong-lanceolate, acuminate, serrate: fls. monoecious, fascicled or solitary, yellow: fr. about the size of a cherry, spherical, green, with pretty white markings. Asia, Afr., Austral. F.S. 12:1202. Var. **erythrocarpa**, Naudin (*B. erythrocarpa*, Naudin). Has red fr. with white marks. I.H. 12:431. F.S. 21:2237. Gn. 6, p. 193.—A warmhouse plant, rarely grown in pots and trained to rafters. Prop. by seeds.

WILHELM MILLER.

**BRYOPHYLLUM** (Greek, *sprouting leaf*). *Crasulaceæ*. A small genus of succulent plants in the same order with stonecrops, hen-and-chickens, cotyledon and echeveria, grown to some extent as flowering plants but more especially as a foliage novelty.

Root-system fibrous and very abundant: sts. upright,

simple or sometimes branching toward the base, of a thick soft tissue over a woody cylindrical core: lvs. opposite, petioled, simple or pinnately compound, succulent: infl. cymose or paniculate; fls. nodding; sepals 4, united into an inflated calyx which incloses the lower half or more of the corolla; corolla cylindrical, ending in 4 petal tips; stamens 8; ovaries 4, separate or more or less united below.

The members of this genus may readily be distinguished from related genera by the "sprouting" habit of their leaves as indicated by the generic name. If a leaf is removed from a plant and placed in a warm moist place, young plants will very soon appear in the notches around its border. This is the simplest method of propagation and is usually accomplished by placing the leaf flat on the wet sand of a growing-bench, in a warm, sunny exposure. Tiny buds will soon appear in the notches and these are followed by numerous fine roots. See Fig. 673. When the small plants have attained a size sufficiently large to be handled, they may be removed from the parent leaf and potted. This method may be employed in growing-houses at any season. Plants are also readily produced from stem-cuttings rooted in sand, or from seed. Seeds retain their vitality more than a year when kept dry. The best plants are to be grown by using rather rich loose, well-drained soil, with plenty of light, heat and moisture. However, they are very tenacious of life and will survive with a minimum of water and a low, but not freezing, temperature. They grow luxuriantly out-of-doors during the summer months but must be housed during the frost period. Useful in various botanical demonstrations.

**pinnatum**, Kurz (*B. calycinum*, Salisb.). Figs. 673-4. Height 2-4 ft.: lvs. opposite, fleshy, becoming leathery with age, earlier ones simple, ovate, with cordate or rounded base, later ones pinnate and then of 3-5 short-stalked lfts., the rachis and petiole with a narrow groove on the upper side, margin crenately doubly-serrate, light green becoming purplish along the veins toward maturity, margin purple as are also the petioles and young st.-growths: fls. pendulous, in terminal panicles; calyx much inflated, purplish green with lighter dots,  $1\frac{1}{2}$  in. long; corolla greenish white with purple-tinted, spreading acute tips. Tropics of both hemispheres. B.M. 1409. L.B.C. 9:877. G.C. III. 41:422. J.H. III. 46:205.



673. Sprouting leaf of Bryophyllum.

R.B. 24:125. R.H. 1900, p. 362. V. 3:117; 4:113; 7:340.—Said to be used in India as a diuretic.

**crenatum**, Baker. Less robust in habit of growth than the preceding: height 2-3 ft.: lvs. very fleshy, simple, 1-3 in. long, becoming smaller upward on the st., ovate with rounded or cordate base, in the latter case strongly crested auriculate, margin coarsely crenate to dentate, bright green with purplish pink margin and strongly bluish glaucous when young as are also the petioles and

sts.; petioles not grooved on the upper side: fls. nodding, in terminal, open, corymbose cymes; calyx membranaceous, inflated,  $\frac{3}{8}$  in. long, pink; corolla  $\frac{3}{4}$  in. long, ending in 4 rounded segms., red. Madagascar. B.M. 7856. G.C. III. 33:59; 41:419. G.W. 10, p. 396; 6, p. 495. R.H. 1900, pp. 175, 176, 362.

*B. proliferum*, Bowie. Occasionally met with, is much more robust in growth, reaching 12 ft. in height: st. 4-angled in new growth, becoming cylindrical later: lvs. pinnatifid to pinnate, the base of the pinnæ very much thickened, blade much contorted and margin finely crenate, rachis and petiole prominently grooved on the upper side. S. Afr. B.M. 5147. F.S. 23:2446.—Of little value more than a novelty.

C. H. THOMPSON.

BUCKEYE: *Esculus*.

**BUCKLEYA** (after S. B. Buckley, American botanist, died in 1884 at Austin, Texas). *Santalaceæ*. Shrubs rarely introduced in botanical collections, without particular ornamental qualities, but interesting as one of the few parasitic shrubs successfully introduced into cultivation.

Leaves opposite, sessile, entire: fls. dioecious, apetalous; staminate in umbels, with 4 short ovate sepals and 4 short stamens; pistillate solitary, terminal, with 4 short deciduous sepals and below with 4 elongated linear-lanceolate persistent bracts; calyx-tube clavate; style short with 2-4-parted stigma; ovules 3-4: fr. a furrowed drupe.—Three species in China and Japan and 2 in N. Amer.

Only the American species, *B. distichophylla*, Torr., is in cult. A slender-branched upright shrub, to 12 ft.: lvs. 2-ranked, ovate-lanceolate or ovate, 1-2½ in. long, acuminate, ciliate: fls. small, greenish: fr. an ovoid or oblong-ovoid yellowish green drupe, about 1 in. long, crowned by the 4 persistent bracts. N. C. and Tenn. G.F. 3:237.—Parasitic on the roots of *Tsuga*. Has proved perfectly hardy in Mass.: there is a plant about 70 years old in the botanic garden at Cambridge. It has also been successfully cult. at the Arnold Arboretum and in a few European botanic gardens. Prop. by seeds; best sown with a potted *Tsuga* in the greenhouse and planted out with its host when the young plants are strong enough, preferably within the reach of the roots of a large *Tsuga*, in order that the original host may be removed later when it crowds the young buckleya too much.

ALFRED REHDER.

**BUCKTHORN**: *Rhamnus*, particularly *R. catharticus*; also *Bumelia*.

**BUCKWHEAT** (*Fagopyrum esculentum*, Moench). *Polygonaceæ*. A tender annual grain plant, flour being made of the large 3-cornered fr. It is much grown in the N. U. S., usually being sown about the first of July. It is also a favorite for bee forage. Buckwheat is native to Cent. Siberia and Manchuria, and is now widely cult., although it is a grain of secondary importance. The Tartarian buckwheat (*F. tataricum*, Gaertn.) is occasionally seen. It has smaller and yellowish fls., and a smaller roughish, wavy-angled fr. This species is often confounded with forms of *F. esculentum*, from which it is really easily distinguished. Buckwheat is a good cleaning crop for weedy and hard lands. For general discussion of buckwheat, consult Cyclo. Amer. Agric.. Vol. II. See *Fagopyrum*.

BUDDING: *Graftape*.



674.

Flowers of *Bryophyllum pinnatum*. ( $\times \frac{1}{2}$ )



**BUDDLEIA** (after Adam Buddle, an English botanist). Syn., *Buddleia*. *Loganiaceae*. Ornamental shrubs or trees, chiefly grown for their handsome flowers profusely produced in showy panicles or globular heads.

Woody plants or rarely herbs, more or less covered with a stellate, glandular or scaly pubescence: lvs. opposite, short-petioled, entire or serrate: fls. in racemes, panicles or clusters; corolla tubular or campanulate, 4-lobed; stamens included, 4: fr. a 2-celled caps. with numerous minute seeds.—About 70 species in tropical and temperate regions of Amer., Asia and S. Afr., of which only a small number of hardier species is cult.

The buddleias are deciduous or sometimes half-evergreen trees or shrubs with usually quadrangular branches, narrow rather large leaves and small lilac, violet, white or yellow flowers in showy panicles or clusters. None of the species is hardy North, but some, as *B. japonica*, *B. Davidii*, *B. Lindleyana* and *B. intermedia* will live through the winter, if protected with dry leaves around the base; even if the stems are killed nearly to the ground, they will freely push forth young shoots in spring, which usually flower the same year. The handsomest in flower are *B. Colvillei*, *B. Davidii*, *B. asiatica*, *B. globosa* and *B. officinalis*.

They grow best in a rich, well-drained soil, in a sunny position; they are rather coarse plants and need much space. Propagation is readily effected by seeds sown in spring in gentle bottom heat, by greenwood cuttings under glass, or by hardwood cuttings taken off in fall and kept during the winter in a frost-proof room.

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A. Corolla small, with long, narrow tube,  $\frac{1}{2}$ – $\frac{3}{4}$  in. long.

B. Fls. in panicles.

C. Color violet or lilac.

D. Lvs. glabrous or only slightly grayish tomentose beneath: stamens inserted below the middle of the tube.

1. *japonica*, Hemsl. (*B. curviflora*, André, not Hook. & Arn.). Three to 6 ft., with spreading quadrangular, winged branches: lvs. ovate-lanceolate, acuminate, remotely denticulate or coarsely dentate, slightly tomentose or nearly glabrous beneath, 3–6 in. long: fls. in dense, terminal, pendulous racemes, 4–8 in. long; corolla slightly curved, lilac with grayish tomentum outside. Japan. I.H. 17:25. R.H. 1870, p. 337; 1878, p. 330.

2. *intermedia*, Carr. (*B. japonica* × *B. Lindleyana*). Hybrid of garden origin, similar in habit to *B. japonica*. Lvs. ovate-oblong, dark green above, 4–5 in. long: fls. violet, in slender, arching or pendulous racemes, 10–20 in. long. R.H. 1873:151. Var. *insignis*, Rehd. (*B. insignis*, Carr.), has the upright habit of *B. Lindleyana*. Branches distinctly winged: lvs. oblong-lanceolate, often in 3's: racemes erect, rather dense, 4–6 in. long, usually panicle at the end of the branches, with rosy violet fls. R.H. 1878:330.

3. *Lindleyana*, Fort. (*B. salicifolia*, Hort., not Jacq.). Three to 6 ft.: lvs. ovate or oblong-lanceolate, acuminate, remotely denticulate, pale green beneath, and slightly pubescent or glabrous, 2–4 in. long: racemes dense, erect, 3–5 in. long; corolla purplish violet, slightly curved, pubescent outside. China. B.R. 32:4. F.S.

2:112. P.M. 14:5. R.H. 1846:201. Var. *sinuato-dentata*, Hemsl. Lvs. sinuately-dentate. China.

DD. Lvs. densely white or yellowish tomentose beneath: stamens inserted slightly above the middle.

E. *Tomentum close*.

4. *Davidii*, Franch. (*B. variabilis*, Hemsl.). Fig. 675. Three to 8 ft.: lvs. nearly sessile, ovate-lanceolate or lanceolate, acuminate, coarsely serrate, whitish-tomentose beneath, 4–10 in. long: fls. in dense, terminal, erect or nodding panicles, 4–6 in. long or in some varieties longer; corolla lilac, with orange-yellow mouth, glabrous outside. Aug., Sept. China. B.M. 7606. R.H. 1898:132; 1902, p. 383. G.C. III. 24:139. Gn. 55:428; 64, p. 153. M.D.G. 1908:136.—A very handsome species with showy and fragrant fls. appearing in great profusion in late summer; several varieties differing from the type which has rather lax panicles of lilac-purple fls. with an orange eye not very marked, by larger and denser panicles and brighter color. Var. *Veitchiana*, Rehd. (*B. variabilis* var. *Veitchiana*, Hort.). More robust, erect at first, later gracefully arching, with denser and larger clusters of bright mauve-colored fls. with a bright orange eye; begins to bloom early in Aug. J.H.S. 27:182. J.H. III. 45:381. G.M. 51:45. G.W. 16, p. 538. Var. *magnifica*, Rehd. & Wilson (*B. variabilis* var. *magnifica*, Wilson). Similar to the preceding: has larger deep rose-purple fls. with deep orange eye and the margin of the petals reflexed, panicles very dense; begins to bloom about the middle of Aug. Gn. 68, p. 161; 69:288. R.B. 33:281. F.S.R. 3, p. 339. G.M. 52:668. Var. *superba*, Rehd. & Wilson (*B. variabilis* var. *superba*, DeCorte). Color of fls. like the preceding variety but petals not reflexed at the margin and panicles larger. R.B. 35:12. Var. *Wilsonii*, Rehd. & Wilson (*B. variabilis* var. *Wilsonii*, Hort.). Tall and arching, with longer and narrower lvs.: panicles drooping, rather loose, sometimes attaining 30 in. length; corolla smaller, bright rose-lilac with bright orange eye; corolla-lobes half upright and reflexed at the margin: in full bloom through Sept., the latest of all. There are also other named varieties.

5. *officinalis*, Maxim. Shrub, to 8 ft.: branchlets nearly terete, grayish tomentose: lvs. oblong to linear-lanceolate, 2–6 in. long, entire or serrulate, grayish pubescent above, whitish or fulvous tomentose beneath: fls. lilac with orange eye, fragrant, in terminal panicles usually 4–6 in. long, consisting of short-peduncled dense clusters; corolla over  $\frac{1}{2}$  in. long with a slender tube pubescent outside and within and twice as long as the oval obtuse lobes. W. China. B.M. 8401. G.C. III. 49:200.—Tender; flowers during the winter in the greenhouse like *B. asiatica*. Page 3566.

EE. *Tomentum fluffy, white or yellowish: stamens inserted just below the mouth*.

6. *nivea*, Duthie. Shrub, to 8 ft.: branchlets, the under side of the lvs. and infl. densely covered with a pure white woolly tomentum: lvs. ovate-lanceolate, 4–9 in. long, acuminate, coarsely serrate, glabrous above: fls. lilac or purple, small, in long terminal panicles; corolla with the tube tomentose outside, glabrous within except at the mouth. Aug., Sept. W. China. G.C. III. 38:275.—Very distinct on account of its white fluffy tomentum, but fls. less showy than in most other species, nearly embedded in the fluffy tomentum of the infl. Tender. Var. *yunnanensis*, Rehd. & Wilson (*B. macrostachya* var. *yunnanensis*, Dop). *Tomentum* less fluffy, yellowish: lvs. pubescent above: fls. larger; panicles usually solitary. W. China.



cc. *Color white: stamens inserted just above the middle of the corolla.*

7. *asiatica*, Lour. (*B. neêmda*, Roxbg.). Shrub or small tree: branchlets terete with white or buff-colored tomentum when young: lvs. lanceolate, 4-8 in. long, acuminate, entire or serrulate, glabrous above, white or buff tomentose beneath: fls. white, very fragrant, in slender drooping panicles, 3-6 in. long and usually several at the end of the branchlets; corolla with the tube villous outside and spreading suborbicular erose lobes or in a less desirable form with ovate, erect and entire lobes. Jan., Feb. China, India, Java. B.M. 6323. G.C. III. 39:106. Gn. 69, p. 89; 76, p. 80. J.H. III. 52:180. G.W. 10, p. 502.—A very desirable greenhouse shrub on account of its slender spikes of deliciously fragrant white fls. in winter. If prop. early in spring, transplanted several times or planted out during the summer, the plants will be of sufficient size in autumn to flower the following winter.

ccc. *Color yellow.*

8. *madagascariensis*, Lam. (*B. heterophylla*, Lindl.). Straggling shrub, 6-20 ft., with densely tomentose branchlets: lvs. ovate-oblong, rounded or slightly cordate at the base, acuminate, entire, dark green and lustrous above, whitish or yellowish tomentose beneath: fls. tomentose outside, in large terminal panicles, appearing during the winter. Madagascar. B.R. 15:1259. B.M. 2324.—Hardy only in subtropical regions. Sometimes cult. in Calif. and used as a half-climbing plant to cover unsightly objects.

BB. *Fls. in globular heads.*

9. *globosa*, Lam. (*B. capitata*, Jacq.). Three to 10 ft. with the branches and lvs. beneath yellowish tomentose: lvs. ovate or ovate-lanceolate, acuminate, crenate, rugose above, 3-7 in. long: fls. orange-yellow, in dense, long-peduncled, axillary heads at the ends of the branches, fragrant. Chile. B.M. 174. Gn. 33, p. 369. G. 28:505. G.M. 53:979. F.S.R. 3:335 (habit).—A graceful and very distinct shrub, standing some degrees of frost.

AA. *Corolla with broad cylindrical tube, limb over 1 in. broad.*

10. *Côlvillei*, Hook. & Thoms. Shrub, occasionally tree, to 30 ft.: lvs. elliptic-lanceolate or lanceolate, serrate, pubescent, and pale or grayish green beneath, 5-7 in. long: panicles broad, pendulous, 12-18 in. long; corolla purple or crimson, with white mouth. B.M. 7449. R.H. 1893:520. I.H. 41:10. F.S. 14:1487. J.H. III. 31:85.—The most beautiful of all buddleias, and a very desirable shrub for warmer temperate regions; only older plants flower freely.

*B. albiflora*, Hemsl. (*B. Hemsleyana*, Koehne). Allied to *B. variabilis*. Shrub or small tree, to 30 ft.: lvs. lanceolate, 5-9 in. long, glabrous above, white or yellowish tomentose beneath: fls. small, lilac, in elongated spikes, sometimes to 20 in. long. W. China. G. 27:501.—Less handsome than *B. variabilis*: fls. not white, as the name implies, given under the impression that the fls. were white.—*B. americana*, Linn. Shrub, 8-12 ft.: lvs. ovate to oblong-lanceolate, cuneate at the base, glabrous above, yellowish tomentose beneath, 4-10 in.: fls. in terminal densely tomentose panicles consisting of sessile subglobose clusters. Mex. to Peru.—*B. auriculata*, Benth. Straggling shrub: petioles auriculate; lvs. oblong-lanceolate, entire or denticulate, grayish white tomentose below, 1½-3 in. long: fls. cream-colored, fragrant, tomentose outside, in terminal compact panicles; stamens above the middle. S. Afr. G.C. II. 16:633; III. 6:529. I.T. 1:20. Tender.—*B. brasiliensis*, Jacq. f. Upright shrub: sts. quadrangular: lvs. ovate to oblong-deltoid, crenate-serrate, white-tomentose below, 4-8 in. long, decurrent into the winged auriculate petiole; fls. orange-yellow, pubescent outside, in axillary clusters, forming terminal narrow panicles; stamens just below the mouth. Mex. to Brazil. B.M. 2713. Tender.—*B. columbica*, André. Upright shrub, similar to *B. Lindleyana*. Lvs. narrow-lanceolate, entire, 4-8 in. long, glabrous: fls. white in terminal slender panicles; corolla with spreading lobes slightly shorter than the corolla-tube. Spring. Of unknown origin. R.H. 1901, p. 37. Tender.—*B. crispa*, Benth.—*B. paniculata*, Wall. (*B. Hemsleyana*, Koehne)—*B. albiflora*.—*B. paniculata*, Wall. (B. *crispa*, Benth.). 6-15 ft.: fls. lilac, in rather dense panicles; branches and lvs. tomentose. B.M. 4793. F.S. 9:958.—*B. pulchella*, N. E. Br. Shrub, 2 ft.: branchlets terete, tomentose: lvs. hastate, irreg-

ularly lobed, or rhomboid to lanceolate, 1-2 in. long, pubescent: fls. white with orange eye, fragrant, in terminal panicles, 2-2½ in. long; corolla with slender tube, pubescent outside. S. Afr. (?)—*B. salicifolia*, Jacq.—*Chilanthus arboreus*.—*B. saligna*, Willd.—*Chilanthus arboreus*.—*B. stenostachya*, Rehd. & Wilson. Allied to *B. nivea*. Less fluffy: lvs. oblong-lanceolate: panicles usually 3, long and slender; fls. larger, anthers inserted above the middle of the tube. W. China.

ALFRED REHDER.

**BUDS.** A bud is an incipient shoot or short growth-axis concealed by the closely investing leaves, or leaf-parts, that it bears. The foliage-shoots and flower-shoots of all seed plants arise from buds. The leaves converge over the true stem-apex or growing-point. The essential thing is that this growing-point continues the terminal growth and gives rise laterally, behind the point, to new leaves, in the axils of which buds may be formed ultimately. In the plumule of the seed the first bud activity is manifest, and thenceforth a bud marks every growing stem-apex.



676. Apple buds—fruit-bud on the left, leaf-bud on the right.

has a more or less equal work as a part of the bud. As the apex elongates and each leaf develops, greater growth on the inner (upper) surface effects its complete exfoliation. Using favorable material, one may completely dissect the bud, laying bare the growing-point, which may be readily examined with a hand-lens. Either of the little pondweeds commonly cultivated, *Elodea* or *Hippuris*, may be used for this purpose.

The buds which are commonly most conspicuous and at the same time most highly specialized are the "resting" buds of temperate shrubs and trees. Such buds are often scaly buds, and they are characteristic of all climates in which there is an interruption to growth, either through cold or dryness. In this case the stem-apex and younger leaves are normally inclosed by persistent more or less indurated leaf-parts modified as bud-scales. Resinous secretions may accompany the scales and the younger leaves may be covered with hairs. The size, form and minute characters of such buds vary widely, but obviously they are, in general, wondrously efficient in the resistance exhibited towards rigorous climatic conditions. The important point is that the bud-structures quite effectually prevent drying out of the young shoot which is there tucked away.

Particularly interesting is the fact that the resting-bud of many trees includes in miniature the entire vegetative or flowering shoot of the next season. In such case the rapid elongation of the axis and unfolding of leaves in the spring is soon followed by the formation of a new resting-bud wherein the shoot of another year is gradually differentiated. Every gradation occurs between this type and the typical active bud of annuals.



677. Pear twigs—fruit-buds on the left leaf-buds on the right.



Interest in buds centers in their spring activity, properly in the awakening and growth resulting when the conditions have remained favorable sufficiently long. Leaves and axes enlarge and elongate rapidly, bursting asunder the dead scales and often carrying forward the expanding younger ones. The growth of

the younger scales exhibits the true nature of these structures, some of which are found to be leaf petioles; some petioles with minute blades; and various other modifications occur. Many resting-buds are awakened from their comparative inactivity by a few days of favorable weather. These are "early" flowers, and of this type are the lilac and the golden bell. Other buds require a longer period, such as the oak and the hick-

ory. It is not strange, therefore, that some plants lend themselves readily to early forcing by etherization, the hot water treatment, and the like, while others are with great difficulty forced.

In the preceding, more specific mention has been made of buds which develop leafy shoots, that is of leaf-buds. It is clear, however, that the resting-bud, as well as an herbaceous bud, may develop a single flower, as in the peach; a cluster of flowers, as in the red maple; or a shoot with leaves and flowers, as in the apple and Norway maple. The occurrence of leaf- and flower-buds with respect to the age of the twig and the relation of pruning to bud disposition are questions of special horticultural interest, but cannot receive consideration in this brief account. Illustrations of flower-buds and leaf-buds are shown in Figs. 676-679.

Buds are normally produced terminally and in the axes of leaves, the latter arrangement therefore corresponding to leaves; but under exceptional circumstances they may arise from the growing tissue of any member. Buds from the roots of the sweet potato and dahlia are important in propagation; likewise are those produced by the leaves of certain species of Begonia. As a matter of fact, buds originating from internodes, roots and leaves—so-called regenerative-buds—are not uncommon; but the development in such situations occurs as a rule only when normal buds are not present.

Buds with the leaves and leaf-parts surrounding them are sometimes organs of food-accumulation. The typical bulb is little more than a fleshy bud, and there are all gradations between the typical bulb and the typical tuber—the latter with many buds. Small bulb-like buds occur in *Lilium bulbiferum* and a few other plants, and they are always important in propagation. It requires no stretch of the imagination to classify the edible shoots of brussels sprouts among unusual buds, and from this it is no great leap to the monstrous "bud" of the cabbage.

Literature: Bailey, *Lessons with Plants*, The Macmillan Company; Strasburger (*et al.*), *A Text-Book of Botany*, The Macmillan Company; Percival, *Agricultural Botany*, Duckworth & Co.

B. M. DUGGAR.

**BUETTNERIA** (D. S. Aug. Buettner, 1724-1768, German botanist). *Byttneria*. *Sterculiaceæ*. About 50 herbs, shrubs or trees of diverse habit, native to eastern and western tropics, scarcely known in cult. Some are prickly climbers or scramblers.

Fls. small, usually dark purple or greenish, in umbels or cymes; petals 5, long-clawed, hooded and oddly appendaged at the top: fr. a 5-celled, globose spiny woody caps. One species is catalogued in S. Calif.: *B. urticifolia*, Schum., from S. Brazil, Argentina: Climbing shrub; branches grooved, spiny, nearly glabrous: lvs. long-petioled, cordate-ovate, acuminate, coarsely serrate, appressed-hairy on both sides: fls.  $\frac{1}{4}$ - $\frac{1}{2}$  in. across, 3-5 in a stalked umbel.

**BUFFALO BERRY** (*Shepherdia argentea*, Nutt *Lepargyrea argentea*, Greene). *Elæagnaceæ*. Fig. 680. A shrub 6 to 18 feet in height, native from Mani-



680. Buffalo berry. ( $\times \frac{2}{3}$ )

toba and Saskatchewan south to Colorado, Nevada and New Mexico, now grown in the upper Mississippi Valley and northward for its abundant acid fruits.

The buffalo berry was brought into use early, mention being made in Hovey's Magazine of Horticulture for 1841, page 251, of its being frequently cultivated. It is a handsome ornamental shrub, with silvery foliage and red berries. Occasional plants are found with yellow fruit. The plant is dioecious; therefore, care should be taken, if fruit is desired, to plant both staminate and pistillate plants. Western nurserymen are beginning to offer these two kinds of plants separately in the ratio of one staminate to four pistillate plants, but the best proportion is not yet known. Many persons who plant the buffalo berry are disappointed by securing only one sex. The staminate or male plants may be known in their winter condition by the dense clusters of rounded flower-buds; the pistillate or female plants by the smaller, flattened, fewer, more slender flower-buds.

The fruit varies greatly in size, quality and season, and is gathered in large quantities for culinary use. It makes a delicious jelly. Some berries are of sprightly flavor, good for eating out of hand. They can also be dried for winter use. The fruit is generally considered better when touched by frost, less sugar being required. The name is said to have come from the custom of eating the berries as a sauce with buffalo meat in the early days. The buffalo berry makes a fine thorny hedge, that is both useful and ornamental.

It is found that sprouts received as dug up in the native thickets from various parts of the Northwest do not always transplant satisfactorily; a year in a nursery row gives them better roots and secures an



678. Sections of pear buds—fruit-bud on the left, leaf-bud on the right.



679.

Buds of the peach. The middle bud is a leaf-bud and the large side buds are fruit-buds.

even stand when set in their permanent place. Seedlings are better rooted. Seedlings are easily raised from seed washed free from the pulp in the fall and stratified for winter, keeping in sand in a box buried just beneath the surface in a well-drained spot in the garden. There should be holes in the box for free drainage and the planting should be done very early in the spring. In Bulletin No. 88, June, 1904, of the South Dakota Experiment Station, Plate 19 shows a field of 7,500 buffalo berry plants of the first generation under cultivation. These plants were raised from seed gathered along the Missouri River of South Dakota, where buffalo berries are especially abundant. However, under cultivation the plant does not respond, as regards early bearing, as quickly as its near relative the Siberian sandthorn (*Hippophae rhamnoides*). It was found that the buffalo berries can be worked on the Russian form of oleaster (*Elæagnus angustifolia*). The fault of the buffalo berry is its small-sized fruit and the difficulty of gathering it, owing to its numerous thorns, but it has been and is an abundant source of pleasant fruit to thousands of settlers in the newer regions of the West. The fruit varies greatly in size and degree of acidity, affording opportunity for selection work in its native home along the Missouri River and tributaries. N. E. HANSEN.

**BUGBANE:** *Cimicifuga*.

**BULB, BULBS.** A bulb is a thickened, fleshy, and commonly subterranean bud, usually emitting roots from its under side. The office of the bulb is to carry the plant over an unpropitious season, as over winter or a dry period.

True bulbs are either tunicated, formed in rings or layers, like those of hyacinths and onions (Fig. 681), or scaly, like those of some liliaceae (Fig. 682); but as popularly understood and in commercial parlance, the term bulbs applies to a large class of flowering and ornamental bulbous-like plants in their dormant condition, during which period they are collected, dug, stored, shipped, sold and planted, like so many potatoes. This class includes, in addition to the true bulbs, many that are botanically known as corms, which are solid, as crocus and gladiolus (Fig. 683); tubers which are succulent and have the buds or eyes near the surface, as the dahlia and potato (Fig. 684); rhizomes, fleshy, creeping underground stems like certain iris, ginger, and many wild plants (Fig. 685); pips, the flowering crowns of lily-of-the-valley; and certain other dormant fasciculated fleshy roots like those of peonies, ranunculus, and the like. A variety of bulbs is shown in Fig. 686. The true or feeding roots grow generally from the base of the bulb, the stems, flowers and foliage from the crown



681. Onion bulbs.

of the bulb, or the eyes. There is an exception to this in certain lilies, which throw out roots above the bulb also (Fig. 687). The bulb is a storehouse for the plant, wherein is formed, after flowering, new stems, leaves and flowers. In fact, the bulb contains a new plant, which is protected and sustained within the bulb by the reserve food and energy collected therein

during one season for the plant's successor. After the flowering period, the plant above the bulb and the roots beneath it ripen off and die away. The bulb is then in a dormant condition. It is during this state of rest, lasting approximately from three to six months, that bulbs are taken out of the ground and transported easily and safely from continent to continent, if required; after which the incipient roots, stems, foliage and flowers may develop with as much luxuriance and perfection as if the bulb had remained in its original environment.

Bulbous flowering plants (bulbs) are very popular with flower-loving people. There is a particular charm and interest in growing them. As a rule, they produce flowers of remarkable beauty, unsurpassed by any other class of plants, and many of them are deliciously fragrant. They comprise an endless variety in habit, form, size and color, are adaptable for many purposes, and many of them flower equally well under either garden or house culture. Soon after their beauty fades they die away, or may be removed; and in the interval, their places may be occupied by other seasonable flowering plants. Not the least among the merits of bulbs is their ease of culture, and the great certainty and perfection with which their flowers are produced, under suitable conditions.

Among bulbous plants are many that are sufficiently hardy to withstand the severity of our northern winters. The kinds that are suitable are nearly all dormant in the fall, which is the proper time for planting them, and they will flower the coming season. In March or earlier, spring is ushered in with the blooming of snowdrops, chionodoxas, anemones, scillas, crocus, winter aconites, bulbocodiums and so on, followed in April with brilliant hyacinths, tulips, narcissus and hosts of others. In April appear the unapproachable late tulips, poet's daffodils, dicentras and the like, followed in succession until frost, notably with peonies, irises, hemerocallis, lilies, montbretias, tritomas and others.

Gardeners usually think of bulbs as divided into two classes,—hardy and tender, or those that stand freezing and those that do not. There is a class from South Africa known as Cape bulbs, which usually bloom in the fall. There are now so many improved hybrids and breeds that are crowding out the types, that the term "Cape bulb" has lost its significance in this country. In the present article, bulbs are treated under the following general heads: Hardy spring bulbs for design bedding; hardy bulbs in the herbaceous garden, mixed flower-border or lawn; subsequent treatment of outdoor bulbs; summer- and autumn-flowering tender bulbs for spring planting; bulbs for flowering in the house and greenhouse; the forcing of bulbs; other indoor methods; subsequent treatment of forced bulbs; keeping dormant bulbs, tubers, and the like; propagation of bulbous plants; hints on buying and selecting bulbs; catalogue of bulbs.

#### *Hardy spring-flowering bulbs for design bedding.*

The only bulbs adapted to geometrical beds are Dutch hyacinths and tulips. It is not best to use both in the same bed for really fine effects. For display bedding in parks, public squares, and like places, only solid bright contrasting colors as a rule are used, since brilliancy of coloring is advisable when the taste of large crowds must be considered. This limits the selection in hyacinths to dark crimson, rose-red, pink, purple, blue, lavender, white and yellow (the latter is seldom satisfactory), and in tulips to dark blood-red, scarlet, rose, blush-pink, yellow, white, and a bluish claret, which last is seldom used. On private grounds many beautiful effects can be obtained by the use of the softer colors, particularly in beds that are situated in partial shade. In ordering the bulbs for this style of bedding, it is important to select kinds that bloom at the same time and are of uniform height; and in the case of hyacinths to choose varieties with a strong stem,



for many sorts are liable to fall over from the weight of the spike and are quickly soiled when they lie on the ground. If the item of expense is to be taken into account, it is possible to use second-size bulbs of hyacinths, often listed as bedding sizes, with satisfactory results, although only fine bulbs give fine bloom.

In planting bulbs in "design beds," it pays for the extra trouble first to remove the soil to a depth of 6



682. Scaly bulb of *Lilium pardalinum*.

inches, spade up the lower soil, using well-rotted manure and plenty of bone dust worked in. Then level off, smooth, and cover with an inch of sand. This prevents the manure from touching the bulbs, and allows the water to drain away from immediate contact with them, thus removing causes which may lead to their decay. Bulbs set in this manner on the sand may be placed in their exact position, after which the top soil is carefully replaced. It is a difficult matter to set bulbs just 4 inches deep and 4 to 6 inches apart with an ordinary trowel. The planter is almost sure occasionally to chop off a piece of a neighboring bulb or displace it. Bulbs planted in the manner advised, being all of an even depth, will flower uniformly; often, when planted with a trowel, some bulbs will be an inch too high and some an inch too low, which in early spring makes considerable difference in the time of blooming. Besides, when bulbs are planted with a trowel or dibble, there is danger of "hanging" a bulb occasionally, where it may perish on account of not touching bottom.

*Hardy bulbs in the herbaceous garden, mixed flower-border, or lawn.*

The mixed border is a favorite place for most hardy bulbs. They should be planted in little colonies here and there among the hardy plants and shrubs; and it is here that bulbs seem to thrive and give the most pleasure. As spring approaches, the somber winter browns and dull greens of the deciduous and evergreen plants are suddenly transformed into an unrivaled setting, studded with brilliantly colored and fragrant flowers, the contrasts being exceedingly effective and cheery; and besides, from the border one does not hesitate to cut a few flowers for the house for fear of spoiling the effect, as would be the case in formal bedding. Furthermore, bulbs seem to do better and last longer in a border because the flowers are cut freely in bud or when just approaching their prime, which is the best possible time for the benefit of the bulb, for the efforts of any bulb to form seeds weakens the bulb. A hyacinth bulb that matures seed is virtually destroyed. Then again, in an herbaceous border the bulbs are not disturbed through the necessity for replacing them with other flowering plants, as such a mixed border when properly planted should do much itself to hide the withering leaves. The foliage then remains uninjured until ripe, thus fulfilling its duty of recharging the bulb with new energy for the next season's display. Of course, after three or four years, the bulbs should be divided if they have grown and spread, and judgment must be used to determine when the lifting should be done with the least injury to the other permanent subjects in the border. It is best, perhaps, to associate with the bulbs plants that are not seriously injured by being moved.

Bold clumps of the taller bulbous plants are very effective on the lawn, where beds of one kind should be isolated, and be given a position not too prominent nor too near. The object desired is a mass of one color, which at a little distance is more striking on account of the contrast with the surrounding green grass and trees.

Among the best hardy bulbous plants for this purpose are: *hemerocallis*, such lilies as *candidum*, *Henryi*, *tigrinum*, *speciosum* and *auratum*; also *dicentra*, crown imperials, *montbretias*, *tritomas*, peonies, and *Kaempferi* and *germanica* *irises*.

Bulbs planted right in the sod on the lawn make a very pleasing picture when in bloom in the early spring. Make patches here and there of golden, white and purple crocus, the little *chionodoxas*, snowdrops, *Scilla amara*, winter aconite, snowflakes, *bulbocodium* and *triteila*. These grow, increase, bloom and ripen the foliage mostly before it is necessary to use the lawnmower, so that the surface of the lawn in summer is not marred. The bulbs may be dibbled in when the ground is moist and soft during the fall rains, but it is better to cut and turn back the sod here and there, plant the bulbs under it, then press the sod back again.

For parks, groves and wild outlying grounds beyond the closely clipped lawn, a very happy style of "naturalizing" bulbous and other plants is coming much into vogue. Such bulbs should be used as can be planted in quantity, twenty-five to a hundred or more of a kind in a patch, and only those should be used which are hardy, and will flower and thrive and increase under neglect. Fortunately, there are many bulbous plants that succeed even better in such rough places than in the prim garden. Among them are hardy anemones, *camassia*, *convallaria*, *dicentras*, *erythroniums*, *funkias*, certain *iris*, *liliums*, poet's *narcissus*, *Von Sion* and many other *narcissi*, *trilliums*, and numerous others.

In regard to the preparation of beds for hardy bulbs, planting and treatment, one can only generalize. Detailed directions suited to the different species, and also varieties where treatment varies, will be found under their respective headings in this Cyclopaedia. As a rule, well-rotted manure (mind that it is well-rotted, not fresh and heating) should be liberally applied and dug into the ground deeply. It must be where the long, feeding roots can get at it, and yet not touch the bulbs, nor be too near their base. This is easily accomplished by removing a few inches of the top soil first, as described under "Design Bedding" above. If it is impracticable to do this, then it is not advisable to use manure at all, for the bulbs are liable to come in contact with it and become diseased. Bone meal alone is then the safest fertilizer to use, and it should be applied lavishly. Most bulbs like rich food if properly applied. Although the embryo flowers were formed within the bulb the season before, yet their size, luxuriance and brilliancy this season depend largely upon the nutrition the roots receive. Liberal applications of manure water, when the bulbs are in bud, often produce excellent results.

The proper depth to plant bulbs varies according to the kinds. It is a common fault to plant them too near the surface. Some kinds, notably the Californian *Humboldtii* and Washingtonian lilies, do best when 10 to 12 inches deep; hyacinths, tulips, *narcissi*, and similar large bulbs from 4 to 6 inches deep; smaller bulbs somewhat shallower. A good rule to follow is to make the depth three times the average diameter of the bulbs. Hardy bulbs root during the fall and early winter, and if planted too near the surface the freezing, thawing and heaving of the upper crust of soil in mild winters often causes the bulbs to break from their roots, and, in consequence, only inferior flowers are produced. When good cold



683. Corm or solid bulb of *gladiolus*.

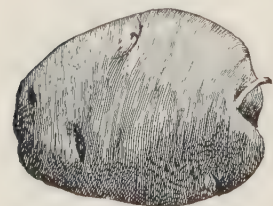
weather has set in and a light crust has been frozen on the soil, then cover the bed with leaves, straw, marsh hay or reeds to a depth of about 4 to 6 inches. This protects not only from severe freezing, but from equally injurious unseasonable thaws. Do not put the covering on too early, for it might warm the soil so that the bulbs would begin to grow and afterward be injured from freezing. Gradually remove the covering in the spring.

The general run of bulbous plants thrive in a loamy soil, inclining to sand. This soil attracts moisture, allows free drainage, and admits air. If the soil is cold and stiff, a liberal admixture of leaf-mold and sand, with the addition of manure applied as previously described, will be beneficial. The texture of the soil should be such that stagnant water will not remain around the bulbs, as it tends to rot them, particularly when dormant. An excess of humus is, therefore, to be guarded against for most bulbs.

While most bulbous plants thrive under the soil conditions advised above, yet there are many exceptions. Happy should be the man on whose grounds is found a variety of soils and exposures, shade and sun. A small wooded valley or ravine, with a brook flowing through it into an open, moist meadow, affords conditions suitable for growing to perfection the greatest variety of bulbous and other plants, many of which cannot be enjoyed in the average garden. The hyacinth is a notable exception in regard to soil conditions. In Holland this bulb is grown in pure sand, and soon becomes diseased in heavier soil. This should indicate that in this country plenty of sand should be added to the natural soil, and that the bulbs should not be left in the ground during the summer.

The sooner bulbs can be put in the ground after they are ripe, the better for the bulbs; for, no matter how long they will keep, they do not improve when out of the ground, but tend to dry out and lose vitality. This is particularly true of the narcissi, which give very noticeably larger flowers when the bulbs are planted early. All of the sorts having a strain of poeticus blood begin the new root-growth almost as soon as they have ripened, and are far better off if they can be in the ground early. There are, however, many reasons why bulbs cannot be planted as soon as ripe; and when they are to be kept for certain purposes, they should be stored as advised below. Hardy spring-flowering bulbs should be planted in the open ground in the fall, not earlier than six weeks before regular frosty and freezing nights are expected. Plant as much later as necessary, providing the bulbs are keeping sound, but it is not advisable to plant them earlier. Cool weather is necessary to deter top growth, which is very liable to start after four

to six weeks of root development; and young, succulent top growth is apt to be injured by the succeeding freezing. In Maine, Ontario, Wisconsin, and other northern parts (about 45 degrees north latitude), such hardy bulbs as hyacinths, tulips and narcissi, may be planted in September. In New Jersey, Pennsylvania, Ohio, and so on (about 40°), plant about the middle of October.



684. Potato.—Example of a tuber.

In the latitude of Richmond, Louisville, and St. Louis, the middle of November is early enough. In the latitude of Raleigh, Nashville, and south, do not plant until middle of December; and for the latter section let the selection of bulbs run to late-flowering varieties, such as Bizarre, Darwin, and late double tulips, late hyacinths, late narcissi, and the like, for they are not so likely to be caught by the occasional freezing weather in January and February. In this southern latitude, however, very early-flowering bulbs, such as Roman hyacinths, Duc

Van Tholl tulips, Early Polyanthus narcissi, and so on if planted in September, are usually through blooming before freezing weather begins. South of the freezing belt, hardy spring-flowering bulbs are not very successful, as a rule, there being no sufficiently cool weather to deter top-growth and force root-action first, without which the flowers and foliage will not develop beyond such sustenance as the bulb can supply; and this sustenance is usually exhausted by the time the flower-spikes are half grown. But there are many half-hardy and tender bulbs that are more easily grown and flowered in the South than in the North.

#### *Subsequent treatment of outdoor bulbs.*

The treatment of bulbs after flowering is important when the bulbs are to be used again, for it must never be forgotten that the flowers and resources for the next season are garnered within the bulb after blooming, through the agency of the roots and foliage. Imperfectly developed and matured foliage this year means poor flowers or none at all next year; so it is best to leave the bulbs alone until the leaves have died down. The further treatment depends upon the kind of bulbs under consideration. Generally speaking, one class may be left in the ground for a number of years, while another thrives better if lifted annually and given a short period of rest out of the ground. Among this latter class must, of course, be included tender bulbs which will not survive the winter if left in the beds or borders and which should be taken up in the fall when matured. Of the hardy bulbs, hyacinths and tulips succeed best if lifted annually. Late tulips in borders may be left undisturbed for two or three years with fairly good results, but the single early kinds ought to be taken up each year.

Lifting of any bulbs should never be done before the foliage assumes a decidedly limp and brown appearance. From that time on until the root-growth begins, they may be taken up, cleaned, and stored away, or divided and replanted at once. The former method is advisable for hyacinths and tulips; the latter for most of the bulbs on the list appended hereto. When bulbs are grown commercially, this yearly lifting is essential in order to make provision for propagation by division or by offsets, as the young bulbs mature more rapidly and perfectly when separated from the parent bulb. When summer bedding-plants are to be substituted, it is sometimes necessary to remove bulbs before ripe. In such cases, the bulbs should be carefully taken up with a spade. Disturb the roots as little as possible, and do not cut or crush the leaves. Heel-in the plants in a shallow trench in some half-shady out-of-the-way place until ripe, taking pains to avoid setting them too close in the trench to secure some air-space about the tops. If the soil adheres to the roots when taken from the beds, the bulbs will be less affected by being disturbed before maturing. As soon as ripe, they should be dug up, cleaned, and stored away. A point to be kept in mind is that it is safer to lift tulips too early than too late; these bulbs should be taken up just before the stems are quite dry. By doing so the protective skin about the bulb is more likely to be retained during the time the bulbs are out of the ground. Darwin tulips have especially thin skins which frequently loosen and come off entirely if the bulbs are left too long, and then the bulbs tend to become soft and flabby during the resting period. Narcissi should be taken up with whatever foliage has not quite withered away. Indeed, it is always wisest never to cut a leaf from choice kinds, but to make plantings of cheap kinds if leaves are wanted for cutting.

#### *Summer- and autumn-flowering tender bulbs for spring planting.*

This class (tender) includes some of our showiest garden flowers, which are almost indispensable. They are of the easiest possible culture. Planted in the spring,



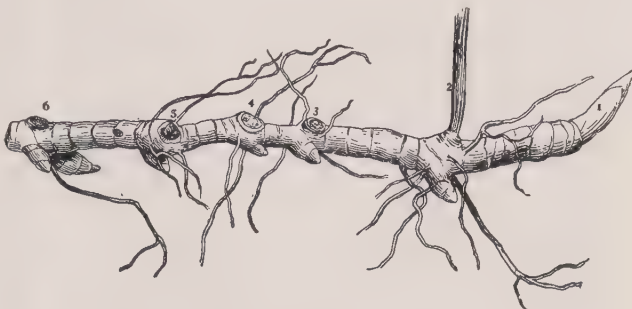
after danger from frost is over, in a sunny position in good rich soil, they will flower with great certainty the same season. After flowering and ripening of the foliage, they should be taken up and stored for the winter as advised under "Keeping dormant bulbs" (p. 593) until wanted next spring. Among the more important species of this class of bulbs are the undermentioned (those marked F must be kept in a semi-dormant condition in a coldframe or greenhouse): *Agapanthus* (F), *Alstremeria* (F), *amorphophallus*, *anomatheca* (F), *antholyza* (F), tuberous *begonia*, *bessera*, *colocasia* (*caladium*), *cooperia*, *crinum*, *cypella*, *gladiolus*, *galtonia* (*Hyacinthus candicans*), *houssingaultia* (*madeira* vine), *montbretia*, *nemastylis*, *border oxalis*, *ornithogalum* (F), *pancratium*, *richardia* (*calla*), *schizostylis* (F), *sprekelia*, *tigridia*, *tuberosa*, *watsonia*, *zephyranthes*.

#### *Bulbs for flowering in the house and greenhouse.*

There is no class of plants that gives more satisfaction for this purpose, with so little skill, than the various bulbs. Perhaps the most important class of all bulbs for winter-flowering and forcing are certain hardy and half-hardy kinds. They are the most easily managed of all, and need occupy no space in the window or greenhouse, excepting when in bud and bloom. Under suitable treatment, they flower with great certainty, and their flowering period may be hastened (forced) or retarded at pleasure, so as to "bring them in" for certain occasions, or to give a continuous succession of bloom. There is a great variety of kinds of bulbs to select from for this purpose (see list of species at end of this article), yet the great demand, at this writing, has centered on the following leaders, especially for forcing purposes: *Allium neapolitanum*, *A. Hermetii grandiflorum*, *Anemone fulgens*, *convallaria* (*lily-of-the-valley*), *Freesia refracta alba*, *gladiolus* "The Bride," early single-flowering Dutch hyacinths and Romans, *Campanelle jonquil*, *Lilium candidum*, *L. Harrisii* and *L. longiflorum*. Several narcissi are in demand, notably among the large trumpet varieties: Emperor, Empress, Golden Spur, Horsfieldii, and Spurius major; among the medium and small trumpets: Sir Watkin, Barrii conspicuus and Poeticus ornatus; of the doubles are Von Sion and Orange Phoenix; of the Polyanthus narcissi: Paper White grandiflora (*Totus albus*), and double Roman (*Constantinople*). Of other species of bulbs, *Ornithogalum arabicum*, *spirea Gladstone*, and single and double tulips of the early varieties are in demand. In the classes of bulbs there is often a great diversity in the fitness of the varieties for forcing. Certain sorts will be found best adapted to early forcing, others to midseason or late work, and in selecting bulbs for forcing these characteristics must be taken into consideration. Besides this general division into early and late forcing kinds, the skilled grower recognizes that each variety has its own peculiar period when it is at its best, if forced. Many tulips and narcissi are very fine if forced early and only moderately good if forced late; the converse is equally true, for often an early variety will do only indifferently well when it is used for late work. This characteristic is well studied by one of the largest forcers for the English market, who devotes whole separate houses to particular varieties of tulips, and puts in charge of each one man who knows the whims of the variety he tends. This should not, however, deter anyone from attempting to force bulbs, as success is sure to be gained if standard forcing kinds are used, and the few important rules are followed. The principles of culture for hardy bulbs for winter-flowering are the same, whether only a few are grown in pots for the window-garden, or whether they are to be forced by the thousand by the florist. The first essential is to secure the strongest bulbs. Remember that the flowers were formed within the bulbs the previous season. If one buys bulbs of narcissi containing only one flower, or hyacinths with only ten bells on a spike, the best

culture possible cannot make them produce more; but good culture will develop such flowers larger and better.

The next most important essential—one might say the secret of success in flowering bulbs in house or greenhouse—is perfect root-development before the tops begin to grow. To aid the uninitiated in this important matter, we will illustrate: When hardy bulbs are planted in the open ground in the northern states in the fall, the weather above them is cool or cold, the ground beneath



685. Example of a rhizome—*Smilacina racemosa*. The figures show the different years' growths.

them is warmer, and the conditions are congenial for root-action but deterrent to top-growth. This results in the perfect development of such flowers as the bulbs contain. On the other hand, when hyacinths, tulips, narcissi, and most other hardy spring-flowering bulbs are planted in fall in our extreme southern states, they may prove disappointing, because the weather is warm, causing the flowers and foliage to begin to grow before the roots; and as soon as such sustenance as the bulb could supply has been exhausted, the plant stops growing and dwindles. When one grows bulbs under artificial conditions, one must make them produce roots first. Failure to do this is responsible for nine-tenths of the disappointments.

When hardy bulbs are to be grown in pots for winter blooming in the house or conservatory, the bulbs should be potted as soon as they are procurable, between August and November. Some writers recommend that bulbs be planted in successional lots to give later and continuous flowers, but such advice is at fault, as the bulbs tend to dry out and lose vitality when kept dry too long. It is no trouble to retard the flowering of hardy bulbs in winter, as hereafter described, without keeping them out of the ground.

The soil should be rich loam. Fresh manure cannot be used. Of thoroughly rotted manure, some may be pulverized and worked into the soil, but it is safer to use pure bone meal, one part to fifty of soil. If the soil is stiff and heavy, mix with it sand and leaf-mold or peat. The size of pots depends upon the kinds of bulbs. A 5-inch pot is best for a first-sized hyacinth, or large-bulbing narcissus, particularly the polyanthus type. Tulips, small narcissi, and bulbs of a similar size, while they can go individually into a 4-inch pot, are better when put three or more of one variety together in a larger pot, as the soil retains a more even temperature and moisture; and for this reason some prefer earthen bulb-pans, which come in various sizes, from 8 to 18 inches in diameter. In potting, place a little broken pottery or lumps of charcoal in the bottom for drainage, then fill the pot with soil and shake it down, but do not pack it. Neither must the bulb be pressed or screwed into the soil, else the soil will be packed under it so that when the roots start they often raise the bulb out of the pot. Plant the bulb just deep enough that its top will not show. Large and soft bulbs, which are liable to rot, may be set in a cushion of sand, and the bulb not covered with soil until it has taken root and become established (Fig. 688).

When planting mixed bulbs in the same pot, pan or box, care should be used in selecting different varieties that will flower at the same time. An early-flowering Duc Van Tholl and a double Tournesol tulip would flower a month apart under the same treatment. Some varieties of hyacinths, of narcissi, and of most species of bulbs vary greatly in time of blooming, which, of course, would spoil the effect.

#### *The forcing of bulbs.*

When florists force bulbs in quantity for cut-flowers, they seldom use pots, but shallow boxes, or flats, of a size to economize bench-room. Usually these boxes are cut down from soap-boxes to a depth of 3 or 4 inches. The bulbs are planted closely in these, from an inch to 2 inches apart, according to the kind. The tops of the bulbs (excepting lilies) are kept about even with the top of the soil. Give a thorough watering to help settle the earth about the bulbs, but give no more water until growth begins, for bulbs in a dormant condition resent an excess of moisture. After the bulbs are potted, or boxed, as described, they should be placed in a cold-frame or cold-pit to root. This is the most important detail in flowering bulbs under artificial conditions.



686. Various types of bulbs and tubers.

1. Tuberose. 2. *Colocasia antiquorum* (*Caladium esculentum*).
3. Easter Lily. 4. Jonquil. 5. *Gladiolus*. 6. *Lilium pardalinum*.
7. Hyacinth. 8. Lily-of-the-Valley.

Cover the pots, boxes or pans with 4 inches of sand, ashes, rotted leaves, tanbark or similar substance, and do not put the sash on until freezing weather, and even then remove the sash on pleasant days. When no coldframe or pits are available, the pots may be covered as advised in a cool cellar, provided close attention is given to be sure that the soil is maintained in a uniformly moist, but not wet condition. It is preferable however, to sink them in the open ground. Very fine flowers were obtained from hardy bulbs when treated as follows: A trench a foot deep is dug in the garden where water will not settle in it, and it is protected from the north and west cold. Three inches of coal-ashes is first placed in the trench, to allow drainage and keep the worms out. The pots are then placed on the ashes, the earth is filled in about the pots, filling the trench rounding over. When the weather gets cold enough to freeze a crust on the soil, an additional covering of about 4 inches of rough stable manure, leaves or straw, is put over. This cover must be heavy enough to keep the pots from freezing, not that this will injure the bulbs, but that it will be almost impossible to remove the pots if the covering of earth freezes solid. Care should be taken that the sides of the trench do not fall in, depositing a layer of earth over the leaves or other cover, which will freeze hard enough to make removal difficult. Often a simple cover of 8 to 10 inches of leaves directly over the pots will be most advantageous if earth has been worked in about the sides of the pots to retain moisture. No further attention is required, as every-

thing is congenial to perfect root-development, while the weather is cool enough to check top-growth. Some early bulbs, such as Roman hyacinths, Paper White narcissi, Duc Van Tholl tulips, and the like, will root sufficiently in five or six weeks to be taken up for first flowers, which should be out by Christmas or earlier, but it is safer to allow all bulbs not less than eight weeks for rooting. A fairly sure indication that the bulbs are ready to be brought into heat is the appearance of about an inch of top growth, and of an abundance of roots through the bottom of the boxes or through the holes in the bottom of the pots. Every two weeks after the first removal of pots, or as needed, further relays of rooted bulbs may be taken out for a continuous display of bloom. When the pots of hardy bulbs have been taken up, place them in a cool greenhouse or cool, light storeroom, with temperature not over 56°. This temperature will allow the flower-stems and foliage to grow, and at the same time prevent the opening of the flowers until the stems have attained their proper height. The pots should be kept shaded for several days until the top-growth has taken on its natural green color, after which the pots may be taken to a sunny, warm window, or wherever they are wanted to flower. Bulbs treated in this manner will produce perfect spikes of flowers.

A practice often followed by florists early in the season is keeping the bulbs in the dark and in heat in order to draw out the flower stems to a proper height. This can often be accomplished by placing an inverted pot over the tops, the light coming through the hole in the bottom being sufficient to draw out the stems. If this is done, the bulbs must be watched to see that the tops are all growing evenly; should some of the bulbs get a start of the others, the pots must be put in the light at once to avoid irregularity in flowering. For early work, this darkening, together with strong bottom heat, will give longer foliage and stem than if the bulbs are subjected to strong light when first brought under glass. But plenty of fresh air must be afforded, and as the buds begin to show color the pots must be removed to a cooler temperature to harden the growth, and enough light given to put color in the foliage and the buds.

A good rule to keep in mind in flowering hardy bulbs is: Temperature, 40° for roots, 50° for foliage and stems, 60° for best flowers, 70° for quick development, 80° to rush bloom with loss of substance and risk of "going blind" (producing no flowers).

The exceptions to the above advice are liliums and lily-of-the-valley. The bulbs of *Lilium Harrisii*, *L. longiflorum* and the various sorts of *L. speciosum*, in addition to throwing out roots from the base of the bulbs, usually form roots from the new stem just above the bulb, and the plants and flowers derive much strength from these top-roots. So in potting lily bulbs, it is best to put them down so deep that there will be sufficient soil above the bulbs to entice and sustain the stem-roots. This may be done when the bulbs are potted, or 2 or 3 inches of soil may be added after growth is under way and the stem-roots have begun to work into the soil. An advantage in the latter method is that some fertilizer may be mixed with the new soil, and sustenance provided when it is most timely. In other respects treat the bulbs after potting as just advised. Winter-flowering lily-of-the-valley forms no new roots. The thick, fleshy, fibrous old roots should be trimmed at the bottom, leaving them from 2 to 3 inches long. This allows them to absorb the abundant moisture with which they should be supplied while the flowers and foliage are developing. They flower just as well in sand or moss, or anything that retains an even moisture and temperature, as they do in soil, but lily-of-the-valley for flowering in the house or greenhouse requires freezing before it can be successfully brought into flower. Without freezing, many pips will "come blind," or pro-



duce malformed spikes. So it is just as well for amateurs to plant their pips an inch or two apart in pots or bulb-pans, and plunge them in the garden, as recommended for other hardy bulbs. Florists generally freeze their pips in refrigerators, or have them placed, just as they arrive from Germany, 2,500 pips in a case, in cold storage, in a temperature of 28° to 30°.

Half-hardy bulbs for winter-flowering and forcing should be treated the same as hardy bulbs, except that after potting they should be placed for rooting where they will not freeze. Yet they can go fairly close to it and be all the better for it. In northern states, a coldframe or pit or cold greenhouse to root them in is, therefore, almost indispensable. For tender winter- and summer-flowering greenhouse bulbs, the culture varies with almost every species, and as no general instructions would suit all kinds, the reader may refer to their individual cultures given under their respective headings in this Cyclopaedia. (See list of species at the end of this article.)

#### *Other indoor methods.*

The flowering of bulbs in glasses, bowls or unique pots, is always interesting. Among the most successful and interesting are hyacinth bulbs in glasses of water. Use early-flowering single varieties only. The seedsmen and dealers in bulbs supply special hyacinth glasses for the purpose. They come in various shapes, colors and decorations, and vary in price from 20 cents to \$1.50 each. These are simply filled with fresh, pure water. A lump of charcoal thrown in absorbs impurities, but it is not absolutely necessary. The bulb rests in a cup-shaped receptacle on top of the glass. In filling, the water should not quite touch the bottom of the bulb. Put in a cool, dark, airy place until the roots have reached the bottom of the glass, which should be in about six weeks. Do not place them in a close, warm closet. They must have fresh air. As the water evaporates, fill the glasses, and change the water entirely when needed to keep it sweet and clear. After rooting, place the glasses in a light store-room where the temperature averages about 50°, until the stems and foliage have developed; then remove to a warm, sunny window for flowers to open. There are other kinds that do equally well when rooted in water, providing the largest healthy bulbs are chosen. Among them are sprekelia (Jacobæan lily), Trumpet narcissi *Horsfieldii* and Golden Spur, polyanthus narcissi *Grand Monarque* and *Gloriosa*, large bulbs of Roman hyacinths, early single tulips, and Mammoth Yellow crocus. Hyacinths have been flowered on a piece of virgin cork floating in an aquarium, a hole being cut through the cork for the roots to reach the water. The so-called "Chinese sacred lily," a variety of *Polyanthus narcissus*, grows and flowers luxuriantly in bowls of water, provided they are not placed in a dry, furnace-heated room, which will cause the buds to blast before opening. Sufficient pebbles or shells should surround the bulbs to prevent them from toppling over.

Crocuses, Roman hyacinths, and lilies-of-the-valley are very pretty when nicely flowered in columnar, hedge-hog- or beehive-shaped hollow pots with holes for the reception of the bulbs. A bulb is placed in front of each hole from the inside, with the crown of the bulb looking outward. The pot is then filled with soil through the large opening in the bottom, moss being pressed in last to hold the contents in place, after which the pots

are put outside for the bulbs to root, as explained for other hardy bulbs for the house.

The growing of bulbs in moss fiber, a method introduced by Robert Sydenham, of Birmingham, England, is well deserving of attention by the amateur. The great advantage of this method is that the bulbs can be grown in decorative china bowls, without drainage, while the compost is clean to handle and, as the bowls are not porous, they may be set about a room without danger of spotting the most highly polished woodwork. The compost is made up of moss or peat fiber and ground oyster-shell in the proportion of three parts dry moss to two parts of the shell; a little pulverized charcoal added tends to keep the material sweet. The moss must be rubbed between the hands thoroughly to break even small lumps and then mix the shell with it very carefully, after which water should be slowly added in the proportion of four quarts to each half-bushel of the mixture. When properly moistened the compost should feel quite damp but no water will be squeezed out if a small quantity is pressed tightly in the hand. A few pieces of charcoal should be placed in the bottom of the bowl to keep the fiber sweet, and the bowls should be filled to within about an inch from the rim. Cover the bulbs with an inch or so of the mixture, taking care not to pack the fiber in so doing, and place the bowls in a cellar or cool room where they can have plenty of fresh air.

For about three weeks the mixture will itself provide sufficient moisture, but after that time they must be examined frequently; nothing is so essential as keeping the fiber uniformly damp to the very bottom of the bowls but there must be no water standing. If dry for but a day there is great risk of the bulbs going blind. The treatment from this point on is identical with that given for bulbs grown in ordinary potting soil.

#### *Subsequent treatment of forced bulbs.*

After being forced or flowered in the greenhouse or window, hardy bulbs are of little value, for most bulbs suitable for the purpose have attained their maximum size, and, in consequence, are ready to break up. Florists usually throw these bulbs away. However, if space can

be spared for the bulbs to complete their growth after flowering, and watering and temperatures are watched, many of them can be matured to be utilized afterwards. The ripening of the foliage is as necessary to forced bulbs as it is to those grown in the open, and to promote this the potted bulbs should receive enough care and nourishment to counteract the artificial conditions under which they are grown. When it is desired to keep forced bulbs, the compost should be made somewhat richer at potting time. After flowering, the pots may be plunged out-of-doors, if freezing weather is over, until the foliage has ripened. Then the bulbs can be shaken out and planted in the mixed border or about the kitchen-garden, where some of them will recuperate and give flowers for cutting within a year or two, and eventually they will regain their vigor sufficiently to be transferred to the bulb-garden. Yet with most of the bulbs the labor involved is scarcely commensurate with the returns, and the bulbs might just as well be discarded at the beginning.

#### *Keeping dormant bulbs, tubers, and the like.*

Bulbs and tubers of the various species, as well as their varieties, vary greatly in size. Some, like oxalis, snowdrops, and chionodoxas, often do not exceed half



687. The Easter lily throws out feeding-roots both below and above the bulb.

an inch in diameter, while other bulbs, such as those of *Caladium esculentum*, certain arums and crinums, attain great size, frequently weighing several pounds each. Such solid bulbs as those of tulips, hyacinths and narcissi, will remain out of the ground solid and plump, in a suitable place, for three or four months. The larger the bulb the longer it will keep, as a rule. Large crinum bulbs have been kept for fifteen months. Still, it is always better to plant the bulbs as soon as possible, for, although they keep, they do not improve, and their tendency is always toward drying out and loss of vitality.

Never keep bulbs packed air-tight. They are liable to generate heat or sweat, mold or rot, or to start. When solid bulbs are to be kept dormant for any length of time, they should be stored away from bright light in baskets, shallow boxes or slatted trays, protected from rats or mice, in a room or cellar in which there is a circulation of fresh air and the temperature is as cool as possible. Forty degrees is the desideratum for all excepting tender bulbs. Scale-like bulbs, as liliums, soon dry out and shrivel, if exposed to the air for any length of time; therefore, they are best kept in open boxes packed with some substance that will retain a slight and even moisture, such as sphagnum moss, rotted leaf-mold, coconut fiber refuse, or moist sand, but they must be kept cold to check any efforts to start. Fleshy roots, like those of peonies, and so on, should be treated like the lily bulbs. When a cold-storage room, with an average temperature of 36° to 40°, is available, it is the safest place to carry over hardy bulbs and roots for spring planting.

Lily-of-the-valley pips are carried in cold storage rooms of about 28° to 30°. The pips and packing freeze solid; and here they are kept for months until wanted for forcing. When they are removed, they must be thawed out gradually and as soon as possible, by plunging in cold water, before they are subjected to any heat; otherwise, they are likely to rot. For this reason, "cold-storage pips" cannot be safely shipped any



683. Bulb with a cushion of sand beneath it to prevent decay.

distance in warm weather, this often being the cause of the country florists' disappointment in results.

Tender dormant bulbs, as begonias, gloxinias, amaryllis, panceratiums, tigridias, tuberoses, must be kept in a warm, dry atmosphere, not below 50°. The cause of tuberoses not flowering is often that the bulbs have been kept below 40°, which destroys the flower germ,

although the foliage grows just as vigorously. Tender tubers, such as dahlias and cannas, should be stored in dry sand in a warm, dry cellar or under the greenhouse bench.

#### *Propagation of bulbous plants.*

Bulbous plants increase usually in either of two natural ways—from division or from seed. Increase by division, with true bulbs and corms, is due, in the first place, to the tendency these plants have after reaching a certain age to break up into a number of smaller parts, each part making a new start for itself and developing with time into a bulb of flowering size. In addition to this breaking up, all bulbs, even those of young growth, form tiny bulbels or offsets, throughout their time of maturing. These bulbels appear in many ways, some forming outside of the protecting skin of the mother bulb, as in the case of the tulip and hyacinth, others developing about the base of a newly-formed corm like the gladiolus. In this connection it is proper to note that the formation of bulbs during the growing season varies

in that some kinds form an entirely new bulb, as the tulip and gladiolus, and others merely add new tissues to the old bulb and increase in size, as the narcissus and hyacinth. As a rule, small bulbs obtained by this process of breaking up do not have the vigor of those from offsets; the younger a bulb is, the greater vigor it always has, although the flower may not show its true size.

Whereas bulbs secured by division always come true, —that is, the flowers resemble that of the parent bulb, allowing for the occasional variation due to "sporting"—propagation by seed is likely to give new varieties, differing in character from the original. Certain kinds of bulbs, such as the scilla, chionodoxa, or freesia, can be propagated by seed and come true, unless cross-fertilized. Bulbs grown from seed take longer to mature than do those from offsets, and for commercial purposes the seed method is seldom employed except when the raising of novelties is an object.

Of the other so-called bulbous plants which are under consideration here, the tuberous kinds increase naturally by the development of new eyes which grow into young plants as the old tuber decays, while the rhizomatous sorts form new plants through the elongation and branching of the running underground stems accompanied by the dying back of the older parts. Artificial propagation of these kinds is an easier affair than with true bulbs, as the separation of the new growth is readily effected by division with a knife, or even with the rougher use of a spade. Such tubers as potatoes, begonias and gloxinias can be cut into small parts wherever an eye has started, and these planted out separately grow into new plants. With certain kinds it is a frequent practice to dust over the tubers where the cut has been made with sulfur or soot to prevent decay. Caution must be used in following this method, as too frequent division of this sort results in weakening the vigor of the stock to be grown. Several tubers, such as the dahlia and begonia, can be propagated either by stem or leaf cuttings taken from the young growth.

Artificial propagation of the hyacinth by cutting the old bulb is the method employed in Holland, while many liliums are increased by loosening the outer bulb scales and inserting them in sand after the manner of cuttings. Certain bulbs like the tulip, as grown in Holland, are subjected to heat after lifting, to ripen the bulbs more thoroughly. Bulbs to be used for propagating are given a higher temperature, which arrests the flowering and tends to increase the breaking up of the mother bulbs. For special methods of propagating, the reader should consult the articles on the various bulbs throughout this Cyclopaedia.

The cultural treatment for the young bulbs is in general the same as that prescribed for the older, larger ones. The offsets need not, of course, be planted so far apart, the very smallest being simply scattered in drills as peas or beans are sown. At first the soil should be somewhat lighter than later on, and must always be kept free from weeds and well cultivated. The young bulbs should be planted early, and when annual lifting is practised they should be the first to come out of the ground.

From an economic point of view it is doubtful whether the so-called Dutch bulbs can be successfully propagated and grown in America. The extremely low cost of labor, and the rapid increase of stocks in the soil and climate of Holland, together with the fact that the secret of ripening the bulbs to perfection is known thoroughly only by the Dutch, makes it improbable that bulbs can be grown as well, or with a reasonable profit, here in America.

#### *Hints on buying and selecting bulbs.*

As already said, bulbs can develop only the flowers which were formed within them before they were ripened. A bulb may be poor because not full-grown or too young, or because grown in impoverished soil or under





XX. A border of hardy bulbs.





uncongenial conditions, or because it may not have been matured when dug; or it may be injured from heating, sweating, rotting or moldiness in storage or transit, caused by improper curing or packing, or it may be dried out from having been out of the ground too long. In the majority of cases in which poor bulbs are planted, however, it is the buyer's fault in procuring cheap bulbs, which in many cases are second grades, lacking age and proper size. The commoner varieties of a species usually propagate the fastest, and it is generally these less salable varieties and inferior seedlings and cullings from the named bulbs that go to make up most "mixed colors" and "mixed varieties." Therefore, for best results, it is advisable to expend a given amount of money for the first-size named varieties, rather than for a larger quantity of cheaper seconds and mixtures, unless, of course, the bulbs are wanted for large permanent plantings, as in promiscuous borders for naturalizing, in which best flowers the first season are of secondary consideration.

The best named hyacinths—"top roots," as they are called in Holland—require from four to six years to attain full size and give best flowers. Such bulbs, according to the variety, should measure from 20 to 24 centimeters (8 to 10 inches) in circumference. These naturally cost more to grow than the younger second or "bedding" grade of bulbs, measuring from 18 to 20 centimeters (6 to 8 inches). There is a third size, ranging from 16 to 18 centimeters (4 to 6 inches), that goes in mixtures, and a fourth size (12 to 14 centimeters) that goes out as "Dutch Romans," "Pan Hyacinths," "Miniatures," and so on. Some growers even scale their sizes a centimeter or two less than mentioned, to enable them to quote lower prices. Crocus, narcissi, tulips and many other bulbs are also sorted into sizes, enabling the growers to catch all classes of buyers.

A first-size crocus bulb should measure 10 centimeters (4 inches) in circumference, and such bulbs produce from six to twelve flowers each. A small, cheap bulb produces only two or three flowers. A narcissus bulb of maximum size will produce from three to five flowers (sometimes more), and an inferior size usually but a single flower. A white Roman hyacinth bulb 14- to 16-centimeter size (5 to 6 inches in circumference) will produce three and often four spikes of firsts and several seconds, while an 11- to 12-centimeter size will average only one first-grade spike and a couple of seconds, or perhaps nothing but seconds. The best lily-of-the-valley pips bear from twelve to sixteen bells on a spike, usually all firsts. Cheaper inferior grades of pips have seldom more than seven to ten bells. If the florist or planter wants the best bulbs, he must pay more money for them, but they are cheapest in the end, for second-grade stock takes up just as much room and requires as much care, fire, and other expenses. It is the grade of flowers called firsts that sell and pay a profit. The supply of seconds is often so abundant that the market price for them does not pay the cost of the bulbs.

Mere size alone should never be taken as the standard in judging bulbs, however, as in this respect there is always a great difference among varieties of the same kind of bulb. A plump, solid bulb, without any suspicion of flabbiness, will give far better blooms than one without these qualities, but if size goes with them the purchaser will be just so much better satisfied. Furthermore, the selection of varieties is of importance since in recent years a great many vastly improved varieties in all classes of bulbs have been introduced. The growers, nevertheless, because of the demand for the older sorts, of which they have large stocks, continue to list many kinds no longer worth growing, unless cheap bulbs are wanted. Attention ought also to be paid to the fact that a number of varieties appear in the lists under different names, a feature of the bulb trade which often leads to great confusion although the rela-

ble dealers usually note synonymous names in such cases. Cheap bulbs may often be secured through the auction sales in fairly good quality, but it is utterly impossible to count upon these being true to name, or even to color. The surest way to obtain first-class bulbs



689. A good pot of narcissi.

is always to purchase from a trustworthy source, and to state clearly, when buying, the exact purposes for which the bulbs are intended and the amount which the buyer desires to spend.

#### Catalogue of bulbs.

To aid in the selection of bulbs for particular purposes, is appended a list of the leading species that are procurable while dormant (between the months specified) from seedsmen and bulb dealers, and a sign is affixed to each to indicate the purpose for which the species—or certain varieties in it—are adapted. Some kinds are useful for more than one purpose, and such have a corresponding number of signs. For example: If a selection of bulbs is to be made for winter-flowering in the house, make a note of those to which an asterisk (\*) is affixed, then turn to their respective headings in this Cyclopedia, where will be found other advice and descriptions; read all cultural instructions carefully, and consult good growers and reliable dealers for the most recent varieties in any species, remembering that new varieties frequently appear.

For winter-flowering bulbs for greenhouse or window, select from species marked \*.

For summer- and fall-flowering bulbs for pots for greenhouse and other decoration, select from species marked †.

For spring-flowering hardy bulbs for gardens, lawns, and the like, select from species marked ‡.

For summer- and fall-flowering hardy bulbs for gardens, lawns, and the like, select from species marked §.

For summer- and fall-flowering (not hardy) bulbs for spring planting in garden, and the like, select from species marked ¶.

For climbing bulbous plants, select from species marked ¶.

Those marked H are hardy; HH, half-hardy; T, tender.

GENERA, ETC.	HARDINESS.	DORMANT.
Aobora ¶ §.	HH.	Oct. to Apr.
Achimenes†.	T.	Oct. to Apr.
Agapanthus † §.	HH.	Oct. to Apr.
Albuca †.	T.	Oct. to Apr.
Allium * †.	H & HH.	Aug. to Dec.
Alstroemeria † §.	HH.	Sept. to Nov.
Amaryllis * †.	T.	Oct. to Apr.
Amorphophallus §.	T.	Oct. to Apr.
Anemone * †.	H & HH.	Aug. to Nov.
Anomatheca §.	HH.	Oct. to Apr.
Antholyza §.	HH.	Oct. to Apr.
Apios ¶ §.	H.	Oct. to Apr.
Arisæma †.	HH.	Oct. to Apr.
Arum * †.	T.	Aug. to Apr.

GENERA, ETC.	HARDINESS.	DORMANT.
Babiana *	HH.	Aug. to Nov.
Begonia, Tuberous † ?	T.	Oct. to Apr.
Bessera ?	HH.	Oct. to Apr.
Blandfordia *	T.	Aug. to Nov.
Bloomeria †	H.	Aug. to Nov.
Bomarea † †	HH.	Aug. to Oct.
Boussingaultia † ?	T.	Oct. to Apr.
Bowiea † †	HH.	Oct. to March
Bravoa †	HH.	Oct. to Apr.
Brodiaea * †	HH.	Aug. to Oct.
Bulbocodium †	H.	Aug. to Oct.
Caladium † ?	T.	Oct. to Apr.
Calochortus * †	HH.	Aug. to Nov.
Camassia †	H.	Aug. to Nov.
Canna ?	T.	Oct. to Apr.
Chionodoxa * †	H.	Aug. to Oct.
Chlidanthus ?	HH.	Oct. to Apr.
Colchicum †	H.	Aug. to Sept.
Commelina ?	HH.	Oct. to Apr.
Convallaria * †	H.	Oct. to Apr.
Cooperia ?	HH.	Oct. to Apr.
Corydalis ?	H.	Aug. to Apr.
Crinum † ?	T.	Nov. to Apr.
Crocodylia ?	HH.	Oct. to Apr.
Crocus * †	H.	Aug. to Oct.
Crown Imperial †	H.	Aug. to Oct.
Cummingia †	T.	Aug. to Oct.
Cyanella †	HH.	Aug. to Oct.
Cyclamen persicum *	T.	Aug. to Nov.
Cyclobothra ?	HH.	Aug. to Nov.
Cypella ?	T.	Oct. to Dec.
Cyrtanthus †	T.	Oct. to Apr.
Dahlia ?	T.	Oct. to Apr.
Dicentra †	H.	Oct. to March
Dioscorea † †	H.	Oct. to Apr.
Eranthis †	H.	Aug. to Oct.
Eremurus †	HH.	Oct. to Apr.
Erythronium †	H.	Sept. to Nov.
Eucharis †	T.	Sept. to Dec.
Eurycles †	T.	Oct. to March
Freesia *	HH.	Aug. to Nov.
Fritillaria * †	H & HH.	Aug. to Oct.
Galanthus * †	H.	Aug. to Nov.
Galtonia ?	HH.	Oct. to Apr.
Geissorhiza †	HH.	Aug. to Nov.
Gesneria * †	T.	Oct. to Apr.
Gladiolus ?	HH.	Sept. to Apr.
Gloriosa † †	T.	Oct. to Apr.
Gloxinia †	T.	Oct. to Apr.
Griffinia †	T.	Oct. to Apr.
Hæmanthus †	T.	Aug. to Nov.
Helleborus †	H.	Oct. to Apr.
Hemerocallis †	H.	Oct. to Apr.
Homeria ?	HH.	Aug. to Nov.
Hyacinth *	H.	Aug. to Nov.
Hymenocallis ? †	T.	Oct. to Apr.
Imantophyllum †	T.	Oct. to Apr.
Iris, Bulbous * †	H & HH.	Aug. to Nov.
Iris, Rhizomatous, etc. † †	H.	Oct. to Apr.
Ismene ? †	T.	Oct. to Apr.
Ixia *	HH.	Aug. to Nov.
Ixiolirion †	HH.	Aug. to Nov.
Jonquil * †	H.	Aug. to Oct.
Lachenalia *	HH.	Aug. to Oct.
Leucojum † †	H.	Aug. to Oct.
Lilium *	H.	Sept. to Apr.
Lycoris ? †	HH.	Oct. to Apr.
Milla ?	HH.	Oct. to Apr.
Montbretia †	HH.	Oct. to Apr.
Muscaria †	HH.	Aug. to Nov.
Nagelia * †	T.	Oct. to Apr.
Narcissus * †	H.	Aug. to Oct.
Nemastylus ?	T.	Oct. to Apr.
Nerine †	T.	Aug. to Nov.
Ornithogalum * ?	H & HH.	Aug. to Nov.
Oxalis, for borders ?	HH.	Sept. to Apr.
Oxalis, Winter-flowering * †	HH.	Aug. to Nov.
Peony †	H.	Oct. to Apr.
Pancratium † ?	T.	Oct. to Apr.
Phædranassa *	T.	Oct. to Apr.
Polygonatum †	H.	Oct. to Apr.
Puschkinia †	H.	Aug. to Oct.
Ranunculus *	HH.	Aug. to Nov.
Richardia * † ?	T.	Sept. to Dec.
Rigidella ?	T.	Oct. to Apr.
Sanguinaria †	H.	Oct. to Apr.
Schizostylis * ?	HH.	Oct. to Apr.
Scilla † *	H & HH.	Aug. to Nov.
Sparaxis *	HH.	Aug. to Nov.
Spiræa (Astilbe) *	H.	Oct. to Apr.
Sprekelia * † ?	T.	Sept. to Apr.
Sternbergia †	H.	Aug. to Oct.
Tecophilæa *	HH.	Aug. to Oct.
Tigridia ?	T.	Oct. to Apr.
Trillium †	H.	Oct. to March
Triteleia †	HH.	Oct. to Apr.
Tritoma †	H.	Oct. to Apr.
Tritonia *	HH.	Aug. to Nov.
Tropæolum, Tuberous * †	HH.	Aug. to Dec.
Tuberose ?	T.	Nov. to May

GENERA, ETC.	HARDINESS.	DORMANT.
Tulip, * †	H.	Aug. to Nov.
Tydaea * †	T.	Oct. to Apr.
Urceolina †	T.	Oct. to Apr.
Vallota †	T.	Oct. to Apr.
Watsonia * ?	HH.	Sept. to Dec.
Zephyranthes * ?	HH.	Aug. to Apr.

PETER HENDERSON & CO.

**BULBINE** (Greek, *bolbos*, a bulb). *Liliacæ*. More than 20 species of half-hardy African and Australian plants, allied to *Anthericum*, but practically not cultivated in this country.

Flowers showy, the petals distinct, 1-nerved, spreading and often recurving in age; stamens shorter than the perianth. Some of the species are bulbous, and require the general treatment given Cape bulbs (see *Bulbs*); but none of the bulbous species is known here.



690. *Bulbine annua*.

*annua*, Willd. Fig. 690. Annual, acaulescent, without any rootstock or bulb: lvs. 12–20, erect but weak: fls. bright yellow, racemose. S. Afr. B.M. 1451 (as *Anthericum*). D.C. Pl. Grasses, pl. 8.—Can be grown as an annual S.

N. TAYLOR.

**BULBINÉLLA:** *Chrysobactron*.

**BULBOCÔDIUM** (Greek, *woolly bulb*). *Liliacæ*. Crocus-like bulbous plants of mts. of Eu. and Russian Asia, spring-flowering or autumn-flowering.

Leaves appearing after (or before) the fls., usually 3, narrow, sheathed at base: fls. close to the ground, 2–3 from each bulb, the perianth funnellform, segms. distinct to the base but conniving in a tube; stamens 6; style 3-fld. at the top.—One variable species, treated in general as crocuses are cult. Allied to *Merendera*, to which some of the former species are referred.

*vénum*, Linn. Fig. 691. Blooms in gardens in earliest spring before the lvs. appear, the fls. resting nearly on the ground: fls. rosy purple, white-spotted on the interior, 1–3 from each bulb: lvs. broad and channelled. B.M. 153 (cf. Fig. 691). F.S. 11:1149. Gn. 75, p. 409.—Bulbs should be taken up and divided every 2 or 3 years. Plant in the fall. Usually blooms in advance of the crocus. *B. versicolor*, Spreng. (*B. ruthenicum*, Bunge), is a small handsome form.

L. H. B.

**BULBOPHYLLUM** (Greek, *bulb*-leaf). *Orchidacæ*. Epiphytic plants, creeping upon rocks or trees; cult. in the warmhouse.

Pseudobulbs 1–2-lvd in the axils of the sheaths, and with the infl. arising from the base of the pseudobulb: fls. small and numerous in a raceme, or larger and few



or solitary; dorsal sepal erect or spreading, free, equaling or shorter than the lateral, which are obliquely broadened at the base and adnate to the foot of the column; petals shorter than or nearly equaling the sepals; lip articulated to the foot of the column, incumbent upon the column; pollinia 4.—A genus of about 125 species, mostly natives of Trop. Asia and Afr.—Bulbophyllum needs a moist atmosphere and should not become dry. Grown on pieces of wood or tree-fern stems.

691. *Bulbocodium vernum*.

- A. *Fls. large, solitary.*  
B. *Petals and lip minute; sepals tessellated with pale brown and yellow.*

*grandiflorum*, Blume. Pseudobulbs 2–3 in. long, 1-lvd.; lf. up to 10 in. long and 2 in. broad, emarginate at the apex; peduncle usually not exceeding the lf. with 2–4 bracts and a solitary large fl. about 8 in. long;

sepals tessellated with pale brown and yellow spots, the dorsal sepal arcuate and incurved, the sides reflexed, the lateral sepals deflexed; petals minute, triangular; lip minute, 3-lobed. New Guinea. B.M. 7787. G.C. III. 17:429.

BB. *Petals and lip large, the former as long as the sepals.*

c. *Lip cordate-triangular; petals reflexed.*

*Dèarei*, Reichb. (*B. Godseffianum*, Hort.). Pseudobulbs 1-lvd. up to 1½ in. long; lf. up to 6 in. long, acute; peduncle as long as or exceeding the lf., bearing a solitary large fl.; sepals and petals tawny yellow, the dorsal sepal ovate-lanceolate, red-spotted, the lateral sepals lanceolate, falcate, purple-marked on both sides; petals linear-lanceolate, with the veins deeper, and some purple spots; lip triangular-cordate. Origin uncertain. G.C. II. 20:108 (as *Sarcopodium*).

cc. *Lip cordate-ovate; petals merely spreading.*

*Löbbii*, Lindl. Fig. 692. Pseudobulbs 1-lvd., up to 1½ in. long; lf. about 6 in. long, narrowed into a petiole; peduncle shorter than the lf., bearing a solitary large fl. 3–4 in. across; sepals and petals buff-yellow, the dorsal sepal with lines of purple spots on the back, ovate-lanceolate, the lateral sepals falcate, marked with rose in the center; petals lanceolate; lip yellow, purple-spotted, cordate-ovate, acute. Java. B.M. 4532. G.C. III. 38:184 (var. *colosseum*).

AA. *Fls. less than ½ in. long, in a raceme.*

*Careyanum*, Spreng. Pseudobulbs ovoid or oblong, 1-lvd.; lf. up to 10 in. long and 2 in. broad; scape with many bracts, bearing a dense raceme, 2–4 in. long, of numerous fls. which are orange-yellow or greenish, spotted with reddish brown or purple; sepals oblong-ovate, acute; petals broadly ovate, minutely awned; lip nearly entire. Himalayas.

*B. auricomum*, Lindl. Burma. B.M. 7938.—*B. barbigerrum*, Lindl. Lip long, narrow, with a tuft of long purple hairs at the apex. Trop. Afr. Gt. 46, p. 491. B.R. 1942. B.M. 5288. R.B. 30:253.—*B. Binnendykii*, J. J. Smith. Java. B.M. 8187. G.C. III. 47:84.—*B. birmanse*, Schlecht. Fls. orange-yellow, very small. Burma. O. 1910:107, desc.—*B. Bittnerianum*, Schlecht. Fls. golden yellow; bracts leafy, greenish white, rose-dotted. Siam. O. 1910:108, desc.—*B. calabaricum*, Rolfe. Fls. small, light yellowish green, with a dull reddish purple lip. W. Trop. Afr.—*B. campanulatum*, Rolfe. Sumatra. B.M. 8281.—*B. capituliflorum*, Rolfe. Fls. very small; sepals and petals whitish green; lip deep purple. W. Trop. Afr.—*B.*

*chrysocéphalum*, Schlecht. Dwarf plant: fls. yellow. S. E. Asia.—*B. comosum*, C. and M. Burma. B.M. 7283.—*B. crenulatum*, Rolfe. Madagascar. B.M. 8000.—*B. cylindraceum*, Lindl. Himalayas. G.C. III. 49:3.—*B. Dayanum*, Reichb. Burma. F.S. 21:2236. G.C. III. 45:194.—*B. dichromum*, Rolfe. Annam. B.M. 8160.—*B. Dixonii*, Rolfe. Fls. small, greenish yellow with numerous dark brown spots; petals with bristle-like tails at the apex. Siam.—*B. Ericssonii*, Kränzl. Fls. umbellate, the sepals and petals green, spotted with purple-brown, the lip triangular, broadly cordate at base, acute, marked with red-brown. Malay Archipelago. B.M. 8088. G.C. III. 21:61; 32:383. O.R. 15:233.—*B. exaltatum*, Lindl. Sepals light green, dotted with brown; lip blackish purple, much fringed. Brazil, British Guiana.—*B. fascinator*, Rolfe. Annam. B.M. 8199.—*B. fuscopurpureum*, Wight. Fls. dull reddish brown, about 1 in. across. S. India.—*B. galbanum*, Riddell. Malay Penin. B.M. 8216. G.C. III. 42:42.—*B. Gentilii*, Rolfe. Scape 1–2 ft. long, bearing a densely fld. spike; fls. scarcely ½ in. long; sepals and petals straw-colored and purple. Trop. Afr. G.C. III. 36:266, desc.—*B. glutinosum*, Cogn. Fls. arranged in 2 rows in short spikes; sepals greenish, spotted inside with red; petals minute, white; lip red. Brazil. O. 1910:108, desc.—*B. inunctum*, J. J. Smith. Fls. larger than in *B. Lobbianum*; sepals densely dotted with purple; petals long and drooping. Borneo.—*B. Kerrii*, Rolfe. Lvs. oblong, deciduous; fls. dull yellow, pubescent. Siam.—*B. kintianum*, Wildem. Similar to *B. barbigerrum*, but the hairs on the lip are not club-shaped. Congo Free State.—*B. lemniscatoide*, Rolfe. Java(?). G.C. III. 45:68.—*B. lemniscatum*, Pax. Burma. F.S. 23:2476. Gn. 35, p. 610.—*B. Lépidum*, J. J. Smith.—*Cirrhopetalum*—*B. lilacinum*, Ridley. Fls. in dense racemes or spikes, lilac spotted with purple. Siam.—*B. longispalum*, Rolfe. New Guinea. G.C. III. 42:211.—*B. macranthum*, Lindl. Burma and Malay Archipelago. B.M. 7208.—*B. mandibulare*, Reichb. f. Borneo.—*B. Medusae*, Reichb. f. Malay.—*B. micropetalum*, Rodrig. A small plant with spikes of tiny transparent green fls. with prominent blackish purple stripes. Brazil.—*B. minutum*, Rolfe. Resembles *B. barbigerrum* but has a broader labellum with white feather-like processes Congo Free State.—*B. mirum*, J. J. Smith. Remarkable for its curious fls.; lateral sepals united; petals consisting of a small round disk with motor filaments. Malaya.—*B. morphologorum*, Hort. Fls. curious in having a small triangular plate between the dorsal and lateral sepals. Siam.—*B. nigræscens*, Rolfe. Sepals yellow dotted with blackish purple; petals and lip blackish purple. Siam.—*B. nudiscapum*, Rolfe. Allied to *B. barbigerrum*. Congo.—*B. orthoplossum*, Kränzl. Malaya. G.C. III. 43:406.—*B. Pahudii*, Reichb. f. Malaya. F.S. 22:2268.—*B. papillosum*, Finet. Raceme twice as long as lvs.; rachis and bracts green; lip dark purple. French Congo.—*B. Péchei*, Bull. Burma. B.M. 7286.—*B. polyblepharum*, Schlecht. Fls. solitary, dark purple. New Guinea.—*B. propinquum*, Hort. Fls. green with dense purple reticulation. Siam.—*B. quadrifarium*, Rolfe. Fls. inconspicuous. Madagascar.—*B. radiatum*, Lindl. Fls. yellowish white, with narrow lanceolate petals and sepals; lf. linear. India.—*B. tremulum*, Wight. E. Indies. G.C. III. 49:291. O.R. 9:361.—*B. tridentatum*, Rolfe. Allied to *B. mandibulare*. British New Guinea.—*B. trifarium*, Rolfe. Fls. arranged like the bracts in 3 rows, dull, lurid purple, with numerous minute darker spots on the sepals. Madagascar.—*B. viræscens*, Thouars. Fls. umbellate; sepals and petals 4–5 in. long, pal-

692. *Bulbophyllum Lobbianum*. (×½)

green, the veins and nerves brown; lip rather fleshy, about ¾ in. long, cordate-ovate, pale green, purple at the base. Java. B.M. 8327. G.C. III. 40:260.—*B. Weddellii*, Reichb. f. Brazil. B.M. 7958. G.C. III. 36:382.

GEORGE V. NASH.

**BULLACE.** A name used in England for half-wild, half-domesticated plums very similar in character to the Damsons. In America there exist no plums for which another name can not be preferred. The bullace, or bullaces (for there are several varieties sometimes

spoken of as bullaces) are usually referred to the botanical name of *Prunus insititia* (e.g., Hedrick, *Plums of New York*, p. 40); but they are also classified with the Damsons, thus taking the botanical name of *Prunus domestica* var. *damascena* (See Bot. Gaz. 27:481.)

F. A. WAUGH.



693. *Acacia cornigera*.

on the under side, so that no water can enter. All the species of true bull-horns have a four-lobed involucre on the peduncle of the flower-spike near the base. The bipinnate leaves have nectar-glands on the rachis and petiole, as in many other acacias, and they are still further provided with peculiar processes on the tips of the leaflets, minute wax-like bodies rich in oil and protoplasm, which Thomas Belt, in his "Naturalist in Nicaragua" (1874), discovered to be used as food by the ants inhabiting the spines, and which in his honor were named Beltian bodies. These apical bodies had long been known, and Linnæus called attention to the nectaries on the leaf-rachis, but Belt was the first to suggest that in return for quarters and subsistence the little ants serve their host as a body-guard of soldiers, and Darwin in his work on the "Effects of Cross- and Self-Fertilization in the Vegetable Kingdom," called attention to Belt's interesting observations and deductions.

Francisco Hernandez, the *protomedico* of Philip II of Spain, sent in 1570 to study the resources of Mexico, figured the peculiar spines and the leaves of one species growing in the Huasteca region of Mexico, in the Tierracaliente, not far from the Gulf coast. This author speaks of the intense pain caused by the stings of the ants and describes their larvæ engendered in the hollow spines. Jacquin, in describing a bull-horn acacia growing near Cartagena (Colombia) in 1763, tells how the little insects rush from the thorns when the tree is struck however lightly, falling upon the unwary intruder and inflicting upon him myriads of burning stings. Long before this (1696) Plukenet had figured the bodies on the apices of the leaflets, and Linnæus himself expressed his wonder as to the function of the extra-floral nectar glands.

In all bull-horn acacias, there are two kinds of leaves with accompanying spines: vegetative leaves in which the stipular spines usually become greatly inflated; and bract-like smaller leaves subtending the flower-

heads or flower-spikes on the axillary raceme-like flowering branchlets, with stipular spines usually small and subulate. The extra-floral glands on the leaf-rachis and petiole are either crater-like and more or less elongated, or round and bead-like, often several in a series at the base of the petiole and sometimes one between each pair of pinne.

The flower-spikes or flower-heads are solitary, geminate, or fascicled in clusters of several in the axils of the small bipinnate leaves on the axillary, raceme-like flowering branchlets. In one species, *Acacia Cookii*, there is apparently no specialized flowering branchlet, but the globose heads are borne in dense clusters in the axils of the large slender-pronged equitant spines. In all true bull-horns the four-toothed involucre is at or near the base of the peduncle. In *A. cochliacantha* the involucre is at the apex of the peduncle, very much as in *A. Farnesiana*. In *A. cornigera*, *A. spadicigera*, and *A. Collinsii*, the spikes are dense, cylindrical and more or less like the spadix of an aroid. In *A. sphærocephala* they are spheroid-ovate or ovate-oblong, with the flowers closely crowded on a fusiform receptacle. In *A. Cookii*, the heads are perfectly globose with the receptacle also globose. In *A. Hindsii*, which Bentham put in a section (*Americana laxifloræ*) apart from *A. spadicigera* and its allies (*Pycnanthæ americana*), the flower-spikes are lax and slender with flowers not very closely crowded.

Between the small flowers are stipitate bracteoles or umbracula which may readily be likened to minute umbrellas with slender handles protecting the flowers before anthesis from moisture and fungus spores. The laminae of these may be ovate-acuminate or hastate and long-pointed, as in *A. cornigera* and *A. spadicigera*; ovate with the margin ciliate, as in *A. sphærocephala*; circular or nearly so, as in *A. Collinsii* and *A. Hindsii*, or very broadly ovate, as in *A. Cookii*.

The flowers themselves consist of a tubular calyx, four- or five-toothed or almost entire, a corolla of four or five lobes, in *A. cornigera* and its allies only slightly longer than the calyx but in *A. Hindsii* about twice as long. They are polygamous; that is, some of the flowers are entirely staminate, others are both staminate and pistillate. The stamens are numerous, with a single pistil in the hermaphrodite flowers rising from the center of the mass; ovary several-ovuled; style filiform, stigma minute, terminal.

In one division, to which *A. cornigera* and its allies belong, the pods are indehiscent, inflated, thin, chartaceous, terminating in a sharp beak (Fig. 693). In another division, to which *A. Hindsii* and *A. Collinsii* belong, the pods are dehiscent (Fig. 696). In *A. Cookii* they are very long and slender and two-valved. In all cases the hard smooth compressed seeds are surrounded by sweetish yellow or orange-colored pulp, somewhat like that found in the pods of the algarroba, or St. John's bread, which causes the fallen pods to be eagerly sought by pigs and other animals. This peculiarity at once distinguishes the bull-horn acacias from *A. arabica*, the type of the genus, which has dehiscent pods devoid of pulp.

Following are the leading species of bull-horn acacias:



695 *Acacia sphærocephala*.



694. *Acacia cornigera*.



A. *Involucels at the base of the peduncle (Basibracteatae, Benth.); pedicelled bracteoles of the fl.-heads peltate. TRUE BULL-HORNS.*

B. *Pods indehiscent thin and fragile, terminating in a sharp, spine-like beak.*

C. *Laminae of pedicelled bracteoles (umbracula) ovate-acuminate or hastate; fl.-spikes dense, cylindrical; inflated spines broadly spreading or incurved, closely resembling the horns of an ox.*

D. *Peduncles of fl.-heads puberulent; laminae of the bracteoles long-acuminate, more or less scabrous above; inflated spines usually brown or chestnut-colored at length.*

A. *cornigera*, Linn. (Arbor cornigera, Hernández). HUITZ-MAMAXALLI. BULL-HORN. CUERNITOS. ARBOL DE LAS HORMIGAS. ANT-TREE. Figs. 693, 694. A shrub or small tree with 1-3 erect sts. and a few lateral branches bearing numerous large inflated spines remarkable for their close resemblance to the horns of an ox or buffalo. The pods are eaten by pigs and other animals. E. Trop. Mex.

DD. *Peduncles of fl.-heads glabrous; laminae of bracteoles short-acuminate not scabrous above; inflated spines usually ivory-white or yellowish.*

A. *nicoyensis*, Schenck. NICOYA BULL-HORN. ESPINO BLANCO. WHITE-SPINED BULL-HORN. A shrub or small tree resembling the former. Occurs in Costa Rica, Guatemala and the adjacent regions of Mex. and Salvador.

CC. *Laminae of pedicelled bracteoles ovate, ciliate, not acuminate; fl.-spikes spheroid-ovate or ovate-oblong; inflated spines not broadly spreading, often V-shaped or U-shaped.*

A. *sphaerocéphala*, Cham. & Schl. BULL-HORN. CUERNITOS DE VERACRUZ. CORNIZUELO. ARBOL DE LAS HORMIGAS. ARBOL HORMIGUERO. Fig. 695. A shrub or small tree resembling A. *cornigera*, from the state of Vera Cruz.

BB. *Pods dehiscent, coriaceous or woody.*

C. *Fls. in globose heads on long thick peduncles clustered in the axils of long fork-like spines; pods very long.*

A. *Coekii*, Safford. BULL-HORN ACACIA OF ALTA VERAPAZ. A small tree or shrub with slender fork-like inflated thorns inhabited by stinging ants. Guatemala.

CC. *Fls. in elongated spikes, borne on special flowering branchlets, in clusters of several, subtended by small bipinnate lvs. with subulate stipular spines or by a pair of spines only: laminae of pedicelled bracteoles circular or nearly so.*

D. *Spikes dense rigid oblong-cylindrical; pods thick and woody, straight or slightly curved, obtuse or shortly acuminate; larger spines swollen at base, usually U-shaped and equitant.*

A. *Cöllinsii*, Safford. A shrub or small tree with inflated U-shaped, olive-greenish or brownish stipular spines curving upward, and sometimes twisted around the branch. S. Mex.

DD. *Spike lax, flexible, linear; pods coriaceous, slender, falcate usually long-acuminate; larger spines very broad and flat, terminating in widely diverging, very sharp points, like an inverted bicorn chapeau.*

A. *Hindsii*, Benth. BROAD-THORN ACACIA. BULL-THORN OF MAZANILLO. BUFFALO HORN. Fig. 696. A small glabrous tree remarkable for its broad flat stipular thorns, which resemble in form an inverted military chapeau. W. coast of Mex.

AA. *Involucel at the apex or above the middle of the slender peduncle; laminae of the bracteoles ovate-ciliate (not peltate); larger spines stout and straight widely diverging. Fls. in globose heads, solitary or geminate, on flowering branchlets, subtended by a small bipinnate lf. with subulate stipular spines or by a pair of small spines only; larger inflated spines at length split longitudinally.*

A. *cochliacantha*, H. & B. (Mimosa campechiana, Miller). SPLIT-THORN ACACIA. SPOON-THORN ACACIA. This species is not a true bull-horn since its peduncles have not a basal involucl and its stipular spines instead of being hollow and subject to the perforations of ants become split longitudinally.

W. E. SAFFORD.

**BUMELIA** (ancient Greek name for an ash-tree). *Sapotaceae*. BUCKTHORN; also IRONWOOD. Woody plants sometimes cultivated in botanical collections, but without particular ornamental qualities.

Small trees or shrubs with milky or gummy sap and very hard wood; branches usually spiny; lvs. alternate, entire, short-petioled; fls. mostly perfect in axillary clusters, long-pedicelled; calyx 5-lobed, persistent;

corolla campanulate, 5-lobed; lobes longer than tube with a small appendage on each side; stamens 5, adnate to the corolla, and 5 petal-like staminodes; ovary 5-celled, pubescent; fr. a 1-seeded drupe.—About 20 species from the southern states to Brazil.

These are evergreen or deciduous small trees or shrubs, usually spiny, with generally obovate to oblong leaves and inconspicuous white flowers on axillary clusters followed by black subglobose to oblong-ovoid drupes. None of the species is of much horticultural value, but as most of them grow naturally on dry, rocky or sandy soil, they may be used sometimes with advantage for planting in similar situations. The hardiest are *B. lanuginosa* and *B. lycioides*, which have proved hardy in sheltered positions at the Arnold Arboretum. Propagation is by seeds.

*lanuginosa*, Pers. CHITTIM WOOD. Tree, sometimes 50 ft.: lvs. oblong-obovate or cuneate-obovate, rounded and often apiculate at the apex, dark green and lustrous above, tomentose beneath, sometimes nearly glabrous at length, 1-2½ in. long; clusters many-fl'd.; pedicels slender, hairy; fr. oblong-ovoid or obovoid, ½ in. long. S.S. 5:247. H.T. 376. Southern states north to S. II<sup>1</sup>, west to Texas.—This is the species most often met with in collections.

*B. angustifolia*, Nutt. Shrub or small tree, to 25 ft.: lvs. persistent, obovate to oblanceolate, glabrous, 1-1½ in. long.; fr. oblong. Fla. S.S. 5:249.—*B. lycioides*, Gaertn. Shrub or small tree, to 25 ft.: lvs. deciduous, elliptic to oblong or oblanceolate, acute, glabrous, 1½-4 in. long; fr. ovoid. Va. to Ill., Fla. and Texas. S.S. 5:248.—*B. tenax*, Willd. Shrub or small tree, to 30 ft.: lvs. obovate to oblanceolate, pubescent beneath, 1-3 in. long; fr. oblong. N. C. to Fla. S.S. 5:246.

ALFRED REHDER.

**BUPHANE** (Greek, *cattle-destroyer*, alluding to poisonous properties). *Amaryllidaceae*. Amaryllis-like bulbs, very little known in this country; culture as for *Brunsvigia*.

The buphanes are large plants, with many red fls. in an umbel with 2 involucl bracts: lvs. appearing late, strap-shaped, thick; perianth tubular; segms. equal and narrow, spreading; stamens 6, exserted, attached on the throat; style thread-like, the stigma small.—Two species in Trop. and S. Afr. The fls. appear before the lvs., being as many as 200 together in a single head-like umbel, on a stout peduncle 1 ft. or less high.

*disticha*, Herb. (*B. toxicaria*, Herb. *Hæmānthus toxicarius*, Thunb. *Brunsvigia toxicaria*, Ker-Gawl). Bulb, 6-9 in. diam., tunicate; lvs. several, distichous, 1-2 ft. long; peduncle or scape stout (6-12 in. high) and solid, compressed, glaucous, bearing a dense umbel. B.M. 1217.—Sparingly offered. Lvs. said to be very poisonous to cattle in S. Afr.; bulb furnishes arrow poison for the natives.

*ciliaris*, Herb. (*Amaryllis ciliaris*, Linn. *Brunsvigia ciliaris*, Ker-Gawl. *Crossyne ciliaris*, Salisb. *Hæmānthus ciliaris*, Linn.). Fewer shorter lvs., and shorter peduncle, bearing 50-100 dull purple fls.; may occur in choice collections. B.R. 1153. L. H. B.

**BUPHTHALMUM** (Greek for *ox-eye*). *Compositæ*. A genus of 7 species of European and W. Asian perennial herbs, sometimes grown in the hardy border. Heads large, with long yellow rays and imbricated involucl bracts: lvs. alternate, entire or dentate; pappus short, often connate into a corona; achenes glabrous. Showy plants of easy cult.

*speciosissimum*, Ard. (*Télékia speciosissima*). Two to 5 ft.: lvs. cordate and clasping, the upper ones oval and acuminate; heads solitary on the ends of the sts., flowering in July and later.

*salicifolium*, Linn. (*B. grandiflorum*, Linn.). Lower lvs. oblong-lanceolate, 3-nerved, somewhat pubescent and slightly serrate; fls. solitary and terminal, large.

*speciosum*, Schreb. (*B. cordifolium*, Waldst. & Kit.). Lvs. very large, cordate, coarse-serrate; fls. very large



696. *Acacia Hindsii*.

and showy, on an upward-thickened peduncle: 3-4 ft., blooming in June and later. J.H. III. 53:187. B.M. 3466 (as *Telekia speciosa*).—The best of all, a bold free and showy perennial growing very close and making good mass-effects.

L. H. B.  
N. TAYLOR.†

**BUPLEÛRUM** (Greek, *ox* and *rib*; of no obvious application). *Umbelliferae*. A genus of 75 species of weedy plants of the Old World, of which one (*B. rotundifolium*, Linn.), is naturalized in the eastern states, and another (*B. falcatum*, Linn.), is cult. in Japan for greens. (A.G. 13:9). Lvs. simple, entire, often perfoliate; fls. umbellate mostly without an involucre except in the species below; calyx-teeth mostly none.

**fruticosum**, Linn. Fig. 697. Shrubby, 3-5 ft.: lvs. oblong, leathery, mucronate, sometimes persistent, usually quite sessile; fls. with a reflexed involucre, the umbels also with a set of bracts, also recurved; fr. oblong. S. Eu.—Suitable for dry, almost sterile, places.

*B. crœcum*, Fenzl. A showy perennial with fls. and involucral bracts bright yellow. Asia Minor.

N. TAYLOR.

**BURBIDGEA** (after F. W. Burbidge, who discovered it in Borneo).

*Zingiberaceae*. Allied to *Hedychium*, but with no lateral perianth segms. and the lip reduced to a small blade. The showy orange-scarlet fls. rival cannas in brilliancy. For cult., see *Alpinia* and *Hedychium*.

**nitida**, Hook. f. Tender herbaceous perennial: height 2-3 ft.: rootstock creeping, matted; sts. tufted, slender; lf.-blades glossy, 4-6 in. long, eared at junction with the sheath: panicle terminal, 4-6 in. long, many-ld.; inner perianth-tube 1-1½ in. long; outer segms. 1½-2 in. long, orange-scarlet, the dorsal one shorter and more roundish than the 2 lateral ones. B.M. 6403. G.C. II. 12:401.

*B. schizochella*, Hort. Dwarfer and more compact in habit than *B. nitida*: Lvs. dull green above, brown-red beneath: fls. orange-yellow. Malaya.

**BURCHÉLLIA** (W. Burchell, botanical traveler). *Rubiaceae*. One species from S. Afr., an evergreen shrub, with opposite short-petioled lvs. and dense terminal clusters of sessile scarlet fls.: corolla tubular, bell-shaped; stamens 5, inserted in the tube; fr. a 2-celled, many-seeded berry. *B. capensis*, R. Br., has been in the American trade, being cult. for its rich, dark foliage and brilliant fls. It is very variable, and has received several names. Three to 10 ft. Prop. by cuttings. Grown under glass. B.M. 2339 (as *B. bubalina*). R.H. 1886:420. J.H. III. 34:81. L.B.C. 7:664. B. R. 466.

**BURDOCK**: *Arctium*.

**BURLINGTONIA**: *Rodriguezia*.

**BURNET** (*Poterium Sanguisorba*, Linn.). A hardy rosaceous perennial, the piquant lvs. of which are sometimes used in flavoring soups and salads. The dried roots are occasionally used as a family remedy. Burnet is little known in this country as a condimental herb. It is worthy a place in the hardy border for the ornamental character of its odd-pinnate lvs. and its little heads of fls. with drooping stamens. The lfts. are very dark green, ovate and notched; sts. 1-2 ft. high, bearing oblong or globular monœcious heads. Of easiest cult., either from seeds or by division of the clumps. Native of Eu.

L. H. B.

**BURNING-BUSH**: *Euonymus*.

**BURRIÉLIA**: *Baeria*.

**BURSÀRIA** (*Bursa*, a pouch, alluding to the shape of the pods). *Pittosporaceae*. Two species of shrubs with white fls. in clusters; sepals, petals and stamens each 5, the petals soon withering; fr. a 2-loculed caps., in shape like that of the shepherd's purse.

**spindosa**, Cav. An elegant spiny shrub or small tree, with drooping branches and pretty white fls., produced in summer: lvs. small, oblong-cuneate, alternate and nearly sessile ½-1 in. long; fls. small, lateral or terminal, mostly terminal in broad pyramidal panicles. Austral. Tasmania. B.M. 1767. Andr. Bot. Rep. 314.—Cult. in S. Calif.

**BURSÈRA** (Joachim Burser, a disciple of Caspar Bauhin). *Burseraceae*. Usually tall trees, with simple or pinnately compound lvs.: fls. small, in clusters, 4-5-parted, with twice as many stamens as petals or sepals, and a 3-parted ovary containing 6 ovules; fr. a 3-parted drupe with usually only 1 seed.—About 40 species of trees in Trop. Amer. For *B. serrata*, see *Protium*.

**Simarûba**, Sarg. (*B. gummifera*, Jacq.). GUMBO-LIMBO or WEST INDIAN BIRCH. Lvs. odd-pinnate with 3-5 pairs of lfts.; lfts. ovate, acute, membranous, smooth on both sides, entire, the netted veins prominent on the under side; fls. staminate and pistillate, appearing before the lvs. or as they unfold, in knotty racemes somewhat resembling those of the choke cherry: fr. a drupe, with a 3-valved succulent rind and 3-5 nuts.—A tall tree with a straight trunk and spreading head, found in Fla., Mex., and Cent. Amer. and the W. Indies. Wood very light, specific gravity when dry 30; useless even for fuel; decays very rapidly. It yields a sweet, aromatic balsam, which is used in Trop. Amer. as a medicine for internal and external application; dried, it is known in the trade as Chibou, or Cachibou resin, or Gomart resin. It is known as a hardy greenhouse plant, and thrives in a compost of loam and peat. Prop. by cuttings under glass, with bottom heat.

G. T. HASTINGS.

**BUSH-FRUIT**. A term used to designate those small-fruits that grow on woody bushes. It includes all small-fruits—as that term is used in America—excepting strawberries and cranberries. Bush-fruits is an English term, but it has been adopted in this country, notably in Card's book on "Bush-Fruits." The common bush-fruits are currants, gooseberries, raspberries, blackberries, and dewberries.

**BUTCHER'S BROOM**: *Sarcococca*.

**BÛTEA** (Earl of Bute). *Leguminosae*. Three or 4 species of trees or woody vines of India and China, with deep scarlet papilionaceous fls. in racemes, and pinnate lvs. In the Old World rarely grown in stoves. In this country 1 is cult. in S. Calif.

**frondosa**, Roxbg. A leafy tree, yielding gum or lac: lfts. 3, roundish, pubescent beneath, the lateral ones



697. *Bupleurum fruticosum*.



unsymmetrical: fls. 2 in. long, orange-crimson, very showy; stamens 9 together and 1 free. E. India and Burma. Rheede Hort. Mal. 6:16, 17.—Reaches a height of 50 ft. Inspissated juice is known as Bengal or Palas kino, or butea gum, which has astringent properties, resembling true kino. Seeds used in India as a vermifuge. The tree yields also stick-lac. The coarse, fibrous material obtained from the inner bark is used for caulking the seams of boats. Dried fls. yield a yellow or orange dye.

**BUTNÈRIA:** *Calycanthus*.

**B Û T O M U S** (Greek, *bous*, ox, and *temno*, to cut; the leaves too sharp for the mouths of cattle). *Eutomaceæ*. Hardy perennial aquatic of easy culture in ponds.

The *Butomaceæ* comprises 3 genera. *Butomus* is allied to *Alisma*, but with several ovules in each carpel; perianth-segms. all prominent and colored; stamens 9; carpels 6, tapering above: lvs. sedge-like. All the species



698. *Butomus umbellatus*. ( $\times \frac{1}{4}$ )

are referred by DC., in Mon. Phan., Vol. III, to *B. umbellatus*, and to the Australian *Butomopsis*, which is also a monotypic genus (by some, however, included in *Tenagocharis*).

**umbellatus**, Linn. **FLOWERING RUSH**. Fig. 698. Rhizome thick: lvs. 2-3 ft. long, iris-like, sheathing at the base, 3-cornered: fls. rose-colored, 25-30 in an umbel, on a long scape; sepals 3; petals 3. Summer. Eu., Asia, in still water. Prop. by division.

**BUTTERCUP:** Species of *Ranunculus*.

**BUTTERFLY WEED:** *Asclepias tuberosa*.

**BUTTERNUT:** *Juglans*.

**BUTTERWORT:** *Pinguicula*.

**BUTTON-BUSH:** *Cephalanthus*.

**BUTTONWOOD:** *Platanus*.

**BÛXUS** (ancient Latin name). *Buxaceæ*. **BOX TREE**. Ornamental small trees or shrubs grown chiefly for their handsome evergreen foliage.

Leaves opposite, short-petioled, penninerved, entire, glabrous or nearly so, coriaceous: fls. monœcious, apetalous, in axillary or terminal clusters, consisting usually of 1 terminal pistillate fl., with usually 6 sepals and with a 3-celled superior ovary with 3 short styles and several lateral staminate fls. with 4 sepals and 4 stamens: fr. an obovate or nearly globular 3-pointed caps, separating into 3 valves, each containing 2 shining black seeds.—About 30 species in the mts. of Cent.

and E. Asia, N. Afr., and S. Eu., also in W. India and Cent. Amer.

These are evergreen shrubs of rather slow growth, with shining, small foliage and inconspicuous flowers and fruits. *Buxus japonica* seems to be the hardiest species, and it has proved quite hardy at the Arnold Arboretum; and *B. microphylla* is of about the same hardiness, while *B. sempervirens* is somewhat tenderer; *B. balearica* and *B. Wallichiana* are still more tender. *B. sempervirens* stands pruning very well, and in the old formal gardens of Europe was formerly much used for hedges, and sometimes trimmed into the most fantastic shapes; the dwarf variety is still often planted for bordering flowerbeds. The very hard and close-grained wood is in great demand for engraving and finer turnery work.

The box tree thrives in almost any well-drained soil, and best in a partially shaded position.

Propagation is by cuttings from mature wood early in fall, kept during the winter in the cool greenhouse or under handlights in the open; in more temperate regions they may be inserted in a shady place in the open air; 4 to 6 inches is the best size for outdoor cuttings. Layers will also make good plants. The dwarf variety is usually propagated by division. In planting borders, it is essential to insert the divided plants deeply and as firmly as possible, and to give plenty of water in the beginning. Seeds are sown soon after maturity, but it requires a long time to raise plants of good size from them.

A. Width of lvs. less than  $\frac{1}{2}$  in.

B. Lvs. oval to oblong-lanceolate, broadest about or below the middle: branchlets usually slightly pubescent.

**sempervirens**, Linn. **COMMON BOX TREE**. Fig. 699. Shrub or small tree, to 25 ft.: branches quadrangular: lvs. oval-oblong or oval, rarely roundish oval or lanceolate, usually obtuse,  $\frac{1}{2}$ -1 $\frac{1}{2}$  in. long, petioles usually pubescent: fls. in axillary clusters; staminate fls. sessile, with a central gland half as long as the calyx. S. Eu., N. Afr., Orient, China. H.W. 3, p. 29. F.E. 18 pl. 81. Gn. 55 p. 62.—Wood much used for engraving. Lvs. employed in medicine. Very variable in size, color and shape of the lvs.; some of the most commonly

cult. forms are the following: Var. **arborëscens**, Linn. Fig. 700. Tall shrub or small tree: lvs. usually oval. The typical form. Var. **argentea**, Loud. (var. **argenteo-marginata**, Hort.). Lvs. irregularly edged with silvery white. Var. **aurea**, Loud. (var. **aurea maculata**, Baill.). Lvs. variegated with yellow or entirely yellow. Var. **marginata**, Loud. (var. **aurea marginata**, Baill. and Hort.). Lvs. edged yellow. Var. **glauca**, Koch (var. **macrophylla glauca**, Hort.). Lvs. oval, glaucous. Var. **rotundifolia**, Baill. (var. **latifolia**, Hort.). Lvs. broadly oval. Var. **Handsworthii**, Koch. Of upright habit, with rather large dark green lvs. Var. **oleaeifolia**, Hort. Of upright habit, with oblong lvs., resembling those of the olive. Var. **elegans**, Hort. (var. **oleaeifolia elegans**, Hort.). A variegated form of the preceding variety. Var. **bullata**, Koch. With large bullate lvs. Var. **angustifolia**, Loud. (var. **longifolia**, Hort., var. **salicifolia**,



699. *Buxus sempervirens*. ( $\times \frac{1}{2}$ )  
The lower spray shows the under surface.

Hort.) Shrubby: lvs. oblong-lanceolate. Var. *myrtifolia*, Loud. Usually low: lvs. small, elliptic-oblong. Var. *rosmarinifolia*, Baill. Low: lvs. small, linear-oblong, revolute at the margin. Var. *suffruticosa*, Linn. (var. *nana*, Hort.). Dwarf: lvs. small, oval or sometimes obovate; flowering clusters usually only terminal.

BB. Lvs. usually obovate, broadest above the middle: branchlets glabrous.

*japonica*, Muell. Arg. (*B. obcordata*, Hort. *B. Fortunei*, Hort.). Shrub, 6 ft., with spreading branches: lvs. cuneate, obovate or roundish obovate, obtuse or emarginate at the apex,  $\frac{1}{2}$ – $1\frac{1}{4}$  in. long, light green with glabrous petioles; clusters axillary; staminate fls. sessile, with a central gland as long as the calyx. China, Japan. S.I.F. 2:38.—Very distinct with its spreading slender branches and light green, lustrous foliage.

*microphylla*, Sieb. & Zucc. (*B. japonica* var. *microphylla*, Muell. Arg.). Dwarf, often prostrate shrub, quite glabrous: lvs. obovate or obovate-lanceolate,  $\frac{1}{4}$ –1 in. long; clusters mostly terminal; staminate fls. sessile, with a central gland like the former. Japan.

AA. Width of lvs.  $\frac{1}{2}$  in. or more.

*baleàrica*, Willd. Shrub, 6–15 ft.: lvs. elliptic or oblong, acute or obtuse at the apex, 1–2 in. long, light green: clusters axillary; staminate fls. pedicelled. S. Spain, Balear.—Handsome shrub, but less hardy than the former.

*B. californica*, Lk. = *Simmondsia californica*.—*B. Fortunei*, Carr. = *B. longifolia*.—*B. Fortunei*, Hort. = *B. japonica*.—*B. Harlandii*, Hance. Branches pubescent: lvs. narrow obovate, emarginate,  $\frac{3}{4}$ – $1\frac{1}{2}$  in. long. China.—*B. longifolia*, Boiss. (*B. Fortunei*, Carr.). Lvs. narrow-elliptic or lanceolate, 1– $1\frac{1}{2}$  in. long. Orient, China.—*B. longifolia*, Hort. = *B. sempervirens* var. *angustifolia*.—*B. Wallichiana*, Baill. Branches pubescent: lvs. linear-elliptic, 1– $2\frac{1}{2}$  in. long. Himalayas.

ALFRED REHDER.

**BYRSÓNIMA** (name refers to use of some species in tanning, in Brazil). *Malpighiaceæ*. Perhaps 100 Trop. American trees and shrubs, frequently climbing, rarely known in cult. Lvs. opposite, thick, simple, entire, the stipules often connate: fls. white, yellow or pink, in terminal simple or branched racemes; sepals and petals 5, the former bearing a pair of glands, the latter clawed and the blades concave; stamens 10, the filaments united at base and bearded: fr. a 3-celled fleshy drupe, with bony seeds, often edible. *B. lucida*, HBK., occurs in Fla. and W. Indies, a much-branched evergreen shrub, with fls. white turning yellowish or rose; apparently not in the trade. *B. crassifolia*, HBK. Mex. and S., is offered in S. Calif. Shrub or small tree: lvs. ovate, tapering each way: fls. yellow in pubescent erect racemes. Said to bear the "nanche," a popular fruit of the Mexicans. This has a sour fermented taste; it is offered for sale in the markets of the west coast Mexican towns, and is eaten raw with salt, or in soups, or in stuffing for meats. The astringent bark, rich in tannin, is used medicinally.



700. *Buxus sempervirens* var. *arborescens*.



# C

**CABBAGE.** The more or less compact leaf-formed head of *Brassica oleracea*; also applied, with designations, to related forms of the same species, as Welsh cabbage, tree cabbage. Closely related plants are the kales (Fig. 706), collards, Brussels sprouts, cauliflower. See *Brassica*.

The Chinese cabbage of this country is a wholly different species from the common cabbages. It does not form a compact and rounded head, but a more or less open and soft mass of leaves, after the manner of Cos lettuce. It is of easy culture, but must be grown in the cool season, for it runs quickly to seed in hot and dry weather.

The culture of the cabbage antedates reliable historical record. Writers of Pliny's time or before refer to variations in growth and character which must have resulted from selections and cultivation for many generations, under conditions very different from those which seem to be the natural habitat of the plant on the comparatively barren chalk cliffs of England, and in similar locations in Europe.

It is indeed hard to realize that the scrawny and somewhat starved-looking plant shown in Fig. 628 (Vol. I) could be the ancestral origin of such corpulent, overfed individuals as are shown in Figs. 701 to 704. Such a change in habit of growth can be accounted for only by the plant's possession of exceptional capacity for using the more abundant food-supply furnished by cultivation for many generations, and the storing of it in a way that makes it available for man's use rather than for the mere perpetuation and multiplication of the parent plants.

*Characteristics of the plant and requisites for best development.*

The cabbage is classed by botanists as a slow-growing bi-annual, and has three distinct periods of life: First, the more or less rapid growth of leaf and plant. Second, a more or less distinct resting period during which the formation of embryonic blossoms is started. Third, the growth and development of the flower and seed. The cultivated cabbages retain very persistently these distinct growing periods, but have added what might be classed as another, that of head-formation, which is in reality simply a distinct division of the first. This additional head-forming period, although essential to the plant's value as a cultivated vegetable,

is not at all necessary for the growth and perpetuation of the plant, which, when it has been held in check by long-continued severe frost or drought, will often revert to the original order of growth and pass directly from the growing to the seeding stages with no attempt at head-formation.

Cultivated cabbage thrives best in a moist and comparatively cool climate, and will not reach its best and rarely a satisfactory or profitable development in a hot dry one, nor where there are likely to be even occasional days of high temperature or hot dry winds. Even if there is abundant moisture in the soil, a few hot dry days, such as corn and tomato plants would delight in, will often not only check but permanently prevent any vigorous or profitable growth. This sensitiveness to over-heat is most pronounced during the second or

unnatural period of growth, and the least so during the first. Young plants will often thrive in temperatures in which it would be quite impossible to induce older ones to form a solid head. Excessive heat is quite as injurious, and often more so, than freezing, but the latter is especially injurious to the younger plants, particularly if they are growing rapidly, the older ones being little injured by frost which would kill rapid-growing seedlings. One notable effect of exposure of young plants to severe or long-continued low temperature is that it takes the place of the resting period, and thus cuts out the second or head-forming period, so that the plant, as soon as established in the field, begins to shoot to seed without forming any head. The degree to which the plant suffers from unfavorable temperature seems to vary not only with different varieties but in different locations. In the Puget Sound country, cabbage plants are often killed by exposure to low temperatures, which those of the same variety and age growing in similar

soil and exposure on Long Island would endure with little apparent injury. In the United States, favorable climatic conditions are most likely to occur in succession during the winter, spring and fall months, as one moves northeast along the Gulf and Atlantic coasts, or in the West along the coast north from Portland, Oregon, and in isolated sections south of that point. Some of the finest cabbages ever produced in America have been grown at points on the Pacific coast as far south as Los Angeles, California. There are also locations,



701. Conical form of cabbage—Jersey Wakefield.



702. Round-headed type of cabbage.



703. Savoy cabbage.



704. A modern cabbage plant in head—Early Flat Dutch.



especially in New York, Ohio, Indiana, Michigan and Wisconsin, near the Great Lakes, or where smaller but deep inland lakes abound, in which cabbage does exceptionally well, but generally, in common with most cruciferous plants, they do better near the sea, in such



705. Section of cabbage head, showing the thickened rachis and leaf-stalks, and the buds in the axils.

locations as the Eastern Shore of Maryland, Long Island and Puget Sound regions, than in the interior or on the borders of even very large bodies of fresh water.

As the plant is a native of the temperate zone, and thrives best in it, and cannot long endure high temperatures, one does not think of it as particularly sun-loving; but there are few garden plants to which abundant sunlight is more essential and shade more detrimental than the cabbage.

In its native habitat, the

plants are found growing alone or in small open groups where they are fully exposed to the sun. Similar conditions are essential to its best development under cultivation so that it can rarely be profitably grown in the shade or in crowded groups or rows, and "shooting to seed" or other failure to form a head is often due to the crowding of the seedlings in the seed-row.

The cabbage is one of the grossest and least fastidious feeders of cultivated plants, and while an abundance of easily accessible food is essential for its profitable culture, it is less particular than most plants as to its proportions and physical condition, if only it has an abundance. Large crops of the best quality are often produced by the use of fresh green and uncomposted manures in almost limitless quantities. Some growers object to the use of manure from hog-pens, yet some of the largest, healthiest and best crops ever seen have been grown by the liberal use of hog manure. Strange as it may seem, abundant fertilization hastens rather than retards the plant reaching marketable condition.

The plant is more particular as to its water-supply than its food-supply, and suffers even more quickly than most vegetables from a lack of sufficient moisture in the air or soil. On the other hand, it cannot long endure an excess, particularly in the soil, and soon succumbs to wet feet. A well-drained soil which at the same time is fairly retentive of moisture is essential to profitable cabbage-culture.

Even more than with most garden vegetables, the physical condition of the soil is a most important factor in determining the development of the cabbage. Large and often very profitable crops may be grown on soils which would be classed as clay, loam, gravel, sand or muck, provided they are rich and friable, but seldom a large, or profitable crop can be grown on even a very fertile soil which after rains quickly hardens and bakes so as to be impervious to air. Permanent friability rather than superior fertility makes some soils exceedingly profitable for cabbage, while it is difficult and often impossible to grow a paying crop on others which are even richer and better watered, but which are liable to cake after every rain. This is especially true of some soils that are generally classed as a very rich clay or muck. Permanent friability is the most essential quality for profitable cabbage-culture, and the want of it the most common cause of failure to grow a profitable crop.

*Varieties of cabbage.* Figs. 701-704, 707.

Few vegetables show a wider range of variation. There are sorts that can be grown to edible maturity

on a square foot and in 90 to 120 days from the seed, while others can hardly be crowded into a square yard or reach prime edible maturity in less than 200 days; sorts so short-stemmed that the flat head seems to rest on the ground, others in which the globular head crowns a stalk 16 to 20 inches long; kinds in which the leaves are long, round, or broad, smooth, or savoyed, light yellowish green, dark green or so dark red as to seem black, with surfaces which are glazed, smooth, or covered with thick bloom. There are many early-maturing kinds, each having characteristics adapting them for different cultural conditions and uses, that will, in fertile soil and a temperature between 60° and 80° by day, and never below 40° at night, form salable heads in 90 to 110 or 120 days from the germination of the seed; others that mature in mid-season; still others that grow the entire season and increase in solidity even while stored for winter.

American seedsmen offer cabbage seed under over 500 more or less distinct varietal names, a large proportion of which stand for different stocks rather than for distinct varietal forms: here only the most distinct types and the most commonly used names are mentioned.

*Early York, Etampes, Large York, etc.*—Very compact, upright-growing smooth-leaved sorts which are comparatively tender to both heat and cold, and form vertically oval comparatively soft heads of excellent quality, but better suited to European than American climatic conditions and market requirements.

*Early Jersey, Large Wakefield, Winnigstadt, etc.*—Compact-growing, very sure-heading sorts which are very hardy to both heat and cold and form comparatively small, but closely wrapped hard sharply conical heads which are of attractive appearance, but not of the best quality. Well suited to the general soil and climatic conditions and very popular in America.

*Enkhuizen Glory, Early Summer, Fottler's Drumhead, etc.*—Second-early sorts, forming small compact to large spreading short-stemmed plants, and nearly round to distinctly flat heads which mature quickly, are of good quality but not well adapted for distant shipment or winter storage.

*Flat Dutch, Drumhead, Ballhead or Hollander, etc.*—Large spreading comparatively slow-growing plants, forming round to oval hard heads, having the leaves very closely wrapped and overlapping in the center. They are generally good keepers, often improving not only in solidity but in quality during storage.

*Savoy.*—A class in which the leaves of both plant and head are crumpled or savoyed instead of smooth as in the preceding. There are varieties of all the forms of smooth-leaved sorts. The plants are hardy, but are slow to form heads, which are likely to be small



706. Curled kale.—*Brassica oleracea* var. *acephala*.

and more or less open or loose-centered, but they are of superior flavor, and this class is worthy of more general cultivation in the home-garden and for local market.

*Red cabbage.*—A class of which there are many varietal forms, and in which the plants and heads vary from purple shaded green to deep red. The heads are generally small, but very solid and are especially suited for use as "cold slaw."

*Portugal Sea-Kale, Tronchuda or Chinese cabbage.*—These are distinct classes and species of cabbage, intermediate in character between the more common sorts and the more distant kales. They have never become generally popular in America, though they are rather largely grown and used by the Asiatics, particularly on the Pacific coast. The sea-kale cabbage is not to be confounded with sea-kale, which is a very different plant.



These are but a few of the almost limitless, more or less distinct variations offered by seedsmen, yet each of them was thought by someone to be superior in some location, under some conditions, or for some purpose. The general recognition of the value of each variation, and the consequent popularity of the sorts in which the variation is best developed, are constantly changing, partly because of local conditions of climate, but more largely because of changes in transportation and market facilities and conditions.

#### *Cultural methods.*

Ideal climatic conditions are found only in very limited areas, and the common cultural practice in each locality is largely shaped by the degree to which local conditions approach them. In the country north of Washington in which a well-lighted and heated greenhouse and experienced help are available, the simplest method, and one by which the very best of early cabbage can be grown, is to plant the seed in flats some sixty to ninety days before danger of killing by frost is past, and as soon as the central bud or leaves appear (which should be in ten to fourteen days) to "prick out" the plants, setting them 2 to 4 inches apart in other flats, according to the relative importance in that particular culture of earliness and cost of production. The house should be given abundant ventilation, and temperatures exceeding 70° or 85° by day and 50° or 60° at night carefully avoided. Often it will be found very advantageous, as soon as the plants are well established, to remove them to well-lighted coldframes. These should be carefully tended in order to give all the air possible, and to avoid over-heating by the sun or falling below 35° at night, and the plants transferred to the open ground as early as this can be done without danger from killing frosts. Some very successful growers plant seed in well-protected coldframes so as to secure a thin, even stand, and by careful attention secure a slow but steady growth through the winter, and the seedlings are first transplanted to the open ground as soon as danger from killing frosts is over. A common practice from Philadelphia or Baltimore southward is to sow the seed in the fall in carefully prepared beds in sheltered locations, and, as soon as the plants are large enough, to transplant them to flat-topped ridges about 30 to 36 inches from center to center and as high as can be formed by two or three back-furrows. These ridges usually are run east to west and the plants are set on the south, the north or the top, or sometimes in the furrow between them, depending upon the judgment of the planter as to which location will give the best result on that particular farm and exposure and in that particular season, as sometimes one and sometimes another location gives the best results. In some sections and often only on certain farms of a section this method gives large very early-maturing and profitable crops, while in different fields, even on the same farm, a large proportion of the plants so handled will be killed by frost or will shoot to seed without heading. In certain locations, notably in the vicinity of Charleston, South Carolina, cabbage-plant farms have been established, from which plants in prime condition for setting in the field can be secured by the million. The location and exposure, and the character of the soil of the most successful of these farms is such that the plants are rarely killed or seriously checked by frost, but make a constant but slow growth all winter and can be pulled at any time so as to retain abundant root and vigor and be safely shipped long distances. The seed is sown and the plant-beds treated much as one would treat a bed of onions for sets or pickles, except that in many cases the rows are as close as 3 inches and the bed receives little or no cultivation after the seed is planted.

Objections that are sometimes well founded to plants from such farms are, that they are slow "taking

hold" and a large proportion of them "shoot to seed" without heading, or the heads are small and of poor quality; but such failures often come from the use by the plant-raiser of cheap and inferior seed, or from the crowded rows and careless handling, or from the farmer sending for and setting the plants too early, or from holding them too long before setting. Some plant-raisers take pains to advertise that they do not guarantee plants shipped by them before December 1 to give satisfactory results (though they often do), but that they are willing to guarantee that plants shipped by them from December 1 to April 1 will, in suitable soil and exposure and with good cultivation, produce full crops of marketable cabbage. Most farmers who use 20,000 to 30,000 plants could grow on their own farms as good plants or better than they could buy from even the best and most reliable growers, and often at materially less cost; but it is



707. Cabbage shapes: Flat; round or ball; egg-shaped; oval; conical.

questionable whether many of them would do so, and it is not surprising that the practice of buying plants, particularly when earliness in market maturity is desirable, is rapidly extending.

The best distance between plants will depend not only upon the variety used but upon the character of the soil, kind of labor available and the condition and way in which the crop is to be marketed. Such small upright-growing sorts as Early York, Etampes, or true Jersey Wakefield, which are to be marketed when still quite soft, can be well grown set as close as 6 or 8 by 18 to 24 inches, requiring 20,000 to 30,000 plants to the acre; but in America such close planting necessitates so much hand labor that it is seldom profitable, and 8 to 12 by 28 to 30 or 36 inches, requiring from 8,000 to 15,000 or 20,000 plants to the acre, is usually found the more profitable distance.

The best method of setting, whether by hand, hand-planters, or machine, will be determined by local conditions. The plants should "take hold" in two to four days and start into vigorous growth in ten days to three weeks, the time depending upon the condition of the plants, and the way they are handled, quite as much as upon the weather. After active growth has commenced, it should continue at a constantly accelerated rate until the head begins to harden, and although toward the last the plants may not seem to increase in size, the heads will gain in weight. The cabbage suffers less than most vegetables from mutilation of the root, yet deep cultivation is undesirable because unnecessary. The essential thing is to prevent any crusting over, and the keeping of the surface in such good tilth as to permit of the free aëration of the soil.

One of the best crops of early cabbage on record was secured from what was regarded as naturally a rather unfavorable soil that was not very heavily fertilized, but received a shallow cultivation with a harrow tooth cultivator every day (except Sundays and on four days when the surface was so wet from rain that it would puddle) after the plants were set until the crop was in market condition.

The time of planting for fall and winter cabbage and the general cultural methods most likely to give good results in any particular location are the same for both seasons, the time of maturity being determined more by the varietal character of the seed than by method of culture. The cultural practice usually followed by neighboring and equally successful growers is often radically different. One planter may always, on some fixed day in May or June, sow seed in flats and as soon as the seedlings are well started pick them out into other flats, and then again into a plant-bed and wait for a favorable day, if necessary until August, before putting them in the field. An equally successful neighboring grower may wait until as late as the last of June and sow thinly in well-prepared seed-beds and transplant from them to the field, while still another may wait for favorable weather even until the last of July and then plant seed in place as is the usual practice of some most successful growers. In New England, growers often drill the seed in place, and when the plants are well established chop out the superfluous ones.



708. An outdoor method of storing cabbage.

The weight or quantity of seed used for a given area varies greatly, as the size of the individual seeds vary, not only with different varieties but with different lots of the same sort. Some growers expect to get plants enough for an acre from less than an ounce, while others require two to five times as much, and those who sow in place often will use four to eight ounces to the acre. Superlative crops have been known to be grown by radically different methods, and very often successful growers have some peculiarity of practice which they deem essential to the best results, but which a neighboring and equally successful grower regards as a foolish waste of labor; but, however the practice of successful growers may differ, there are some points in which they all agree. Among these are, the use of the best obtainable seed of some particular variety which they have found by experience, or which they believe is best adapted to their conditions and is uniform in time of maturity, so that all the heads are in prime condition and may be gathered at the same time, which is an important factor in determining cost of production, while uniformity in shape, form and color are equally important in determining salability. The quality of the seed used, while not the only factor, is generally the most important one in determining the uniformity of product of any particular culture. Unchecked and constantly accelerated rate of growth are most important factors in securing the best possible development of any particular culture. Every check, whether it come from overcrowding of the seedlings, careless transplanting, or the caking and want of friability in the surface soil, tends to divert the energy of the plant from the unnatural and excessive leaf-formation upon which

its value as a cultivated vegetable depends to the more natural but less useful formation of blossoms and seed. Just how on any particular farm the most favorable conditions can be secured cannot be told in general cultural directions, but must be decided by the grower from his knowledge of the character and wants of the plant, the condition of the soil, and last, but by no means least, his facilities for controlling the conditions upon which the growth of the crop depends.

#### Harvesting.

This is the simplest and easiest part of cabbage-growing. With an easily acquired dexterity, each head in five or six rows can be cut, trimmed and tossed into a central windrow by a single well-directed stroke of a well-sharpened spade or heavy hoe. Occasionally, because of some unnatural growth of the plant, or want of attention, a head will need retrimming, but by the exercise of a little care, practically all of them can be kept in marketable shape. From the windrows, the heads are gathered and loaded loose into cars, delivered to factories or placed in storage. Yields secured vary greatly, being influenced by the sort, the quality of the seed, the character of the soil, loss from insects and disease; they generally range from five to twenty tons to the acre. The crop is usually readily salable in the fall, delivered at factory or on board cars at prices ranging from \$4, or even less, to \$10 to \$20 a ton.

#### Marketing.

*Cabbage greens.*—In some sections, notably southern Mississippi and Louisiana, considerable acreage is grown and marketed as cabbage greens. The seed is sown in place or the plants are set quite close in the row, and as soon as they have commenced active

growth and long before they have formed a distinct head, they are cut and marketed much in the same manner as spinach or kale, but this method of culture and use is very limited.

*Early cabbage* is generally considered marketable as soon as the leaves have closed into a head, even if this is still so soft and loose that it would be quite unmarketable later in the season. If cabbages are cut when soft and immature, they soon wilt and lose all crispness and palatability; to avoid this, the earlier shipments are made in small open crates containing less than a score of heads, or sometimes in larger closed ones carrying ice, and often in refrigerator cars. Later in the season, as the heads become larger and harder, they are shipped in slat crates about 12 by 18 by 38 inches, or in ventilated burlap-covered barrels holding about two and three-fourths bushels.

*Fall and winter cabbages* are usually sold by the ton, of much more closely trimmed heads than are considered marketable earlier in the season, and are commonly shipped in open and well-ventilated cars without special container or packing, except as may be necessary to protect from hard freezing. Many acres are grown on contracts with shippers, packers of sauerkraut, and the like, who contract for the delivery direct from the field to factory or on board cars, of the usable product of a certain acreage at an agreed price per ton. While this is sometimes a very satisfactory arrangement, many careless and incompetent growers are induced to contract, and their neglected crops become infected with disease and insects which spread to the fields of even the most careful growers, and the crop in the vicinity of such factories and shipping-points soon becomes unprofitable.



*Storing.*

Formerly the most common practice was to let the plants stand until danger of hard freezing, then pulling, allowing the roots to retain what earth they would, but breaking off some of the most spreading leaves and crowding the plants together (with heads all up or all



709. Cabbage in winter storage in cabbage-house.

down and at a uniform height), with earth packed between them, in long shallow trenches that were gradually covered with sufficient coarse straw or litter to protect from severe freezing. A variation of this method is to pull, leaving what roots and earth adheres, and set as closely and level as possible in a shallow cellar not over 3 feet deep, which after filling is covered with a roof of boards, tarred paper and litter sufficient to keep out rain and frost, and high enough in the center to allow of handling the cabbage. It is essential to success with either trench or cellar that they be located where there is the least possible danger from standing water, rats and other vermin, and as well protected as possible from severe winds and cold. Advantages of this method are that heads quite too soft to be salable become hard and firm, and that cabbages so stored retain to a remarkable degree their crispness and flavor, and are thought by some to be even better than when fresh from the field; but when taken from the trench or cellar, they soon lose their crispness and will not stand shipment so well as heads which were trimmed before storing. A very common method is to cut and partially trim the heads and place in piles 4 to 6 feet high and broad, and of convenient length, built over a board-covered trench which is ventilated by open ends and tiles up through the cabbage, the piles being gradually covered and the openings closed so as to prevent hard freezing (Fig. 708).

In certain sections a large proportion of the cabbages grown for late winter and early spring market are trimmed and stored in bins or on shelves in frostproof storehouses (Fig. 709).

*Diseases.*

*Clubroot* (*P.asmodiophora brassicae*).—A soil parasite affecting cabbage and other cruciferous plants. It thrives best in acid soils and in some cases can be checked by a liberal use of lime, but its presence in any field in destructive abundance is seldom suspected until too late to save the crop. Planting cabbage or other cruciferous crops on such a field should not be repeated for several years, during which it should have continued dressings of lime and ashes. Care should be taken to secure uncontaminated soil for seed-beds, and to destroy all affected plants before cattle have access to them, as the disease may be carried by such refuse in the manure from cattle who have eaten it.

*Wilt or Yellowing, Black-rot, Stem-rot, Fusarium, Phoma*.—Infectious diseases which sometimes become so abundant in certain sections as to prevent the profitable culture of cabbage. They are all distributed by means of contaminated seed, by manure from cattle fed on diseased refuse, by soil carried on tools from affected fields; distribution in this way should be carefully avoided. All diseased plants should be destroyed by fire as soon as noticed. The soil used in the seed-beds should be sterilized by live steam or

soaked in a weak solution of formaldehyde (one part to 260 of water). The seed should be soaked fifteen minutes in the weak solution of formaldehyde, then rinsed in clear water and immediately planted.

*Animal pests.*

*Flea beetles*.—The securing of vigorous plants is sometimes prevented by the attacks of innumerable flea beetles, *Phyllotreta vittata*. This may be prevented by surrounding the beds with frames made of 10- to 12-inch boards connected across the top with 2-inch strips and then covered with 20- to 40-thread to the inch cheesecloth. This should be put on as soon as the seed is planted and be removed, in order to harden the plants, four to six days before they go to the field.

*Cut-worms*.—These are best guarded against by keeping the field perfectly clear of all vegetation for six to ten days before setting, then mix four quarts of bran meal or flour, one cup of molasses or sugar, and two tablespoonfuls of paris green, with water enough to make about the consistency of milk, and sprinkle on twenty to fifty times its bulk of fresh-cut grass and scatter over the field the night before setting the plants.

*Cabbage worm*.—Keep careful watch of the plants and if the green worms appear in abundance and seem to reach full size, sprinkle or spray the plants with kerosene and whale-oil soap emulsion, or paris green and water in the proportion of four gallons of emulsion and one pound of paris green to fifty gallons of water. After the heads are two-thirds grown, powdered hellebore, one ounce to two gallons of water, should be substituted for the poisonous paris green mixture.

*Root-knot* (*Necrotodes*).—Although seldom very destructive north of Philadelphia, this is often the unsuspected cause of failure in the South, particularly of fall crops in light lands. The only practical remedy is the avoidance of affected fields or sterilizing the soil by freezing or live steam.

*Seed-breeding and -growing.* Figs. 710, 711.

It is only through careful study of the practical value and correlation of varietal differences, the exercise of great care in selection and growing of the plants, and in the saving of the seed, that this or any vegetable can be improved or even its present good qualities maintained. Under favorable conditions the plant is capable of producing abundant seed, a single plant having been known to yield thirty-five ounces, enough to plant 25 to 40 acres, but such yields are very exceptional, and one-half to four ounces a plant is much more common. Although botanically the plant is self-fertile, when isolated it seldom yields much and often no viable seed. It transmits very persistently through many generations any distinct variation, but often without expression, although such hitherto unexpressed variations are apt to appear in the seed of self-fertilized plants, so that such seed is frequently less uniform than that from a field of plants of the same ancestry. At least one of our popular varieties is made up of the descendants of a single isolated plant, but it is a curious fact that in the second and subsequent generations 90 per cent of the plants, although quite uniform, were very different in character from that of the selected individual from which they were descended. The originator of one of our best varieties maintains that it is essential to the production of the best seed of that sort that seed-plants of very different types should be set together, and by crossing they will produce seed giving plants of the desired type. In spite of these facts, it is thought that the practice which will give the best results with other plants is equally desirable for the cabbage, and that first a distinct and well-defined conception of the varietal form desired must be formed and the stock started from the plant or plants whose seed most uniformly developed into plants of the desired



710. Wild cabbage plant in seed. Chalk-cliffs of England.

character, rather than from those in which it was exceptionally well developed. Often even professional seed-growers have but a very vague and constantly changing conception of what a given variety should be.

The greatest profit is not from the field that produces even a good many of the most perfect specimens, but from that in which the largest proportion of the plants are most uniformly of the desired character. In order to produce seed which will give such results, one must first form a very clear conception of just what one wants in plant and head, and learn the relation between easily noted but economically unimportant qualities, and others not so easily seen but more important in determining value. Having selected a number of ideal plants, one should grow these either singly, or in groups of three or four that are nearest alike. Save and number the seed of each plant separately and plant a small sample of each number, carefully noting the numbers in which the product was most uniformly of the desired character. From the



711. Cultivated cabbage in seed.

reserved seed of the numbers which most uniformly developed the desired form, one can start a stock for field planting. It is not safe, however, to rest there; one must start a new selection of the desired character so as to continually renew one's stock. In raising seed, plant-

ings should be made a little later than one would for fall market cabbage. As the plants develop, each lot should be repeatedly looked over and not only those which show no disposition to form a head, or one in which the inclosing leaves do not pass over the center, but also those which show any departure (even if it be of itself a desirable one) from the desired form, should be removed. The plants should be left in place until there is danger of the ground being closed by frost and should then be pulled, a few of the larger leaves removed and then packed into narrow trenches in sheltered and well-drained localities, taking pains to pack the earth closely about the roots and stems. Gradually, as necessary to prevent hard freezing, they should be covered with earth and with coarse litter, the aim being to keep them as cold as possible without actually freezing, and to prevent them starting into growth. As early in the spring as possible, they should be set for seeding, giving each plant about twice the space needed for market cabbage. In setting, the plants, should be more or less inclined, so that while the top of the head is but little above the surface, the roots are not buried in hard and cold subsoil. As they are set, the heads should be scarred across the top, not deep enough to injure the sprouting center, but so as to facilitate its pushing its way through the head. The seedstalks should not be cut until they begin to shed the seed, which turns black and seems ripe before it is fully mature.

The entire plant should be cut and stored until quite dry, when the seed can be easily threshed, cleaned, and spread not over  $\frac{1}{2}$  inch deep in full sunlight for a few days and then stored.

*Commercial seed-growing.*—Although one occasion-

ally sees heavily seeded plants in all parts of the United States, cabbage seed rarely proves a profitable crop, except in very limited areas along Long Island Sound, the eastern shores of New Jersey, Maryland and Virginia, and in the Puget Sound region, where the yield commonly secured varies from 300 to 700 pounds to the acre, although exceptional crops sometimes reach 1,500 to 2,000 pounds. The common method of growing does not vary materially from that described, except that very often too little care is exercised in securing stock seed, and it is sowed or the plants set so late that they fail to develop sufficiently to enable one to do very effective roguing out of inferior stock. In Holland, seed is often raised from much better matured heads than are commonly used in America and which are cut from the root, but leaving more stem than for market use, and planted so that the top is level with or slightly below the surface. Treated in this way, they root like a great cutting and form loose, well-branched plants which are not so liable to injury from wind, and are said to yield more seed than would be produced if the entire plant was used. It is possible that this method might give good results in the Puget Sound region, but it would not in the East.

W. W. TRACY.

**CABÓMBA** (aboriginal name). *Nymphaëaceæ*. FAN-WORT. Submersed aquatics of the western hemisphere, used in ponds and aquaria.

Flowers small; sepals and petals 3, persistent; stamens 3-6; carpels 3-18, separate: submerged lvs. finely dissected, mostly opposite.—Six species.

*caroliniana*, Gray (*C. aquatica*, DC., not Aubl. *C. viridifolia*, Hort.). WASHINGTON PLANT. FISH-GRASS. Floating lvs. green, oblong-linear: fls. axillary,  $\frac{1}{2}$  in. broad, white, with 2 yellow spots at base of each petal; stamens 6. Ponds and slow streams, S. Ill. to N. C., Fla. and Texas. A.G. 15:157.—Hardy as far north as Phila. if not frozen. The commonest plant for fish-globes and aquaria; roots easily in earth, grows well, is dense and bushy, and a good oxygenator; prefers water free from lime. Prop. by cuttings set in earth in 1-2 ft. of water at 55-70° F. Commonly sold for aquaria in bunches of 6-12 shoots 8 in. long, wrapped with lead at base; without earth the bunch lasts 4-8 weeks, when it drops most of its lvs. and must be replaced. Var. *rosafolia*, Hort., is a form with reddish lvs., less durable, and more difficult to prop. A. G. 15:157. Var. *pulcherrima*, Harper, has stp. reddish purple, lvs. darker with narrower segms. and petals bright purple. Ga. The true *C. aquatica*, Aubl., of Trop. Amer., with yellow fls. and nearly orbicular floating lvs., is shown in B.M. 7090.

H. S. CONARD.

**CACÀLIA** (ancient Greek name). *Compositæ*. Perennial herbs of wide distribution, some of which are planted in the open for ornament.

Flowers paniculate or corymbose, the florets all hermaphrodite, with white, flesh-colored, or orange, exclusively tubular corollas, each of the 5 lobes with a midnerve: achenes glabrous: lvs. petioled, alternate. The genus is by some considered as a section of *Senecio*, differing in never having ray-fls.—Species about 40, about one-fourth Asian and the remainder mostly American. They need protection in the North.

*lutea*, Mill. A slender rather attractive perennial, with alternate, widely separated lvs. half clasping the st.: fls. orange-yellow, in heads about  $\frac{1}{2}$  in. diam., corymbose. St. Helena; perhaps not a true cacalia.

*C. aurea* and *C. lutea* of gardens may be *Emilia*.—*C. coccinea*, Sims=Emilia.

N. TAYLOR.†

**CACALIOPSIS** (*Cacalia*-like). *Compositæ*. Perennial, for garden planting.

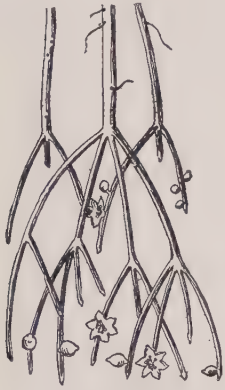
Heads discoid, very many-fld. of perfect yellow florets; corolla rather deeply 5-cleft, the lobes lanceolate: lvs. palmate.—One species, little known in cult.



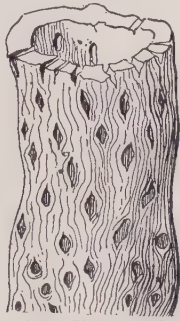
**Nardósmia**, Gray. Stout, 1-2 ft. high, loose, woolly, but becoming nearly glabrous: lvs. nearly all radical, not unlike those of *Petasites palmata*, long-stalked, 5-9-cleft or very rarely parted, the lobes dentate or cut: heads an inch high, in a loose cluster at the summit of the nearly naked st., fragrant. Pine woods, Calif. to Wash.—Intro. by Gillett in 1881 as a border plant.

**CACAO, COCOA:** *Theobroma*.

**CACTUS, CACTI.** The plants correctly designated by this name constitute the family *Cactaceæ*. Scarcely any group in the whole vegetable kingdom is more remarkable for its strange and varied forms, the beauty of its flowers, and wonderful adaptation to desert life. It is not, however, confined to desert regions; for in the moist forests of the tropics of the New World it is represented by a number of interesting forms often epiphytal or scrambling in their habit of growth, with beautiful flowers and sometimes with delicious edible fruit.



712. Tips of *Rhipsalis cassytha*.



713. Skeleton of *Opuntia* stem.



714. *Pereskia aculeata*.

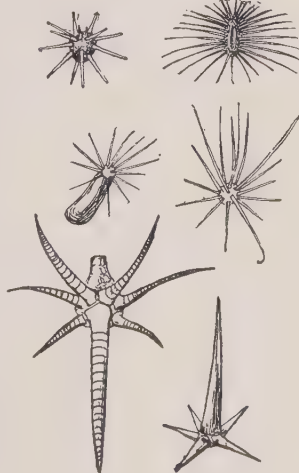


715. *Opuntia* joint with leaves.

The *Cactaceæ* are confined to America, the only apparent exception being the genus *Rhipsalis*, composed of plants with the habits of the mistletoe, growing on the trunks and branches of trees, and bearing small pellucid glutinous berries (Fig. 712). This genus, endemic in tropical America, has found its way to Africa, the island of Mauritius and even to Ceylon; and several opuntias, or prickly pears, occur on the shores of the Mediterranean, in South Africa, and Australia, where they have made themselves so thoroughly at home as to be regarded by many writers as indigenous. The *Cactaceæ* are not confined to tropical or even semi-tropical regions. At least two species of *Opuntia* extend northward into British Columbia, and species of *Echinocereus*, *Echinocactus*, and *Mamillaria* are found in the state of Colorado. The xerophytic forms flourish especially in the southwestern United States, the Mexican plateau, the peninsula of Lower California, where there are great cactus forests, and the vicinity of Tehuacan, in the southern part of the Mexican state of Puebla, a region celebrated for its remarkable and gigantic tree-like forms related to the genus *Cereus*. For an account of the vegetation of the deserts of the southwestern states and of Mexico, the reader is referred to Frederick V. Coville's "Botany of the Death Valley Expedition," published as Vol. IV of the "Contributions from the United States National Herbarium, 1893," Coville and MacDougal's "Desert Botanical Laboratory of the Carnegie Institution—1903"; and to D. T. MacDougal's

tion as low as possible. They have a more or less pronounced woody axis surrounded by pulpy cellular tissue (parenchyma) in which the water-supply is stored. The stomata are usually situated in depressions or grooves in the leathery cuticle; and as an additional means for checking transpiration, the cell-sap is nearly always mucilaginous, while in some forms latex cells are present, filled with milky or gummy fluid which hardens on exposure to the air and effectively heals wounds in the soft fleshy plant. Certain species of *Echinocactus* (viznagas) are like great barrels studded with spines and filled with pulp of the consistency of watermelon rind,

which is sometimes made into conserves like citron (dulces de viznaga). Other forms, like species of *Pereskia*, *Pereskioopsis*, and arboreal opuntias have hard, woody stems and branches. The reticulated skeletons of certain species of opuntia (Fig. 713) are manufactured into walking-sticks, legs of furniture, napkin rings, and even into veneering for woodwork. In Lower California and some parts of South America, where other vegetation is lacking, the stems of columnar cerei, or "cardones," are used for constructing habitations, inclosures, and for timbering mines. Columnar cacti are also planted for living fences, or hedges, especially the "organ cactus" (*Mytillocactus geometrizans*) of tropical Mexico. Leaves are present in nearly all cacti, but in some species they are mere vestiges and can scarcely be seen with the naked eye. In other species they are large and perfectly developed, either with distinct petiole and feather



716. Cactus spines.



717. *Opuntia leptocaulis*, showing sheathed spines.

the genera *Opuntia* and *Pereskopsis*, the areoles also bear minute short barbed which will penetrate the skin and become detached at the slightest contact and are the source of annoying irritation which often persists for many hours.

The spines (Fig. 716) are not connected with the axis of the stem or branches, but emerge from the areoles. In some forms they are simple and straight, bristle-like, awl-shaped, or short and conical. In others they are bent like fishhooks or are curved and horn-like, with transverse ribs. Sometimes they are minutely downy or hairy and sometimes even plumose or feathery. They may be either naked or enveloped in a membranous barbed sheath (Fig. 717). They may be grouped in star-like clusters, with straight or curved rays spreading from a common center, or in comb-like fascicles, with the radial spines arranged in two rows on each side of a longitudinal axis (pectinate). In addition to the radial spines, there are usually erect central spines either straight and rigid, or more or less curved. One of the most striking forms is that of the organ cactus, *Myrtillocactus geometrizans*, in which the stout erect central spine resembles the blade of a dagger and the radials a guard for the hilt. In contrast with this may be mentioned the spines of *Pelecyphora aselliformis*, which resemble miniature sow-bugs, or aselli (Fig. 718).

The flowers in most cases issue from the upper portion of the areoles, but in certain mamillarias and allied

forms they come forth from between the tubercles or from their base at the end of a dorsal groove. Usually the flowers are solitary and sessile, but in the genus *Pereskia* (Fig. 714) they are peduncled and often clustered. They may be tinted with rose-color, crimson, purple, yellow or orange, or rarely with copper-color or scarlet, but they are never blue. Often they are pure white at first, gradually becoming suffused with rose-color in age. In a few species they are inconspicuous, as in the epiphytal *Rhipsalis* (Fig. 712). Some are diurnal, others nocturnal; some open at sunrise and close at night or when the sky becomes clouded; others open at a certain hour and close at another fixed hour of the day or night; some last for only a few hours, others for a day, and some persist for several days. Some, like the "night-blooming cereus" are delightfully fragrant, while others are ill-smelling or have no perceptible odor.

The perianth is not divided sharply into calyx and corolla, although the outer floral leaves are usually sepal-like and the inner ones are true petals. In one great division of the family including *Opuntia*, which has been named *Rotatifloræ*, the perianth is more or less wheel-shaped or widely spreading (Fig. 719); in the other division, *Tubulifloræ*, to which *Cereus* belongs, the floral leaves form a tube, often

remarkably long and slender, and crowned with a spreading limb. The floral leaves are not arranged in definite series but somewhat like those of a water-lily, the scale-like lower or outer leaves gradually becoming broad and petaloid as they approach the center (Fig. 720). In all cases the perianth crowns the ovary, and sometimes persists after withering on the apex of the fruit (Fig. 721). The stamens are very numerous and are inserted on the petals or perianth-tube (Fig. 722). The single style is longer and stouter than the slender filaments, and usually terminates into a radially divided stigma (Fig. 723). Sometimes the stigma is conspicuously colored and issues star-like from the center of the



720. *Leuchtenbergia principis*, showing transformation from scales to petals.



718. Extreme condensation of the plant body.—*Pelecyphora aselliformis*. (Nat. Size.)



719. *Opuntia* flower.



721. *Cephalocereus* fruit.

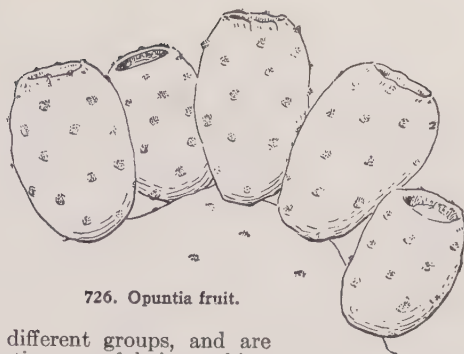




722. *Echinocactus* flower, showing insertion of stamens.



723. *Opuntia* flower, showing styles and ovary.



726. *Opuntia* fruit.

mass of stamens, as in the genus *Echinocereus*, in which the emerald-green star contrasts prettily with the golden-yellow or orange-colored stamens, rising from a rosette of rose-purple petals (Fig. 724). The ovary (Fig. 723), although formed of several carpels, is 1-celled. The placentæ are parietal, bearing an indefinite number of ovules, the stalks of which (funiculi) become fleshy as the seeds develop and form a sugary pulp around the seeds.

The fruits of the Cactaceæ are variable in form. That of the leafy *Pereskia* is apple-shaped and bears a number of leaf-like bracts on the skin (Fig. 725), on which account the fruit of *P. aculeata* is called blad-appel, or leaf-apple, in the Dutch colonies, while in the British West Indies it is known as Barbados gooseberry and is made into tarts and sauces like real gooseberries. In some of the pereskiopses, the fruit is elongated and shaped like a prickly pear, with watery rind and seeds covered with cottony hairs. In *Opuntia* and *Nopalea* the fruit is commonly called prickly pear, or tuna (by the ancient Aztecs, *nochtli*). These fruits bear small fleshy leaves at first, like the flattened pads of the plants, and when the leaves fall off the areoles persist armed with the irritating sharp-barbed glochidia described above (Figs. 717 and 726).

Many species allied to the genus *Cereus* bear edible fruits, usually called pitahayas. Those of the tall columnar cardones (*Lemaireocereus*) are covered with easily detachable tufts of wool and spines but never bear glochidia. Those of *Cephalocereus* (Fig. 721) are spineless. The triangular climbing forms which are often trained over garden walls in tropical countries, sometimes bear enormous juicy fruits of fine flavor (Fig. 727). Those of *Echinocactus* (Fig. 728) are more or less scaly. The fruits of certain species of *Echinocereus*, called *alicoches* by the Mexicans, are known to Americans as strawberry cacti, on account of the fine flavor of their juicy pulp. Those of *Echinocactus longihamatus* are known in northern Mexican markets as *limas de viznaga*, or cactus limes, on account of their acid taste; and the small smooth crimson fruits of many *mamillarias* are called *chilitos*, on account of their resemblance to small chili peppers. Very much like them are the fruits of melon cacti (Fig. 729) which issue from the dense crown of bristles like scarlet radishes or fire-crackers tipped with a fuse.

The seeds of the Cactaceæ vary considerably in

the different groups, and are sometimes useful in making generic determinations.

Thus the woolly seeds of *Pereskopsis* are sharply distinct from the black glossy seeds of the genus *Pereskia*, with which the first-named genus was at one time confused. In *Opuntia* and *Nopalea* they are flat, hard and bony, somewhat ear-shaped in the flat-jointed opuntias (Figs. 730, 733,) and usually discoid and marginless in cylindrical opuntias (Figs. 730, 735). In *Cereus* they are glossy black, with the testa either quite smooth or minutely pitted (Figs. 730, 732); in *Echinocereus* they are covered with minute tubercles or granules (Figs. 730, 734). In *Echinocactus*, which is not a very homogeneous group, the seeds are pitted in some species and tuberculate in others. In one section of *Mamillaria* (*Eumamillaria*) they are glossy and marked with sunken rounded pits (Figs. 730, 731), while in another section, which should probably be made a distinct genus (*Coryphantha*) they are frequently smooth. In the closely allied *Ariocarpus* they are relatively large and tuberculate. In the genus *Pelecypora*, they are sometimes kidney-shaped, as in *P. aselliformis*, and sometimes of a peculiar boat-like form with a very large umbilicus, as in *P. pectinata*. In the epiphytal *Rhipsalis cassytha* they are kidney-shaped and finely granular.

The seeds of many of the species of *Pachycereus* ("cardones") are used by the Indians of Lower California and Mexico for food. In southern Puebla the fruit of *Pachycereus columnar-trajani*, called *tetezo* figs (higos de tetetzo) are a regular food staple, offered for sale in the markets of Tehuacan during the month of May.

Other cactus fruits of great economic importance are those of the giant *Cereus* of our arid southwestern region, *Carnegiea gigantea*, locally known as *pitahayas de sahuara*, first brought to notice in the year 1540 by the members of Coronado's expedition. They are not spiny like the fruits of *Pachycereus* and they burst open when quite ripe. The fruit of *Lemaireocereus Thurberi*, known as *pitahaya dulce*, although much sweeter, bears clusters of stout spines issuing from tufts



724. *Echinocereus* flower, showing radiate stigma.



725. *Pereskia* fruit.



727. Fruit of *Hylocereus*.

of wool. Closely allied to it is *Lemaireocereus griseus* of central and southern Mexico, which yields much nutritious fruit. The fruit of the organ cactus, *Mytillocactus geometrizans*, sold in the markets as garambullas, either fresh or dried, must also be mentioned as of economic importance.

Of medicinal importance is the narcotic peyote or "mezcal button"



728. Fruit of *Echinocactus*.



729. Melon cactus bearing fruits.

(*Lophophora Williamsii*), used as an intoxicant and febrifuge by certain tribes of Indians, and regarded by some of them with superstitious reverence. This little plant was regarded by some of the early Spanish writers as a fungus and was used by the Mexican Indians to produce marvelous visions.

For an account of the methods of propagation and culture of cacti and their application to ornamental gardening the reader is referred to a paper by Charles Henry Thompson, on "Ornamental Cacti: Their Culture and Decorative Value," issued by the United States Department of Agriculture as Bulletin No. 262 of the Bureau of Plant Industry, December 17, 1912. See also *Succulents*, vol. VI.

W. E. SAFFORD.

**CÁCTUS** (shortened from *Melocactus* by Linnæus). *Cactaceæ*. A single small species, sometimes grown in under-glass collections and in open succulent gardens South.

Stems globose or ovoid, with vertical ribs, crowned at maturity with a "cephalum"—a prolongation of the axis densely covered with small tubercles imbedded in wool and bearing in their axils small fls. and berries. The plant has the appearance of an *Echinocactus*, but the fls. and berries resemble those of *Mamillaria*.

**Melocactus**, Linn. (*Melocactus communis*, Link & Otto). Fig. 731. Ribs 10-20, acute; areoles nearly 1 in. apart; radial spines 8-11, straight or curved, subulate; centrals 1-4; cephalum at first low, hemispherical, becoming cylindrical in time, reaching a height of 8 in.; the dense wool of the cephalum is pierced by many red or brown bristles; fls. red, slender; fr.  $\frac{2}{3}$  in. long, crowned by the persistent remains of the fl., red. W. Indies; called there "Turk's head." B.M. 3090. J. N. ROSE.

**CADÁLVENA:** *Kaempferia*.

**CÁDIA** (Arabic name, *Kadi*). *Leguminosæ*, tribe *Sophorææ*. Small evergreen shrubs of Arabia and Africa, remarkable for their regular mallow-like flowers.

Leaves pinnate; fl. axillary, mostly solitary, drooping; stamens 10, free, shorter than the petals; pod linear, acuminate, flattened, leathery.—Four species.

Can be grown outdoors in Calif. or S. Fla.; in the N. in the temperate house. Prop. by seeds and cuttings.

**purpurea**, Forsk. (*C. varia*, L'Her.). A small shrub, the branches woody; lfts. 20-40 pairs, very narrow, almost sessile; fls. bell-shaped, pedunculate, rose-red, the corolla about 1-1½ in. long and very veiny, not spiny. Arabia.

*C. Ellisiana*, Baker, has few large lfts. and rose-colored fls. Madagascar. B.M. 6685.—*C. pubescens*, Bojer. Lfts. 8-10 pairs, broad-oblong. Madagascar.

N. TAYLOR.†

**CÆSALPÍNIA** (Andreas Cæsalpinus, 1519-1603, Italian botanist). *Leguminosæ*. **BRASILETTO**. Including *Guilandina*, and *Poinciana* in part. Ornamental tropical or subtropical trees or shrubs chiefly grown for their showy flowers and also for their attractive finely divided foliage; some species yield tanning materials and dye-stuff.

Calyx with short tube and 5 imbricated lobes, the lowest concave and larger; petals 5, clawed, usually orbicular or obovate and nearly equal; stamens 10, curved; ovary sessile with few ovules and a slender elongated style; pod ovate to lanceolate, usually compressed, often indehiscent.—About 30 species in tropical and semi-tropical regions. The genus belongs to the subfamily Cæsalpinioidæ, in which the fls. are not papilionaceous, and is allied to *Gleditsia*.

Cæsalpinias are armed or unarmed trees or shrubs, rarely climbers, with finely divided bipinnate leaves and conspicuous yellow or sometimes partly red flowers in racemes, often forming terminal panicles. Many species are very showy in flower and are favorites in tropical and subtropical countries; in this country they can be grown only in Florida and southern California except *C. japonica*, which is the hardiest species and will probably stand the winter in sheltered locations as far north as Washington, D. C. They are also grown sometimes in warm glasshouses.

Propagation is readily effected by seeds, which should be well soaked in warm water for some hours before sowing. A sandy soil should be chosen for the seed-bed, and lightly shaded. After the plants show the first true leaf, they should be potted off into small pots of ordinary garden soil, not too rich, made light by the addition of sand, if of a clayey nature. The plants grow very rapidly, and must be shifted into larger pots as their size requires for greenhouse culture, but in tropical climates may be transplanted into permanent positions outdoors after they reach a fair size in pots. The dwarf species are elegant subjects for subtropical gardening during the summer months in temperate climates, provided a sunny location is given them, as they revel in rather dry very warm soil, and do not require artificial watering after being established. A rocky, sunny situation may be given *C. pulcherrima* and its variety *flava*, where they will bloom during many weeks of summer, until frost checks them, if strong plants about a foot high are selected in early summer. Care should be taken to harden off plants gradually in the house, so that they may not be chilled when transplanted outdoors. While they will do well in a poor soil, an application of manure or chemical fertilizer may be given them to advantage, causing them to make a more vigorous growth and give better and larger heads of flowers. In the tropics, and also in subtropical climates, these shrubs and trees are always admired and are commonly planted for ornament. The royal poinciana (*C. regia*, but properly *Poinciana regia*, which see), and also the dwarf poinciana, or flower-fence (*C. pulcherrima*), will thrive in close proximity to the sea, and are valuable for planting in exposed coast situations. (E. N. Reasoner.)

**A. Stamens long-exserted:** fls. very showy; trees, unarmed or nearly so.

**Gilliesii**, Wall. Shrub or small tree, with very many small lfts., scarcely  $\frac{1}{2}$  in. long, oblong, obtuse, glabrous:



730. Seeds of Cacti.

1. *Mamillaria*; 2. *Cereus*; 3. Flat-jointed opuntias; 4. *Echinocereus*; 5. Cylindrical opuntias.





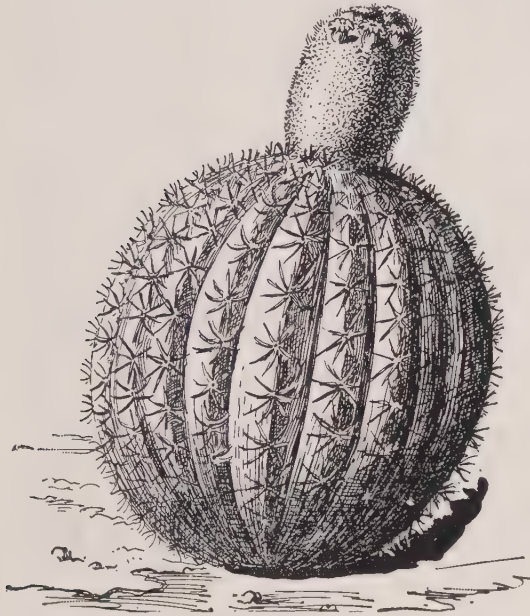
XXI. Cherry.—Specimen fruits of one of the heart cherries.





fls. light yellow, with brilliant red stamens protruding 3-5 in., in terminal racemes; sepals hairy-fringed. S. Amer. B.M. 4006 (as *Poinciana Gilliesii*, Hook.). F.S. 1:61. R.H. 1893:400. G.C. III. 15:73. Gn. 76, p. 4.—A very showy and worthy plant which bears in Calif. the popular name of "Bird of Paradise" like *Strelitzia Reginae*. It will stand a temperature as low as 20° F.

**pulcherrima**, Swartz. BARBADOS PRIDE. BARBADOS FLOWER-FENCE. DWARF POINCIANA. Shrub, with few scattered prickles, delicate, evergreen, mimosa-like lvs. with 12-18 pinnae, each with 20-24 oblique-oblong lfts. less than 1 in. long, and very gaudy red-and-yellow crisped fls. on the ends of the new growth: stamens and style red, and long-exserted. Generally distributed in the tropics. B.M. 995. P.M. 3:3. Gn. 75, p. 594.—One of the most popular shrubs in warm climates, as S. Fla. There is a var. *flava*, with yellow fls.



731. Cactus Melocactus. (× 1/2)

AA. Stamens not much exceeding the petals, or shorter.

B. Lfts. very obtuse.

c. Branches unarmed.

**pannosa**, Brandeg. Medium-sized tree with slender branches spreading horizontally and clothed with white, deciduous bark: lvs. decomposed; pinnae 2-4, each with 4-6 oblong and retuse lfts.: fls. yellow, showy: pod glandular, 1-2-seeded. Lower Calif.—A rapid-growing species which can be used for fences and is therefore called "palo estaca" in Lower Calif.

cc. Branches prickly.

d. Pod smooth: shrubs.

**sepiaria**, Roxbg. Scrambling pubescent shrub: lvs. glaucous, slightly pubescent beneath; pinnae 12-20, each with 16-24 oblong lfts., rounded at both ends, 1/2-1 in. long: fls. yellow in simple stalked racemes. India.—Furnishes dye-wood; also used as a hedge plant.

**japonica**, Sieb. & Zucc. Loose, spreading shrub, armed with stout, recurved prickles: lvs. with 6-16 pinnae, each with 10-20 lfts., oblong, very obtuse: fls. in large, panicle-like clusters, canary-yellow, the stamens bright red. Japan. B.M. 8207. G.C. III. 42:43. R.H. 1912:60 Gn. 40:588; 61, p. 81; 76, p. 411. J.H. III. 34:531; 51.181.—Endures the winters in some

parts of England. The hardiest species of the genus, probably hardy as far north as Washington, D. C.

**Nûga**, Ait. Vigorous climber: branches flexuose with copious hooked prickles: lvs. glabrous; pinnae 4-6, each with 4-6 ovate-obtuse lfts. 1 1/2-2 in. long: fls. bright yellow in large panicles; calyx glabrous: pods ovoid-oblong, 2 in. long, indehiscent, 1-seeded. Himalayas and Philippine Isls. to N. Austral. and Polynesia. Blanco, Fl. Filip. 150.

DD. Pod prickly: tree.

**echinata**, Lam. Tree, with prickly rusty pubescent branches: lvs. unarmed, glabrous; pinnae 5-9, each with 15-20 rhombic-oblong obtuse lfts. 1/2-3/4 in. long: fls. yellow in axillary and terminal racemes; calyx pubescent; stamens shorter than petals: pod oblong, 3 in. long. Brazil. Fl. Brasil. 15, 2:22.—Yields dye-wood.

BB. Lfts. acute or mucronulate: pod prickly.

**minax**, Hance. Diffuse shrub, thorny: pinnae 10, with 12-20 ovate-lanceolate glabrous lfts. 1-1 1/2 in. long: racemes panicle, many-fl'd., with very large bracts; fls. white and purple: pods 7-seeded (seeds large and black), prickly. China.

**Bônduc**, Roxbg. Climbing shrub, with prickly, pubescent bipinnate lvs., oblong-ovate mucronate lfts. 1 1/2-3 in. long, yellow fls., and a few large yellow seeds in a short, prickly pod. Tropics; S. Fla.

*C. bijuga*, Swartz (Acacia Bancroftiana, Bert.). Spiny shrub, with ultimate lfts. in 2 pairs: fls. paniculate. Jamaica.—*C. kauaiensis*, Mann=Mezoneuron kauaiense.—*C. regia*, Dietr.=Poinciana regia.—*C. vernalis*, Champ. Tall climbing prickly shrub: fls. in racemes. China. B.M. 8132.

L. H. B. and ALFRED REHDER.

CAHOUN: *Attalea Cohune*.

CAILLËA: *Dichrostachys*.

**CAJÂNUS** (aboriginal name). *Leguminosæ*. A tropical shrub, grown for the nutritious peas. One variable species, probably originally from Africa.

**indicus**, Spreng. (*Cytisus Cajan*, Linn.). GRANDUL. CONGO PEA. PIGEON PEA. DHAL. TOOR. URHUR. Erect, 3-10 ft., villous or often tomentose: lfts. elliptic-oblong, exstipellate, resinous-punctate beneath: fls. yellow and maroon, pea-like, continuing all through the year, in axillary racemes: pod pea-like, hairy, constricted between the many seeds. Much cult. in the tropics for the seeds or pulse, being treated usually as an annual. It varies greatly in stature and in character of seeds: *C. flavus*, DC., has yellow fls. and 2-3-seeded pods which are not spotted; *C. bicolor*, DC., a smaller plant, has red-striped fls., and 4-5-seeded pods which are spotted. See B.M. 6440 and R.H. 1874:190. The pigeon pea is much grown in the W. Indies, some varieties being preferred for human food and some for live-stock; run wild.

L. H. B.

CAJÓPHORA: *Blumenbachia*.

CALABASH: *Crescentia*.

CALABASH GOURD: *Lagenaria*.

**CALADIUM** (origin of name obscure). *Aracæ*. Warmhouse large-leaved plants, grown for the foliage; also employed in summer bedding.

Herbaceous perennials, arising from large rhizomes or tubers, acaulescent, with usually beautifully marked, long-petioled lvs.; the secondary nerves oblique to the few spreading primary nerves: peduncles usually solitary; spathe with the tube convolute, constricted at the throat, the blade boat-shaped; spadix erect, a little shorter than the spathe, the lower part naked, stipe-like, the staminate part longer than the pistillate; fls. unisexual: fr. a berry, white.—A dozen or less species in Trop. S. Amer. Two of the species are immensely variable, and many named horticultural varieties are in the trade. Engler in DC. Monog. Phan. 2:45? (1879); also F. S. 13.

As soon as *Caladium* plants begin to lose their leaves in the fall, water should gradually be withheld until the leaves are all gone. The pots should then be removed to a position under a bench, and laid on their sides, or taken from the soil and placed in sand. During the resting period they should not be subjected to a lower temperature than 60° F., and kept neither too wet nor too dry. About the beginning of March the tubers should be started for the earliest batch to be grown in pots. Arrange the tubers in their sizes, and keep each size by itself. The largest-sized tubers will start quickest, and it is desirable to begin with these for pot-plants. Start them in chopped moss in boxes. The tubers may be arranged rather close together in the box, and merely covered over with the moss to the depth of about an inch. The new roots are made from the top part of the tuber, so it is important that this part should be covered to encourage the roots. For starting, a heat varying between 70° and 85° will suffice. As soon as a healthy lot of roots makes its appearance, the plants should be potted, using as small-sized pots as possible. The soil for this potting should be principally leaf-mold, with a little sand. In a short



732. *Caladium bicolor* var. *Chantini*. (No. 17).

time they will need another shift; the soil should on this occasion be a little stronger; give a position near the glass, and shade from strong sunshine.—New forms are raised from seed, this operation being an exceedingly easy one with the caladium, as they cross-fertilize very readily. The flowers, unlike those of the Anthurium, are monœcious, the females ripening first. To pollinate them, part of the spathe must be cut away. Seedlings at first have the foliage green, and it is not until the fifth or sixth leaf has been developed that they show their gaudy colorings. Propagation of the kinds is effected by dividing the old tubers, the cut surfaces of which should be well dusted with powdered charcoal to prevent decay.—As bedding plants, the fancy-leaved caladiums are gradually becoming more popular. To have them at their best for this purpose, the ground should be worked for some time previous to planting out, with a goodly quantity of bone meal incorporated with the soil. The tubers are best put out in a dormant state, as then they make very rapid progress, and eventually make finer plants than when they are first started in the greenhouse, as by this system they are too likely to sustain a check in the hardening-off process, and lose their leaves. The fine, highly colored

kinds are not so well suited for outdoor work as those having green predominating in the foliage, but some of the kinds, such as Dr. Lindley and Rosini, do remarkably well. Frequent watering with manure-water is absolutely necessary to the development of the foliage, both outdoors and in. (G. W. Oliver.)

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It will be seen that most of the cultivated caladiums are considered to be forms of *C. bicolor* and *C. picturatum*. Only five species are concerned in the following list: *Schomburgkii*, 1; *marmoratum*, 7; *bicolor*, 8; *picturatum*, 48; *Humboldtii*, 57.

#### A. Blade not at all peltate, obliquely elliptical-ovate.

1. *Schömburgkii*, Schott. Petiole slender, 4 times longer than the blade, sheathed one-third its length; blade obliquely elliptical-ovate; midrib and 4-5 acutely ascending primary nerves silvery, pale, or red; sparsely spotted above, paler beneath. French Guiana to Para.—Runs into the following forms:

##### (1) Veins red.

2. Var. *marmoreum*, Engl. Blade dull green, with brownish red nerves, bordered with yellow.

3. Var. *erythræum*, Engl. (*C. Schmitzii*, Lem. *C. cordatum*, Hort.). Midribs and nerves red. I.H. 8:297.

4. Var. *pictum*, Engl. With white or red spots between the red veins. S. Amer.

##### (2) Veins silvery or green.

5. Var. *argyroneurum*, Engl. (*C. argyroneuron*, C. Koch. *C. Schalleri*, Lem.). Midrib and veins silvery I.H. 8:297.

6. Var. *subrotundum*, Engl. (*C. subrotundum*, Lem.). Lf.-blade rounded at the base, or shortly cordate, with white or red spots. Brazil.

#### AA. Blade distinctly peltate.

B. Lf. sagittate-oblong-ovate; basal lobes united for two-thirds their length, or more.

7. *marmoratum*, Mathieu (*Alocasia Roëzlii*, Bull. *C. thripedestum*, Lem.). Petiole cylindrical, 12-16 in. long, twice as long as the blade, variegated; blade 6-8 in. long, 4-6 in. wide, dark green, with irregular gray, yellowish green and snow-white spots, glaucous-green beneath, sagittate-oblong-ovate, the upper lobe semi-ovate, slightly cuspidate, the basal ones unequal, one-third or one-half as long as the upper, connate two-thirds to three-fourths their length: spathe-blade pale green, 2-3 in. long. Ecuador. I.H. 5, p. 59, desc.



**BB.** *Lf.* not as above; basal lobes united one-third their length or less.

**C.** Shape of *lf.* ovate-triangular, or ovate-sagittate (8-47).

8. **bicolor**, Vent. (*Arum bicolor*, Ait.). Petiole smooth, 3-7 times as long as the blade, pruinose toward the apex; blade ovate-sagittate, or ovate-triangular, variegated above, glaucous beneath; upper lobe semi-ovate, narrowing gradually to a cuspidate point, the basal ones one-half to but little shorter than the upper, oblong-ovate, obtuse, connate one-fifth to one-third their length. S. Amer. Intro. into cult. in 1773. B.M. 820.—Very common in cult., furnishing many of the fancy-leaved caladiums. The marked varieties are as follows (9-47):

(1) *Lf.-blade and veins of one color.*

9. Var. **Velloziànum**, Engl. (*C. Velloziànum*, Schott. *C. Purdieànum*, Schott. *C. pusillum*, C. Koch. *C. Spruceànum*, Schott. *C. firmulum*, Schott.). *Lf.*-blade dark green above; basal lobes connate past the middle. Brazil, Peru. R.B. 10:169.

(2) *Lf.-blade more or less variegated.*

(a) *With a colored disk* (Nos. 10-18).

(b) *Disk transparent.*

10. Var. **transpàrens**, Engl. (*C. transpàrens*, Hort.). Blade with a pale green, nearly transparent disk; midrib and primary veins red-purple.

11. Var. **rubicundum**, Engl. (*C. bicolor*, Kunth). Petiole green, or variegated green and violet; blade green, with a red, transparent, central disk, and a very narrow red line between the disk and the margin.

(bb) *Disk opaque.*

(c) *Purple disk.*

12. Var. **Baràquinii**, Engl. (*C. Saràquinii*, Hort.). Petiole violet; blade with a purple-red disk; beautiful green between the disk and margin; nerves and midrib red-violet. Para. I.H. 7:257. F.S. 13:1378.

13. Var. **Kétteleri**, Engl. (*C. Kétteleri*, Hort.). Petiole crimson, variegated toward the base; blade with purple disk, midrib and primary veins, sparsely marked between the veins with many small, rosy spots.

(cc) *Red disk.*

14. Var. **spléndens**, Engl. (*C. ròseum*, Hort. *C. spléndens*, Hort.). Petiole green below, red above; blade with a red disk at the middle; midvein and primary veins red-purple; green between the nerves and along the margin. Lowe, 4.

15. Var. **Lèopoldii**, Engl. (*C. Lèopoldii*, Hort. *C. Gàrdtii*, C. Koch. *C. Rogièrii*, Chant. & Lem.). Petiole violet beneath, red-purple above; blade with a broad, reddish disk; margin green, red-spotted; midrib and primary veins dark red-purple. Para, 1864.

16. Var. **albomaculatùm**, Engl. (*C. Alfred Bleu*). Petiole green; blade green, with red disk, midrib and primary veins, and marked clear to the margin with many large, white spots between the nerves.

(ccc) *Rose disk.*

17. Var. **Chàntinii**, Engl. (*C. Chàntinii*, Lem. *C. Connàrtii*, Hort. *C. amànum*, Hort. *C. Martersteigianum*, Hort. *C. punctatissimum*, Hort. *C. Haageànum*, Hort.). Fig. 732. Petiole more or less violet; blade broadly red-purple along the midrib and primary nerves, rosy at the center, and with very numerous, unequal spots between the nerves clear to the marginal vein. Para, 1858. I.H. 5:185. F.S. 13:1350-51. B.M. 5255. A.F. 8:129. G. 12:375.

(ccce) *Light green disk.*

18. Var. **Houllétii**, Engl. (*C. Houllétii*, Lem. *C. Mooreànum*, Hort.). Petiole green, the sheath and a little of the base violet-variegated; basal lobes of the

blade somewhat introrse, rounded, connate one-third; blade obscurely green toward the margin, the midrib and primary veins slightly reddish, and with a pale disk marked with many irregular white spots.

(aa) *Without a colored disk.*

(b) *Margins colored throughout.*

(c) *Red margin.*

19. Var. **marginàtum**, Engl. (*C. marginàtum*, C. Koch). Blade dark green, with a red line on the outer margin.

(cc) *Yellow margin.*

20. Var. **Kramerianum**, Engl. (*C. Kramerianum*, Hort.). Veins purple; yellow margin.

21. Var. **Stangeànum**, Engl. (*C. Stangeànum*, C. Koch). Blade reddish; green along the narrow margin, yellowish toward the margin.

(ccc) *Solid white margin.*

22. Var. **Perrièrii**, Engl. (*C. Perrièri*, Lem.). Petiole violet-black; blade dull green, with many red-purple spots, and white along the margin. Brazil, 1861.

(ccce) *Spotted margin.*

23. Var. **Éckhartii**, Engl. (*C. Éckhartii*, Hort.). Petiole violet-blotched at the base, green above the middle; blade green, with few rosy spots along the margin, and small white ones in the middle.

24. Var. **Hèndersonii**, Engl. (*C. Hèndersonii*, Hort.). Petiole variegated violet and green, reddish toward the apex; blade mostly green, reddish next the lower parts of the nerves; midrib and primary veins red-purple spotted; small red spots along the margin.

25. Var. **Sièboldii**, Engl. (*C. Sièboldii*, Hort.). Petiole violet and green, reddish toward the apex; basal lobes of the *lf.* somewhat introrse, connate one-third their length, dark green; midrib and primary veins beautifully red-purple spotted, and a very narrow white border, marked with small purple-red spots. A.F. 8:127.

(ccccc) *Purple margin.*

26. Var. **Houbyànum**, Engl. (*C. Houbyànum*, Hort.). Petiole dirty green on the lower surface, bright red above; blade bright green, with large pale spots, and small red-purple ones between the midrib and primary veins; a red-purple spot above the insertion of the petiole, and a pale purple line around the margin.

27. Var. **pellucidum**, Engl. (*C. pellucidum*, DC.). Petiole reddish, variegated with violet; blade broadly reddish purple spotted along the midrib and primary veins, and more or less marked with transparent, reddish purple spots between the primary veins; a continuous purple line along the outer margin.

(bb) *Margin colored only on basal sinus.*

28. Var. **Devosiànum**, Engl. (*C. Devosiànum*, Lem. *C. Wallisii*, Hort. *C. Ottònis*, Hort.). Petiole green; blade bright green, with small, irregular white spots between the midrib and primary veins, and a narrow crimson border at the sinus. Para. I.H. 9:322.

29. Var. **hæmatostigmatum**, Engl. (*C. hæmatostigmatum*, Kunth. *C. pellucidum*, DC. *C. discolor*, Hort.). Petiole violet; blade dark green, with a purple line on the basal sinus, and sparsely marked with blood-red spots. Para.

30. Var. **pœcile**, Engl. (*C. pœcile*, Schott. *C. pallidinnervium*, Hort.). Petiole reddish brown, or closely streaked-variegated; blade dark green; midrib and primary veins paler, often whitish; a red-purple spot where the petiole joins the blade, narrowly purple-margined in the sinus. Brazil.

31. Var. **regale**, Engl. (*C. regale*, Lem. *C. Wàgnieri*, Hort. *C. surinamense*, Miq. *C. sagittafolium*, Sieb.). Blade bright green, purple-margined at the sinus, every-

where marked with small, confluent white spots. W. Indies, 1710. I.H. 9:316.

(bbb) *Margin and disk without color.*

(c) *Variegated green blade.*

32. Var. *Brongniartii*, Engl. (*C. Brongniartii*, Lem.). Very large; petiole variegated violet and green, reddish toward the apex; blade green, except along the nerves below, where it is colored reddish, paler green between the primary nerves, deep green toward the margin; veins and nerves red-purple. Brazil, 1858. F.S. 13:1348-9. I.H. 5, p. 58, desc.

33. Var. *mirabile*, Engl. (*C. mirabile*, Lem.). Petiole green; blade bright green, densely covered with large and small irregular pale green spots between the primary nerves and midvein. Para. I.H. 10:354.

(cc) *Blue-green blade.*

34. Var. *pictum*, Kunth (*C. pictum*, DC.). Petiole greenish, variegated beneath; basal lobes connate one-fifth their length; blade thin, blue-green, marked with large, irregular, usually confluent, pale yellowish semi-transparent spots. Lowe, 43.

(ccc) *Colorless blade.*

35. Var. *Duchártrei*, Engl. (*C. Duchártrei*, Hort.). The long petiole green above, variegated below the middle with violet-black; blade colorless, except the midrib and all the veins, or here and there pale rosy or red-spotted, or even more or less dirty green. A.F. 8:129.

(cccc) *Solid green blade.*

(d) *Dark green.*

36. Var. *argyróspilum*, Engl. (*C. argyróspilum*, Lem.). Petiole grayish red, sparsely and finely streaked; blade a most beautiful green, with a crimson spot at the middle, and with many small white spots between the primary veins. Para. F.S. 13:1346-7.



733. *Caladium picturatum* var. *Belleymei*. (No. 49.)

37. Var. *Curwádlii*, Engl. (*C. Curwádlii*, Hort.). Petiole greenish, slightly violet-blotched toward the base; blade reddish purple along the midrib and primary veins, marked between the veins with large white spots; otherwise dark green.

38. Var. *Köchii*, Engl. (*C. Köchii*, Hort.). Lf-blade more rounded, dark green, with small white spots midway between the midrib and margin. Para, 1862.

39. Var. *macrophyllum*, Engl. (*C. macrophyllum*, Lem. *C. griseo-argenteum*, Hort.). Petiole green; blade dark green, marked everywhere with many small, scarcely confluent white or slightly rosy spots. Para, 1862. I.H. 9:316.

40. Var. *Neumannii*, Engl. (*C. Neumannii*, Lem.). Petiole green; blade very beautiful dark green, with scarcely paler veins, marked between the primary veins with large and small white-margined, reddish purple spots. F.S. 13:1352-3. B.M. 5199.

(dd) *Light green.*

(e) *Not spotted.*

41. Var. *rubellum*, Engl. (*C. rubellum*, Hort. *C. Reichenbachianum*, Stange). Blade green, with reddish purple midrib and primary veins.

42. Var. *rubrovenium*, Engl. (*C. rubrovenium*, Hort. *C. rubronervium*, Hort.). Petiole variegated green and violet; blade small, oblong-ovoid, the basal lobes somewhat introrse, obtuse, connate almost to the middle, pale caulescent or red-green along the midrib and primary veins; veins pale red or scarlet. Para, 1862.

(ee) *Spotted.*

(f) *With white spots.*

43. Var. *Laucheanum*, Engl. (*C. Laucheanum*, C. Koch). Blade bright green, with white spots at the middle.

(ff) *With purple and white spots.*

44. Var. *Wightii*, Engl. (*C. Wightii*, Hort.). Petiole pale green; blade very beautiful green, marked between the primary veins with large, red-purple and small white spots. French Guiana.

(fff) *With red or crimson spots.*

45. Var. *Enkeanum*, Engl. (*C. Enkeanum*, C. Koch). Blade bright green, marked with large and small red spots.

46. Var. *Lindenii*, Engl. (*C. Lindenii*, Hort.). Blade bright green, with confluent small red spots.

47. Var. *Verschaffeltii*, Engl. (*C. Verschaffeltii*, Lem.). Petiole pale green; blade very beautiful green, with few irregular crimson spots. I.H. 5:185. B.M. 5263. Lowe, 46.

cc. *Shape of blade lanceolate-sagittate.*

48. *picturatum*, C. Koch. Petioles usually green, variegated below, elongated; blade lanceolate-sagittate, cuspidate and submucronate at the apex, the upper lobe nearly triangular, oblong or ovate-lanceolate, basal lobes over half as long, lanceolate subacute, connate one-sixth to one-fourth their length, separated by a triangular sinus; primary lateral veins 4-7, erect-spreading or spreading. Brazil.—Variable, furnishing many of the fancy-leaved caladiums.

(1) *Transparent white blade.*

49. Var. *Belleymei*, Engl. (*C. Belleymii*, Hort.). Fig. 733. Petiole greenish above, variegated violet beneath; blade slenderly hastate-sagittate, white, translucent except the green veins and nerves, with small green spots along the margin; basal lobes 1-5, or rarely one-fourth or one-third connate. Para. I.H. 7:252. A.F. 8:127. G. 2:89.

(2) *Pale green blade.*

(a) *With transparent blotches.*

50. Var. *hastatum*, Engl. (*C. hastatum*, Lem.). Petiole long, stout, white, violet-spotted; blade hastate-sagittate, slightly contracted above the lobes; dull, pale green, very irregularly marked with transparent blotches; basal lobe one-fourth connate, crimson margined in the sinus. Para.

(aa) *Opaque.*

51. Var. *albostriatulum*, Engl. Blade greenish white along the midrib and veins, white-striped and dotted between the nerves.

52. Var. *Osyànum*, C. Koch. Blade white along the midrib and primary veins, with purple spots between the veins.



53. Var. *porphyronëuron*, Engl. (*C. porphyronëuron*, C. Koch. *C. cypreum*, Hort. *Alocasia porphyronëura*, Lem.). Petiole pale reddish, variegated with dull violet; blade broadly hastate-sagittate, dull, pale green, slightly reddish on the veins, opaque basal lobes one-sixth to one-third connate. Peru and Brazil. I.H. 8:297.

(3) Dark green blade.

54. Var. *élegans*, Engl. Petiole rosy, greenish below, variegated; blade narrowly hastate-sagittate, slightly contracted above the lobes, dark green above, broadly red or purple next the midrib and primary lateral veins; basal lobes one-fifth connate.

55. Var. *Lemaireanum*, Engl. (*C. Lemaireanum*, Barr. *C. picturatum albinëvium*, C. Koch. *C. picturatum viridissimum*, C. Koch.). Blade shaped like preceding, dark green; midrib and primary veins pale green or white. S. Amer., 1861. I.H. 9:311.

56. Var. *Troubetskoyi*, Engl. (*C. Troubetskoyi*, Chantin. *C. Appunianum*, Hort.). Petiole red, variegated; blade very narrowly hastate-sagittate, slightly contracted above the lobes, dark green above, broadly marked with pale red along the midrib and primary veins, and with scattered, transparent, small white or rose spots. F.S. 13:1379.

ccc. Shape of blade oblong-ovate, or oblong: plant small.

57. *Humboldtii*, Schott. (*C. argyrites*, Lem.). Fig. 734. Petiole slender, variegated, 2 to 3 times longer than the blade; sheath slender, narrow; blade oblong-ovate, or oblong, green along the margin, midrib and primary veins, with many large and small transparent spots between; shortly and very acutely acuminate, the apical lobe oblong-ovate, twice as long as the oblong or ovate-triangular, obtuse basal ones; basal lobes one-third connate, separated by an obtuse triangular sinus, the 3-4 primary veins of the apical lobe uniting in a collective nerve remote from the margin. Brazil. I.H. 5:185. F.S. 13:1345. Gng. 3:279. A.F. 10:197. Lowe, 22. C.L.A. 19:343. G. 14:501.

58. Var. *myriostigma*, Engl. (*C. myriostigma*, C. Koch.). Blade marked everywhere with small white spots.

The following names are in the trade, or occur in the lists of dealers and fanciers, but are not identified botanically:—*albanense*, *Barratii*, *candidum*, *Endlicherianum*, *Fenzlianum*, *Orgiesii*, *Petschkanii*, *Rodeckii*, *speciosum*, *Thelemannii*, *venosum*.

*C. esculéntum*=*Colocasia antiquorum esculenta*.—*C. odoratum*, Lodd.=*Alocasia macrorrhiza*.—*C. pubescens*, N.E.Br. A new species, distinct from those already in cult. by being pubescent. Peru. B.M. 8402.

JARED G. SMITH.  
GEO. V. NASH.†

**CALAMAGRÓSTIS** (Greek, *calamos*, a reed, and *agrostis*, a grass). Syn. *Deyeuxia*. *Gramineæ*. Usually tall or reed-like perennials bearing rootstocks. Including hay grasses and a few more or less ornamental species.

Spikelets 1-flid., the rachilla prolonged behind the palea as a usually hairy pedicel; lemma hairy on the callus, awned from the back.—Species about 120, distributed throughout the world in temperate and arctic regions, usually in damp or swampy soil. The species are often valuable native forage grasses. One species, *C. canadensis*, Beauv., is a source of an excellent quality of native hay in the northwestern states, where it is called blue-joint. Another species, *C. stricta*, Beauv., native of the northern states, is sometimes cult. in a variegated form as an ornamental.

*C. brevipilis*=*Calamovilfa brevipilis*. A. S. HITCHCOCK.

**CALAMINT, CALAMINTHA**. *Satureia*.

**CALAMOVÍLFA** (Greek, *calamos*, a reed, and *vilfa*, a kind of grass). *Gramineæ*. PURPLE BENT-GRASS. A group differing from *Calamagrostis* in having awnless

spikelets and no prolongation of the rachilla. Species 3, in S. E. U. S. *C. brevipilis*, Hack., is cult. as an ornamental grass. This is a stout, tufted grass, 2-4 ft., with short, horizontal rootstocks, pyramidal purplish panicle 4-8 in. Sandy swamps in pine-barrens, N. J. to N. C. Dept. Agric., Div. Ágros. 7:156; 20:84.

A. S. HITCHCOCK.



734. *Caladium Humboldtii*. (No. 57.)

**CALÁMPELIS**: *Eccremocarpus*

**CÁLAMUS** (Greek for reed). *Palmáceæ*, tribe *Lepidocarpeæ*. A group of interesting, usually climbing pinnate palms of the Old World tropics, not much known to the trade although over thirty species are in the European catalogues.

Stems very slender, always more or less prickly, usually climbing and never bearing a terminal infl.: lvs. alternate, pinnate, often ending in a terminal sometimes elongated cirrus, by which they are attached to their support; lfts. narrow, with 1-5 nerves; lf.-sheaths at first completely inclosing the internodes, sometimes split and open: spadix laterally attached at the summit of the lf.-sheaths, often elongate and slender and frequently ending in a tail-like appendage (flagellum) which is thorny; spathes long and narrow, hardly if at all split, differing from *Dæmonorops* which has a readily opening spathe; fls. dioecious, paniculate or branched 2 or 3 times; corolla coriaceous, longer than the calyx in male fls., as long as the calyx in the female: fr. globose, ovoid or ellipsoid, topped by a short permanent style.—There are more than 200 species, most of which inhabit India. See Beccari's excellent monograph Ann. Royal. Bot. Gard. Calcutta 11, 1908.

*Calamus* is an easily grown group of palms, very ornamental, even in a young state. Some of the species have stems several hundred feet long, which enable them to unfold their leaves at the tops of the tallest trees. The leaves are peculiarly well adapted to assist the plant in climbing, having numerous hook-like processes arranged on a long continuation of the midrib of the leaf. When accommodations can be given, these plants should be selected, as their growth is rapid, and they are capable of furnishing a large conservatory quickly. Numerous suckers are produced, so that when the main stem ascends the lower part is clothed in foliage. *Calamus tenuis* (or *C. Royleanus*) and *C. Rotang* furnish the rattan canes. Malacca canes are furnished by *C. Scipionum*.—Young plants thrive best in a rooting medium containing a considerable quantity of leaf-mold. Older plants need soil of a more lasting nature; a quantity of ground bone and charcoal in the soil may

be used to advantage. Old well-furnished plants need enormous quantities of water. All of them require stove temperature. (G. W. Oliver.)

**ciliàris**, Blume. St. slender, climbing by means of long axillary leafless branches, covered with short hooked spines: lvs.  $1\frac{1}{2}$ – $2\frac{1}{2}$  ft. long, 6 in. wide; lfts. 40–50 on each side, hairy; petiole 2 in. long with few hooked spines: spadix of female and male fls. finely hairy-hispid on the spathe: fr. globose, about  $\frac{1}{2}$  in. diam. Java and Sumatra. F.R. 1:607. G.C. III. 21:86.—Intro. into cult. in 1869. To be grown in tropical house.

**aspèrrimus**, Blume. St. slender, climbing by the prickly cirrus of the lvs. and the prickly branches: lvs. without stalks, about 18 in. long, bearing not more than 8–10 thin, papery, irregularly placed lfts. on each side of the rachis: spadix simply decompound, about 7 ft. long, terminating in a slender prickly appendage. Mts. of Java.—Can be grown in a cooler house than the preceding.

*C. Andreadum*, Hort., Pill & Mitterb=(?).—*C. calicàrpus*, Griff.=*Demonorops calicarpus*, Mart.—*C. dealbatus*, Hort.=*Acanthophoenix rubra*, Wendl.—*C. Lewisianus*, Griff.=*Demonorops Lewisianus*, Mart.

N. TAYLOR.

**CÁLAMUS** or **SWEET FLAG**: *Acorus Calamus*.

**CALÁNCHOË**: *Kalanchoë*.

**CALANDRÌNIA** (J. L. Calandrini, Genevan botanist, who wrote an important thesis in 1734). *Portulacacææ*. Fleshy, spreading or nearly trailing plants, sometimes cult. in borders and rockeries, or used for edgings in sunny places.

Flowers red or pink or rose-color, of short duration; petals 3–7; sepals 2; stamens 5 (or 3) to 12; style with 3 branches: lvs. alternate, narrow.—About 60 species, Brit. Col. to S. Amer. and in Austral. Annuals and perennials, but the latter mostly treated as annuals; not much grown in gardens.

A. Fls. in a short umbel-like cluster.

**umbellàta**, DC. Perennial, 4–6 in.: lvs. linear and hairy: fls. in a corymb, or umbel-like terminal cluster, bright crimson. Peru. R.H. 1853:5.—The *C. umbellata* of gardens is hardy in many parts of the U. S.; in New York it should be planted in a well-sheltered position, or provided with ample protection in winter; sometimes it acts like the biennials, but, as seeds are produced very freely, young seedlings spring up constantly between the old plants, and one does not miss the few which may decay during the second year; the plant forms a very neat, slightly spreading tuft; fls. are produced in many-fld. umbels, terminal, numerous, and large, glowing crimson-magenta, saucer-shaped, very showy. June to Nov. Full exposure to sun, and light sandy soil, are needed to bring out the rare beauty of these plants. The fls. close up when evening comes, like the annual portulacas, but they reopen on the following day. In the sunny sloping part of a rockery, even when quite dry, or among other low plants in a bed or border, they are highly satisfactory. Although perennial, it may also be treated like the annuals, as it flowers the first summer as freely as afterwards. Can be prop. by cuttings.

AA. Fls. in longer clusters, pedicels often more or less drooping.

**díscolor**, Schrad. (*C. elegans*, Hort.). Perennial, 1– $2\frac{1}{2}$  ft.: lvs. fleshy, spatulate to obovate, purple beneath, gray-green above, blunt: fls. bright light purple, 2 in. across, with yellow stamens. Chile. B.M. 3357.

**Ménziesii**, Torr. & Gray (*C. speciosa*, Lindl.). RED MAIDS. Annual: 3–12 in. high, with green herbage, glabrous, or nearly so: lvs. linear, or spatulate-oblongate: fls. rose-red or purple, rather large and long-peduncled (petals  $\frac{1}{2}$  in. long). Calif., N. B.R. 1598.—Variable. There is a white-fld. variety advertised.

**grandiflòra**, Lindl. Perennial, 1–3 ft.: much like *C. discolor*, but lvs. oval and pointed, narrowed to petiole, green, 4–8 in. long: fls. somewhat smaller, light purple. Chile.

**spectàbilis**, Otto. & Dietr. Perennial, 2 ft.: lvs. lance-spatulate or rhomboid,  $1\frac{1}{2}$  in. long, somewhat pointed: fls. bright purple, 2 in. across. Chile.—Said to produce seed seldom; prop. by cuttings.

**Bùridgii**, Hort. Annual, 1 ft.: lvs. linear-lanceolate, smooth: fls. many, small, copper-rose or brick-red, in leafy clusters. S. Amer.

**chromántha**, Griseb. One ft., loosely branched: lvs. rather large: fls. and buds rose-colored: fr. orange-yellow, persisting. Argentina.

*C. oppositifolia*, Wats.=*Lewisia oppositifolia*.

J. B. KELLER.

L. H. B.

**CALÁNTHE** (Greek for beautiful flower). *Orchidacææ*. Sub-epiphytal or terrestrial hothouse orchids found in the eastern hemisphere, and sparingly in the western hemisphere.

Scapes erect, many-fld.: lvs. broad, plaited: fls. white or rose-colored, rarely yellow: pseudobulbs angulate, with grayish green sheaths in the Vestitæ section, but absent in the Veratrifoliæ section.—Forty to 50 species in tropics of both hemispheres.

Most of the species and the numerous varieties grown are deciduous, losing the foliage about the time of flowering, and, at this season, water is given sparingly until the flowers are cut; then the bulbs are kept in a dry warm place until signs of growth in spring. All calanthes are terrestrial and should be potted each year in fibrous loam, with a small portion of old manure and sand mixed in. Use plenty of drainage as for other orchids, and about 2 inches of soil; secure the bulbs firmly by means of part of the old wiry roots; water very sparingly until active root-action takes place; but, when in full growth, weak manure-water may be given at each watering. The young foliage is very sensitive to sun, and must be shaded as soon as it develops; keep the plants near the glass and give all light possible, and the warmest treatment permitted in orchid culture. They enjoy a little heat, even in summertime, from the pipes at night. The best place to grow calanthes is a sunken, well-heated pit facing south, lowering the plant as the foliage nears the glass. *Calanthe veratrifolia* is an evergreen species and may be treated similarly to the Phaius. Calanthes are easily increased by separation of the bulbs at the time of repotting. Young bulbs are often produced from the apex of old ones; old ones will start again the second year and make increase. (E. O. Orpet.)

**vestita**, Lindl. (*C. oculàta*, Hort.). Lvs. broadly lanceolate, nearly 2 ft. long, from grayish green pseudobulbs: fls. nearly 3 in. across, numerous, in racemes; petals and sepals whitish, all more or less overlapping, the former oval-oblong, the latter obovate-oblong; labellum flat, large, 3-lobed, the mid-lobe cleft; a yellow or crimson blotch in front of the short column; scapes from 2–3 ft. high, hairy. Blooms in winter. Malaya. B.M. 4671. F.E. 9:325. A.F. 6:655. F.S. 8:816.—A most popular orchid. There are many forms, of which the following are the most important: Var. **gigantèa**, Hort. Larger in all parts: fls. white, with red eye. Var. **nivàlis**, Hort. Fls. pure white. Var. **Tùrneri**, Hort. (*C. Tùrneri*, Reichb. f.). Fls. more numerous, labellum with a crimson blotch; blooms later in the season than the next. Var. **rùbro-oculàta**, Hort. Labellum with a crimson-purple blotch. Oct.–Feb. G. 10:629. Var. **lùteo-oculàta**, Hort. Yellow-blotched. Var. **Regnièri**, Hort. (*C. Regnièri*, Reichb. f. *C. Stevensiana*, Regnier). Pseudobulbs more elongated, with a depression above the middle: labellum rose-colored, with a purple blotch in front of column, less deeply



lobed than in the type. A.F. 6:655. Var. **Regniéri Williamsii**, Hort. (*C. Williamsii*, Hort.). Sepals white, sometimes shaded pink; petals white, rose-bordered; lip deep rose.

**veratrifolia**, R. Br. Lvs. oblong-lanceolate, about 2 ft. long, from a creeping rhizome; fls. white, in dense corymbose racemes; petals obovate-spatulate; sepals obovate-oblong; labellum 4-parted, the anterior lobes usually broader than the posterior or basal lobes. Blooms May–July. Malaya. B.M. 2615.

**Veitchii**, Lindl. Fig. 735. A hybrid between *C. rosea* and *C. vestita*: fls. rose-colored; labellum with white spot near the base. Winter-flowering. There is also a white variety. This hybrid was raised by Veitch, in 1856. B.M. 5375. Gng. 14:134. A.F. 25:1093. Forms of this are var. **bélla**, Hort., with pink fls.; var. **nigro-oculata gigantæa**, Hort., with stout sts., the fls. white with an eye of reddish crimson; var. **Sandhurstiana**, Hort., with crimson fls.; var. **Sedenii**, Hort., with deep rose fls.; var. **supérba**, Hort., has richer color.

**Masûca**, Lindl. Scape 2 ft. long, with large, many-ribbed, dark lvs.: fls. 1 in. across, the segms. overlapping, deep violet, fading to lilac, the lip deep violet-purple. Summer and autumn. N. India. B.M. 4541. Var. **grandiflora**, Hort., is of greater size throughout.

*C. burmanica*, Rolfe. Fls. mauve-purple, with yellow crest. Burma.—*C. Clute*, Hort. (*C. Veitchii* × ?).—*C. Cooksonii*, Hort. (*C. Veitchii* × *C. vestita luteo-oculata*). Fls. pure white, except a blotch of yellow in the throat and a few lemon-yellow lines on lip.—*C. Cornelius Vanderbilti*, Hort. (*C. vestita rubro-oculata* × *C. Veitchii*).—*C. discolor*, Lindl. Sts. leafy: fls. with claret sepals and petals and a 3-lobed white lip flushed rose. Japan. G.C. III. 35: 389. B.R. 26:55.—*C. Eijermannii*, Hort. (*C. vestita rubro-oculata* × *C. Veitchii*). Racemes shorter than in *C. Veitchii*, with larger, more spreading white fls. with a reddish blotch at the base of the lip. G.F. 4:17.—*C. gigas*, Hort. (*C. grandiflora* × *C. Regniéri*). Fls. nearly 3 in. across, borne on a st. over 5 ft. tall; sepals and petals milk-white, the latter tinged rose at base and apex; lip 4-lobed, bright rose, striated with pale rose or white, a reddish crimson blotch at the base.—*C. Hennisii*, Loher. Similar to *C. vestita*. Philippines. G.C. III. 46:34, desc.—*C. madagascariensis*, Rolfe. Sepal and petals rosy mauve; lip dull magenta with white spot at base. G.C. III. 28: 335, desc.—*C. McWilliamsii*, Hort. = (?).—*C. Orpetiana*, Hort.—*C. sumatense*, Hort.—*C. Wárpuri*, Rolfe. Sepals white; petals much narrower, white; lobed lip dull purple, changing finally to orange. Madagascar.

GEO. V. NASH.†

**CALATHËA** (Greek for *basket*, the application not apparent). *Marantaceæ*. Perennial foliage plants of warmhouses, with maranta-like leaves arising in a tuft from the crown.

Sepals 3, free and equal; corolla tubular, with 3 spreading lobes; stamens 3, petal-like, 2 sterile, and 1 bearing an anther on its side (compare *Canna*). From *Maranta* the genus differs chiefly in technical characters. In *Maranta* the fr. is 1-seeded, in *Calathea* usually 3-seeded; in the former the fl.-clusters are branched and few-fld., in *Calathea* usually capitate or cone-like.—Of *calatheas* there are more than 100 species, mostly of Trop. Amer., but a few of trop. Afr. The lvs., for which the plant is grown, are variously marked with shades of green, red, brown, yellow, and white. They spring from the very base of the short st., just above the rhizome, the rhizomes themselves more or less tuberiferous (Fig. 736). Monogr. by Schumann in Engler's *Pflanzenreich*, hft. 11 (1902).

All the *calatheas* thrive in a moist tropical house in a temperature that does not go below 65° F., with a rise during the day to 90° or 95° F. For general purposes, the best compost in which to grow them is made of equal parts of good turfy loam, leaf-mold and sand. Some of the more delicate species are best grown in leaf-mold and sand only. Stagnation of the soil must be particularly avoided by abundance of drainage, as they require to be kept rather moister at the roots than most stove plants. The close moist atmospherical conditions that these plants require can be secured

only by constant syringing and damping down amongst the plants; therefore the need for abundance of drainage is apparent, whether they are grown in pots or planted out in a border. It is only by planting them out with a free root-run that *calatheas* may be had in their full beauty; and when so grown a collection of these plants forms one of the most beautiful examples of tropical foliage. Particular attention should be given to protecting them from all strong sunshine, the thin texture of their leaves rendering them specially liable to damage from this cause. Most of the species are of easy culture providing the above conditions are followed. Many of them spread rapidly and make quick growth; therefore they require to be potted or overhauled every spring, but when once well established, they may be fed with liquid manure once a week.—Propagation is by dividing the crowns, or by cuttings



735.  
*Calathea Veitchii*.  
(× 1/2)

in those kinds that make secondary growths, these cuttings being taken just below the nodes. In spring, just before growth begins, is a good time for this work. Tubers may be used, if produced.

In Florida, *calatheas* grow exceedingly well in shady lath plant-houses. The soil should be leaf-mold and very old cow-manure added to the original natural soil. Commercial fertilizer should never be used. In very cold weather they should be covered with pine branches and leaves or pine-needles. All the kinds soon form very beautiful clumps. All of them need much water while they are growing, but not in the winter if they are planted out in beds. Each spring they must be replanted in fresh soil. Then the clumps may be divided, or if large specimen plants are desired, they may be left intact. (Nehrling.)

The *calatheas* are a confusing group to the horticulturist, because the differences that he knows lie mostly in characters of leaf and habit and these are variable. The size of leaf and plant depends much on the treatment, and in some species the juvenile leaves are different from the mature ones. The coloration of the foliage depends much on the age, and the way in which the plants are grown. However, we may roughly throw the species into two groups,—the small

leaved and the large-leaved, although it is a question where to place such intermediate kinds as *C. Veitchiana*, *C. insignis*, *C. leopardina*, *C. Sanderiana*, *C. nigricans*, and some others; or we may arrange them in two groups by the red-marked kinds (of foliage), and by the green-, gray- and white-marked kinds, but this would not account for the juvenile and adult stages of *C. leopardina*, *C. imperialis*, *C. Chantrieri*, *C. ornata*, and others. The botanical classification by floral characters would be of little use to the general horticulturist. Some plants known in collections as calatheas are likely to be marantas, phryniums, monotagmas, ctenanthe, or others. The radical tufted leaves and capitate inflorescence of Calathea, and the zigzag stems and branched inflorescence and small flowers of Maranta are general characters of separation between these two genera. In the present account, the attempt has been made to draw the characters as much as possible from cultivated specimens apparently authentically named.

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A. Markings of lf. (upper surface) in red or brown, at least in part.

1. *ròseo-pícta*, Regel (*C. ròseo-lineata*, Hort.? *Maránta ròseo-pícta*, Lind. *M. Wágneri*, Hort.). Dwarf: lvs. nearly orbicular, purple beneath, the upper side dark green, the midrib red, and an irregular red zone (sometimes two zones) two-thirds of the distance from the midrib toward the margin. Amazon. F.S. 16:1675-6. Gn. 2, p. 3.

2. *Pavòni*, Kørn. (*C. tubispatha*, Hook. f.). Two feet or less high: lvs. obovate-elliptic, short-acuminate or cuspidate, thin, greenish beneath, lively green above, and marked midway between the rib and the margin with lighter green and squarish patches of brown. Peru. B.M. 5542.

3. *angustifòlia*, Kørn. (*Maránta discolor*, Hort.). Habit loose, erect, only slightly spreading at apex: growths bearing 1-4 lvs. from 1-5 ft. high; blade lanceolate, unequilateral,  $\frac{3}{4}$ -2 ft. long, rich light green with fine lines of purple-red above, rich shining red beneath; petiole erect, stout, 1-3 ft. high, rich dark red, heavily marked with light green tuberculate spots; sheath extending from one-third to one-half its length: in the juvenile form the whole of the plant is densely covered with reddish brown hairs, but in the adult plant, the blade is almost entirely glabrous. Cent. Amer. B.M. 8149.

AA. Markings of lf. mostly on the order of green or white (exceptions in juvenile stages of Nos. 35, 36, 37 and others).

E. Lf.-blades small or short, usually less than 12 in. long.

C. Under side of lvs. green, grayish, or yellowish (violet in forms of No. 14).

4. *micans*, Kørn. (*Maránta micans*, Math. *Phrynium pumilum*, Klotzsch). Very small: lvs. 2-3 in.

long, and 1 in. wide, oblong-lanceolate, somewhat acuminate, green and shining above, the rib in a feathered white stripe, paler beneath. Brazil.—Probably the smallest cult. Calathea.

5. *chimboraensis*, Lind. Dwarf: lvs. oblong-ovate, 8-12 in. long, acuminate, green above and below, with a very dark green white-margined band running lengthwise the blade midway between the rib and each margin. Neighborhood of Mt. Chimborazo. I.H. 17:6.

6. *Wiotiana*, Makoy (*Maránta Wiotii*, Morr.). Habit dwarf, spreading: rhizomes branching freely: growths bearing only a single lf. each; blade linear-lanceolate, slightly oblique, 4-12 in. long, undulate, acute,



736. Tuber of calathea.

( $\times \frac{1}{2}$ )

upper side silvery gray with a narrow band of light green around the margin; midrib green, with a row arranged pinnately, along either side of the midrib, of dark olive-green blotches or stripes; under side dull grayish green finely striated all over between the principal veins with patches of light yellowish green; petiole 3-15 in. long, erect or spreading, light green, terete sheath entirely absent. Probably Brazil.—A most beautiful species; thrives best in leaf-mold and sand.

7. *trifasciata*, Kørn. (*Phrynium propinquum*, Poepp. & Endl.). Habit dwarf, spreading, with short free-branching rhizomes: growths bearing 1 lf. only; blade cordate-ovate, unequilateral, 3-12 in. long, apex acute, and half twisted around, upper side silvery gray shading to green at the margins and with a row on either side of the midrib of dark green stripes arranged pinnately, under side light green, prominently striated on both upper and lower sides with a network of fine veins connecting all the principal lateral veins; midrib pale yellowish brown on the under side and covered with dark brown hairs in the lower half and extending for an inch or more on the apex of the petiole; petiole 3-12 in. long, light green, glabrous except in the upper inch or so; scale lvs. reddish brown. Guiana.—A companion plant to *C. Wiotiana*, to which it is closely allied, but differs in the broader and paler color of the lvs. Of easy cult.

8. *fasciata*, Regel & Kørn. Habit dwarf, compact: lvs. 10-18 in. long, reflexed; growths bearing 1-3 lvs.; blade broadly ovate or orbicular, acute or obtuse, glabrous 5-10 in. long, slightly undulate; upper side rich dark olive-green alternately marked by transverse bars of silvery white; under side dull grayish green; petiole 4-8 in. long, spreading, dull green, covered with short and minute brownish hairs; sheath extending up to one-half the length of the petiole, upper part terete. Brazil. Gn. 2, p. 3.—Considered by some to be a variety of *C. rotundifolia*, Kørn. *C. farinosa* and *C. ovalifolia* are probably stages in the development of this plant or perhaps slight varieties.

9. *Luciana*, Hort. Habit medium to strong, compact, more or less tufted: growths with 2-5 lvs., usually with 3, arching over at the tips and  $\frac{1}{2}$ -3 ft. high; blade elliptic, oblique, glabrous, acute, slightly undulate, 3-12 in. long, upper side light pea-green feathered along the midrib with pale greenish white and with a concentric zone of the same shade near the margin of the lf., under side dull grayish green; petiole erect, slender, rigid, pale green, glabrous or nearly so; sheath extending from one-half to nearly the entire length of the petiole, upper part oval, slightly flattened on each side; infl. a short few-fl. spike; peduncle 1-3 in. long; bracts spreading or erect, ovate, light reddish brown,  $1\frac{1}{2}$  in. long; fls. in pairs, yellow; sepals thin, linear, one-third the length of the tube; corolla yellow; petals elliptic,  $\frac{2}{3}$  in. long, spreading, acute; the 2 petaloid aborted stamens obovate,  $\frac{1}{2}$  in. long, bright yellow,



and striped or blotched with bright red; style curved,  $\frac{1}{2}$  in. long, yellow. Trop. Amer.

10. *flavescens*, Lindl. Habit tufted, glabrous in all parts: growths with 3-5 lvs., 1-2 $\frac{1}{2}$  ft. high; blade elliptic, slightly oblique, 6-12 in. long, acute, light green above, soft grayish green below; petiole 12-18 in. long, pale yellowish green finely spotted with darker green; sheath one-third to one-half the length of the petiole, upper part oval: infl. a dense globose short raceme; peduncle less than an inch; bracts large, elliptic, outer ones 2 in. long, bracteoles smaller, linear or lanceolate; fls. in pairs, sessile or nearly so, an inch diam.; sepal primrose, equal, lanceolate; petals large, bilobed, obovate, bright yellow. Brazil. B.R. 932.—Perhaps to be referred to *C. grandiflora*, Schum.

11. *Sagoreana*, Hort. (*Maránta Sagoreana*, Hort.). Habit dwarf and compact: growth bearing 2-4 lvs., usually with 3, and from 6-18 in. high, erect at first, arching towards the apex; blade lanceolate, unequilateral, 4-9 in. long, pale yellowish green with a row on either side of the midrib of arrowhead-shaped blotches of dark green which give this plant a distinct and pretty appearance, the under side in plain yellowish green; petiole slender, erect, 6-12 in. long; sheath extending only to about a quarter of its length, upper part terete.

12. *vittata*, Kœrn. (*C. albo-lineata*, Hort. *C. ornata* var. *albo-lineata* and *Maránta albo-lineata*, Hort.). Habit dwarf, compact,  $\frac{1}{2}$ -2 ft. high: growths with 2-5 lvs.; blade elliptic-lanceolate, slightly oblique, 3-12 in. long, glabrous, acute, upper side light green, pinnately striped with white from apex to base, underside pale dull green shaded between the veins with slightly lighter yellowish green; petiole slender, erect or spreading, 3-15 in. high, light green, glabrous; sheath extending from one-third to one-half its length, upper part terete. Probably Colombia.

13. *Wálisii*, Regel (*Maránta Wálisii*, Lind.). Habit strong, but neat and graceful, branching and forming numerous growths: growths bearing from 2-7 lvs., and 1-4 ft. high; blade broadly ovate, acute or obtuse, 6-12 in. long, rich light velvety green along the margin and midrib and with a row on either side of the midrib of dark irregular blotches of olive-green, under side soft grayish green; petiole erect, slender; sheath, extending to half the length of the petiole, and covered with soft hairs, upper part terete: with the exception of the sheathing lower half of the lf.-stalks, the whole plant is glabrous. Peru.—One of the commonest species in cult. and of very easy culture. A useful and decorative pot-plant.

14. *virginális*, Lind. Lvs. soft-hairy below, broad-oval, rather blunt, 7-9 in. long, 4-6 in. broad, upper surface light green, and below, in the common form, whitish green and lighter zones shown, as on the upper surface,—or in another form, which has been distributed in gardens as *C. (Maránta) Marcellii*, under side shaded a light violet and without zones. Brazil. A.F. 7:611.—Allied to *C. Veitchiana*, but has bracts with indurated tips rather than membranaceous.

cc. Under side of lvs. violet, purple, or suffused with red.

15. *Álbertii*, Hort. (*Maránta Álbertii*, Pynaert & Van Geert). Habit dwarf, spreading, less than a foot high: growths bearing 2-5 lvs., erect or spreading; blade oblique, elliptic, undulate, acute, 4-9 in. long, glabrous, upper side dark green feathered on either side of the midrib with a band of pale yellowish green, under side dull green suffused with light purple-red: infl. a few-fl. terminal spike; peduncle 3-4 in. long, pale green; floral bracts half reflexed outwards, orbicular or broadly ovate,  $\frac{3}{4}$  in. long; bracteoles 4-6, white, scarious; fls. in pairs, pure white; sepals half the length of the tube; petals lanceolate,  $\frac{1}{2}$  in. long, tube  $\frac{3}{8}$  in. long; 2 petaloid stamens slightly longer than the

petals, obovate, fertile stamen hooded and curved over the stigma; style and stigma short curved, white.

16. *Makoyana*, Nichols. (*Maránta Makoyana*, Morr. *M. olivaris*, Hort.). One to 4 ft.: lvs. broad-oblong, obtuse or somewhat short-pointed, the stalks red, the lf. olive-green or cream-colored above but marked against the midrib with outspreading, dark green blotches of oblong, oval or pyriform shape, the under surface similarly marked, but in red. Brazil. F.S. 20:2048-9. G.C. 1872:1589. Gn. 4, p. 87.

17. *nitens*, Bull. Habit dwarf; blade elliptic, acute, glabrous, upper side bright green, with oblong acute bars of dark olive-green, alternate long and short, on either side of the midrib, under side dull green tinted with dull red. Brazil.—Distinct and pretty.

18. *crocata*, Morr. & Joris. Whole plant 12 in. high: lvs. sub-distichous; petiole 2-3 in. long, sheathing most of its length; blade 4-5 in. long, erect, ovate-lanceolate, acuminate, somewhat undulate, dark green and veined above, rose-purple beneath: spike short, the bracts bright saffron-yellow. Brazil. B.M. 7820. G.C. III. 28:113. G.M. 53:265. J.H. III. 60:329. G. 32:263. F.W. 1876:161.—A free bloomer and showy when in flower.

19. *Veitchiana*, Hook. f. Fig. 737. Habit strong, loose, and spreading, 1-4 ft. high: growths with 2-8 lvs., usually with 3; blade ovate or elliptic-ovate, oblique, acute, undulate, glabrous, 4-12 in. long, upper side rich dark glossy green, feathered along either side of the midrib with an irregular band of pale green and with an inner zone of dark olive-green blotches and an outer one of pale yellowish green (often shading to white) between the midrib and margin; under side similarly blotched, but in shades of purple-red and rosy red; petiole  $\frac{1}{2}$ -3 ft. long, stout, green and glabrous above, tinted with reddish brown and hairy in lower part; sheath extending from one-third to one-half the length of the petiole, upper part terete: infl.



737. *Calathea Veitchiana*

on erect densely fld. spike on peduncle 4-6 in. long; spike 2-3 in. long, with a rosette 2 in. diam., of large green foliolose erect or capped spreading bracts; floral bracts erect, spreading at the tips, ovate, an inch long, outer ones covered in lower part with brown hairs; fls. in pairs, primrose-white, tube  $\frac{3}{4}$  in. long, slender; sepals erect,  $\frac{1}{2}$  in. long, lanceolate; petals elliptic  $\frac{1}{2}$  in. long, reflexed; fertile stamen hooded, small, 2 aborted petaloid ones longer than the petals, obovate, bilobed, with a bright violet blotch on the front; style and stigma small, curved. Peru. B.M. 5535. G.C. 1870:924. Gn. 2, p. 545. F.S. 16:1655-8.—A dwarf var. *F6xii*, Raffall, has recently been intro. into cult. from Venezuela. It differs from the type in its dwarf habit, rarely exceeding 10-12 in. high: lvs. broader, more reflexed, and with a bright rose or red midrib; the color of the markings of the lf. are darker and of a slightly different shape, the dark inner zone of green being more broken in outline, and running into the midrib: infl. smaller, but the fls. in size and color are the same as in the type.

20. *illústris*, Nichols. (*Maránta illústris*, Lindl.). Habit dwarf and compact, 6-9 in. high: lvs. spreading, growths bearing 2-5 lvs. 6-9 in. long; blade oblique, ovate, acute, undulate, 4-6 in. long, 2-5 in. broad, upper side rich dark shining olive-green, with a bluish metallic luster over the whole, the midrib being feathered on either side with dull silvery white and an irregular zone of the same color running the complete circle of the blade, under side dull purplish red; petiole 2-3 in. long, spreading, dull greenish brown; sheath extending to one-half the length of the petiole, upper part terete; petioles, lf.-scales and under side of the midrib covered with minute brown hairs: infl. an erect, capitate, few-fld. spike, on slender peduncle 4-6 in. long; bracts of two kinds, the upper 3 or 4 green, foliolose ovate, spreading over the floral bracts, and curving upward at the tips; lower bracts scarious, orbicular, light brown and shading to bright red at the point of attachment to the rachis, bracteoles 2-4, lanceolate, shorter than the bract: fls. in pairs; sepals white, two-thirds length of the tube, tube  $\frac{2}{3}$  in. long; petals lanceolate, white, spreading,  $\frac{1}{2}$  in. long; 2 aborted petaloid stamens larger than the petals, obovate, lower one heavily blotched with purple; stamen hooded; style and stigma white, curved,  $\frac{1}{2}$  in. long; ovary minute, white. Ecuador. F.S. 16:1691-2.—By some regarded as derived from *C. roseo-picta*.

21. *Louisæ*, Chancier (*Maránta Louisæ*, Hort.). Habit tufted, 2-3 ft. high: growths with 2-5 lvs.; blade elliptic, only slightly oblique, glabrous, acute margins plain or slightly undulate, 6-12 in. long, upper side light pea-green, feathered along the midrib with white, changing with age to a soft greenish white; under side light green tinted with pale purple-red; petiole  $\frac{1}{2}$ -2 $\frac{1}{2}$  ft. long, slender, erect, green, covered with soft minute brown hairs; sheath extending from one-third to one-half the length of the petiole, upper part terete: infl. an erect spike, elliptic in outline, on a leafy peduncle 4-12 in. long; bracts creamy white, reniform, obtuse or acute, bracteoles numerous, white, scarious; fls. in pairs; sepals linear, cream, half the length of the tube, tube  $\frac{3}{4}$  in. long; petals lanceolate, reflexed; lip elliptic, with bright yellow disk reflexed with scarious margins; column white or cream, linear curved towards the lip.

22. *Vándenheckei*, Regel (*Maránta* and *C. Goulétii*, Hort.). Habit dense and tufted, 1-2 $\frac{1}{2}$  ft. high: growths with 1-3 lvs., usually 2; blade oblique, elliptic or elliptic-ovate, 3-9 in. long, acute, upper side glabrous, rich dark green, marbled with silvery white along the midrib and an irregular undulating line of the same color running the complete circle of the blade, the intervening tissue in some cases will be also entirely composed of this silvery white colored tissue and the

green part reduced to a marginal ring  $\frac{1}{2}$  in. diam.; these two strikingly distinct forms of lvs. will often be found on a single plant in adjoining growths; in this case it is not that either of them represent the adult stage, as both are of frequent occurrence on the same plant and both produce infls.; under side, dull purple-red; petiole erect or spreading, dull reddish brown; sheath reaching from one-third to one-half its length, upper part terete or oval: infl. an erect narrow spike, sometimes sessile but more commonly on a peduncle 3-15 in. high; bracts erect, ovate, green tinted with brown, closely adpressed and forming a narrow cone-like mass some 3-5 in. long, the upper pair of bracts always being enlarged and spreading outwards like 2 small elliptic lvs.: fls. in pairs, white; sepals half the length of the tube; tube  $\frac{3}{4}$  in. long; petals elliptic spreading; column curved, white with brown stripe.—A fine stove plant for large or small pots, and on account of its tufted habit is of great use for decoration. Of very easy cult.

23. *Liétzei*, E. Morr. (*Maránta conspicua*, Bull. M. Neübertii, Hort.). Habit dwarf, spreading by means of runners: growths bearing from 1-7 lvs.  $\frac{1}{2}$ -2 ft. high; blade obliquely elliptic, acute, undulate, glabrous, 3-9 in. long, upper side soft velvety green, striped along the principal veins with dark olive-green and feathered between the veins with splashes of yellowish green, lower side dull purple-red, midrib brown; petiole 3-15 in. long, softly tomentose in lower part; sheath extending from one-half to nearly the entire length of the petiole: infl. borne upon long slender leafy sts., which later become swollen and root at the nodes and change to runners, thus forming an easy means of prop: few-fld., bracts green, ovate; fls. in pairs in axil of each bract, pure white,  $\frac{1}{2}$  in. diam.; sepals linear; petals obovate. Brazil. B.H. 25:273.

24. *picta*, Hook. f. (*Maránta picta*, Hort.). Habit dense and compact, covered in all parts with soft velvety hairs: growths with 4-10 lvs. and  $\frac{1}{2}$ -3 ft. high; blade elliptic, undulate, acute, 6-15 in. long, upper side rich velvety olive-green, feathered on either side of the midrib, pale yellowish green; under side rich purple-red; petiole 3-18 in. long, dull red; sheath extending nearly the entire length of the petiole, the upper inch or two being terete, and rather brighter in color than the lower part: infl. a dense cone-like spike, borne on long slender terete sts. 1-3 ft. long and bearing 1 or more lvs. which change into runners after the fls. are over, becoming fleshy and rooting at the nodes, forming a ready means of prop.; bracts 1-2 in. long, erect, elliptic or ovate, pale primrose tinted with rose or violet; fls. in pairs, 1 in. diam., primrose tinted with violet. Brazil. B.M. 7674. G.C. III. 22:293.

25. *noctiflora*, Hort. (*Maránta noctiflora*, Regel & Körn. *M. grácilis*, Hort.). Habit loose and spreading, 1-2 $\frac{1}{2}$  ft. high: growths with 2 or 3 lvs.; blade elliptic or elliptic-ovate, 6-12 in. long, pendulous or horizontal, upper side pale yellowish green, pinnately striped with rich dark green bars along the principal veins, lower side light green faintly suffused with dull red, the principal veins being more strongly marked with a deeper shade of red; petiole erect, rigid, 6-18 in. long; sheath, extending to half its length, upper part terete, green. Probably Brazil.—Perhaps a true *Maránta*.

26. *exímia*, Körn. (*Phrynium exímium*, Koch). Habit loose and spreading: growths bearing 1-3 lvs., usually 2, and from 1-3 ft. long; blade elliptic or elliptic-ovate, acute, 6-15 in. long, upper surface alternately striped with rich olive-green and light silver tissue, and arranged in the form of a feather, midrib channeled pale yellowish green, under side rich dark wine-red, glabrous above, softly tomentose with brown hairs beneath; petiole spreading, stout, 1-2 ft. long, lower part light green, reddish brown above, beneath extending from one-third to nearly the entire length of



the petiole, upper part oval or terete. Cent. Amer. Gt. 686.—One of the finest and most beautiful members of the genus.

27. *rufibárba*, Fenzl. Habit erect, densely tufted: growths with 3-7 lvs.  $1\frac{1}{2}$ -4 ft. long; blades linear-lanceolate, 6-12 in. long, rich shining green, suffused with purplish red below, undulate, acute; petiole  $\frac{3}{4}$ -2½ ft. long, terete above the sheath; sheath extending from 2-10 in. of the base of the lf., dull red heavily spotted with green. Probably Brazil. B.M. 7560.—Densely hairy in all its parts.

28. *Lindeniana*, Wallis (*C. Lindenii*, Wallis & André). Lvs. elliptic-oblong, short-acuminate (12 in. or less long), deep green above with an olive-green zone either side of the midrib, and beyond which is a darker zone of green, the under side counterfeiting the upper side, but with purplish zones. Brazil. I.H. 18:82.—By some considered to be a form of *C. roseo-picta*.

29. *princeps*, Regel (*Maránta princeps*, Lind.). Lf. elongated or elliptical-lanceolate, 7-10 in. long, 3-3½ in. broad, light green above, with broad black-green, flaming, broken band along the middle nerve, violet-purple below. Amazon.

30. *Legrelliana*, Regel. Lf. elliptical, pointed, 5-6 in. long, 2-3½ in. broad, above shining green, with broad, white, flaming, broken middle band along the middle nerve and numerous broken white linear small bands between the side nerves; lower surface whitish green and marked with red and green. Colombia, Ecuador.—A neat species.

BB. Lf.-blades larger, mostly upwards of 12 in. long.

C. Under side of lvs. green (red in juvenile states of Nos. 34 and others and in No. 37 and perhaps No. 45).

31. *crotalífera*, Wats. RATTLESNAKE PLANT. Lvs. oval, abruptly acute at each end,  $1\frac{1}{2}$ -2 ft. long, and 10-12 in. broad, yellowish green, with a white-margined midrib, paler underneath; petiole 2-3 ft. long, curved, sheathing; peduncles 1 or 2, 8-10 in. high, bearing distichous yellow-fld. spikes. Guatemala.—Offered in Fla. The spikes suggest the rattle of a rattlesnake (*Crotalus*) whence the specific name.

32. *Alluia*, Lindl. Habit erect: growths bearing 4-10 lvs. 2-4 ft. long; blade 1-2 ft. long, elliptic, arching in upper half, light green above, pale silvery gray below, margins slightly undulate; petiole erect, often as much as 2 ft. long, green, striped with dull red on each side, the sheath extending up to within 2-3 in. of the apex, where it becomes terete. W. Indies.—*Alluia* is a native Carib name.

33. *leopardina*, Regel (*Maránta leopardina*, Bull). Habit strong and vigorous, quickly forming a large and fine specimen: growths bearing 3-7 erect or spreading lvs., often as much as 5 ft. high, and arching over at the tip; blade to 20 in. long, elliptic, slightly oblique, acute, slightly undulate, and glabrous in all parts, upper side rich green in the adult stage; in the juvenile stage the lvs. are dark olive-green in the center, with an irregular outer band of paler green, forming a complete zone between the dark green center and margin; under side light green; petiole 1-4 ft. high, rigid, erect; sheath extending from one-third to one-half the length of the petiole, upper part terete, glabrous, shining light green. Brazil.—A near ally of *C. Chantrieri*, but not so brightly colored in the markings of the lf.

34. *Chantrieri*, Hort. (*Maránta Chantrieri*, André). Habit strong and vigorous, erect, spreading and arching above: growths bearing 3-4 lvs. and reaching as much as 6 or 7 ft. high in the adult stage; blade elliptic, glabrous; in the juvenile stage the larger part of the upper side of the lf. is a pale yellowish green with a dark green irregular band running around the margins and along the midrib, the under side is rich purplish red, in the adult stage the color on both sides of the lf. is all lost and becomes a rich dark green, the intermediate stages of development are marked by a gradual loss of the light yellowish green on the upper side and purple-red of the lower and the gradual encroachment of the dark green color which predominates in the adult stage; petiole  $1\frac{1}{2}$ -5 ft. long, downy when young, glabrous when old, spreading outward; sheath extending from one-half to three-fourths of its length, upper part terete. Brazil.—A near ally, if not a variety of the older *C. leopardina*, Regel.

cc. Under side of lvs. in shades of purple or red (or perhaps green in No. 45).

35. *ornata*, Koern. (*Maránta ornata*, Lind. *M. regalis*, Hort.). Habit vigorous, erect, spreading with age: growths bearing 1-4 lvs.; blade elliptic or elliptic-cordate, acute, 1-3 ft. long, rich shining green above (in the adult stage), dull purple-red below, the lvs. in the juvenile stage all beautifully striped between the principal veins with rose or pink, which in the intermediate stage changes to white and disappears entirely in the adult; petiole erect spreading with age,

often as much as 4 ft. long and thick in proportion; sheath extending from one-third to one-half its length, upper part terete, slightly downy, especially in the lower part. Guiana to Ecuador. F.S. 4:413-14.—The forms this plant assumes during the different stages of its development have been distinguished by some nurserymen who have distributed them under separate names, *C. regalis*, *C. majestica*, and *C. roseo-striata* all being stages of the one plant. To add to the confusion they are also known in the trade under the generic name of *Maranta*. The plant known as *C. albo-lineata* or *Maranta albo-lineata*, has been referred by some authors to this species, but it has no near affinity and is a different plant from *C. ornata*, *C. imperialis* or *C. Sanderiana*.

36. *imperialis*, Hort. (*Maránta imperialis*, Hort.). Habit vigorous, erect, spreading in the adult stage: growths with 2-7 lvs. 6 in. to 5 ft. long; blade as much as 2 ft. long when adult, elliptic-ovate, acute, entire, shiny green above, rich purple-red below; petiole stout, erect or spreading, dull green; sheath developed about half its length, upper part terete.—One of the best species for decorative effect. This species presents a striking dissimilarity between the juvenile and adult stages of growth. The juvenile stage is much the better for horticultural purposes as the lvs. are then striped with bright rose or pink between the principal lateral veins. This color gradually changes as the plant grows stronger and becomes vigorous, the stripes on the lower lvs. first becoming white and gradually disappearing on the lvs. that are developed after the plant reaches the adult stage, until a stage is reached when all the color and stripes on the upper side of the lvs. are lost and the lvs. are a rich shining green color. The high color is again developed as soon as the plant is disturbed at the roots either for prop. or by injury.



738. *Calathea zebrina*.

37. *Sanderiàna*, Hort. (*Maránta Sanderiàna*). A species closely allied to *C. imperialis* but differing in the broader and shorter lf.-blades, darker color of the under sides of the lvs., transverse striation between the veins, the hairy character of the petioles and under side of the lvs. Habit erect, spreading with age; growths bearing 1-4 lvs.; blades ovate, or elliptic-ovate, up to as much as 2 ft. long when adult, acute, green above (in the adult stage), rich plum-red below; lvs. in the juvenile stage are striped with bright rose which become white in the intermediate stage and entirely disappear in the adult; petiole erect, stout; sheath extending from one-third to one-half its length, upper part terete; lf.-scales, petioles and under sides of the lvs. slightly pubescent. Brazil.—*C. ornata*, *C. imperialis* and *C. Sanderiana* are probably all forms of one very variable species.

38. *insignis*, Bull. Habit tufted, dwarf and compact: growths bearing 2-3 lvs. and from  $\frac{1}{2}$ -3 ft. high; blade linear-lanceolate, 3-18 in. long, undulate, acute, glabrous, upper side highly glabrous, pale yellowish green shading to rich olive green at the edges, and with a row on either side of the midrib arranged pinnately of alternate long and short blotches of dark olive-green, giving the plant a most distinct and striking effect; under side a rich dark maroon-red; petiole 3-20 in. long, rigid, slender; sheath only developed near the base, upper part terete, green. Brazil. J.H. III. 45:218.—One of the most beautiful foliage plants in cult. and one which thrives well in a hot moist stove in a mixture of leaf-mold and sand.

39. *argyrophylla*, Hort. A garden hybrid. Habit spreading: growths with 2-5 lvs. 1-3½ ft. long, 12-20 in. long, elliptic, silvery white, feathered with pale green above and rich reddish brown below; petiole 12-20 in. long, pale green, striped along the back with red; sheath extending up to within 4-8 in. of the lf.-blade, upper part terete and slightly channeled on upper side, glabrous in all parts.

40. *nigricans*, Gagnep. Habit loose, light and elegant, erect at first, spreading with age: growths bearing 2-3 lvs., 2-5 ft. high; blade elliptic, occasionally lanceolate, acute, undulate, 12-20 in. long, rich dark velvety green above, dull red below; petiole 1-4 ft. long, erect; sheath extending to one-third the length of the petiole, upper two-thirds terete, dull green in color: infl. arising from center of the growth of the lvs., an erect globose spike with large foliose bracts: fls. 2-3 in the axil of each bract, 1 in. diam., primrose in color, petals shaded with purple; tube 1 in. long; bracts green, reflexed, upper ones forming an umbrella-like mass under which the fls. are developed in the axils of the lower bracts. Trop. Amer. R.H. 1904, p. 576.

41. *Sôphia*, Hort. Habit medium to strong: growths with 3-7 lvs. and 1-3 ft. high; blade elliptic, acute, undulate, 12-18 in. long, rich bright velvety green with a bright yellowish green channeled midrib above, light red below; petiole erect, rigid, covered with soft tomentum; sheath extending from one-third to one-half the length of the petiole, upper part terete.—Closely allied to *C. nigricans*.

42. *zebrina*, Lindl. (*Maránta zebrina*, Sims). ZEBRA PLANT. Fig. 738. Habit compact, 1-3 ft. high: growths bearing from 6-20 spreading lvs.; blade elliptic, obtuse or acute, slightly undulate,  $\frac{3}{4}$ -2 ft. long, upper side rich velvety green, with alternating bars of pale yellowish green and dark olive-green, under side light purple-red in the adult stage, and pale grayish green in the young stage; petiole  $\frac{1}{2}$ -2 ft. long, pale green; sheath large, canalliculate, and extending nearly the whole length of the petiole; scape short. Variable. Brazil. B.M. 1926. L.B.C. 5:494. R.H. 1865, p. 90. S.H. 1:164. Lowe, 1.—The commonest species, occurring in nearly all collections of warm greenhouse plants.

Var. *Binôti*, Hort., is a stronger-growing variety with darker colored foliage, with lvs. as much as 4½ ft. long.—One of the finest and best stove foliage plants in cult., of easy culture and one that should be in all collections.

43. *pulchella*, Kœrn. (*Maránta tigrina*, Bull). Weaker grower than *C. zebrina*, the lvs. lighter colored, with two series (large and small) of broad green bars. Brazil.—By some considered to be a form of *C. zebrina*.

44. *Warscewiczii*, Kœrn. Rather large: lvs. 2-5 in. long, oblong-lanceolate, acuminate, purple beneath, dark, velvety green above, but the midrib broadly feathered with yellow-green. Costa Rica. F.S. 9 339-40. Gn. 17:560. Lowe, 17.—One of the best.

45. *Bachemiàna*, Morr. Lvs. unequilateral, cordate at the base, ovate-lanceolate or rarely oblong, at enuata-actuminate, smooth, silvery green above, finely striate, with parallel greenish or whitish markings along the primary nerves, purplish or greenish beneath. Brazil.

*C. argyræa*, Kœrn. Lvs. very short, unequal, oblong-lanceolate, short-acuminate, above deep green and ash-colored, beneath purple. Country unknown.—*C. arrecta*, Lind. & André. Tall: lvs. oblong, red beneath, green above, with the nerves all prominent. Ecuador. I.H. 18:77.—*C. bambusaæa*, Poepp. & Endl.—Ischnosiphon.—*C. Baraquinii*, Regel. Lvs. oval-lanceolate, green, with bands of white. Brazil.—*C. fascinator*, Hort. Dwarf: lvs. broad-ovate-oblong, purplish beneath, green above and with blotches of lighter color and transverse narrow bars of red. Brazil. I.H. 41:104 (as *Maranta Fascinator*).—*C. giga*, Gagnep. Eight ft.: lf.-blade lanceolate, 2 ft. long, 8-10 in. broad, violet-purple when young but becoming green; petioles 5 ft. long: spike cylindrical, about 4 in. long, bearing 8 pairs of yellow-and-white fls. Trop. Amer.—*C. hieroglyphica*, Lind. & André. Dwarf: lvs. short-ovate, short-pointed, purplish beneath, green above and marked by many oblique bands or bars of silvery white. Colombia. I.H. 20:122-3.—*C. Kerchovæana*, Hort.—*Maranta bicolor* var.—*C. Lageriàna*, Hort. Lvs. large, dark red beneath, the prominent veins rich bronze.—*C. major*, Hort.—Ischnosiphon.—*C. Massangæana*, Hort.—*Maranta bicolor* var. *Massangæana*.—*C. medio-picta*, Makoy (*Maranta prasina*, Bull). Lvs. oval-lanceolate and tapering to both ends, dark green, with the rib feathered with white from base to summit. Brazil.—*C. musaica*, Hort. (*Maranta musaica*, Bull). A dwarf-growing species with obliquely cordate ovate lvs. 4-6 in. long, glabrous, acute, upper side pale shining green marked with numerous close set transverse veins of a lighter shade; petiole 3-6 in. long. Brazil.—*C. Oppenheimiàna*, Morr.—*Ctenanthe*.—*C. pardina*, Planch. & Lind.—*C. villosa*.—*C. smaragdina*, Lind. & André—*Monotagma*.—*C. splendens* and *splendida*, Hort.—*Maranta splendida*.—*C. villosa*, Lindl. Large: lvs. 10-20 in. long, oblong-ovate, pale green, with dark brown angular blotches: fls. yellow. S. Amer. F.S. 11:1101-2 (as *C. pardina*); also, Lowe, 32.

L. H. B.

C. P. RAFFILL.

**CALCEOLARIA** (Latin *calceolus*, a slipper, alluding to the saccate flower; these plants are sometimes called lady-slippers, but the name is best used for *Cypripedium*). *Scrophulariaceæ*. Showy-flowered herbs and shrubs, grown both in the greenhouse and in the open.

Leaves mostly opposite, usually hairy and rugose, entire or incised or pinnatifid; corolla 2-parted nearly to the base, the lower part or lip deflexed and inflated slipper-like, the upper lip smaller and ascending, but usually saccate; stamens 2 or rarely 3, and no rudiments (A, Fig. 739): fr. a many-seeded caps.—About 200 species, mostly from the Andes of Peru and Chile, but extending north to Mex.; also 2 in New Zealand. Monogr. by Kränzlin, Engler's Pflanzenreich, hft. 28 (1907).

Many species of *Calceolaria* have been cultivated at one time or another, but the number now grown is few, most of the garden kinds apparently being hybrids or marked variations from specific types. The genus falls into two horticultural sections, the herbaceous kinds, and the shrubby kinds. The former are the only ones generally known in this country, being treated more or less as annuals. The herbaceous garden forms Rodigas considers to be offshoots chiefly of *C. arachnoidea* and *C. crenatiflora*, and he has called this race *C. arachnoideo-crenatiflora* (see I.H. 31:528, 536; 35:54). In this work, however, the more inclusive terms *C. herbeohybrida* of Voss is employed (Fig. 739); and also the corresponding *C. fruticoybrida* for the shrubby



derivatives. *C. crenatiflora* seems to have left its impress most distinctly on the greenhouse forms. The calceolarias are grown for the variously colored and often spotted slipper-like flowers. The shrubby forms, grown much in England, do not thrive in the heat of the American summer.

The cultivation of the herbaceous and the shrubby kinds of calceolarias is about the same, with the difference that the herbaceous kinds are nearly always grown from seeds, while the shrubby varieties are oftener grown from cuttings.—Seeds may be sown from the end of March until the first of September, according to the size of the plant required. Those sown early are more easily carried through the hot months than any that are propagated in the end of May or in the month of June. Sow the seeds in shallow pans with good drainage in a compost of equal parts of sand and of



739. *Calceolaria herbeohybrida*.

the peat which is shaken out of fern-root that is to be used for potting orchids, adding about one-fourth of charcoal. All this should be sifted through a fine sieve. This material should be well mixed and placed an inch in depth in the receptacle that the seeds are to be sown in. The surface should be made as level as possible, and the seeds, after being thinly scattered over the same, may be pressed gently into the compost, covering them very lightly with sphagnum moss sifted through a very fine sieve. Water by dipping the pan in a tank of water, allowing it to soak through the holes in the bottom of the pan. This mode of watering is not so liable to disturb the small seeds, as an overhead watering with a fine rose on the watering-pot. A temperature of 60° will cause calceolaria seeds to germinate, but the sun should not strike them until the cool of autumn comes. A greenhouse with a northern aspect is best for them until the end of September, giving all the air possible day and night. From the first of October until the end of March, the plants will stand the full sun, and should then be grown in a night temperature of 40°, allowing 10° or 15° of rise during

the day. For a first potting (which may be to 2-inch pots) the same mixture in which the seeds were sown is the best, and the seedlings should be big enough to be easily held between the finger and thumb; and as the plants are moved along into larger pots, equal parts of fibrous loam, fern-root, leaf-mold, sand and dried cow-manure may be used, always having this compost in as lumpy a state as can be equally and conveniently packed around the plant. When the plants are well rooted in their flowering pots, they may be watered with manure water. An ordinary handfull of green cow-manure to about three gallons of water may be used, and if any of the commonly used fertilizers are to be employed for a change, the same amount of fertilizer to an equal amount of water is about right; but always water with clean water twice between these applications.—If cuttings are to be used for the propagation of calceolarias, they should be rooted in a temperature of 45° to 50°, kept shaded from the sun. Cuttings may be procured from the plants that are trimmed into shape during their growing period (in August or September) and should have two leaves attached and another joint to go in the sand. When rooted, treat them as described above for the seedlings. The varieties of the rugosa section are largely used for bedding plants in Europe.—Calceolarias are very subject to attacks of green- and white-fly; the best means of keeping these pests in check is by fumigation with hydrocyanic gas. In the evening is the best time to fumigate, and the foliage of the plants should be perfectly dry; in fact, it is better if possible to use no water at all in the greenhouse the day they are to be treated. In the hot months of summer, a cool evening should be selected and one-quarter of an ounce of cyanide of potassium, one ounce of sulfuric acid and two ounces of water to every 1,000 cubic feet contained in the greenhouse may be used. (See *Fumigation*.) The house at this season of the year should be opened up in forty-five minutes after the cyanide has been dropped into the liquid. Repeat at intervals of about three weeks. In winter the quantity may be doubled to the same cubic feet of space, and the house may be kept closed until morning. When opening the ventilators after fumigating in this manner, do not breathe in the greenhouse until the air has changed, say about half an hour after, as the gas is deadly to human beings. Fumigating with tobacco will kill the green-fly, but it has no effect on the white-fly. (Geo. F. Stewart.)

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A. *Herbaceous calceolarias, some of them parents of the florists' varieties of this country.*

B. *Lvs. simple.*

C. *Fls. essentially yellow.*

1. *crenatiflora*, Cav. (*C. pendula*, Sweet. *C. mirabilis*, Knowl. & Wesc.). One to 2 ft., the st. soft-hairy, terete: radical lvs ovate and long-petioled (the petioles winged at top), undulate and dentate, sometimes obscurely lobed, rugose and pubescent, paler beneath, often purplish toward the tip; st.-lvs. shorter-petioled and becoming sessile above: fls. in a forking corymb, the slipper large, oblong or oblong-obovate, furrowed or crenate, hanging, yellow, with orange-brown dots. Chile. B.M. 3255.—From this species we appear to have derived the spots of calceolaria fls.

2. *corymbosa*, Ruiz & Pav. (*C. Wheeleri*, Sweet). One to 3 ft. high, the st. 4-angled: radical lvs. ovate and sometimes cordate, obtuse or nearly so, doubly crenate, rugose and hairy, whitish beneath: st.-lvs. smaller and narrower, somewhat clasping, opposite: fls. small (about half as large as in *C. crenatiflora*), in a broad, somewhat loose corymb, the slipper somewhat short-oblong, clear yellow outside and marked with red lines inside. Chile. B.M. 2418.

3. *biflora*, Lam. (*C. plantaginea*, Smith. *C. suberecta*, Hort. *C. Morrisonii*, Don). Herbaceous, stemless:

lvs. ovate-spatulate, toothed at top: scapes many, few-fl.; fls. large, yellow, lower lip large and the upper one small and notched, the under side of the slipper dotted with red. Chile, Argentina. B.M. 2805. L.B.C. 15:1402. F.S.R. 2:312.

4. *Pavonii*, Benth. An erect, strong-growing, herbaceous, or half shrubby species: st. terete, green, stout: lvs. perfoliate, on short winged petioles, ovate or elliptic, coarsely serrate, 5-9 in. long (in a vigorous plant), and a rich light green in color: sts. and lvs. densely hairy;

infl. paniculate, terminal, large and handsome; fls. rich golden-yellow and marked in throat with brown, and about 1 in. diam. Peru. B.M. 4525. G. 27:663. J.H. III. 50:489. J.F. I, pl. 32.—One of the parents of several handsome hybrids.

5. *Burbidgei*, Hort. (*C. hybrida* var. *Burbidgei*, Gumbel). A garden hybrid raised at Trinity College, Dublin, by Burbidge between *C. Pavonii* on the one side and *C. deflexa* (*C. fuchsifolia*) or possibly *C. amplexicaulis* on the other: plant erect: sts. hairy, terete: lvs. light green, lanceolate, 5-9 in. long, serrate, winged along the petiole: infl. large, in terminal free-branching panicles; fls. 1 in. diam., rich golden yellow. G. 25:547. Gn. 47:306.—One of the finest of cool greenhouse kinds and valuable also as a bedding plant as it grows into a fine large specimen as much as 6 ft. high and branches freely from the base. Readily prop. by cuttings.

cc. Fls. purple.

6. *purpurea*, Graham (*C. Herbertiana*, Lindl.). Sts. erect, pubescent, 1-2 ft.: radical lvs. spatulate and acutish, with a strong midrib, sparsely hairy, rugose, dentate; st.-lvs. broad-cordate and clasping, less toothed: fls. in loose corymbs, small, purplish or reddish violet, the slipper somewhat furrowed. Chile. B.M. 2775. B.R. 1313.—Supposed to have entered largely into purple-fl. varieties.

7. *arachnoidea*, Graham. St. a foot or two high, terete, branchy, woolly, with appressed hairs: lvs. oblong or lingulate, narrowing into long-winged petioles, clasping, obscurely toothed, rugose, woolly

on both sides: peduncles in pairs, forking: fls. small, dull purple, the slipper nearly globular and furrowed. Chile. B.M. 2874. L.B.C. 16:1557.

BB. Lvs. compound, or essentially so.

8. *scabiosæfolia*, Sims (*C. pinnata*, Ruiz & Pav. *C. heterophylla*, Willd.). Often 2 ft., the st. terete, hairy, and leafy: lvs. opposite, with clasping petioles, cut nearly or completely to the midrib; lfts. varying from lanceolate to broad-oval, acuminate, ciliate, dentate: fls. very small, in small hairy corymbs, pale yellow, the slipper nearly orbicular in outline. Chile, Peru, Ecuador. B.M. 2405.—This is sold by seedsmen as an annual bedding plant.

9. *pinnata*, Linn. Often reaches 3 ft. or more: lvs. pinnatifid or completely compound, the divisions short and nearly entire, obtuse or nearly so: fls. small, sulfur-yellow. Chile, Peru, Bolivia. B.M. 41.—The first known garden species, still sold as an annual.

10. *herbeohýbrida*, Voss (*C. hybrida*, *C. herbacea*, *C. Yoüngii*, Hort., and others). Derivatives of the herbaceous calceolarias: mostly dwarf or small (2 ft. or less), in many colors, usually with well-inflated slippers.

AA. Shrubby calceolarias.

B. Fls. yellow.

11. *integrifolia*, Murr. (*C. rugosa*, Ruiz & Pav. *C. salviaefolia*, Pers.). Two to 6 ft. high, branchy and bushy: lvs. glabrous, oval-lanceolate, crisped and dentate, the short petioles winged: fls. in terminal clusters, small, yellow. Chile. L.B.C. 10:942. B.R. 744, 1083.—Variable. Probably the chief source of shrubby calceolarias. Var. *viscosissima*, Hort. (Fig. 740), is a sticky-hairy form with sessile lvs. and showy fls.

12. *thyrsiflora*, Graham. More shrubby: lvs. linear and clustered, toothed, sessile, not hairy: fls. small, yellow, in a close, terminal cluster. Chile. B.M. 2915.

13. *amplexicaulis*, HBK. A foot or two high: lvs. cordate-ovate to ovate-lanceolate, long-acuminate, pubescent, woolly beneath and deep-rugose above, clasping: fls. small, in an upright corymb, pale yellow and spotless, the slipper hoof-shaped. Ecuador, Peru.

BB. Fls. white.

14. *álba*, Ruiz & Pav. Shrubby, erect, branched, the branches opposite: lvs. linear, toothed above, with fascicles of fls. in axils: fls. small, white, of 2 very unequal lips, the upper one being very small, the throat equal. Chile. B.M. 4157. G.C. III. 22:141. Gn. 51:60; 75, p. 6. J.H. III. 61:419.—A most beautiful species in England when planted out in a soil rich in humus, but should be shaded from hot sun. The plant dislikes pot culture. This species has recently been used by the hybridist in order to secure a race with white fls. The new hybrid *C. Veitchii* is likely to prove a great acquisition to gardens, and is partly derived from this species.

15. *fruticohýbrida*, Voss (*C. ascendens*, Hort., not Lindl. *C. dentata*, and *C. integrifolia*, Hort., for the most part). Here may be grouped the shrubby garden calceolarias that are derivatives of most other species. They are marked by the prevailing under-color of yellow, orange or orange-red; sometimes they are yellowish white or dull red.

*C. andina*, Benth. (*C. Herbertiana* var. *pallidiflora*, Lindl.). Shrubby, glandular-pubescent: lvs. orbicular-ovate, thick, rugose, hairy: fls. small, yellow, the slipper crenate. Chile. B.M. 7326. B.R. 1576.—*C. bicolor*, Ruiz & Pav. Shrubby: lvs. ovate, dentate: fls. small, the slipper sulfur-yellow above and white below. Peru. B.M. 3036. L.B.C. 18:1783.—*C. cana*, Cav. Herbaceous, tufted, scape, 1-1½ ft.: lvs. radical, oblong-lanceolate, spatulate or obovate: fls. white with small purple or rose-colored lines and blotches. Chile. B.M. 8416.—*C. Chiránii*, Hort.—*C. profusa*, F.E. 28:143.—*C. deflexa*, Ruiz & Pav. (*C. fuchsifolia*, Hemsl.). Shrubby: lvs. lanceolate: fls. yellow, panicled, the upper lip very large. Peru. B.M. 6431. G.C. II. 15:269. Gn. 15:258.—*C. flexuosa*, Ruiz & Pav. Shrubby at base: lvs. large-ovate, coarsely crenate-dentate: fls. rather large, clear yellow, with very large



740. *Calceolaria integrifolia* var. *viscosissima*. (X 1/2)



green calices. Peru. B.M. 5154. F.S. 22:2331.—*C. Forstii*, Skan. Undershrub, 1-1½ ft., slender: lvs. ovate, obtuse or somewhat acute, serrate: fls. small, pale yellow with a large reddish brown blotch inside the lower lip. Peru. B.M. 8436.—*C. fuchsiaefolia*, Hemsl.—*C. deflexa*.—*C. Hénnici*, Hook. f. Shrubby, evergreen: lvs. willow-like, small-toothed: fls. panicle, clear yellow, the upper lip large. Peru. B.M. 5772.—*C. hyssopifolia*, HBK. Shrubby: lvs. crowded, small, lanceolate and toothed, or at top of st. linear and entire, margins revolute: fls. rather large, in many-fld. corymbs, pale sulfur-yellow, the slipper obovate-orbicular and crenate. Ecuador.—*C. Jeffreyi*, Hort., is a hybrid group between herbaceous greenhouse kinds and *C. integrifolia*, produced about 10 years ago in England: 2-6 ft., with branching panicles bearing fls. about 1 in. across of few colors.—*C. kewensis*, Hort. Cross of *C. Jeffreyi* with herbaceous varieties: more compact and larger-fld. than *C. Jeffreyi*; colors of wide range: plant 1-2½ ft. high and about as broad when in good bloom. G.C. III. 39:390.—*C. lobata*, Cav. Herbaceous: lvs. triangular-ovate, palmately 5-7-lobed, dentate: fls. in terminal clusters, clear, pale yellow, and spotted on the up-curved slipper. Peru, Bolivia. B.M. 4525, 6330.—*C. mexicana*, Benth., is a small-fld., pale yellow species hardy in England: annual: lower lvs. 3-parted or -lobed, the upper ones pinnatisect. Mts., Mex., Costa Rica.—*C. petiolaris*, Cav. (*C. floribunda*, Lindl.). Herbaceous: lvs. ovate, the lower ones wing-petioled, toothed, rugose: fls. yellow in loose panicles, the lips connivent. Chile.—*C. piscumensis*, Meyen. Shrubby: lvs. ovate-cordate, nearly or quite obtuse nearly sessile, irregularly crenate, margins reflexed: fls. large, orange varying to red, the slipper up-curved. Peru. B.M. 5677.—*C. polyrrhiza*, Cav. A dwarf and tufted species from Patagonia, with dark yellow purple-spotted fls.: herbaceous, caespitose: lvs. crowded, lanceolate. S. Chile, Patagonia. For rockwork.—*C. profusa*, Hort. (*C. Clibranii*, Hort.). On the order of *C. Burbidgei*. A garden form of free-flowering habit.—*C. Sinclairii*, Hook. Herbaceous, half-hardy: lvs. oblong-ovate, stalked, crenate-dentate, hairy: fls. small, lilac or flesh-colored, spotted within, the 2 lips nearly equal, not saccate. New Zeal. B.M. 6597. Now referred to *Jovellana* (*J. Sinclairii*, Kränzl.).—*C. tenella*, Poepp. & Endl. Herbaceous, half-hardy, 6 in. high: lvs. ovate or orbicular, small (½ in. long), nearly or quite sessile: fls. yellow, spotted within. Chile. B.M. 6231.—*C. Veitchii*, Hort. Hybrid of *C. alba* and a garden variety: 3-5 ft., erect and branched: fls. many, rather small, pale lemon-yellow. G.C. III. 51, Suppl. June 1. Gn. 76, p. 271. (See No. 14.)—*C. violacea*, Cav. (*Jovellana violacea*, Don). Shrubby: lvs. small, ovate-cordate, deep-toothed, stalked: fls. yellow-salmon, spotted within and without, the two lips not saccate. Chile. B.M. 4929.—*C. virgata*, Ruiz & Pav. Bushy, 1-1½ ft.: lvs. ovate, short-stalked: fls. rather small, numerous, white. Peru, Bolivia. G.C. III. 51:50.

L. H. B.

**CALÉNDULA** (Latin, *calendæ* or *calends*: throughout the months). *Compósitæ*. Flower-garden plants.

Small herbs, the common cult. species annual, others perennial, with alternate simple lvs., mostly large heads with yellow or orange rays, glabrous incurved achenes, plane naked receptacle, pappus none, and involucre broad, with scales in one or two series, their margin usually scarious.—Some 15 species from Canary Isls. to Persia.

*officinalis*, Linn. POT MARIGOLD. Fig. 741. Annual: 1-2 ft. high, more or less hairy: lvs. oblong and more or less clasping, entire, thickish: heads solitary, on stout stalks, large with flat spreading rays, showy, closing at night. S. Eu. B.M. 3204. V. 5:44; 16:165.—One of the most universal garden fls., running into many vars., distinguished by size, color, and degree of doubling. The color varies from white-yellow to deep orange. This is the marygold of Shakespeare's time. The fl.-heads are sometimes used in cookery, to flavor soups and stews. The calendula is of the easiest culture in any warm, loose soil. The seeds are usually sown where the plants are to stand, but they may be sown indoors or in a frame and the plants transplanted. The achenes are large and germinate quickly. The plant blooms the whole season, particularly if the fls. are picked. It is a hardy annual, and in the southern states will bloom most of the year. In the N. it blooms up to the first frosts, sometimes beyond. Sown in summer or autumn, it makes a good winter bloomer. Florets are used in medicine as a vulnerary and anti-emetic. The flowering plant was formerly used for removing warts.



741. *Calendula officinalis*, double-flowered. (× ½)

*suffruticōsa*, Vahl (*C. Noëana*, Boiss.). More diffuse, annual: lvs. sessile, lanceolate, somewhat dentate: heads bright yellow, not doubled, very numerous, on long peduncles. W. Medit. region.—Seeds are sold by American dealers.

*C. Pöngelii*, Hort., and *C. pluviialis*, Linn., will be found under *Dimorphotheca*.

L. H. B.

**CALICO BUSH:** *Kalmia*.

**CALIFORNIA POPPY:** *Eschscholtzia*.

**CALIFORNIA YELLOW BELLS:** *Emmenanthe penduliflora*.

**CALÍMERIS** (Greek, *beautiful arrangement*). *Compósitæ*. Good daisy-like border plants.

Calimeris comprises about 10 Asian herbs, now mostly united with *Aster*, but horticulturally distinct, and differing from that genus in the hemispherical involucre of few nearly equal scarious-margined bracts, and broad convex receptacle: achene flat and hairy. Hardy perennials of low growth, suited to the border in front of stronger plants. *C. tatarica* is described in the genus *Heteropappus*.

*incisa*, DC. (*C. incisafolia*, Hort.? *Aster incisus*, Fisch.). One to 2 ft., erect, corymbose at the summit: lvs. lanceolate, remotely incise-dentate; scales of involucre red-margined: fls. large, purple-rayed or almost white, and yellow-centered.—Of easy cult. in any good soil, making a display throughout July and Aug. The commonest species in cult.

*altáica*, Nees (*Aster altáicus*, Willd.). Lower, pubescent or hispid: lvs. linear-lanceolate and entire: scales of involucre pubescent and white-margined; rays narrow, blue.

L. H. B.

**CALIPHRÛRIA:** *Calliphuria*.

**CÁLLA** (ancient name, of obscure meaning). *Aráceæ*. A monotypic genus, containing a native bog-plant with a white spathe.

Herb, with creeping rhizomes and 2-ranked lvs. Differs from *Orontium* in the parallel secondary and tertiary veins of the lf.-blade, as well as in having a prominent more or less fleshy persistent spathe enveloping the spadix, and in the absence of perianth; lower fls. perfect, upper staminate; fr. a red berry. See *Zantedeschia* for *C. æthiopica*, *C. albo-maculata*, and others. The calla of florists, or calla lily, is *Richardia* of recent books, but is properly *Zantedeschia*, where it is described and the culture given in this work.

*palústris*, Linn. WATER ARUM. Fig. 742. Rhizome bearing many distichous lvs. one year, the next only 2 lvs. and the peduncle: petioles cylindrical, long-sheathed; blade cordate: spathe elliptical, or ovate-lanceolate, white. Eu., N.

Asia, and E. N. Amer. V. 2:197; 14:244. B.M. 1831.  
—An interesting little perennial plant, useful for outdoor ponds.

JARED G. SMITH.

**CALLIÁNDRA** (Greek, *beautiful stamens*). *Leguminosæ*. Evergreen shrubs and trees of greenhouse culture, planted in the open far south.

Leaves bipinnate; fls. numerous; fls. usually in globose heads or clusters; corolla small, obscured by the numerous, long, silky, purple or white stamens.—About 120 species, widely distributed in tropics. Distinguished from *Acacia* by the presence of a thickened margin on the pod.

Propagation is by cuttings placed in sand over bottom heat. Keep in warm-house, with the exception of those from Mexico.

**Lambertiána**,

Benth. (*Acacia Lambertiána*, D. Don.) Unarmed; branches terete; lvs. puberulous-villous; pinnae 2-3-yoked; fls. 9-12-yoked, oval-oblong, obtuse at both ends; peduncles 3-5, racemose, heads roundish; stamens 20-25, pink. Mex. B.R. 721.

**tetragóna**, Benth. (*Acacia tetragóna*, Willd.). Unarmed; branches tetragonal; pinnae 5-6-yoked; fls. 16-29-yoked, linear, acute, the outer larger; heads pedunculate, axillary; fls. white. Trop. Amer.

**portoricénsis**, Benth. (*Acacia portoricénsis*, Willd.). Unarmed shrub or small tree; pinnae 2-4-yoked; fls. 15-25-yoked, linear, obtuse, closing at evening; branchlets pubescent; heads globose, pedunculate, axillary, the white fls. opening as lvs. close; calyx ciliate on the margin; stamens 20-25; filaments long, white; pod straight, linear, tapering at base. W. Indies.—Endures temperatures as low as 24° F. in Calif. Var. *majior*, a splendid form, is known abroad. B.M. 8129.

**Twoëdyi**, Benth. Unarmed shrub, lightly pubescent; pinnae 3-4-yoked; fls. 20-30-yoked, linear, obtuse, shining; peduncles axillary, 1-2 in. long, from large scaly buds; calyx and corolla silky, lobes erect; stamens long, numerous, purple. Brazil. B.M. 4188.

*C. californica*, Benth. A stiff, hairy, much-branched shrub cult. in Calif. It is native near Magdalena Bay and is the most northerly known representative of the genus.—*C. caracasana*, Benth. (*Mimosa caracasana*, Jacq.) differs from *C. portoricénsis* in having purple stamens, but is probably not distinct.—*C. grandiflora*, Benth. Not over 10 ft.; foliage glaucous; fls. scarlet. Intro. by Franceschi.—*Mimosa grandiflora*, L'Her. (?)—*C. Samán*, Griseb., = *Pithecolobium Samán*.

HARVEY MONROE HALL.

**CALLIANTHEMUM** (Greek, *beautiful flower*). *Ranunculáceæ*. Two or 3 little herbs of the mountains of Eu. and Cent. Asia, allied to *Anemone*, sometimes mentioned for outdoor planting. Lvs. radical (very small or none on the st.), compound; fls. terminal, white or rose-color; sepals 5, deciduous; petals 5-15, showy, with nectaries at the base. The species apparently intergrade. *C. anemonoides*, Endl. Three to 10 in. high, blooming in spring; lvs. as broad as long, triangular in outline, bipinnatifid; fls. 1½ in. or less across; sepals broad; petals narrow; rhizome somewhat fleshy. Tyrol. Useful in rockwork.

**CALLICÁRPA** (Greek, *beauty and fruit*). *Verbénacææ*. Ornamental woody plants cultivated chiefly for their brightly colored berry-like fruit appearing late in autumn; also for the attractive flowers which appear in summer.

Flowers perfect; calyx short-campanulate, truncate or slightly 4-toothed, rarely 4-parted; corolla with short tube, 4-lobed; stamens 4, of equal length; ovary 4-celled, cells 1-ovuled; fr. a subglobose berry-like drupe with 2-4 stones.—More than 30 species in tropical and subtropical regions of Asia, Austral., N. and Cent. Amer.

*Callicarpas* are shrubs or trees, often with stellate hairs, with opposite, usually serrate, deciduous leaves and small pink, bluish or whitish flowers in axillary clusters, followed in autumn by small berry-like lilac, violet or red, rarely white fruits. The hardiest are *C. dichótoma*, *C. japonica* and *C. Giraldii*, which may be grown even North in sheltered positions, if somewhat protected during the winter. If killed to the ground, young shoots spring up vigorously, and will produce flowers and fruit in the same season. If grown in the greenhouse, they require a sandy compost of loam and peat, and plenty of light and air. Propagation is readily effected by greenwood cuttings in spring or summer under glass; also by hardwood cuttings, layers and seeds.

A. Lvs. tomentose beneath.

**americana**, Linn. Shrub, 3-6 ft., with scurfy, downy tomentum: lvs. cuneate, elliptic-ovate, acuminate, obtusely serrate, 3-6 in. long; cymes short-stalked; corolla bluish, glabrous; fr. violet. July, Aug. Woods and rich soil. Va. to Texas and W. Indies.—One of the handsomest in fr., but more tender than the Japanese species. Var. *álba*, Hort., has white fr.; very conspicuous in fall and early winter.

AA. Lvs. not or slightly pubescent below and glandular: corolla glandular outside.

B. Peduncles longer than petioles: lvs. glabrous or nearly so below.

**japonica**, Thunb. (*C. Mimurazaki*, Sieb.). Fig. 743. Shrub, 2-5 ft.: lvs. cuneate, elliptic or ovate-lanceolate, long-acuminate, serrulate, 2½-5 in. long; cymes peduncled, many-fl.; fls. pink or whitish; fr. violet. Aug. Japan. S.I.F. 1:70. G.C. 1871:173. P. F.G. 2, p. 165. H.F. 1861:12. Var. *leucocarpa*, Sieb. With white fr.

**dichótoma**, Koch (*C. grácilis*, Sieb. & Zucc. *C. purpurea*, Juss.). Shrub, 1-4 ft.: lvs. cuneate, elliptic or obovate, crenately serrate above the middle, entire toward the base, 1½-3 in. long;



743. *Callicarpa japonica*. (×¼)



742. *Calla paustris*.



cymes peduncled, few- or many-fl'd.; fls. pink; fr. lilac-violet. Aug. Japan, China. Gn. 23:540.—Closely allied to the former, but smaller in every part.

BB. *Peduncles shorter than petioles.*

**Girálzii**, Hesse. Shrub: lvs. broadly elliptic or elliptic-ovate to elliptic-lanceolate, 2–4 in. long, dentate, glandular beneath, and sparingly stellate-pubescent; petioles slender,  $\frac{1}{3}$ – $\frac{1}{2}$  in. long; fls. pink in dense cymes on pubescent stalks shorter than the petioles; fr. violet. W. China.

*C. cina*, Linn. Shrub: lvs. broadly elliptic, shining above and whitish-tomentose beneath; fr. deep purple. E. India, China, Philippine Isls. B.M. 2107.—*C. longifolia*, Lam. Shrub: lvs. oblong-lanceolate or lanceolate, narrowed at both ends, 3–5 in. long, stellate pubescent and glandular beneath; cymes short-peduncled; fls. pink or purple; fr. white. Himalayas, China. B.R. 10:864. H.E. 2:133.—*C. mollis*, Sieb. & Zucc. Shrub, to 4 ft.; lvs. oblong-lanceolate, rounded at the base, tomentose beneath; fls. and fr. pink. Japan. S.I.F. 1:70.—*C. pedunculata*, R.Br. (*C. lanata*, Schau., not Linn.) Shrub: lvs. oblong-ovate, nearly sessile, and rounded at the base, green and slightly tomentose beneath; cymes slender-peduncled. E. Indies. Austral. Sieb. Flor. d. Jard. 4:97.—*C. rubella*, Lindl. (*C. dichotoma*, Hort., not Juss.) Shrub or small tree, to 20 ft.; lvs. cordate-oblong, tomentose beneath; fr. purple. Himalayas, China. B.R. 11:883. F.S. 13:1359. I.H. 6:202. G.C. 1859:96. R.H. 1859, p. 106, 107.

ALFRED REHDER.

**CALLICHRÒA**: *Layia*.

**CALLIÓPSIS**: *Coreopsis*.

**CALLIPHURIA** (Greek, *beautiful prison*; referring to the spathe inclosing the flowers). Written also *Caliphuria*. *Amaryllidaceæ*. Tender bulbs.

Distinguished from *Eucharis* by the stamens, the filaments being petaloid, with 3 large linear teeth on top, the middle one bearing the anther. The fls. appear with the lvs.; perianth funnel-shaped, spreading upward; stamens inserted at the throat of the tube; caps. tardily splitting.—Three species from Colombia.

Calliphurias are warmhouse plants and should be grown in a rich soil of loam, peat or leaf-mold and sand. Propagated by offsets.

**Hartwegiana**, Herb. Bulb ovoid, 1 in. thick, stoloniferous, with brown membranous tunics: lvs. bright green, firmer and more closely veined than in *Eucharis*, with an oblong-acute blade 4–5 in. long, 2 in. broad, narrowed into a petiole, which is flat above and round beneath; scape slender, 1 ft. long; fls. 6–8, in an umbel, white; perianth 1 in. long and wide. Andes of Bogota.—B.M. 6259. B.R. 30, p. 87, desc. Intro. in 1889 by Reasoner.

*C. subdentata*, Baker=*Eucharis subdentata*.

N. TAYLOR.†

**CALLIPRÒRA**: *Brodiaea*.

**CALLIPSÏCHE** (Greek, *beautiful* and *butterfly*). *Amaryllidaceæ*. Three bulbous plants from Ecuador and Peru, the lvs. produced after the yellow or greenish yellow fls., probably not in the horticultural trade. Leaves thin, oblong and stalked: fls. many in an umbel on a hollow peduncle or scape; perianth funnelliform with short tube, the segms. all equal and oblanceolate to oblong; stamens 6, much exserted, attached at the throat; fr. a deeply 3-lobed caps., with many seeds. They require the general treatment given amaryllis. *C. mirabilis*, Baker, has an oblong bulb 2 in. diam.: lvs. 1 or 2, blade 5 or 6 in. broad: peduncle 2–3 ft.; fls. greenish yellow, about 30 in a dense umbel; stamens three times as long as perianth and widely spreading. July, Aug. *C. aurantiaca*, Baker, has an ovoid bulb 1 in. diam.: lvs. few: peduncle  $1\frac{1}{2}$ –2 ft.; fls. bright yellow, 6–8 in the umbel; stamens green, twice the length of perianth. Autumn and winter. B.M. 6841.

L. H. B.

**CALLÍPTERIS** (Greek, *beautiful fern*). *Polypodiaceæ*. Ferns allied to *Asplenium* and *Diplazium*, with elongate sori formed on both sides of the veins, and the veins uniting to form meshes or areoles.—Some 15 species are known from the warmer parts of both hemispheres.

The following is the only one in cult. Culture the same as for tropical aspleniums.

**prolifera**, Bory (*Asplenium decussatum*, Swartz). Lvs. 3–6 ft. long, the stalks 1–2 ft. long, the pinnæ numerous, 6–12 in. long, 1–2 in. wide, with deeply crenate margins and frequently with bulblets in the axils; veins pinnate, with the branches of contiguous veins uniting. Polynesia and Malaya.

L. M. UNDERWOOD.

**CALLÍRHOË** (Greek mythological name). Written also *Callirrhoë*. *Malvaceæ*. Hardy showy herbs, for outdoor planting.

Perennials or annuals: lvs. alternate, with lobed or cleft blades or more finely dissected: fls. showy, axillary or sometimes in terminal racemes, the petals irregularly cut at the apex or truncate, differing in this from the notched petals of *Malva*; involucrel of 1–3 bracts, or wanting.—Nine species, native.

The callirhoës are of the easiest culture, and deserving of a much greater popularity. They are chiefly propagated by seeds, but the perennial species may also be propagated by cuttings.



744. *Callirhoe pedata*.

A. Annual: involucrel absent.

**pedata**, Gray. Fig. 744. Height 1–3 ft.: st. erect, leafy: radical and lower lvs. round-cordate, palmately or pedately 5–7-lobed or -parted, the lobes coarsely toothed or incised, upper 3–5-cleft or -parted, usually into narrow divisions: fls. red-purple, cherry-red, varying to lilac. On plains and in sand, S. U. S., spring and summer. R.H. 1857, p. 430.

AA. Perennial: involucrel present.

**involucrâta**, Gray. Height 9–12 in., plant hirsute or even hispid: root large, napiform: sts. procumbent: lvs. of rounded outline, palmately or pedately 5–7-parted or -cleft, the divisions mostly wedge-shaped, incised, the lobes oblong to lanceolate: fls. crimson-purple, cherry-red or paler. All summer. Minn. to Texas. R.H. 1862:171 (as *C. verticillata*).

Var. **lineariloba**, Gray (*C. lineariloba*, Gray). Less hirsute than the type: sts. ascending: lvs. smaller, 1–2 in. across, the upper or all dissected into linear lobes: fls. lilac or pinkish. Texas and adjacent Mex.—An excellent trailer, especially for rockeries. Thrives even in very dry soils, the root penetrating to a great depth. A sunny position is preferable.

*C. Papaver*, Gray. A perennial decumbent or ascending plant with 3–5-lobed or -parted lvs. and involucrel purple-red fls. S.U.S.—Useful for very dry sandy places.

N. TAYLOR.†

CALLISTA: *Dendrobium*.

**CALLISTÈMON** (Greek, *kallos*, beauty; *stemon*, a stamen; in most of the species the stamens are of a beautiful scarlet or crimson color). *Myrtaceæ*. BOTTLE-BRUSH. Ornamental shrubs, thriving without irrigation in California, where they are hardy and much used; also planted to some extent elsewhere in warm climates and occasionally seen under glass. Page 3566.

Leaves alternate, entire, lanceolate or linear, mostly with oil- or resin-dots and fragrant when crushed: fls. in dense cylindric spikes, at first terminal but the axis growing out as a leafy shoot; calyx-teeth 5; petals 5, deciduous; stamens indefinite in number, not united; anthers versatile, the cells parallel and bursting longitudinally; ovary inferior, maturing into a caps. which persists for several years.—About 25 species, natives of Austral., where they inhabit arid districts. Distinguished from *Melaleuca* only by the stamens, which in that genus are united into bundles. Hall, Univ. Calif. Pub. Bot. 4:22.

The showy flower-clusters, resembling bottle-brushes in shape, and so giving the common name to the genus, are highly colored and render these shrubs very ornamental. The quantity of bloom may be much increased by judicious autumn pruning. The various species are recommended for parks, depot-grounds, school-yards, and also for smaller yards if kept well pruned. Hardy only in warm-temperate districts but enduring temperatures less than 20° F.

Propagation from seeds is satisfactory: these are gathered during the summer months by allowing the capsules to open in boxes or on sheets of paper kept in a warm place; sow in early spring in finely sifted mixture of sand, leaf-mold, and loam, and cover very lightly; the ordinary cool greenhouse is warm enough. Some nurserymen state that plants from cuttings of ripened wood or of wood which is getting firm at the base will blossom earlier than seedlings; others find no advantage in this method. Although adapted to nearly every variety of soil, these plants make but slow growth in heavy clay.

A. Stamens  $\frac{3}{4}$ –1 in. long.

**lanceolatus**, DC. (*Metrosideros semperflorens*, Lodd.). Fig. 745. Height 6–12 ft.: lvs. lanceolate,  $1\frac{1}{4}$ – $2\frac{1}{2}$  in. long, about  $\frac{1}{4}$  in. wide, acute, reddish when young; midrib and lateral veins prominent: spikes 2–4 in. long, bright red, less dense than in the following species: fr. ovoid, contracted at summit. Jan.–June. B.M. 260



745. *Callistemon lanceolatus*. ( $\times \frac{3}{4}$ )

(as *M. citrina*). Maiden, Fl. Pl. and Ferns of New S. Wales, 8.—Attains 30 ft. in Austral. where the hard and heavy wood is used for wheelwrights' work and for mallets. Garden hybrids between this and other species have been developed, especially in Eu.

**speciosus**, DC. Large shrub: lvs. narrowly lanceolate, obtuse or acute,  $1\frac{1}{2}$ –4 in. long, about  $\frac{1}{4}$  in. broad; midrib prominent but lateral veins obscure: spikes 2–6 in. long, bright red, very dense; fr. nearly globose, the summit scarcely contracted. March–June. B.M. 1761.—The most highly colored callistemon, the golden anthers contrasting well with the dark red filaments. There are many garden forms varying in color, habit, and size.

**viminális**, Cheel. Tall slender tree of pendulous habit: lvs. linear-oblong: stamens slightly shorter: rim of fr. thinner.—A handsome, graceful tree, very showy when in full bloom. Grown at Santa Barbara, Calif. (Formerly referred to *C. speciosus*, of which this may be a form.)

**rigidus**, R. Br. (*C. linearifolius*, DC.). Lvs. narrowly linear, rigid, sharp-pointed, 2–5 in. long, about  $\frac{1}{4}$  in. wide; midrib and marginal ribs prominent; cross-nerve often hidden by oil-dots: spikes deep red, large, dense. March–July. B.R. 393.—Stiffly branched shrub, the branches inclined to become rangy; best form and bloom secured by means of autumn pruning. In order to have fine specimen plants, cult. well and now and then give an application of commercial fertilizer.

**linearis**, DC. Scarcely more than an extreme form of *C. rigidus* with very narrow lvs. channeled above, the midvein quite obscure: fr. more globular and contracted at opening.

AA. Stamens  $\frac{1}{2}$  in. or less long.

**salignus**, DC. Tall shrub or small tree: lvs. lanceolate, acute,  $1\frac{1}{2}$ –3 in. long,  $\frac{1}{4}$ – $\frac{3}{4}$  in. wide (much narrower in one variety), very distinctly penniveined: spikes yellow or light pink, 1–2 in. long; fr. nearly globose, with rather large opening. Apr., May. B.M. 1821. Var. *viridiflorus*, Fr. v. M. Lvs. only 1–2 in. long, thicker, rigid; veins obscure: fls. greenish yellow. B.M. 2602.

**brachyandrus**, Lindl. Slender shrub, young shoots soft-hairy or whole plant gray with a soft pubescence: lvs. rigid, nearly terete,  $\frac{3}{4}$ – $1\frac{1}{2}$  in. long: spike 2–3 in. long, the filaments dark red but nearly obscured by the golden yellow anthers.—The slender habit, gray foliage, and golden bloom render this shrub very desirable for ornamental planting.

HARVEY MONROE HALL.

**CALLISTEPHUS** (Greek words for *beautiful crown*, said to be in allusion to character of fruit). *Compositæ*. CHINA ASTER. (See page 419, Vol. 1.) One species in China and Japan. The genus *Callistemma*, also erected by Cassini, is older than *Callistephus*, but the latter is one of the "nomina conservanda" of the Vienna code, retained because accepted and in general use for fifty years following its publication. Under both these generic names, Cassini described the China aster as *C. hortensis*. It was first named by Linnaeus, however, as *Aster chinensis*, and Nees subsequently transferred this name to *Callistephus*, so that the plant now would better bear the name *Callistephus chinensis*, Nees.

*Callistephus* is closely allied to *Aster*, from which it differs, among other things, in its pappus, which is minute and forming a crown in the outer series, and of slender longer barbellate and caducous bristles in the inner series: annual, erect, hispid-hairy branching herbs, with showy terminal fl.-heads. lvs. alternate,





XXII. Carnations.—Types of the American winter-flowering varieties. (Half size.)





broadly ovate or triangular-ovate and deeply and irregularly toothed; blade decurrent into a petiole, those on the upper parts becoming spatulate or narrower: heads in wild plant heterogamous and radiate, the ray-florets in 1-2 series and pistillate, the disk-florets perfect and fertile; involucre hemispherical, the bracts imbricated in many series and the outer ones large and green: fr. a compressed achene. The rays become much multiplied under cult., and they are also variable in size, shape and color. The colors are violet, purple, blue and white, the rays never being true yellow. Widely variable under cult., and one of the best of the garden annuals, growing from 6 in. to 2½ ft. high. It is the Reine-marguerite of the French and the Sommeraster of the Germans.

L. H. B.

**CALLÍTRIS** (from the Greek for *beautiful*). Including *Frenêla* and *Widdringtonia*. *Pináceæ*. Evergreen trees or shrubs, not quite hardy in the open in England, but thriving well in the southernmost parts of the United States; allied to Thuja.

Leaves scale-like or awl-like, in whorls of 3 or 4 on jointed branches, or sometimes alternate: monœcious; sterile catkins cylindrical or ovoid, the stamens in whorls of 3 or 4, the scales broad and sometimes peltate; fertile cones of 4-8 scales, and borne on short and thick peduncles, either solitary or clustered, usually ripening the second year and often persisting after the seeds have fallen.—About 15 species in Austral., New Caledonia and Afr. Little known in cult. here.

A. Cone 6-valved.

**robústa**, R. Br. (*Frenêla robústa*, Cunn.). *CYPRESS PINE*. Ranging from a shrub to a tree 90 ft. high: branchlets crowded, short and erect: sterile catkins ¼ in. or less long, solitary or in 3's: cones solitary or few-clustered, nearly globular, about 1 in. diam.; seeds usually 2-winged. Austral.—Trees about 30 years old are said to be growing at Santa Barbara. In S. Fla. it makes good specimens, in 5 years becoming 10-12 ft. high. The tree somewhat resembles red cedar, and is reported as useful for tall hedges and windbreaks. This is one of the "pines" of Austral., the wood being used in building and for the making of furniture.

**rhombóidea**, R. Br. (*Frenêla rhombóidea*, Endl.). Smaller, reaching 25-50 ft.: branches somewhat slender and often drooping, angled when young: cones usually only one-half the diam. of those of *C. robusta*, globular, the 6 valves alternately larger and smaller, the larger valves having a broadly rhomboidal apex with a protuberance at the center. Austral. and Tasmania.—Timber used for telegraph poles and in construction.

AA. Cone 4-valved.

**quadriválvis**, Vent. (*Thûja articulâta*, Vahl). *ARAR-TREE*. *SANDARACH*. *GUM TREE*. Small tree, with fragrant hard durable wood: branches jointed and spreading: lvs. very small, flattened, distichous, reduced to scales at the nodes: cone 4-sided, small, the valves oval and with a protuberance near the tip. N. Afr., in the mts. L.B.C. 9:844.—Furnishes varnish resin (gum sandarach).

**Whýtèi**, Engler (*Widdringtonia Whýtèi*, M. Wood). The wood is dull reddish white, strongly aromatic, and locally used for furniture and for doors and windows. Tree attaining a maximum height of 140 ft., with a diam. of 5½ ft. at a point 6 ft. above the ground, the trunk being clear for 90 ft.: lvs. on ultimate branchlets, deltoid and closely appressed opposite; on other branchlets usually linear-lanceolate, spreading at the tips, alternate: in seedling stage linear, spreading and about 1 in. long: cones 4-6 together, about ¾ in. long and ¾-1 in. wide when open. S. E. Afr.—It grows at an altitude of 5,000-7,000 ft. on Mt. Milanji in Nyassaland and is known as the Milanji cypress or cedar. Apparently hardy in parts of Cent. Calif.

L. H. B.

**CALLÓPSIS** (*Calla*-like). *Aráceæ*. A single species from German E. Afr.: *C. Vólkensis*, Engler. Spathe like that of a little calla, snow-white, 1½ in. long by 1 in. broad, the spadix partly united to it (and yellow): lvs. crowded, cordate-ovate, 5 in. long, shining, the petiole about 2 in. long; semi-epiphytic, with creeping rhizome. Probably cult. only in botanic gardens or other collections.

**CALLŪNA** (Greek, *to sweep*; the branches are sometimes used for making brooms). *Ericáceæ*. *HEATHER*. Low evergreen shrubs cultivated chiefly for their bright rosy pink, rarely white flowers appearing in great profusion late in summer.

Leaves scale-like, opposite, in 4 rows, the branchlets therefore quadrangular: fls. in terminal, 1-sided spikes; corolla campanulate, 4-parted, shorter than the 4-parted colored calyx; stamens 8, with 2 reflexed appendages: fr. a septicidal, 4-celled, few-seeded caps.—One species in W. and N. Eu., also in Asia Minor; in E. N. Amer. in some localities naturalized. The genus differs from the closely related *Erica* in its deeply 4-parted colored calyx, longer than the 4-parted corolla. For culture, see *Erica*.

*vulgâris*, Salisb.(*Erica vulgâris*,

Linn.). Fig. 746.

From ½-3 ft.: lvs.

oblong-linear, ob-

tuse, sagittate at

the base, glabrous

or pubescent: fls.

small, in long, erect,

rather dense rac-

emes, rosy pink,

sometimes white.

Aug., Sept.—Some

of the most distinct

of the numerous named varieties are the following: Var.

*álba*, Don (and var. *álba Hammondii*), with white fls.;var. *Alpörtii*, Kirchn., of more vigorous growth, with rosycarmine fls.; var. *cárnea*, Hort., with flesh-colored fls.;var. *plêna*, Regel, with double rose-colored fls.; var.*hirsûta*, Gray (var. *tomentôsa*, Don), the branchletsand lvs. with grayish tomentum; var. *nâna*, Kirchn.(var. *pýgmæa*, Hort.), forming low moss-like tufts;var. *rûbra*, Kirchn., with deep rosy carmine fls.; var.*prostrâta*, Kirchn., with the branches spreading andpartly prostrate, fls. pink; var. *Sêarleii*, Hort. (var.*álba Sêarleii*, Hort.), fls. white, appearing late in autumn.

—The heather is a very handsome small shrub, well

adapted for borders of evergreen shrubberies, or for

dry slopes and sandy banks and preferring sunny posi-

tions; it is also found growing well in swamps and in

partly shaded situations. Cut branches keep their

life-like appearance for many months.

ALFRED REHDER.

**CALOCHÓRTUS** (Greek for *beautiful* and *grass*).*Liliáceæ*. Incl. *Cyclobôthra*. *MARIPOSA LILY*. *STAR**TULIP*. *GLOBE TULIP*. West American cormous plants,

the occidental representatives of Tulipa, useful as border

plants and to some extent for indoor culture.

Stem usually branched, and from a coated corm,

more or less leafy: perianth of unequal segms., the outer

ones the smaller and more or less sepal-like, the 3 inner

ones large and showy and bearing glands and hairs;

stigmas 3, sessile and recurved; stamens 6; fls. showy,

shallow-cupped on the inner segms., arching.—From

40-50 species, mostly on the Pacific side of the con-

746. *Calluna vulgaris*. (Plant  $\times \frac{1}{2}$ )

tinant from Wash. to Mex., and some of them in the interior country. Nearly all the species are in cult. Monogr. by J. G. Baker, Journ. Linn. Soc. 14:302-10 (1875); and by S. Watson, Proc. Amer. Acad. Arts and Sci. 14:262-8 (1879). See also *Calochorti* in the Sierra Nevada, by George Hansen, Erythra, 7:13-15; A. Davidson, Erythra, 2:1-2, 27-30; Mallett. Gn. 1901, 60:412, vol. 61, pp. 185, 203, 220; Carl Purdy, Proc. Calif. Acad. Sci., 3d ser., vol. 2, No. 4 (1901).

*Calochortus* extends into British America, and a few, belonging to a peculiar group, are found in Mexico; the remainder are natives of the United States, from Nebraska to the Pacific Ocean. While the generic characteristics are unmistakable, the species and even varieties have the most variable inclinations as to soil, exposure and climate. The Colorado Desert and the summits

of the Sierra Nevada, the heavy clay lands of Californian valleys, the volcanic soils of the foothills and the meadows of the Northwest, each has its own representatives of this beautiful tribe. The character of the genus can be treated better under the various groups. Nearly every known species is in cultivation to some extent. Some are readily grown, others present considerable cultural difficulties; but while there are some that probably will always be difficult to cultivate, there are many species—and the number includes the very best—that can be grown successfully by anyone who is willing to give a little special care to them; and there are a few that possess such vigor and hardiness as to be adapted to extensive cultivation.

All *calochortus* are hardy in the sense of withstanding extreme cold, but they will not endure alternate thawing and freezing nearly so well; and thus there is the paradox of their going safely through severe eastern or European winters and suffering the loss of foliage in mild ones. They should be planted in the fall, and it is better to plant late, so that leaf-growth is delayed until spring. Diverse as are their natural habitats, one soil will answer the needs of all. A light loam, made lighter with sand or sawdust, powdered charcoal, or spent tan-bark, is best. Excellent results have been secured with a mixture of equal parts of a good light loam and spent tan-bark, with a little broken charcoal. Wallace, one of the most successful English growers, recommends making a bed sloping to the south, composed of leaf-mold and road grit in equal parts, with a smaller proportion of sharp sand. The idea is to have a light and porous, not too stimulating soil, with perfect drainage. Wallace recommends covering the beds with reeds to throw off the heavy rains. The same end may be attained by such thorough drainage that the rains pass through quickly. In New York, they have been carried through the winter safely under a covering put on before the ground freezes hard. It is well to keep a few leaves about the shoots for a time and to have extra leaves at hand to be used when frost threatens. It is better to lift the bulbs as soon as

they ripen, and replant in the fall. Water sparingly at all times. Under suitable conditions they are hardy and tenacious of life, but excessive moisture, either in air or ground, is not to their liking after the flowering season arrives. Theoretically, all *calochortus* of Section A (star and globe tulips) should have shade, and all *mariposas* (AA) sunshine; but the light shade of a lath-house suits all alike, giving much finer bloom in the *mariposas*. The flowering season extends over three months, according to species.

They take well to pot culture with similar soils and treatment. While not to be forced rapidly, they considerably anticipate their out-of-door season. The same treatment can be used in coldframe culture, but they must not be coddled too much.

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A. Blossoms or fr. more or less nodding (unless No. 4): inner perianth-segms. strongly arched: lvs. long and glossy, not channeled. (*Eucalochortus*.)

B. Fls. subglobose, nodding: st. usually tall and branching. GLOBE TULIPS.—These have a single long and narrow shining lf. from the base, and slender, flexuous, leafy sts., the perfection of grace in outline. The fls. are exquisite in delicacy of tints. Woodland plants.

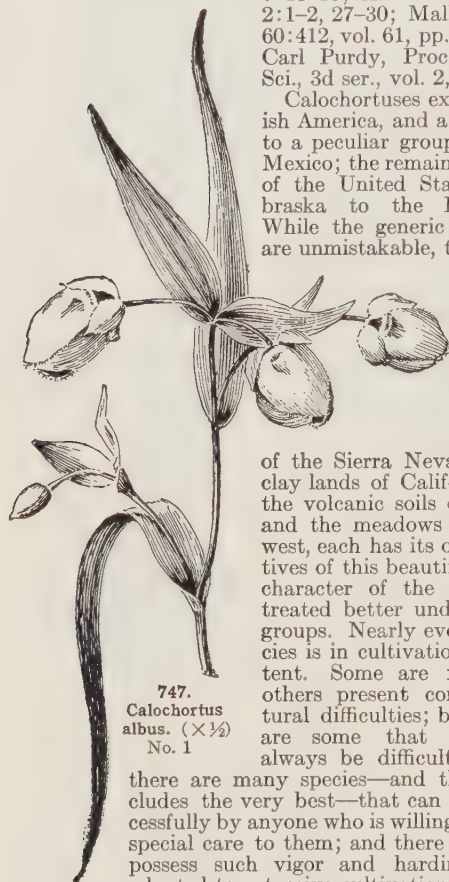
1. *álbus*, Douglas (*Cyclobóthra álba*, Benth.). Fig. 747. Strong, 1-2 ft. high, glaucous: fls. globular, pendent, 1 in. across, of a satiny texture, delicately fringed with hairs, very strongly inarched or practically closed. Calif. B.R. 1661. F.S. 11:1171.—Chaste and delicate. The form from the Coast Range is the Pearl *calochortus* of gardens; the form from the Sierras with fls. less strongly inarched and at length opening slightly is the *C. albus* of horticulture.

Var. *amœnus*, Hort. (*C. amœnus*, Greene). Like *C. albus*, but rose-colored, lower and more slender: fls. opening in full bloom. Fresno and Tulare Co., Calif.

2. *pulchellus*, Douglas (*Cyclobóthra pulchella*, Benth.). Stout, glaucous, 8-16 in., usually branching: fls. yellow, strongly inarched but parts not overlapping; sepals shorter than petals, ovate-acuminate, yellow tinged with brown on the back; petals ovate, obtuse, 1 in. or less long, canary-yellow, with long silky hairs above the gland. Cent. Calif. B.R. 1662.

3. *amabilis*, Purdy. Habit like *C. albus*: sts. stout, usually branching in pairs: petals clear yellow, very strongly inarched so that the tips overlap each other much like a child's pin-wheel; gland lined with stiff hairs that cross each other; petals margined with a line of stiff hairs. Cent. and N. Calif.

4. *Góldyi*, Watkins. Possibly *C. Benthamii* × *C. amabilis*. Sts. several, freely branched, bearing 15-20 fls.: lvs. narrow-lanceolate: fls. erect, 1 in. across, straw-yellow, inner surfaces covered with long silky sulfur-tinted hairs and a few shorter crimson hairs deep down in the cup; petals rounded and very hooded. Apparently of garden origin.



747.  
*Calochortus*  
*albus*. (× 1/2)  
No. 1



**BB.** *Fls. bell-shaped, erect when open, mostly lined with hairs, the pedicels becoming recurved: st. mostly low, and fls. often more or less umbellate.* **STAR TULIPS** proper.—Like the globe tulip, but smaller as a rule, and the fls. dainty open cups. All of the species resemble each other, and were first included under the name *C. elegans*.

5. **Maweanus**, Leichtl. Plant low (3–10 in.), very slender, usually branched: fls. white, purplish at the base, filled with silky hairs, the gland covered by a broad semi-circular scale: caps. long-elliptic. Calif., north. B.M. 5976 (as *C. elegans*).—Variable. Var. **majör**, Hort. Twice as large in all its parts: fls. lighter colored. Var. **röseus**, Hort. Fls. tinged rose.

6. **Bénthamii**, Baker. Sts. 7 in. high, very flexuose, dividing into pairs: lvs. linear-lanceolate: fls. nearly erect, yellow, the segms.  $\frac{1}{2}$  in. long and brown at the base. Sierra Nevada, in Calif. B.M. 6475. J.H. III. 30:549. Var. **Wallacei** (*C. Wallacei*, Hort.). Claw of the petal dark red or nearly black.

7. **cæruleus**, Wats. Similar to small plants of *C. Maweanus*, but lined and dotted with blue: low, 2–5-fl., the pedicels very slender; perianth ciliate inside: caps. nearly or quite orbicular. Calif., in the Sierras. Not variable.

8. **élegans**, Pursh. Similar to the last: petals greenish white and purplish at base, bearded, little or not at all ciliate: gland covered by a deeply fringed scale. Ore., Idaho.

Var. **nānus**, Wood (*C. Lyallii*, Baker). Subalpine, dwarf and very slender: petals delicate cream-color, narrow and usually more acute, more hairy and ciliate. Mts. Calif., N.

9. **Löbbii**, Purdy (*C. elegans* var. *Löbbii*, Baker). St. 3–5 in. high: petals white tinged green, broadly rhombic-ovate, very deeply pitted and with the pit showing as a prominent knob on back of petal. Mt. Jefferson, Ore.

10. **umbellātus**, Wood (*C. collinus*, Lemm.). Low and branching, 3–15 in., flexuose: fls. 5–10, white; petals broadly fan-shaped, nude excepting for many white hairs just above the scale. In open grassy places around San Francisco Bay.

**BBB.** *Fls. bell-shaped: like BB, but tall (1 ft. or more), and stoutly erect, with several fine, erect cups, similar to C. Maweanus.* **GIANT STAR TULIPS**.—In this splendid group the very dainty silky fls. and handsome glossy lvs. of the star tulip are shown with a stout st. a foot or two high, and large fls. Unlike the others, they grow naturally in open places, and have a vigor and health which are a high recommendation.

11. **Tölmiei**, Hook. & Arn. Stout, a foot high, generally branched: petals often more than an inch long, tinged lilac, with purple and white hairs: gland without a scale: caps. broad-elliptic, acutish. Mt. Shasta, N.—Remains a long time in bloom.

12. **apiculātus**, Baker. Taller and stouter, 12–18 in., with umbellate straw-colored fls. N. Idaho.

13. **Pürdyi**, East. Glabrous and glaucous, 8–16 in., rather stout, branching, 2- to many-fl.: fls. creamy white or purple-tinged, filled with blue hairs, gland absent. S. Ore. G.C. III. 23:395.—Very handsome.

**BBBB.** *Fls. bell-shaped, the petals naked or hairy only at the base: low: lf. solitary.* **MEADOW TULIPS**.—These calochortuses are natives of wet meadows. *C. uniflorus* and *C. Vesta* grow well in all soils so long as well drained, and, as garden plants, thrive everywhere. In habit they are low, flexuose and leafy. The cups are open, erect and numerous, an inch or so in diam.

14. **nūdus**, Wats. Low, 2–4 in., delicate: lf. solitary: fls. 1–6, umbellate, small, greenish white or pale lilac,

nude except for a tuft of 2 or 3 short hairs at each extremity of scale, denticulate. Calif., in the Sierras.

15. **uniflorus**, Hook. & Arn. (*C. lilacinus*, Kell.). Handsome species, 4–8 in. high: fls. 4–10, on long pedicels, clear lilac, hairy only at base: caps. elliptic, obtuse. B.M. 5804.—Grows naturally in wet meadows, and makes offsets very freely. Often seen in a depauperate starved form, but responds at once to good treatment.

**AA.** *Blossoms on stout, erect pedicels, the sts. stout and strict: fls. open-bell-shaped.* **MARIPOSA TULIPS**.—Excepting in B, the mariposa or butterfly tulips have slender, grassy, radical lvs., stiff, erect sts. bearing cup-shaped fls., and sparingly leafy and with an erect caps. Bulbs small.

**B.** *Caps. oblong, acute-angled or winged: fls. lilac or white.* These are hardy species, growing in the meadows from Ore. to Mont., where they endure much cold. They form a connecting link between the giant star tulips and the true mariposas. Their lvs. are like those of the star tulips—long, broad and glossy. Like the star tulips, also, the seed-pod is handsome, 3-cornered and winged. The sts. are stiffly erect: the fls. cup-shaped, not so brilliant as the true mariposas, but very delicate: the plants are hardy, healthy and vigorous, and are to be highly recommended for cold climates.

16. **nītīdus**, Douglas. Scape erect, but not stiff: lf. solitary, glossy, narrow: fls. 1–3, large and showy, lilac, yellowish, or white, with a deep indigo blotch in the center, lined with yellow hairs. Meadows, E. Ore. to Mont. and N. E. Nev. Specimens from Yellowstone Lake are yellow.—Very beautiful and showy.

17. **Greēnei**, Wats. St. stout and branching, 1 ft., 2–5-fl.: sepals with a yellowish hairy spot; petals lilac barred with yellow below, and somewhat purplish, loose-hairy, not ciliate: caps. beaked. Calif. and Ore.

18. **longebarbātus**, Wats. Slender, about 1 ft. high, bulb-bearing near the base, with 1 or 2 narrow radical lvs., 2-branched and usually 2-fl.: fls. erect or nearly so, lilac with yellow at base, scarcely hairy except the long-bearded gland. Wash.

19. **Höwellii**, Wats. St. erect, 1 ft. or more, 1–2-fl.: lvs. very narrow: sepals ovate, short-acuminate; petals yellowish white, 1 in. long, denticulate, slightly ciliate near the base, brown-hairy inside, the gland yellow-hairy. Ore.

**BB.** *Caps. oblong, obtuse-angled.*

**c.** *Color yellow or orange or orange-red, more or less marked with brown and purple (except in forms of C. luteus): in cult. forms running into other colors.*

20. **Weēdii**, Wood. Radical lf. single, glossy, broad: st. tall, leafy, bearing large orange-colored fls. dotted with purple: petals triangular, square-topped: gland small, hairy: bulb heavily coated with fiber. S. Calif. B.M. 6200 (as *C. citrinus*). G.C. III. 16:183.—Varies to white.

Var. **purpurāscens**, Wats. (*C. Plummeræ*, Greene). Similar, but lilac or purple and very showy. Calif. G.C. III. 16:133. J.H. III. 29:289. Gn. 47:80.—A fine form with fl. of large size and full outline, lined with long, silky yellow hairs.

Var. **vēstus**, Purdy. Petals much more truncated and curiously fringed with brown hairs; reddish brown. Santa Barbara.

Var. **obispoēnsis**, Purdy (*C. obispoēnsis*, Lemm.). Fig. 748. Tall and slender, branching, very floriferous: petals yellow, verging to red at the tip and less than half the length of the orange-brown sepals. Calif. G.F. 2:161 (adapted in Fig. 748).—Odd and bizarre.

21. *Kennedyi*, Porter. Bulb small and ovoid: st. very low, 1-4 in.: lvs. linear, tufted from the branching of the st.: fls. 2-4, in an umbel; sepals broad with a purple spot; petals red-orange to vermilion, not ciliate nor prominently hairy, purple-spotted at the center. Desert species of S. Calif. B.M. 7264. Gn. 43:108.—Brilliant and desirable, but difficult to grow.

22. *aureus*, Wats. Low, 4-6 in., with a single carinate leaf: petals yellow, not hairy, the hairy gland purple-bordered. S. Utah.



748. *Calochortus obispoensis*. No. 20 var. (X 1/2)

23. *clavatus*, Wats. Petals yellow lined with brown, the lower part bearing club-shaped (clavate) hairs, the gland deep and circular; anthers purple. Calif.—In this excellent sort we have the largest-fl. and stoutest-stemmed of all mariposas. The bulb is very large, the single bare lf. 1 or 2 ft. long: the st. is heavy, stout and zigzag. The fls. are shaped like a broad-based bowl, sometimes 5 or 6 in. across. The color is a deep, rich yellow, and the lower half is covered thickly with stiff yellow hairs, each tipped with a round translucent knob, and in the light look like tiny icicles. There are various strains: Eldorado, the largest, not so deep yellow; Ventura, very stout, deep yellow; Obispo, like the last, but the upper half of the back of each petal is olive-brown, which shows through the deep yellow of the inside, giving changeable shades.

24. *cóncolor*, Purdy (*C. luteus* var. *cóncolor*, Baker). Bulb large reddish: lvs. narrow, glaucous: st. 1-2 ft., umbellate, if more than 1-fl.; not zigzag; petals a rich deep yellow, tending toward orange, lower third densely hairy with long yellow hairs above an oblong gland. A desert species of S. Calif. Much like *C. clavatus* in general aspect.

25. *luteus*, Douglas. BUTTERFLY TULIP. St. 1-10 fld., bulb-bearing near the base: lvs. very narrow: sepals narrow-lanceolate, with a brown spot; petals 2 in. or less long, yellow or orange, brown-lined, slightly hairy below the middle, the gland densely hairy. Calif. B.R. 1567.—Variable. Some of the forms are sold as *C. venustus*.

Var. *citrinus*, Wats. (*C. venustus* var. *citrinus*, Baker). Petals lemon-yellow, with a central brown spot.

Var. *oculatus*, Wats. (*C. venustus* var. *oculatus*, Hort.). Petals pale or white, lilac or yellowish, with a dark spot.

Var. *robustus*, Purdy (*C. venustus* var. *robustus*, Hort.). A very bulbiferous form having white fls. luridly tinged in browns and purples. Very beautiful and also one of the hardiest.

26. *Vésta*, Purdy. BUTTERFLY TULIP. Tall and large-fl. with petals more narrowly cuneate than in *C. luteus* var. *oculatus*, and the gland narrow and doubly lunate, color from white tinged through lilac to pink and lilac-purple; fl. often lacinately gashed, above the gland bearing rich maroon pencilings and markings. N. W. Calif. in adobe soil.—One of the largest-fl., showiest and most easily grown of mariposa tulips. Named by its author in compliment to his wife.

cc. Color prevailing white or lilac, but sometimes running into yellows.

27. *venustus*, Benth. BUTTERFLY TULIP. Stout, 6-36 in.: petals white or pale lilac, with a reddish spot at top, a brown-yellow center, and brown base: gland large and oblong, usually densely hairy: caps. 1-2½ in. long. Calif. B.R. 1669. F.S. 2:104. Gn. 46, p. 395.—Very variable. The yellow forms (as var. *sulphureus*, Hort.) are often treated as forms of *C. luteus*. To this group of calochortuses is properly applied the Spanish name mariposa (butterfly), for their brilliantly colored fls., with eye-like spots on each petal and sepal, and other delicate markings with dots, lines and hairs, which are strongly suggestive of the wings of a brilliantly colored butterfly. Botanists have variously divided this great group of allied forms between *C. luteus* and *C. venustus*. Botanically all may be considered as either strains of one variable species or as a number of closely allied species.

Var. *Eldorado*, Purdy. The finest strain of *C. venustus* in cult. It occurs naturally in a wonderfully varied mixture, in color from pure white through pink, to deep glowing reds and through lilac to deep purples. In one locality a few may vary to light yellow. Some of these forms have been named var. *pictus* for the white form, var. *sanguineus* for the blood-red. The purple forms are entirely distinct from *C. venustus* var. *purpurascens*. Sierran foothills from Eldorado County to the far South. Altogether these plants comprise the loveliest group of the mariposa tulips.

Var. *purpurascens*, Wats. Petals deep lilac or purplish, darker at center, the fl. fully 3 in. across. Coast Range. Strong grower. Gn. 46:394.

Var. *roseus*, Hort. (*C. roseus*, Hort.). Creamy white or lilac, with an eye midway and a rose-colored blotch at apex. Gn. 46:394.

Var. *sulphureus*, Purdy. Taller than the type: petals light warm yellow with eye, and with a rose-colored blotch at top. Lower part of San Joaquin Valley, Calif.

28. *spléndens*, Douglas. Tall and slender, 1-2 ft.: fls. 1-1½ in. across, deep purple with a dark spot on the claw and with or without a gland covered with matted hairs. San Diego Co., Calif. Known in horticulture as *C. splendens* var. *atroviolaceus*.

Var. *major*, Purdy. Strong and tall, 1-2 ft.: fls. 2-3 in. across; petals large, clear lilac, paler below, with a



darker claw and scattered long white hairs below the middle. Coast Ranges, Monterey Co., Calif.

Var. *montānus*, Purdy. More slender than the type, often bulbiferous: lilac to salmon-pink, densely hairy with short yellow hairs about the gland. High mts., S. Calif.

Var. *rūbra*, Purdy. Large, with deep-seated reddish bulb, 1-3 ft.: fls. reddish lilac, pink or purple; petals quite hairy, with short hairs on the lower third. Lake Co., Calif.

29. *flexuosus*, Wats. Related to *C. splendens*, but with sts. so weak as almost to be said to creep. The fls. are large and very brilliant, a dazzling purple, with a darker purple eye, and yellow hairs below. S. Utah.—Intro. by Purdy in 1897.

30. *Pálmeri*, Wats. St. 1-2 ft., very slender and flexuous, 1-7-fld., bulb-bearing near the base: sepals with long, narrow, recurved tips, spotted; petals 1 in. or less long, white (or yellowish below), with a brownish claw and bearing scattered hairs about the gland: caps. very narrow. S. Calif.—The *C. Palmeri* of dealers is sometimes *C. splendens* var. *montanus*.

31. *catalinæ*, Wats. (*C. Lyonii*, Wats.). Habit of *C. splendens*: st. 1-2 ft., branching: fls. white to lilac, or deep lilac, very large and handsome, a large round black spot at base of each petal.—A lovely species between *C. splendens* and *C. venustus*. Remarkable for blooming with the star tulip section, fully a month before other mariposas. Native to Santa Catalina Isl., off S. Calif.; also to Calif. coast.

32. *Núttallii*, Torr. & Gray. SEGO LILY. St. erect and stiff, 1-2 ft., bulb-bearing at base, usually with only 1 cauline lf., 1-5-fld.: sepals ovate-lanceolate, often dark-spotted; petals 1-2 in. long, white tinged with greenish yellow or lilac, with a purplish spot or band above the yellow base and hairy about the gland; anthers obtuse. Dak. and Neb. to Calif. and New Mex., having the widest range of any calochortus.—There are no more exquisitely beautiful fls. than these sego lilies (the Mormon name) of the Great Basin. Most of them are plants of the sage-brush deserts. The lvs. are an ashy green, the foliage scant, but the great fls. are wonderful in tintings. There are shades in blue, pink, lilac, and yellowish; also white. The sego lily is the State flower of Utah.

33. *Leichtlinii*, Hook. f. Slender alpine species (5-6 in. high), by some regarded as a form of *C. Nuttallii*: fls. smoky white, banded with green and marked with dark brown. Sierra Nevada. B.M. 5862. F.S. 20:2116.

34. *Gúnnisonii*, Wats. Fig. 749. Much like *C. Nuttallii*: anthers acuminate: fls. light blue or almost white, delicate yellowish green below the middle, purple-banded at the base, and bearing a band of green hairs across each petal. Rocky Mts., Wyo. to New Mex.

35. *macrocarpus*, Douglas. GREEN-BANDED MARIPOSA LILY. St. stiff, the cauline lvs. 3-5: fls. 1 or 2; sepals acuminate, sometimes spotted; petals 2 in. or less, acute, lilac with a greenish midvein, somewhat hairy. B.R. 1152. N. Calif. to Wash. and Idaho.—This fine species forms a group by itself. It has a very large bulb, a stout almost leafless st.; and a large fl. of an exquisite pale lavender, banded down the back with green. Petals long, narrow and pointed.

BBB. Caps. linear, not winged or prominently angled.

36. *flāvus*, Schult. f. (*Cyclobóthra fláva*, Lindl.). St. slender, 1-2 ft., forked: lvs. 2 or 3 below the

fork, linear, long-acuminate: fls. yellow, upright; petals and sepals acute, rhombic-oblong, with a darker somewhat hairy gland, the petals hairy and usually denticulate. Mex.

37. *Bonplandiānus*, Schult. f. (*C. purpureus*, Baker. *Cyclobóthra purpurea*, Sweet). Rather stout, 3 ft.: st.-lvs. short, acuminate-lanceolate: fls. yellow and purple: the sepals with a purple pit and the petals purple outside: gland naked. Mex.

CARL PURDY.  
L. H. B.



749. *Calochortus Gunnisonii*. (× 1/2)

**CALODÉNDRUM** (Greek, *beautiful tree*). *Pallásia*, Houtt, which is the older name. *Rutæcæ*. One of the handsomest deciduous trees at the Cape of Good Hope; cultivated in northern greenhouses, and outdoors in southern California and southern Florida.

The great panicles of white or flesh-colored fls. are sometimes 7 in. across and 6 in. deep. It is a symmetrical tree, with attractive evergreen foliage and many interesting features. Called "wild chestnut" in Afr. Prop. by cuttings of half-ripened wood under glass in heat. A monotypic genus.

*capensis*, Thunb. CAPE CHESTNUT. Height in Afr. 70 ft.: branches opposite, or in 3's: lvs. simple, decussate, ovate, obtuse retuse or acute, parallel-nerved, 4-5 in. long, studded with oil-cysts, which look like translucent spots when held to the light: panicles terminal; peduncles usually trichotomous; calyx deciduous; petals 5, linear-oblong, 1 1/2 in. long, 2 lines wide, sprinkled with purple glands; stamens 10, 5 alternate, sterile, and petaloid: seeds 2 in each cell, larger than a hazelnut, black and shining. G.C. II. 19:217. Also written *Calodendron capense*.

**CALONYCTION** (Greek, referring to the beauty of the flower, and the night-blooming habit). *Convolvulæcæ*. MOONFLOWER. Twining perennial herbs with large night-blooming flowers.

Flowers white or purple, fragrant, showy; sepals 5, the outer ones with horn-like tips; corolla salverform, the limb more or less flat, the tube very long and not dilated at the throat; stamens 5, exserted; style capitate and obscurely 2-lobed; ovules 4: lvs. broad, alternate.—Three species in Trop. Amer., two of which are widely cult. By some, the genus is united with *Ipomœa*, but it is well distinguished by the salverform rather than funnelform or bell-shaped corolla, by the exserted stamens and style, and by the night-blooming habit.

*aculeatum*, House (*C. speciosum*, Choisy. *Ipomœa Bona-nox*, Linn.). MOONFLOWER. Fig. 750. St. 10-20 ft. high, with milky juice: lvs. 3-8 in. long, cordate to hastate, angular or 3-lobed, acute, glabrous: peduncles 2-6 in. long, 1-7-fld., equaling the petioles; corolla 3-6 in. long, 3-6 in. wide, trumpet-shaped, white, sometimes with greenish plaits; fls. fragrant, usually closing in the morning, sometimes remaining open till noon. Aug., Sept. B.M. 752. B.R. 11:889, 917 (as *Ipomœa latiflora*). Gn. 21, p. 259; 27, p. 473. V. 10:359. Known in gardens chiefly as *Ipomœa Bona-nox* var. *grandiflora*, Hort. (*I. grandiflora*, Roxbg. and Hort., not Lam.), which does not differ materially from the type. Most of the large-fld. and very fragrant forms in cult. may be referred here. Var. *grandiflorum*, Hort., is sold under the following names: *Ipomœa Childsii*,



750. Moonflower—*Calonyction aculeatum*. (× 1/2)

*I. noctiphyton*, *I. noctiflora*, *I. mexicana grandiflora*, *I. mexicana grandiflora alba*, *I. mexicana grandiflora vera*. These trade names represent strains of varying excellence. (*C. grandiflorum*, Choisy, is *Ipomœa Tuba*.) A form with variegated lvs. is offered. Var. *heterophyllum*, has lvs. 3-5-lobed and subhastate.—The moonflower is most popular as a garden plant, but it also does well trained along the roof of a low house or against a pillar. It is excellent for cut-fls. in the evening. Little grown in the open N. because it does not mature in the short seasons. It grows wild in swamps and thickets in peninsular Fla., and is probably indigenous there. Widespread in tropics of both hemispheres.

*muricatum*, G. Don. (*Convolvulus muricatus*, Linn. *Ipomœa muricata*, Jacq. *Calonyction speciosum* var. *muricatum*, Choisy). Fls. purple, smaller than those of *C. speciosum*, the tube very slender and the expanded part of the tubenot over 3 in. broad.—Tropical regions; extensively cult. in Japan and India, and often seen in American conservatories.

*C. latense*, House (*Ipomœa latense*, Brandeg.), is the third species of *Calonyction*. It is native to Lower Calif., and not in cult. *C. grandiflorum*, Choisy, = *Ipomœa Tuba*. L. H. B.

**CALOPHACA** (Greek, *kalos*, beautiful, and *phaka*, lentil). *Leguminosæ*. Ornamental plants cultivated chiefly for their bright yellow flowers appearing in summer.

Deciduous shrubs or herbs, with alternate, odd-pinnate, pubescent, and often glandular lvs.: stipules scarious or herabaceous, adnate to the petiole: fls. papilionaceous, solitary or in racemes; calyx tubular with 5 nearly equal teeth; standard upright; wings oblong, free, as long as keel; ovary sessile with many ovules: pod pubescent and glandular, cylindrical.—About 10 species from S. Russia to E. India.

The two cultivated species are low, prostrate shrubs, with grayish green foliage, and rather large yellow flowers in erect axillary racemes, followed by decorative reddish pods. They prefer a well-drained soil and sunny position, and are well adapted for borders of shrubberies and sandy or rocky slopes. Propagated by seeds sown in spring; the young seedlings should have plenty of light and air, as they are very liable to damp-off if kept too moist and shady. Sometimes grafted high on *Caragana* or *Laburnum*, forming a very attractive small standard tree with pendulous branches.

*wolgàrica*, Fisch. Fig. 751. Two to 3 ft.: pubescent and glandular: lfts. 11-17, roundish-ovate or oval,  $\frac{1}{3}$ - $\frac{1}{2}$  in. long: racemes long-peduncled, with 4-7 fls.; corolla over  $\frac{3}{4}$  in. long. June, July. S. Russia, Turkes-

tan. *C. grandiflora*, Regel, is similar, but lfts. 17-25: racemes 10-16-flid.; corolla 1 in. long. S. Russia. Gt. 35:1231.

ALFRED REHDER.

**CALOPHYLLUM** (Greek, *beautiful-leaved*). *Guttiferæ*. Woody plants of the Old World and American tropics, with shining leathery leaves, sometimes planted South.

Leaves parallel-veined at right angles to the midrib: fls. polygamous in many axillary or terminal clusters; sepals and petals 4-12, in 2-3 series; stamens very numerous: fr. a drupe with a single erect seed.—Sixty species. Closely related to *Garcinia*, which, however, has only 4-8 sepals.

In India, several species are of considerable economic importance, especially *C. ionophyllum*, which is the source of a gum, and the seeds of which contain the well-known domba oil used extensively for lighting purposes. They must be grown in a warmhouse and in a rich well-aërated soil.

*Calàba*, Jacq. **CALABA TREE**. A tree, to 60 ft.: lvs. variable, dark glossy green, 3-10 in long.: fls. in axillary racemes, white, rarely produced in cult., the petals about 3 lines long: fr. about 1 in. diam. W. Indies, perhaps intro. from the Old World. Timber and oil.

*ionophyllum*, Linn. A medium-sized tree, with gray smooth bark: lvs. 4-8 in. long, 3-4 in. wide, shining on both surfaces: racemes in the upper axils, the fls. about  $\frac{3}{4}$  in. diam. and pure white; inner sepals petal-like: fr. about 1 in. diam., yellow, smooth, almost fleshy. Trop. Asia. N. TAYLOR.

**CALOPOGON** (Greek, *beautiful beard*, in allusion to the fringed or bearded lip). *Orchidææ*. A very attractive native orchid, sometimes planted in bog-gardens and rock-gardens.

Flowers magenta-crimson, varying to white, in a loose raceme on a naked scape; sepals and petals all distinct and spreading, the lip narrow at base but broader and hairy above; column winged at summit, not attached to other parts; pollinia 2 in each anther cell.—One species, in bogs and moist meadows, Newfoundland to Fla. and westward. *Cathea* is an older name, but, because of its general acceptance, *Calopogon* is retained in the "nomina conservanda" of the Vienna code.

A moist and shaded position and very porous soil are most suitable for this pretty plant, although it may do admirably in a rock-garden only slightly shaded at midday if the plants are watered very freely every day during hot or dry weather. Propagated by offsets, separated from the old tubers, but the old established plants should not be disturbed very often. Collected clumps of many native orchids are offered at very reasonable figures, and these give immediate results, while the small offsets would not be strong enough to flower for several years, and require much attention during the first year, or perhaps longer (J. B. Keller).

*pulchellus*, R. Br. (*Limodorum tuberòsum*, Linn., in part). Height 12-18 in., from a solid bulb or corm, bearing a single grass-like lf. at the base: scape 2-12-flid.; lip bearded with white, yellow, and purple club-shaped hairs; pretty. G.F. 10:505. J.H. III. 35:45. B.M. 116.

L. H. B.†

**CALOSCÓRDUM**: *Nothoscordum*.

**CALOTHAMNUS** (Greek, *beautiful bush*). *Myrtidææ*. Australian shrubs (more than twenty species) somewhat similar to *Callistemon* but more graceful in habit; evergreen greenhouse subjects, and hardy out-of-doors in California.

Leaves long, alternate: fls. showy, usually red, in lateral clusters; stamens united in bundles opposite the petals; anthers erect, attached by the base, oblong or linear; cells parallel, turned inwards, opening by longitudinal slits. For cult., see *Callistemon*.





**quadrifidus**, R. Br. Height 2-4 ft.: lvs. narrow, terete or slightly flattened, heath-like, glandular-dotted: fls. rich crimson, 4-merous; calyx 2-lobed in fr.; staminal bundles nearly equal, of 15-20 or more filaments. W. Austral. B.M. 1506.

*C. rupéstris*, Schau. Evergreen shrub, the branches densely covered with needle-like small lvs.: fls. in small clusters on previous year's growth; stamens with crimson filaments and yellow anthers. B.M. 7906.

J. BURTT DAVY.

**CALÓTROPIS** (from Greek words referring to the beauty of parts of the flower). *Asclepiadaceæ*. Milkweed-like shrubs, or small trees, grown in the American tropics and one species offered in southern California.

Branching, glabrous or tomentose-canescens: lvs. opposite, subsessile, broad: fls. with 5-parted calyx glandular inside; corolla bell-shaped or somewhat rotate, 5-parted with broad lobes; crown of 5 narrow fleshy scales adnate to the staminal tube and free and recurved at the base; pollinia solitary in each cell, obovate-oblong and compressed, hanging from the apex; fr. short horned gibbous acuminate pods mostly in pairs; seeds with silky hairs.—Three species in Trop. Asia and Afr., sometimes grown under glass in collections but in this country practically confined to the tropics. The bark of *C. gigantea* produces a strong úber, and the acrid milky juice dries into a substance like gutta-percha. The silk on the seeds is used in fabrics by natives; that of *C. procera* is said to be exported from the Cape Verde Isls. as kapok (kapok is usually from the ceiba or silk-cotton tree).

**gigantea**, R. Br. (*Asclépias gigantea*, Willd.). GIANT MILKWEED. Tree-like, 8-15 ft., with pale bark and woolly shoots: lvs. obovate to broad wedge-shaped, entire, woolly beneath: fls. rose and purple, in simple or compound umbels with involucre scales, the corolla-segms. bent downwards and twisted with age: fr. 3-4 in. long; seeds broadly ovate. B.R. 58. India, and planted or escaped in W. Indies.

**procera**, Dry. (*Asclépias procera*, Ait.). Shrub or bush, to 15 ft.: lvs. more oblong and acute than those of *C. gigantea*, grayish: fls. white and purple in long-peduncled cottony umbels; corolla-lobes erect: fr. 4-5 in. long, recurved; seeds ovoid. B.R. 1792. India.—Offered in S. Calif., and said to be known in Porto Rico as Algodon de seda.

L. H. B.

**CALPÚRNIA** (after Calpurnius, an imitator of Virgil, because these plants are allied to Virgilia). *Leguminosæ*. Trees and shrubs from tropical and southern Africa, cultivated out-of-doors in southern California and other subtropical regions.

Leaves odd-pinnate with numerous lfts.: racemes long, axillary and terminal, the peduncles often paniculate, giving rise to a splendid showy infl.; fls. yellow, the calyx bell-shaped; petals pea-like: pods membranous-winged on one side, often flattish.—Ten species.

**sylvática**, Mey. Shrub, 6-10 ft. high: lvs. 2-6 in. long; lfts. in 3-10 pairs, membranous, obovate-elliptical, retuse or obtuse: fls. ½ in. long; ovary glabrous. Caffraria.—Also rarely cult. N. as a greenhouse shrub.

**lasiogyne**, Mey. (*C. aurea*, Benth.). A taller shrub, very rarely tree-like, with larger evergreen lvs., more coriaceous, more pubescent, and exactly elliptical or oblong lfts: fls. racemose, much like Laburnum, appearing in winter, as do the fls. of most S. African plants. The silky ovary at once distinguishes it. Natal.

N. TAYLOR.†

**CÁLTHA** (Latin name of the marigold). *Ranunculaceæ*. Beautiful hardy blooming marsh plants, the largest and best of which are used about water-gardens and moist parts of borders.

Succulent perennial herbs, glabrous, with a fascicle of strong, fibrous roots: lvs. simple, rather rounded-cordate at base: fls. yellow, white or pink; sepals large,

deciduous, petal-like; petals none; stamens numerous: carpels sessile, becoming follicles, with 2 rows of seeds.—About 10 species of temperate and frigid regions. Monogr. by G. Beck, in Kaiserlich-Königliche Zool. Bot. Gesellschaft (Vienna, 1886), 36:347-363; E. Huth, Monogr. in Helios 9:69-74.

*Caltha* flourish best in wet places near running water. Though naturally bog-plants, they succeed admirably well in an ordinary border in rather rich soil. They should be introduced more liberally into the flower-garden, where they bloom very freely year after year, and usually mature a second quite abundant crop of bloom in the fall. The flowers last a long time in water, and sell readily in the cut-flower market.

The propagation is naturally accomplished by roots and by seed. The roots divide easily and several of the species send out rootstalks. The divisions may be made best in late fall or mild winter weather. If seeds are used, they must be fresh and given a moist, cool place in partial shade.

**biflora**, DC. No true st.: scape slender, usually 2-fld.: lvs. as in *C. palustris*: sepals 6-9, nearly white or sometimes bluish: follicles at maturity distinctly stalked. Spring. Calif. to Alaska.

**leptosepala**, DC. Stout scape, 8-12 in.: lvs. all basal or barely 1 on st.; nerves at base nearly parallel, otherwise like those of *C. biflora*: sepals 7-10, oblong, becoming narrower, white: fls. solitary: follicles scarcely stalked. May, June. Alaska to Wash. and Colo. Gn. 30:340.

**palustris**, Linn. MARSH MARIGOLD. St. hollow, 1-2 ft., branching, several-fld.: lvs. cordate or reniform, dentate, crenate or entire: fls. bright yellow, 1-2 in. broad; sepals 5 or 6, rarely 7: follicles compressed, ½ in. long. Apr.-June. Wet ground. Carolinas to Canada and westward. Gt. 47, p. 630. Gn. 59, p. 166.—Used before flowering in the spring as "cowslip greens." Var. **monströsa-pleno**, Hort. (var. *flöre-pleno*, Hort.). An improvement on the above: fls. larger, of greater substance, and often much doubled. Very beautiful. Var. **Tyermanii**, Hort. A dwarf form with golden fls. G.M. 52:415.

**polypétala**, Hochst. Two ft. high: lvs. 10-12 in. across: fls. 3 in. across. Caucasus and Asia Minor.—The plant spreads rapidly by stolons and may thus be easily prop. Gn. 69, p. 269.

*C. elata*, Duthie. Fls. smaller than in *C. palustris*, golden yellow with orange-colored filaments and black anthers. Himalaya. Gn.W. 21:666, desc.

K. C. DAVIS.

**CALTROPS**: *Trapa*.

**CALVÔA** (apparently a personal name). *Melastomaceæ*. A half-dozen or more herbs and shrubs in Trop. Afr., often succulent, with terete or 4-angled branches, enlarged nodes, long-petioled ovate 3-5-nerved lvs., and red, rosy or violet fls. in scorpioid cymes. None of them is likely to be in commerce for cult., although *C. orientalis*, Taub., is known in botanic gardens. It is a small shrub with 4-angled sts. producing aërial roots: lvs. nearly ovate, shining green and veined red at the base, the petioles red: fls. red, becoming violet, less than ¾ in. across.

**CALYCÁNTHUS** (*Kalyx* and *anthos*, flower; the calyx is large and conspicuous). Syn. *Butneria*. *Calycanthaceæ*. CAROLINA ALLSPICE. SWEET-SCENTED SHRUB. Ornamental shrubs, cultivated chiefly for their fragrant flowers.

Winter-buds small, without bud-scales, hidden by the base of petiole before the lvs. fall: lvs. opposite, petioled, entire: fls. with numerous imbricate sepals and no distinct petals; stamens many, short with innate anthers; pistils many, inclosed in a hollow receptacle: fr. caps.-like, formed like the rose-hip by the calyx-tube and containing numerous achenes.—Four species in N. Amer.

These are deciduous shrubs of aromatic fragrance, with opposite rather large leaves usually rough above and brown or brownish usually fragrant flowers, terminal on leafy branchlets followed by a large capsule-like dry fruit. Except *C. occidentalis*, the species are hardy or nearly hardy North. They grow in almost



752. *Calycanthus floridus*.

any well-drained and somewhat rich soil, and succeed as well in shady as in sunny positions. Propagated by seeds sown in spring; also increased by layers put down in summer, and by suckers or division of older plants.

*A. Lvs. densely pubescent beneath.*

**flořidus**, Linn. Fig. 752. Three to 6 ft.: lvs. oval or broad-ovate, acuminate, dark green above, pale or grayish green beneath,  $1\frac{1}{2}$ –3 in. long; fls. dark reddish brown, fragrant, about 2 in. broad. Va. to Fla. B.M. 503. Gn. 21, p. 184; 33, p. 392.—This species is much cult. for its very fragrant fls. and is the hardiest of all. Var. *ovatus*, Lav. (*C. ovatus*, Ait.). Lvs. ovate to ovate-oblong, rounded or subcordate at the base. L.I. 24.

**AA. Lvs. glabrous beneath or nearly so; fls. slightly or not fragrant.**

**fertilis**, Walt. (*C. ferox*, Michx. *C. lævigatus*, Willd. *C. nana*, Loisel.). Three to 6 ft.: lvs. usually elliptic or oblong, acute or acuminate, green beneath,  $2\frac{1}{2}$ – $5\frac{1}{2}$  in. long; fls. reddish brown,  $1\frac{1}{2}$  in. broad; anthers oblong; fr. ovoid, contracted at the mouth as in the preceding species. Alleghanies; from Ga. to N. C. and Ala. B.R. 6:481.—Roots, lvs. and bark used for their antiperiodic properties. Fr. said to be poisonous to sheep. Var. **glaućus**, Schneid. (*C. glaućus*, Willd.). Fig. 753. Lvs. usually ovate or oblong-ovate, acuminate, glaucous beneath; fls. paler. B.R. 5:404. Var. **oblongifolius**, Nutt., with oblong-lanceolate lvs. glaucous beneath.

**occidentalis**, Hook. & Arn. (*C. macrophyllus*, Hort.). To 12 ft.: lvs. usually rounded at the base, ovate or oblong-ovate, green beneath and sometimes slightly pubescent, 4–6 in. long; fls. light brown, 3 in. broad; anthers linear; fr. campanulate, not contracted at the mouth. Calif. B.M. 4808. F.S. 11:1113. R.H. 1854: 341. Gn. 33, p. 392.

*C. Mōhrri*, Small. Shrub, 2–6 ft.: lvs. ovate to oblong-ovate at the base, rounded to subcordate or broadly cuneate, densely pubescent beneath, 2–7 in. long; fls. purple, fragrant, more than 2 in. across. Tenn. and Ala. Little-known species, very similar to *C. floridus* var. *ovatus*, but the fr. campanulate and not contracted at the mouth. It has proved hardy at the Arnold Arboretum.—*C. præcox*, Linn.=*Meratia præcox*.

ALFRED REHDER.

**CALYCOCARPUM** (Greek, *cup-fruit*, alluding to the stone). *Menispermaceæ*. A tall-climbing vine: genus monotypic. *C. Lyonii*, Nutt., in rich woods, Ky. to Kans. and south: woody twiner: lvs. large and broad, simple, deeply palmately 3–5-lobed, the lobes pointed; fls. small, greenish, in long racemose panicles, in May and June: fr. a globular drupe, the stone or pit hollowed out on one side, ripe in Aug.

**CALYCOTOME** (*Kalyx*, and *tome*, a section or cut; *ealyx* looks as if cut off). *Leguminosæ*. Ornamental shrubs chiefly grown for their profusely produced yellow flowers; also used for low hedges.

Leaves 3-foliolate, without stipules: fls. papilionaceous; calyx turbinate, truncate, colored; standard upright; keel obtuse, curved, shorter than standard; stamens 10 with the filaments connate; ovary sessile, many-ovuled: pod linear-oblong, along the upper suture winged or strongly thickened, 2-valved.—Five species in the Medit. region.

Calycotomes are low spiny shrubs with small 3-foliolate deciduous leaves and fascicled or solitary yellow papilionaceous flowers. Hardy only in warmer temperate regions. They prefer a sunny position and well-drained soil. For propagation, see *Cytisus*.

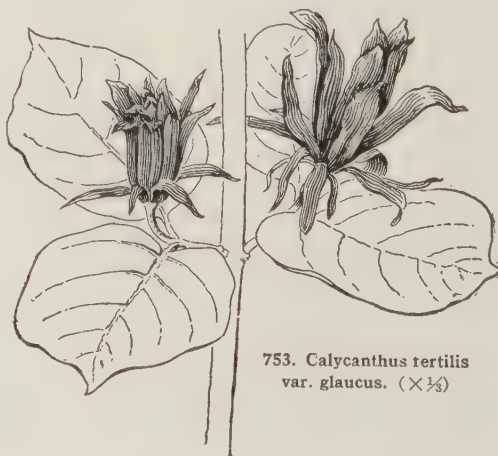
**villōsa**, Link. Two to 4 ft.: branchlets grayish tomentose: lfts. obovate to oblong-obovate, densely silky beneath, under  $\frac{1}{2}$  in. long; fls.  $\frac{1}{2}$  in. long, 3 or more, fascicled: pod villous. May, June.—It is excellent for dense low hedges.

**spinōsa**, Link. Closely allied, but somewhat larger in every part, and with glabrous branchlets and pods: fls. solitary or few. B.R. 32:55. ALFRED REHDER.

**CALÝPSO** (from the Greek goddess, whose name signifies concealment; referring to its rarity and beauty). *Orchidaceæ*. One of the rarest and most prized native orchids.

A delicate bog-plant, 3–4 in. high, with a small bulb, 1 roundish or ovate striated lf., and 1 pink fl. with a spotted sac. For culture, see *Calopogon*; but more difficult to grow than that plant. A monotypic genus.

**bulbōsa**, Oakes. Fig. 754. Lf. an inch wide and long: scape 3–4 in. high, with about 3 sheaths; sepals and petals similar, ascending, lanceolate, acuminate, pink; lip larger than the rest of the fl., with brown spots in lines and purple and yellow markings, woolly-hairy



753. *Calycanthus terřilis* var. *glaućus*. ( $\times \frac{1}{4}$ )



within; column petal-like, ovate, bearing the lid-like anther just below the apex. Maine to Minn. and N.; also Eu. Abundant in parts of Ore. and Wash. B.M. 2763. G.C. II. 16:656.

**CALYPTRÓGYNE** (from *calyptra*, hidden, and *gyne*, woman; in allusion to the half-hidden gynæcium). *Palmaceæ*, tribe *Geonomeæ*. Short, almost completely stemless and unarmed palms with unequally pinnate terminal leaves.

Stems frequently stoloniferous, when present, ringed below: lvs. numerous, often with the pinnate segms. joined together, in extreme youth 4-parted instead of bi-partite as in most related genera; lfts. somewhat irregularly disposed on the rachis, broadly or narrowly scythe-shaped, running at the tip to an abrupt point, at the base revolute; petiole very short or practically none: spadix simple or sometimes branched at the base, long-stalked; spathes 2; fls. a little unequal, with 3 sepals, 3 petals and 6 stamens, the style half immersed in the spadix: fr. oblong or obovoid, 1-seeded.—About 4 species, all from Trop. N. Amer. From *Geonoma*, a near relative and horticulturally a much more important genus, *Calyptrogyne* is distinguished only by the almost stemless habit, and the purely technical character of having prominently arrow-shaped anthers. In *Geonoma* the anthers are pendulous, but not sagittate.

*Calyptrgyne*s are handsome palms, seldom seen outside of large collections. Special care must be given to the soil so that it will be sweet and porous, especially after the plants leave the seed-pan. Well-drained pots and a little charcoal mixed with the soil, and the plants kept in a uniformly moist state, are conditions essential to the healthy growth of the plants. In this genus, *C. Ghiesbreghtiana* is the most widely known species, another garden name for which is *Geonoma Verschaffeltii*. These are shade-loving palms, having leaves of comparatively thin texture, and consequently are subject to attacks of red spider unless properly cared for in regard to moisture. *Calyptrgyne*s are most useful in a small state, old plants in general being rather leggy and poorly furnished. (G. W. Oliver and W. H. Taplin.)



754. *Calypso borealis*.

*glauca*, H. Wendl. (*Geonoma glauca*, Oerst.). Practically stemless: lvs. 4–5 ft. long, the sheathing petiole brownish, about 1 ft. long; lfts. numerous, about 2–3 in. apart, with 4 principal nerves, and scarcely any secondary ones: spadix simple, differing from the following species in which the spadix is often branched, 2–3 ft. long, the pistillate fls. half hidden in tiny pits. Cent. Amer. G.C. III. 30:179.—Not a common species, but young plants are specially attractive.

**Ghiesbreghtiana**, H. Wendl. (*Geonoma Ghiesbreghtiana*, Lindl. & H. Wendl. *G. magnifica* and *G. Verschaffeltii*, Hort.). St. short or almost none: petiole 5 ft. long; lvs. elongate-oval; segms. in 6 pairs, unequal, almost opposite, rather remote, lanceolate, very long-acuminate, falcate, the 2 uppermost on each side very wide: spadix often branched below, the fls. half hidden in tiny pits. Chiapas, Mex. B.M. 5782.

*C. sarapiguensis*, H. Wendl. St. short: lvs. 6 ft. long. Costa Rica. G.C. III. 29:217, desc.—*C. spicigera*, H. Wendl. St. evident: lvs. irregularly pinnate, 3 ft. or less long, the stalks flat on upper side. Guatemala.—*C. Suartzii*, Hort., is a *Geonoma*. N. TAYLOR.

**CALYPTROSTIGMA**. *Diervilla Middendorffiana*.

**CALYSTËGIA**: *Convolvulus*.

**CAMARÔTIS** (a *vault*, in reference to the cavity in the apex of the lip). *Orchidaceæ*. Epiphytic hothouse orchids.

Stems elongated, with short lvs., and many-fld. racemes: sepals and petals similar, spreading; lip spurred, 3-lobed; rostellum and anther beaked; pollinia 2, upon long thin stipes.—Species 2, in E. India.

*rostrata*, Reichb. (*C. purpurea*, Lindl. *Sarchochilus purpureus*, Benth.). Fig. 755. Sts. 2–3 ft. long, climbing: lvs. oblong-linear, bifid at apex, 3–4 in. long: racemes longer than lvs.; fls. crowded, about 1 in. diam., rose-purple, the lip somewhat darker. India. P.M. 7:25.—A scarce plant, now offered in American lists. Free-growing plant with aerial roots similar to some epidendrums. The treatment accorded to the vandas and saccolabiums with similar roots will suit the *camarotis*.

GEORGE V. NASH.

**CAMÁSSIA** (*Quamash* or *Camass* is the Indian name). Sometimes written *Quamasia*. *Liliaceæ*. CAMASS. West American spring-flowering bulbs.

Leaves all radical, long-lance-shaped, sheathing, from a true bulb that is pointed and with a rounded rather flattened base: sts. erect, 2–3 ft., bearing many bracted blossoms that open from the bottom of the raceme upward, in long succession: fls. blue, purple, white or cream, with 6 spreading 3–7-nerved segms.,



755. *Camarotis rostrata*.

6 thread-like filaments, filiform style, and 3-angled, 3-valved, several-seeded caps.—Five or 6 species in the temperate regions of W. N. Amer. from Cent. Calif. to Brit. Col. and east to Texas and Ark. They have resemblances to *Scilla*, but are much handsomer. The bulbs produce no offsets unless wounded. All the



756. *Camassia cusickii*. (fls.  $\times \frac{1}{2}$ )

species vary greatly in width of lvs., size and number of fls., so that definite figures mean little. The large bulb and broad bluish lvs. of *C. cusickii*, the heavy st., regular fls., and twisted old segms. of *C. leitchlinii*, the irregular fl. and drooping segms. of *C. quamash*, and the time of flowering of *C. howellii*, are good general characters to distinguish them.

Camassias are natives of rich meadows, very wet in winter and spring but dry in summer. Water often stands on the surface at flowering time. While the very best success can perhaps be attained by giving them a rather heavy soil with abundant moisture in the early season, they are most amenable to cultivation and thrive in any loam (only avoiding too rank manures), and they are perfectly hardy. They have been thoroughly tested throughout the region from Illinois east. Plant in early fall, from 3 to 4 inches apart and 3 to 6 inches deep, and do not disturb thereafter. As cut-flowers, they are excellent as they open in long succession. Seeds grow readily, but from three to four years are required to make flowering plants.

*Cusickii*, Wats. Fig. 756. Bulbs very large (weighing 4–8 ozs.); lvs. numerous, broad, glaucous, somewhat undulate (15 in. long by  $1\frac{1}{2}$  in. wide); st. often 3 ft. high; fls. 30–100, very pale delicately blue; segms. spreading, crinkled at base, faintly 3–5-nerved. Ore. G.F. 1:174 (adapted in Fig. 756).—The very large bulb and broader and more numerous lvs. easily distinguish this species. Very easily grown.

**Quámash**, Greene (*C. esculénta*, Lindl.). **COMMON** CAMASS. Fig. 757. This species varies greatly; some forms are low and slender, others 2–3 ft. high, stout and many-fl.; it can be distinguished by the irregular perianth in which 5 segms. are more or less on one side and 1 on the other: lvs.  $\frac{3}{4}$  in. broad or less; fls. 10–40, varying from almost white to intense ultramarine in the varieties; segms. 3–5-nerved and a little longer than the stamens, narrow and channeled at the base; pedicels not exceeding the fls.: caps. ovate-oblong, obtuse, transversely veined. Calif. to Utah and north to Brit. Col. B.R. 1486. F.S. 3:275. Gn. 46:338 and p. 339.—Bulb cooked and eaten by the Indians. The fls. vary to white. The large ultramarine form is the one in the trade. The withered segments fall down about the pedicel irregularly.

**Leitchlinii**, Wats. Stout, often 3 ft. or even more in height; fls. white, cream-colored, blue or purple, nearly regular; stamens and style ascending; segms. broad and flattened at the base, usually 5–7-nerved; caps. oblong-ovate, emarginate, obliquely veined. The withered segms. of the perianth twist about the caps. like bonbons; this is an infallible distinctive mark of the species. *C. Leitchlinii* is not common, but is distributed from Mendocino Co., Calif., to Brit. Col. B.M. 6287 (as *C. esculénta* var. *Leitchlinii*, Baker).—In Mendocino Co., a clear blue form grows rarely in mountain meadows. In the Umpqua Valley, Ore., the type is clear cream approaching white. In the same region and farther north, a very large deep blue or purple form is found, while in Brit. Col., the cream-colored form again appears but is rare. At their best, the sts. are stiff and heavy, the fls. large and many, and the masses of bloom approach the *Eremurus* in beauty and are even finer in separate fls. *C. Leitchlinii* is the finest of all camassias. Several color forms are described, as var. *atroviolácea*, deep purple, and others.

**Howellii**, Wats. Bulb rather small: lvs. few, 1 ft. long and less than  $\frac{1}{2}$  in. wide; st. often 2 ft. high, many-fl., with spreading pedicels twice or more the length of the linear bracts: fls. pale purple, opening in the afternoon, the segms.  $\frac{1}{2}$  in. long, 3–5-nerved; pedicels longer than the fls.: caps. small, broadly ovate and very obtuse. S. Ore. Intro. by Pilkington & Co., 1892.

**esculénta**, Robins. (*C. Fraseri*, Torr.). Scape 12–18 in. high: lvs. keeled: fls. light blue, smaller than in *C. quamash*; segms. 3-nerved; pedicels mostly longer than fls. Pa., west and south. B.M. 1574 (as *Scilla esculénta*).

**Var. angústa** (*C. angústa*, Hort.). Very slender, and lvs. narrower ( $\frac{1}{4}$  in. wide): fls. smaller,  $\frac{1}{3}$  or  $\frac{1}{4}$  in. long. La. and Ark. to Texas.

CARL PURDY.



757. *Camassia quamash*. ( $\times \frac{1}{2}$ )



**CAMELLIA** (after George Joseph Kamel or Camellus, a Moravian Jesuit, who traveled in Asia in the seventeenth century). *Ternstroemiaceæ*. **CAMELLIA**. Woody plants, chiefly grown for their showy white or red flowers and also for their handsome evergreen foliage.

Evergreen trees or shrubs with alternate short-petioled serrate lvs. and large terminal or axillary white or

red fls. followed by subglobose woody caps.: fls. sessile, upright; sepals many, imbricate, deciduous; petals 5 or more; stamens numerous, more or less connate; ovary 3-5-celled, with slender styles connate, at least be-



758. *Camellia japonica*—Abby Wilder.



759. *Camellia japonica*—Lucida.

low: fr. a dehiscent caps., with few large subglobose seeds.—About 10 species in tropical and subtropical Asia. Often united with *Thea*, which differs in its nodding and stalked fls. with a persistent calyx consisting of 5 nearly equal sepals. There is a monograph of this genus by Seemann in *Trans. Linn. Soc.* 22:337-352 (1859) and by Kochs in *Engler Bot. Jahrb.* 27:577-634 (1900). Illustrated monographs of the horticultural varieties are: Curtis, *Monogr. of the genus Camellia* (1819); Baumann, *Bollweiler Camelliensammlung* (1828); Chandler, *Camelliæ* (1831); Berlèse, *Monogr. du genre Camellia* a (1839); Verschaffelt, *Nouvelle Monographie du Camellia* (1848-1860): the last with 576 and the previous one with 300 colored plates.

Camellias grow like natives on sandy lands and even on high pine land in central Florida, but they flower best in half-shady somewhat moist places. The half-double varieties of *Camellia japonica* do best, while the very double kinds often drop their buds entirely. The flowers suffer very much from the sun and cannot be grown much farther south than central Florida. *Camellia Sasanqua*, single, half-double and double kinds, grow much more satisfactorily than the varieties of *C. japonica*. They begin to flower late in October and early November, and the double white *C. Sasanqua* is a mass of pure white usually at Christmas time. All the varieties of *C. Sasanqua* have somewhat fragrant flowers. *C. reticulata* does equally well in Florida. It is very distinct in foliage from the two former species which have glossy leaves, while the leaves of *C. reticulata* are dull green. All the camellias are extremely slow growers if not carefully cultivated and fertilized. A mulch of old cow-manure, now and then a little commercial fertilizer, and thorough watering during the dry season several times a week start the bushes into a vigorous and healthy growth. They are so extremely beautiful when in flower that all the care given them is well repaid. (H. Nehrling.)

A. Ovary and lvs. perfectly glabrous.

*japonica*, Linn. (*Thea japonica*, Nois.). Fls. 758-761. Shrub or tree, sometimes to 40 ft., glabrous: lvs

very shining and dark green above, ovate or elliptic, acuminate, sharply serrate, 2-4 in. long: fls. red in the type, 3-5 in. across; petals 5-7, roundish. China, Japan. B.M. 42. S.Z. 82. F.S. 20:2121. S.I.F. 1:73. Gn. 24, p. 411; 28, p. 203; 36, p. 241. Var. *alba*, Lodd Fls. white. L.B.C. 7:636. Gn. 54, p. 243. J.H. III. 54:227; 64:397. Var. *alba-plena*, Lodd. Fls. white, double. L.B.C. 3:269. Gn. 53, p. 244. Var. *anemoniflora*, Curtis. Fls. red, with 5 large petals, the stamens changed into numerous smaller and narrow petals; the whole fl. resembling that of a double anemone. L.B.C. 537. B.M. 1654. Gn. 44, p. 329. Var. *magnoliæflora*, Hort. Fls. pale rose, semi-double, with 12-15 petals rather narrow and half upright. Gn. 76, p. 31. Var. *apucæformis*, Rehd. (*C. apucæformis*, Jacob-Mackoy). Lvs. bifid at the apex.—For the numerous other garden forms, see the above-mentioned monographs; also, *Flore des Serres*, *L'illustration Horticole*, and other older horticultural publications contain a large number of varieties with illustrations.

AA. Ovary and lvs. on the midrib above pubescent.

*reticulata*, Lindl. (*Thea reticulata*, Pierre). Large shrub, glabrous: lvs. dull green, not shining above, reticulate, flat, elliptic-oblong, acuminate, serrate, 3-5 in. long: fls. 5-7 in. across, purplish rose; petals 15-20, obovate, loosely arranged. China. B.R. 13:1078. B.M. 2784. P.M. 3:101. G.M. 35: suppl. Apr. 2. F.W. 1880:321. G. 25:59. Var. *plena*, Hort. Fls. with twice as many petals, and more regularly arranged. B.M. 4976. F.S. 12: 1279-80.

**Sasánqua**, Thunb. (*Thea Sasánqua*, Nois.). Shrub of loose, straggling habit, and with the branches pubescent when young: lvs. elliptic to oblong-ovate, bluntly pointed at the apex, crenate-



760. *Camellia japonica*—H. A. Downing.

serrate, shining, dark green and hairy on the midrib above, 1-2 in. long: fls. 1½-2 in. across, white; petals 5 or more, obovate or oblong. China, Japan. Gn. 54:142. S.Z. 83 (except the red vars.). S.I.F. 2:52. J.H. III. 43: 131. G.M. 36:51.

Runs into many forms. Var. *semi-plena*, Hort. Fls. semi-double, white. B.R. 1:12; 13:1091. Var. *anemoniflora*, Seem. Fls. large, double, outer petals white, inner ones much smaller, yellow. B.M. 5152. Var. *oleösa*, Rehd. (*Thea Sasánqua* var. *oleösa*, Pierre. *C. oleifera*, Lindl.). Of more robust habit, with lvs. and the single white fls. larger than in the type. B.R. 11: 942. L.B.C. 11:1065. Var. *Kissi*, Rehd. (*Thea Sasánqua* var. *Kissi*, Pierre. *C. Kissi*, Wall.). Lvs. oval-oblong to ovate, long-acuminate, to 3½ in. long. Himalayas.



761. *Camellia japonica*—President Clark.

*C. azillaris*, Roxb.=*Gordonia anomala*.—*C. cuspidata*, Hort.=*Thea cuspidata*.—*C. drupifera*, Lour. Shrub. to 8 ft.: lvs. elliptic, long-acuminate: fls.  $1\frac{1}{2}$  in. wide, fragrant, white, petals obovate. Himalayas, India. L.B.C. 19:1815.—*C. euryoides*, Lindl.=*Thea euryoides*.—*C. euryoides*, Hort.=*Thea maliflora*.—*C. hongkongensis*, Seem. (*Thea hongkongensis*, Pierre). Tree with glabrous branches: lvs. ovate-lanceolate to lanceolate, indistinctly serrate, lustrous above, coriaceous, 3-4 in. long; fls. red, 2 in. across; petals slightly emarginate; ovary pubescent. Hongkong. Trans. Linn. Soc. 22:60.—*C. maliflora*, Lindl.=*Thea maliflora*.—*C. rosiflora*, Hook.=*Thea maliflora*.—*C. sinensis*, Kuntze=*Thea sinensis*.—*C. spectabilis*, Champ.=*Tutcheria spectabilis*.—*C. Thea*, Link=*Thea sinensis*.

ALFRED REHDER.

**CAMOËNSIA** (Louis Camoens, Portuguese poet). *Leguminosæ*. Two species of climbing shrubs from W. Trop. Afr., with digitately 3-foliolate lvs., and large papilionaceous fls. Calyx top-shaped; petals with long claws, the standard orbicular or nearly so; stamens free; ovary stipitate, with many ovules, the stigma small and capitate; fr. a broad-linear flattened 2-valved pod. *C. máxima*, Welw., has recently been offered by an English firm. Described by Baker as "a magnificent species" and by Bull as "one of the most gorgeously beautiful of tropical climbers." lfts. obovate-oblong, 5-6 in. long, cuspidate: fls. milk-white tinged with gold and frilled on the edges of the petals, in short-stalked 6-8-fld. axillary racemes; standard projecting 4 in. beyond the calyx, 3-4 in. broad; other petals shorter and not more than 1 in. broad: pod 6-8 in. long. Trans. Linn. Soc. 25:36. B.M. 7572. G.C. III. 20:597.

L. H. B.

**CAMPÁNULA** (Latin, *little bell*, from the shape of the corolla in some species). *Campanulaceæ*. BELL-FLOWER. HAREBELL. BLUEBELL. A large group of attractively flowering herbs, containing some of the most popular garden plants, especially of hardy herbaceous perennials.

Annual, biennial or perennial, mostly the last, often small and tufted: root-lvs. usually larger than the stem-lvs., and often of different shape and more or less transitory: fls. blue, violet or white, sometimes yellow; calyx 5-fid; corolla 5-lobed or 5-fid; stamens 5, free; filaments wide at the base, membranaceous; stigmas 3 or 5, filiform: caps. 3-5-valved, dehiscent on the sides or (as in Fig. 762) at the base by 3-5 small valves; seeds ovate, complanate or ovoid.—Probably 250 species, nearly all in the northern hemisphere with the center of distribution in the Medit. region; about a dozen species are N. American. The species mostly inhabit swamps or moist ground, or alpine and boreal regions. Allied genera of garden value are *Adenophora*, *Jasione*, *Lightfootia*, *Michauxia*, *Ostrowskia*, *Phyteuma*, *Platycodon*, *Specularia*, *Symphyandra*, *Trachelium*, and *Wahlenbergia*, in which genera many species originally described as campanulas may be sought. Of these, perhaps the two best known cases are *Platycodon grandiflorum*, the "balloon flower," with its characteristic inflated buds, dark green, glossy, leathery lvs.; and *Specularia perfoliata* (*C. Speculum*), "Venus' looking-glass," a pretty annual, which grows in the grain fields of S. Eu., and is cult. for its violet fls. with a white eye. The calyx-tube of *Specularia* is relatively much longer than in any campanula. The most prominent campanulas now in cult. seem to be the forms of *C. Medium*, *C. carpatica*, *C. persicifolia*, *C. pyramidalis*, *C. punctata*, *C. pusilla* (*cæspitosa*), *C. rotundifolia*.

Botanically, campanulas fall into two important groups, based on the presence or absence of calyx appendages. The subgenus *Medium* has the appendages, and *Eucodon* lacks them. These appendages are often small and disguised. The genus may also be

thrown into two broad groups based on the dehiscence, —the subgenus *Medium* with capsule opening near the base, and *Rapunculus* with the openings near the top. For the horticulturist, the most serviceable classification is based on the use that he makes of the plants, —whether as a garden vegetable, as border plants, or as rock-garden or alpine subjects; and this is the division attempted here. In cultivation, campanulas tend to become taller and more robust, less hairy, more branched, and more floriferous. Blue is the prevailing color in the genus. A very few have white or yellowish flowers, with no blue or violet forms. Any blue or violet-flowered form is likely to have white varieties, and double and semi-double forms are common in three or four of the most popular species. All flowers tend to become larger and more numerous on a stem. In cultivation, the three-celled species are likely to have five stigmas instead of three, and five-celled capsules, often along with normally constructed flowers on the same plant. The height is the most variable feature of all, and in the scheme below *C. carpatica*, *C. punctata* and forms of *C. glomerata* especially will seem wrongly placed to many. But the characters used by botanists are well-nigh useless to the gardener, and nothing but a distinction of height can bring out the two important cultural groups of campanulas. For a recent garden monography of dwarf campanulas, see Correvon, "The Garden," 59 (1901) pp. 276, 450; 60, pp. 51, 64, 111, 161, 218.

*Cultivation*.—The genus *Campanula* is extraordinarily rich in flowering garden plants of merit. The alpine section is distinguished by a charming grace both in character of growth and size and bearing of flowers. The peach-leaved class (*C. persicifolia*) is characterized by the noble and beautiful form of single and semi-double blossoms carried by thin erect stems 2-3 feet high. The luster and clearness of tints of the bushy biennial *Medium* and calycanthema type are remarkable, while the rambling habit and the marvelous floriferousness of the varieties *C. isophylla* and its descendant *C. Mayii*, indicate the wide range of ornamental usefulness of bellflowers. Considering the good lasting qualities in a cut state and the great popularity of the flowers of long-stemmed sorts for indoor decoration, it is safe to say that campanulas will steadily gain in importance as material upon the florists' counter as well as for garden planting. The greatest curiosities are *C. punctata*, *C. macrostyla*, *C. Zoysii* and *C. rotundifolia* var. *soldanellaeflora*. For exhibition and for pot culture and also for large single specimens, *C. pyramidalis* is most used. For edgings, *C. carpatica* is perhaps the favorite. Of all wild forms, the best known is certainly *C. rotundifolia*, the true harebell, or "blue bells of Scotland." It is native in North America as well as in Europe, on rocky banks and shores.—Wherever rock-gardens are planned, alpine campanulas have become indispensable. The greater part of typical mountain inhabitants chiefly available for this purpose being spring-flowering plants, the summer flowers of campanulas are especially welcome. One of the best bellflowers for rock-gardens is *C. carpatica*, blue and white, with its var. *compacta* also in blue and white, var. *cælestina*, sky blue, var. *pelvisiformis*, light blue, and var. *Riverslea* with large dark-blue bells; but there are a number of other very handsome species possessing commercial value that deserve the attention of progressive growers. The demand is for a plant material easy to handle, resistant and free-flowering. As such may be recommended for rockeries, *C. garganica* and *C. garganica* var. *hirsuta*, both 4 inches high, flowers light blue. *C. pusilla*, in white and blue, is regarded as the hardiest low-growing alpine bellflower. Excellent effect may be secured from a number of the garden hybrids, when rightly employed; plantations of *C. Wilsonii*, cross between *C. pulla* and *C. turbinata*, dark blue, 6 inches tall, and *C. Fergusonii* and *C. Hen-*



762. Capsule of *Campanula* with basal dehiscence.



*derosonii*, 12 to 18 inches, all blooming freely from late in June to early August, are good examples. *Campanula glomerata* var. *acaulis*, a clustered-flowering low-growing form, violet-blue, June and July, answers the same purpose, while *C. glomerata* var. *dahurica*, 12 to 18 inches, dark violet-blue and white, very free-flowering, is valuable also as a border plant. Other good rocky kinds are *C. fragilis* (which needs protection, but makes a good pot-plant), *C. pulla* in sheltered position, *C. Portenschlagiana*, and *C. rotundifolia*. Many of the larger-growing kinds are also good for the rock-garden. —The best two representatives of the biennial class, are *C. Medium* and *C. calycanthemata*, both standard garden flowers. In the northern states, especially, they do exceedingly well. When used for mass effects, their full bloom becomes a prominent feature of June. The delicate shades of pink and pale lavender, the purity of the white, and the rich tints in purple and blue are a revelation. They transplant very easily, even in an advanced state of growth, and readily respond to mild forcing under glass in spring. In a cut state, they show remarkably good lasting qualities and are of excellent value as material for filling vases. A few other good biennials are *C. sibirica*, *C. primulaefolia*, *C. spicata*, (p. 650), *C. thyrsoides*. —The peach-leaved section comprises the most perfect forms of the bellflower family, although *C. persicifolia* has been surpassed in popular favor by the more vigorous *C. grandiflora* varieties in white and blue, which are really platycodons. *C. isophylla*, native of Italy, is not hardy in Maine and must be overwintered under glass. It is a very effective basket- and balcony-box plant, its long hanging vines being covered with large and attractive flowers in July and August. The color is a delicate light blue, while the bells of its garden descendant *C. Mayii*, have a deeper shade. For the South, both are valuable acquisitions for rockeries. —Of the perennial species, according to Robert Cameron, the best border plants are the following: *C. carpatica* and vars. *alba* and *turbinata*; *C. glomerata*, especially var. *dahurica*; *C. lactiflora*; *C. latifolia*, especially its vars. *eriocarpa* and *macrantha*; *C. nobilis* (about 2 ft. in height); *C. persicifolia* and its numerous vars., especially the white kinds; *C. punctata* (about 1½ ft.); *C. pyramidalis*, a very showy plant when well grown, but not quite reliable in the eastern states as to hardiness, making a good pot-plant for the cool greenhouse; *C. rapunculoides*, which spreads rapidly and must be so placed that it will not crowd out the other plants that are near it; *C. rotundifolia*; *C. Trachelium*; *C. Van Houttei*, a hybrid, and one of the best bellflowers. —Campanulas are raised from seed and also by division or cuttings. Seeds should be started early under glass. Cover very shallow, and place the shallow seed-pans near the light in an average temperature of 60°. Shade at midday while in process of germinating; avoid over-watering and "sticky" atmosphere. Transplant seedlings into flats as soon as they can be handled. Harden young plants gradually and transfer them to the open ground in May. *C. Medium*, *C. calycanthemata*, and all the *C. persicifolia* varieties, when grown for the cut-flower trade, should be placed on beds where they are intended to be flowered and cropped the next season. They thrive best in a rather light well-manured garden soil. Some of the alpine species require a sandy humus with additions of fine limestone material. When grown for floral garden effect, the open sunny position is preferable throughout the North, while for the South half-shade at midday is likely to prolong the flowering season. Seedlings of single varieties come true to color to a high percentage. Of the semi-double and double *C. persicifolia* sorts, propagation is usually by division in September. *C. isophylla* and *C. Mayii* are shy seeders and are propagated by cuttings in spring. For winter protection, a light covering of straw, leaves or evergreen boughs is sufficient south of New York. In more

northern parts, hardy campanulas require a uniform layer of leaves 2 to 3 inches thick. The annuals can be raised in the border by seeds sown late in April or May, or raised in the greenhouse and then transferred to the border. The best of the annuals are *C. ramosissima* and var. *alba*, *C. drabifolia*, *C. Erinus*, *C. macrostyla*, and *C. americana*. (Richard Rothe.)

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| <i>glomerata</i> , 12.        | <i>punctata</i> , 24.         | <i>Zoysii</i> , 48.          |

*C. primulaefolia* and *C. spicata* will be found in the supplementary list, p. 650.

GROUP I. Kitchen-garden vegetable: roots radish-like: a salad plant.

1. *Rapunculus*, Linn. (*Rapunculus verus*, Fourr.). RAMPION. Fig. 763. Biennial or perennial, 2-3 ft.: root spindle- or long-radish-shaped, ½ in. thick, white; st. erect sulcate: lower lvs. obovate, short-petioled, somewhat crenate; st.-lvs. linear-lanceolate, entire: fis. calyx-tube obconical, lobes lilac, in a spike or raceme; glabrous or bristly, erect, awl-shaped, a half shorter than or nearly equal to the funnel-shaped corolla. Eu., Orient, N. Asia, N. Afr.—The roots and lvs. are eaten as a salad. The seeds, which are very small, are sown in the open ground in early May either broadcast or in drills. A little sand mixed with the seed gives an even sowing. Press firmly, and water carefully. Thin out the seedlings if necessary. Water freely in hot weather. A fresh sowing may be made in June, as early-sown plants may run to seed. Roots are gathered in Oct. and may be stored in sand for winter use. "Rapunculus" means a little turnip.



763. Root of rampion—*Campanula Rapunculus*.

GROUP II. Tall or border campanulas, characteristically a foot or 15 in. or more high. Nos. 2-23.

A. Calyx with an appendage at the base of each sinus.

B. Caps. 5-celled and stigmas 5 (variable in No. 3).

C. Style excessively long, the stigma an inch or more long.

2. *macröstyla*, Boiss. & Heldr. Annual, 1-2 ft., branched from the base, hispid with rigid spreading scattered bristles; branches stout; lvs. scattered, small for the size of the plant, sessile, bristly on both surfaces; lower ones ovate-oblong, acute; upper ovate-lanceolate, recurved, cordate, eared at the base; calyx-tube hidden by the bladderly appendages, small, broader than long; fls. solitary; on stout peduncles, 2-2½ in.

broad; corolla very broad and open, pale purple without, dull purple within, marked with violet, and hairy toward the bottom; lobes very broad, short and acute. Mt. Taurus in Anatolia. Gn. 15: 356 and 12, p. 209. B.M. 6394. —The very long exerted style is brown and spindle-shaped before spreading open. Self-sown seeds sometimes remain a year before sprouting.

cc. Style not excessively long.

3. *longéstyla*, Fomine. Perennial, 1½-2½ ft., more or less hairy: basal lvs. lance-oval, lobed, the st. lvs. oblong and sessile; fls. blue-purple, drooping; calyx-lobes lanceolate-pointed, the appendages reflexed on the peduncle; corolla

almost urn-shaped, dilated below the middle; style exerted with 3, 4 or 5 stigmas; caps. 3-5-celled. Caucasus. Gn. W. 23:671. Var. *parviflora*, Bois. Fls. smaller. R.H. 1911:548; p. 549.

4. *Médium*, Linn. (*Médium grandiflorum*, Spach). CANTERBURY BELLS. Fig. 764. Biennial, 1-4 ft.; plant pilose: st. erect; lvs. sessile, ovate-lanceolate or lanceolate, crenate-dentate: raceme lax, many-fl.; fls. violet-blue, varying to several shades and to white, 2 in. long; calyx-lobes ovate-acuminate, the appendages half as long as the ample ovate obtuse lobes; corolla bell-shaped, inflated. S. Eu. Gn. M. 14:9. Two forms (aside from the single-fl.) occur: the double, Fig. 764a, with 1-3 extra corollas, and the var. *calycánthema*, Hort., Fig. 764b, with an enlarged spreading and petal-like outer part sometimes deeply divided and sometimes little lobed or nearly entire (varying on the same plant). The var. *calycánthema* is the CUP-AND-SAUCER form (the

name hose-in-hose, sometimes applied in Campanula, would better be retained for *Primula elatior*); a fair percentage come true from seed; usually a stronger plant than the common *C. Medium*. G.C. III. 24:65. R.H. 1896, p. 301; 1897, p. 238. Gng. 5:88. Gn. 48, p. 295. F.S. 19, p. 152. G.W. 3, p. 291. G.Z. 17: 113. Var. *Wiëgandii*, Hort. Lvs. golden yellow; fls. blue. Var. *imperialis*, Hort., is a very floriferous form or possibly a hybrid. —Canterbury bells are most commonly treated as hardy biennials, the seed being sown in the open border, but they do not flower the first year. They can also be treated as tender annuals, the seed being sown indoors in early spring and the plants set out May 1-15. They will then flower well the first season, but always better the second year. Sowings may also be made in April, May or later, in pots, boxes or beds, and plants then be transferred into some sheltered place where they can be slightly protected during the winter, and then transplanted in spring to their permanent places into good rich soil, where they will make a great show if they have had the right treatment. Let them stand 18-24 in. apart. Seedlings potted up in autumn may be brought into bloom readily indoors in spring; and even blooming plants, if not spent, may be potted direct from the garden and used in the house in autumn.

BB. Caps. 3-celled: stigmas 3.

5. *alliarifolia*, Willd. (*C. lamiifolia*, Bieb. *C. macrophylla*, Sims). Perennial, 1½-2 ft.: st. erect, striate, woolly, branched only at the top: root-lvs. large, heart-shaped, crenate, tomentose; st. lvs. on petioles which gradually shorten upward, the highest being sessile: fls. white, nodding, on short stalks, borne singly in the axils of the floral lvs. as in *C. sarmatica*, but the floral lvs. larger and broader; calyx a third or a fourth shorter than the corolla, with margins rolled back, and appendages less minute than in *C. sarmatica*; corolla always white, 2 in. long, ciliated at the margin, and with characteristic tooth-like processes at the base of each sinus. Caucasus, Asia Minor. B.M. 912. Gn. M. 14:9.

6. *sarmatica*, Ker-Gawl. Perennial, 1-2 ft.: st. simple, striate, pubescent; lvs. remarkable for their gray color, harsh, leathery, wrinkled, tomentose, oblong-cordate, crenate, the lower long-petioled, the upper sessile: calyx with minute reflexed appendages, and a short, densely hairy tuft: fls. about 6 on a st., nodding; corolla about 1 in. long, and 1½ in. across, pale blue, marked with 5 hairy lines. Caucasus, in subalpine places. B.M. 2019. L.B.C. 6:581.

7. *Grössekii*, Heuff. Has the habit and infl. of *C. Trachelium*, but the calyx is appendaged; perennial, 2½ ft., branching from the base, angled, pilose: lvs. hispid, the lower cordate, unequally petioled, doubly crenate-serrate, the uppermost ovate-acute, narrowed into a petiole: calyx setose-ciliate, lobes spreading, reflexed at the apex, appendages lanceolate, a third shorter than the lobes; corolla hispid, 2 or 3 times longer than the calyx-lobes; fls. large, bell-shaped, violet, in a long raceme. Hungary. Gt. 35, p. 477. G. 27:459.

8. *mirábilis*, Alboff. Biennial or short-lived perennial, 1 ft. or more; whole plant forms a broad dense cone with such a profusion of bloom as almost to hide the foliage: lower lvs. 4-6 in. long, obovate or spatulate, obtuse, coarsely toothed, petiole winged; fls. pale lilac, erect, broadly campanulate, 2 in. across, the corolla hairy on margins and back. Caucasus. B.M. 7714. G.C. III. 24:33; 42:144-5. Gt. 47, p. 192. Gn. 54, p. 454; 60, p. 58. G.W. 12, p. 445. —A very beautiful and remarkable plant.

AA. Calyx without an appendage at the base of each sinus.

B. Fls. rotate or wheel-shaped.

9. *americana*, Linn. Annual and biennial, 3-6 ft.: st. erect, simple; lvs. thin, serrate, somewhat pilose;



764. *Campanula Medium*, the Canterbury Bell. Modified forms are shown.



root-lvs. ovate-acute, subcordate, petiolate; st.-lvs. ovate-lanceolate, acuminate at both ends: calyx-tube long, obconical, the teeth linear-acuminate, almost entire, spreading, shorter than the 5-fid, wheel-shaped corolla; fls. light blue, 1 in. broad, in long spikes, solitary or in 3's; corolla shallow, lobes pilose outside and at the apex; style long, strongly declined and upwardly curved; caps. cylindrical, grooved. Shaded low ground Canada to Iowa, south to Fla. and Ark.—Rarely cult. It is possible that *Phyteuma canescens* is still cult. as *C. americana*.

BB. Fls. saucer-shaped or broadly bell-shaped, i. e., the tube shallower and the limbs more widely spreading than the bell-shaped.

c. St.-lvs. linear-lanceolate, crenulate.

10. *persicifolia*, Linn. Fig. 765. Perennial, 2-3 ft.: st. erect; lvs. glabrous, rigid, crenulate; root-lvs. lanceolate-obovate; st.-lvs. linear-lanceolate or spatulate, often 3 in. long; calyx-lobes acuminate, wide at the base, entire, half as long as the broadly bell-shaped corolla: fls. blue or white, pedicelled, solitary, terminal and axillary, often  $1\frac{1}{2}$  in. long, 2 in. broad: caps. ovoid, 3-grooved. Eu. B.M. 397. G.C. III. 43:384. Gn. 75, p. 30. G. 6:297. Gn. M. 14:9. G.W. 3, p. 292. C.L.A. 13:478; the white form in G. 13:71 and Gn. W. 23:Suppl. Jan. 27; the double white in G.C. III. 27:409 and G. 3:563. One of the best of all perennial campanulas. Var. *macrantha* is a large-fl. form with fls. all along the st. Gt. 44, p. 148. Gn. 48, p. 306. A.F. 6:383. S.H. 1:131. Var. *alba grandiflora* and var. *Bäckhousei* are among the popular white-fl. forms. There are double and semi-double forms in blue and white. The double white is useful for cutting. For portraits of var. *grandiflora*, see G. 27:458; 28:553, 673; G.W. 12, p. 433. Var. *coronata*, Hort., is a semi-double white form. F.S. 7:699. The pictures in B.M. and F.S. show distinctly saucer-shaped fls. Var. *Moerheimeii*, Hort. White-fl., double, 2-3 in. diam.: excellent. G.C. III. 27:414. G.M. 49:535. G.W. 6, p. 545; 12, p. 434. A.G. 23:497. Var. *marginata*, Hort., has white fls. tinted blue on the borders. R.B. 32, p. 252. This species occasionally runs wild, especially in England. The lvs. are very characteristic, and, once seen, are never forgotten.

cc. St.-lvs. wider and coarsely toothed.

11. *latifolia*, DC. (*C. grandis*, Fisch. & Mey.) Perennial, 1-1½ ft., glabrous: st. erect, simple, terete: st.-lvs. 3-5 in. long, 4-6 lines wide, lanceolate, narrowed at both ends, crenate-serrate: calyx-lobes ovate-acute, broad, entire, erect, one-half shorter than the broadly bell-shaped corolla: fls. blue, often 2 in. wide, sessile, solitary or somewhat clustered, sometimes equaling the ovate-acute, dentate bracts. Mt. Olympus. P.M. 10:31. H.U. 3, p. 137. Gt. 7:202.—Fls. like *C. persicifolia*. Quickly forms a dense carpet. Variable in color. Var. *alba*, Hort. White fls. G. 19:440.

BBB. Fls. bell-shaped or tubular, not saucer-shaped.

c. Infl. a dense roundish head.

12. *glomerata*, Linn. One of the most variable: perennial, 1-2 ft., typically pubescent: st. erect, simple, terete: lvs. serrulate, lower ones rough with very short, stiff hairs,  $1\frac{1}{2}$ -3 in. long, 1-2 in. wide, with a cordate, ovate-oblong blade shorter than the petiole; upper ones sessile, ovate, acute: fls. violet-blue to white, in dense heads or glomes, 15-20 in the terminal heads, fewer in axillary ones. Eu., Armenia, Persia, Siberia; sometimes escaped in this country. Gn.M. 14:9. B.M. 2649 is var. *speciosa*, which has the largest fls. L.B.C. 6:505 is var. *sparsiflora*, with much smaller clusters.—This is one of the earliest flowering and easiest of cult. Fls. typically dark purple, running into lighter varieties. Var. *dahurica*, Hort., is probably the commonest form: terminal clusters 3 in. or more thick, a very characteristic infl. The fl. has a longer tube than

*C. lactiflora* and *C. thyrsoides*. G. 26:305. Var. *acaulis*, Hort., is an almost stemless form with very large fls.: sts. only 3-5 in. high. G.W. 9, p. 272. Var. *superba*, Hort., is a cross of the dwarf variety with var. *dahurica*: large heads of deep violet fls.

cc. Infl. a spike or raceme, dense or loose.

D. Color of fls. normally white or yellowish.

E. Corolla small, short-tubed.

13. *lactiflora*, Bieb. Perennial, 2½-6 ft.: st. erect, branching: lvs. sessile, ovate-lanceolate, acutely serrate: calyx-lobes very broad, acute, serrulate, one-half shorter than the broadly bell-shaped corolla: fls. in a loose or dense panicle, which may be 3½ in. long and thick; corolla white or pale blue, 1 in. long, nearly 1½ in. broad: caps. ovoid, erect. Caucasus, Siberia. B.M. 1973. G.C. III. 50:438. Gn. 61, p. 29; 63, p. 90; 71, p. 418; 75, p. 89. G.M. 46:168; 48:545. Gn. W. 23:623. The normally milk-white blue-tinged fls. are characteristic. Var. *coerulea*, Hort., has light blue fls.—*C. celtidifolia*, Boiss., referred to the above, may be a strongly marked variety. *C. biserrata*, Koch, is also referred here.

14. *thyrsoides*, Linn. Biennial, 1-1½ ft.; st. grooved: lvs. all covered with long hairs at the margin; root-lvs. sessile, spatulate or obtusely lanceolate, 2½ in. long, ¾ in. wide, in a dense rosette, lying on the ground; upper lvs. more narrow and acute: fls. 40-50, sulfur or creamy yellow, in a dense thyrselike spike, which may be 6 in. long and 2½ in. broad; style exserted. Alps and Jura, 3,000-6,000 ft. B.M. 1290. L.B.C. 17:1644.—Intermingled with the fls. in the spike are lvs. which are longer than the fls., which is not true of *C. lactiflora*. Should not be confounded with *C. thyrsoides*, Lapeyr., which = *C. speciosa*, (see supplementary list). Apparently no blue or purple forms are known. The picture in B.M. shows a characteristic red-tipped calyx. Garden hybrids are reported with *C. spicata* (see Kew Bull. 1910, p. 322).



765. A narrow-flowered form of *Campanula persicifolia*.

EE. Corolla large, long-tubed.

15. *Vidalii*, H. C. Wats. Perennial, 1-2 ft.: st. branching from the base: some branches short, sterile, others tall, floriferous, all grooved, clammy, glossy: lvs. 3-4 in. long, oblong-spatulate, coarsely serrate, thick, fleshy, firm, viscid, the upper ones gradually becoming bracts: fls. 2 in. long, nodding, about 9 in a loose terminal raceme; calyx-lobes triangular, thick, one-fourth shorter than the corolla; corolla tubular, swelled below, constricted above, white with a yellow base. Azores. B.M. 4748. F.S. 7:729. A.F. 3:116. G.C. III. 18:95; 34:330-1. Gn. 54, p. 299; 63, p. 297; 74, p. 402; 75, p. 410. J.F. 3, pl. 274.—Very distinct.

DD. Color of fls. normally blue or purple (with white varieties).

E. Size of fls. large.

F. Raceme pyramidal or long-conical, usually dense.

16. *pyramidalis*, Linn. CHIMNEY CAMPANULA. Fig. 766. Glabrous perennial, 4-5 ft.: lvs. glandular-den-

tate, lower petiolate, ovate-oblong, subcordate; st.-lvs. sessile, ovate-lanceolate: calyx-lobes acuminate, spreading, half as long as the broadly bell-shaped corolla: fls. numerous, in pyramidal racemes, pale blue varying to white and darker at the base. G.C. III. 32:388. Gn. 45, p. 67; 48, p. 306; 51, p. 221 (a staked pot plant); 47, p. 86 (with extensive cultural notes); 53, p. 535; 62, p. 254; 64, p. 96; 68, p. 137; 69, p. 4; 74, p. 548. R.H. 1897, p. 238. G.M. 46:612; 53: 811. G.W. 1, p. 39; 7, p. 7; 11, p. 137; 13, p. 571.

Var. *alba*, Hort., has white fls. Gn. 74, p. 645. J.H. III. 51:257. Var. *compacta*, Hort. Dwarfier: fls. larger and of better substance. The compact variety is very floriferous and convenient for conservatory, but lacks the characteristic erect, pyramidal habit. Gn. 73, p. 54. G. 18:64. S.H. 2:97. *C. Fergusonii*, Hort., is a hybrid of *C. pyramidalis* and *C. carpatica*, resembling a dwarf form of the former in growth, 18 in.: petals more pointed than those of the latter: fls. bright lilac. Gn. 66, p. 276.

Hybrids between *C. pyramidalis* and *C. versicolor* are reported.

FF. Raceme not pyramidal, usually looser.

17. *latifolia*, Linn. Perennial, 3-4 ft.: lvs. large, doubly serrate; root-lvs. sometimes 6 in. long, petiolate, cordate, covered with soft hairs; st.-lvs. sessile, more acuminate: peduncle 1-fl.; calyx-lobes long-acuminate, one-third shorter than the corolla; fls. 6-15 in a loose spike or raceme about 8 in. long, erect, very large, 2½ in. long, purple or dark blue, hairy. Eu., Persia. G.W. 8, p. 445. Var. *macrantha*, Sims (*C. macrantha*, Fisch.) is commoner in cult. than the type, a little hairier, with a glabrous calyx and very large fls. B.M. 2553, 3347. R.H. 1897, p. 239. J.H. III. 60:263. Var. *ericarpa*, DC., has the st. and lvs. pilose and more pallid, and a hispid calyx-tube. There is a white-fl. form. It is native to England, and is easily naturalized there in wild gardens. The st.-lvs. are probably the largest of any of the garden kinds, often 3½ in. long and 2 in. wide.

EE. Size of fls. small, less than 1 in. long.

18. *bononiensis*, Linn. Perennial, 2-2½ ft.; scabrous: st. simple: lvs. serrulate, ovate-acuminate, pallid beneath; root-lvs. cordate-petiolate; upper lvs. clasping: calyx-lobes acuminate, one-fourth shorter than the funnel-shaped corolla: fls. normally purplish, in a long, loose, pyramidal spike, which may be 2 ft. long, with 60-100 small fls.; corolla ¾ in. long and broad. E. Eu., W. Siberia, and Caucasus. Var. *ruthénica* (*C. ruthénica*, Bieb.), has lvs. wider and tomentose beneath. Caucasus and Tauria. B.M. 2653. There is a white-fl. form. The fls. are much smaller than in *C. latifolia*, and the raceme is much larger.

19. *rhomboidalis*, Linn. Perennial, 1 ft., sometimes 2 ft.: st. simple, erect: lvs. sessile, ovate-acute, serrate:

calyx-lobes awl-shaped, one-half shorter than the bell-shaped corolla; fls. 8-10 in an almost corymbose raceme, the lower pedicels of which may be 3 in. long, the uppermost 1 in. or less; corolla purplish blue, 1 in. long, and a little wider. Mts. of Eu. B.M. 551 (as *C. azurea*). J.H. III. 50:541. Var. *alba*, Hort., has white fls. G.W. 3, p. 14.—It flowers in July and August, after which the sts. and lvs. die down quickly.

20. *Trachelium*, Linn. THROATWORT. Fig. 767. Perennial, 2-3 ft.: st. angular, somewhat bristly (as also the fls.): lvs. rough, acuminate, coarsely crenate-dentate; root-lvs. cordate, ovate, short-stalked: calyx-lobes erect, triangular-acuminate, one-third shorter than the bell-shaped blue or white corolla: peduncle 1-3-fl.; fls. erect at first, at length tending to droop in a loose raceme, which may be 12-18 in. long: caps. nodding. Eu., Caucasus, Siberia, Japan, and run wild in parts of N. Amer. R.H. 1897, p. 239. There is a double-fl. form and variations in color.—One of the commonest and hardiest of the border plants, often running out the other campanulas, and passing under many names, especially as *C. urticifolia*.

21. *rapunculoides*, Linn. Fig. 768. Perennial, 2-4 ft.: st. indistinctly pubescent or almost smooth: lvs. rough, ovate-acuminate; root-lvs. petiolate, cordate, crenulate; st.-lvs. serrulate: calyx a little rougher than in *C. Trachelium*, the lobes linear-lanceolate, at length reflexed, one-fourth length of the oblong-campanulate bright blue corolla; fls. soon declined or nodding, in long mostly 1-sided racemes or spikes, bright blue. Eu., Caucasus, Siberia, and common in patches on old roadsides and about yards. Summer. Gn. M. 14:9.

22. *versicolor*, Sibth. & Smith. Perennial, 3-4 ft.; plant glabrous: st. ascending: lvs. serrate; root-lvs. long-petioled, ovate-acute, subcordate; st.-lvs. short-petioled, ovate-lanceolate, acuminate: calyx-teeth acuminate, spreading, at length reflexed, one-half as long as the corolla: fls. in long, spicate racemes; style exserted: caps. spheroid. Greece.

ccc. Infl. an open, compound panicle.

23. *divaricata*, Michx. Glabrous perennial, 1-3 ft.: st. erect, slender, paniculate above: branches slender, divergent: lvs. sparse, subsessile, ovate-lanceolate, acuminate at both ends, coarsely serrate: calyx-lobes awl-shaped, one-half shorter than the tubular, bell-shaped corolla; fls. small, nodding, pale blue, in a very open and compound panicle; style straight, exserted. Alleghanies, from Va. to Ga.—Rare in gardens.

GROUP III. Low-growing or rock-garden campanulas, mostly less than a foot or 15 in. high. Nos. 24-49.

A. Calyx with an appendage at the base of each sinus, often minute or disguised in form.

B. Throat of corolla spotted violet.

24. *punctata*, Lam. (*C. nobilis*, Lindl.). Named from the spotted whitish corolla, the purplish spots being inside and showing through faintly in the fresh fl. but



766. *Campanula pyramidalis*.



767. *Campanula Trachelium*. (×½)



more plainly in the dried specimen: like *C. alliariaefolia*. Perennial, 1 ft., with long and loose hairs: upper lvs. nearly sessile, and more sharply toothed than the lower: calyx-lobes one-third as long as the corolla, longer, looser and hairier than in *C. alliariaefolia*, and the margins much more recurved: peduncle 1-4-fld.; fls. nodding; corolla cylindrical,  $2\frac{1}{4}$  in. long, white, spotted within, strongly ribbed. Siberia, Japan. G.C. III. 38, supp. Aug. 26; 42:96. Gn. 73, p. 423; 75, p. 458. G.M. 51:781. G. 29:595.—*C. nobilis* has been considered distinct. In F.S. 3:247 the corolla is dark violet without, the limb hairy, while in B.M. 1723 (*C. punctata*) the corolla is white outside and not bearded. In F. S. 6:563 (*C. nobilis* var. *alba*) the limb is not bearded and the st. is red, and not hairy. The three pictures show great differences in foliage, pubescence and appendages. This is one of the most interesting of all campanulas, and is, unfortunately, usually considered more quaint than beautiful. The spotted throat readily separates it from other campanulas.

BB. Throat of corolla not spotted.

c. Sts. commonly 1-fld.

25. *Van Houttei*, Carr. Perennial, 2 ft.: root-lvs. long-petioled, roundish cordate, more or less lobed; st.-lvs. sessile, oval-lanceolate, irregularly bi-dentate,  $2\frac{1}{2}$ -4 in. long, more or less villous, strongly nerved: fls. usually solitary, nodding at the end of a small branchlet, 2 in. long, half as broad, indigo-blue, or violet; calyx-lobes linear, spreading, 1 in. long.—A garden hybrid resembling *C. punctata*. Intro. into France 1878 by Thibaut and Keteleer. Var. *pallida*, Hort., has pale lavender fls.

26. *Allionii*, Vill. Perennial, 3-5 in.: rootstock slender, creeping underground, sending up sts. at intervals of  $\frac{1}{2}$ -1 in.: lvs. few, about 7 on a st., 1-2 in. long, linear-lanceolate, sessile, slightly hairy, entire, midrib distinct, lower ones in a whorl of about 5, upper ones similar but more erect: calyx-lobes lanceolate, half as long as the corolla, the appendages ovate, reflexed, one-third the length of the calyx-lobes; fls. purple, with a rare white variety, only one on a st., inclined or nodding,  $1\frac{1}{2}$  in. long, and as broad across the mouth, probably the largest for the size of the plant of any campanula. A very local species, found only in the western Alps. B.M. 6588. G.C. III. 52:52. Gn. 60, p. 51.

cc. Sts. usually several-fld.

d. Margin of corolla bearded.

27. *barbata*, Linn. Perennial, 6-9 in.: st. pilose: lvs. villous, entire or nearly so; root-lvs. tufted, lanceolate; st.-lvs. few, ligulate (?): raceme loose, 3-4-fld.; fls. nodding, pale blue; calyx appendage ovate, obtuse, half as long as the lobes; corolla bell-shaped, shorter than in *C. Allionii*, and with a bearded mouth. Alps. L.B.C. 8:788. G.C. III. 48:388. Gn. 48, p. 297. G.W. 12, p. 447.—There is a white-fld. form, but apparently no purple. Readily distinguished from *C. Allionii* by the different colored, bearded and smaller fls., which are rarely borne singly, and by the dense, soft hairs of the st. Alps, 2,400-6,000 ft., widely distributed; mts. of Norway, and the Carpathians. Becomes coarse when grown in rich ground.

dd. Margin of corolla not bearded.

E. Fls. erect.

28. *mollis*, Linn. Perennial, velvety gray, 6-8 in.: sts. procumbent, about 2-fld.: root-lvs. tufted, obovate or spatulate; st.-lvs. ovate or rotund: fls. loosely panicled; calyx-lobes lanceolate, erect, half shorter than the glabrous, bell-shaped corolla; appendages minute, shorter than the calyx-tube; corolla erect, dark purplish blue or lavender, with a white throat, the tube long, segms. short, broad, spreading, acute. Spain, Crete. B.M. 404.—Rock or border plant.

EE. Fls. nodding.

29. *alpina*, Jacq. Perennial, 3-8 in.: st. furrowed: lvs. smaller than in *C. barbata*, more narrowly lanceolate, entire, hairy: fls. typically deep blue, bell-shaped, with broader and shorter segms. than in *C. barbata*; calyx-lobes proportionately very long, surpassing the fl.-bud, and nearly as long as the flower, but widely spreading. Alps of Austria, Lombardy and Transylvania, 6,000-7,000 ft. altitude. B.M. 957. J.H. III. 29:5.—There is a white-fld. var. The plant has a characteristic shaggy appearance from the hairy lvs. Easy of cult.



768. *Campanula rapunculoides*. ( $\times \frac{5}{8}$ )

30. *sibirica*, Linn. (*C. Höhenackeri*, Fisch.). Biennial or perennial, setaceous-pilose: st. erect, simple, panicled above: lvs. crenulate; root-lvs. petioled, obovate, obtuse; st.-lvs. lanceolate-acuminate: calyx hairy, the lobes long-acuminate, a third shorter than the corolla; calyx appendages like the lobes but half shorter and reflexed; fls. 25 or more, violet, with a longer and narrower tube than in *C. alpina*, and longer divisions of the limb. N. Asia, Caucasus, W. Eu. B.M. 659. R.H. 1861:431.—The type is rare, but var. *eximia*, Hort., is somewhat commoner: it is dwarfer, much branched, with long, scabrous lvs. and pale bluish to violet fls. Var. *divergens*, Willd., has larger fls. and broader lvs. than the type. G.C. III. 16:597. *C. sibirica* usually does best when treated as a biennial.

AA. Calyx without appendages.

B. Fls. very wide-spreading, i.e., rotate, wheel-shaped, almost flat.

c. Blossoms all erect.

31. *Waldsteiniäna*, Roem. & Schult. Perennial, 4-6 in.: sts. rigid, glabrous: lvs. fleshy, sessile, gray-green,

lanceolate, slightly serrate-dentate, the lower obtuse, the upper long-acuminate: calyx-lobes awl-shaped, spreading or recurved, one-fourth shorter than the corolla: fls. 5-9 in a corymbose raceme  $1\frac{1}{4}$  in. long,  $\frac{3}{4}$  in. wide, pale purplish blue; corolla rotate, almost starlike, with a dark spot in the throat; pistil large, white, twice the length of the corolla, with a yellow stigma. S. Austria. Gn. 8, p. 173. G. 18:81. G.W. 12, pp. 446, 710. *C. Tommasiniana*, Hort., is an allied plant, with very wiry growth and pendent pale blue fls. *C. Stansfeldii*, Hort., is a supposed hybrid, perhaps between *C. Waldsteiniana* and *C. carpatica*.

32. *ramosissima*, Sibth. & Smith (*C. Lorei*, Poll.). Annual, 1 ft. or less, branching: lower lvs. obovate and crenate; upper lvs. narrow, entire: fls. violet with white base and blue intermediate parts, erect on long simple pedicels. Eu. B.M. 2581. Var. *alba*, Hort. Fls. white.

cc. Blossoms not all erect.

d. Habit trailing or pendulous.

33. *fragilis*, Cyrill. Perennial, 4-6 in.: st. diffuse, trailing: root-lvs. long-petioled, roundish-cordate, obtusely dentate, or crenately lobed; st.-lvs. smaller, scattered, the uppermost ovate-lanceolate: fls. pale purplish blue with a white center,  $1\frac{1}{2}$  in. wide, in loose corymbs; calyx-lobes linear-lanceolate, acuminate, erect, almost equaling the corolla; style exserted: caps. ovoid. Italy B.M. 6504. P.M. 11:25. G.C. III. 43:378. Gn. 8, p. 174; 47, p. 278; 63, p. 53. G. 18:120. G.W. 2, p. 381. Var. *hirsuta*, DC., is a hairier form.—This is the best species for hanging-baskets, window- and veranda-boxes, and for covering large stones in the rockery. Prop. by cuttings in spring, the roots being too fragile to divide well. Not so hardy as *C. garganica*.

769. *Campanula carpatica*. ( $\times \frac{3}{8}$ )

cuttings in spring, the roots being too fragile to divide well. Not so hardy as *C. garganica*.

34. *garganica*, Tenore. Perennial, 3-6 in.: st. diffuse, with pendent branches: lower lvs. reniform-cordate, crenate-dentate; upper lvs. ovate-acute, dentate: raceme lax; peduncles 1-2-flid.; calyx-tube spheroid, the lobes spreading, a third or fourth shorter than the glabrous blue rotate corolla. Mt. Gargano in Italy, and elsewhere. B.R. 1768. Gn. 48, p. 295; 43, p. 25. G.M. 54:664. G.W. 4, p. 255. Var. *hirsuta*, Hort., is a hairier form. Gn. 46, p. 253; 48, p. 297.—Half-shaded position. Prop. by cuttings or by division.

DD. *laevi* not trailing or pendulous.

35. *Elatines*, Linn. Perennial, more or less pubescent, 5-6 in.: lvs. cordate, coarsely and acutely dentate, lower rotund, others ovate-acute: raceme lax; calyx-tube spherical, the lobes spreading, linear-lanceolate, somewhat unequal, a half shorter than the rotate purplish corolla; style exserted. Piedmont. Gn. 60, p. 64.—Rare rock-plant for light, stony soil.

36. *Portenschlagiana*, Roem. & Schult. (*C. muralis*, Port.). Perennial, 6-9 in.: sts. somewhat erect: lvs. all

alike petiolate, cordate, roundish, acutely angular-dentate; calyx-tube spheroid, lobes erect, acuminate, a third shorter than the infundibuliform blue-purple corolla: fls. racemose. Dalmatia.—Allied to *C. garganica*, but the corolla not so deeply 5-cut. Gn. 61, p. 225; 72, p. 469. Var. *major*, Hort. Fls. nearly twice larger than in the type,  $1\frac{1}{2}$  in. across, making a large mound of purple-blue. G.C. III. 48:58. Gn. 30, p. 111; 63, p. 110. G.W. 3, p. 13.

BB. Fls. broadly bell-shaped, less widely spreading than in B, wider than in BBB (except perhaps in No. 40).

c. Height 2-3 in.

37. *Räinerii*, Perpent. Perennial, 2-3 in.: sts suberect, branching: branches 1-3-flid.: lvs. subsessile, ovate, distantly serrate, the lower smaller and obovate: calyx-tube obconical, the lobes long-acuminate, erect, half shorter than the broadly infundibuliform corolla: fls. large, solitary, erect, dark purplish blue; style short, not exserted: caps. obovate. Mts. N. Italy. F.S. 18:1908. Gn. 60, p. 163.—One of the choicest rock-plants, but somewhat rare. Several forms of the hybrid *C. Wilsonii* are often cult. under this name, but their lvs. are lighter green and less tomentose than *C. Räinerii*. Thrives in a well-drained, sunny position.

cc. Height more than 2-3 in.

d. Style not exserted.

38. *Tenorii*, Moretti. Perennial, 8-12 in., glabrous: st. ascending or prostrate: lvs. leathery; root-lvs. long-petioled, ovate, subcordate, irregularly serrate; st.-lvs. petiolate, ovate-acute, coarsely serrate: calyx-lobes linear-lanceolate, spreading, half as long as the broadly bell-shaped corolla: fls. racemose, blue: caps. spherical. Apennines, near Naples.—This is referred by botanists to the Grecian species *C. versicolor*, which is typically taller, but is kept distinct by Correvon and others. In the garden, *C. Tenorii* resembles *C. pyramidalis* in foliage and fl., but is shorter.

39. *carpatica*, Jacq. Fig. 769. Perennial, 9-18 in., glabrous: st. branching: lower lvs. thin, long-petioled, ovate-rotund, cordate, coarsely dentate, undulate; upper ones shorter petioled, ovate-acuminate: peduncles long, terminal and axillary, 1-flid.; fls. large, often  $1\frac{1}{2}$  in. wide, bright deep blue; calyx-tube obconical, the lobes acute, wide at the base, subdentate-erect, a third or half as long as the broadly bell-shaped corolla; style not exserted: caps. ovoid-cylindrical. Carpathian Mts. of Austria. B.M. 117. G.C. III. 46:412. G.W. 12, p. 436. Gn. 48, p. 297; 62, p. 326. Var. *coelestina*, Hort. Fls. sky-blue. Var. *alba*, Hort. Fls. white. G.M. 55:615. Var. *turbinata*, Hort. (*C. turbinata*, Schott), is dwarfier, more compact, with fls. more bell- or top-shaped, and often 2 in. across, purplish blue. It also has larger lvs. and more decumbent habit. Gn. 45, p. 171; 68, p. 179; 75, p. 201. G.W. 12, p. 446. F.E. 17:15. A form



770. *Campanula pulla*. (Detail  $\times \frac{2}{3}$ )



with pallid fls. is rarer. Var. *Wilsonii*, Hort. (*C. Wilsonii*, Hort.), is a hybrid of var. *turbinata* and *C. pulla*, with the large fls. of the former and the handsome dark foliage of the latter: it is compact, dwarf, and small, ovate, very hairy lvs., with crenate-serrate margin. Gn. 60, p. 219. Var. *haylodgensis*, Hort. (*C. haylodgensis*, Hort.), is a garden hybrid, probably between *C. carpatica* and *C. caespitosa*. Raised by Anderson Henry, Hay Lodge, Edinburgh. Height 6-9 in.: root-lvs. tufted, roundish cordate, slightly dentate; st.-lvs. light green, ovate-cordate, conspicuously toothed: fls. light blue, bell-shaped, few, at the ends of sts. Var. *pelviformis*, Hort., from Crete, has very large, pale lilac, almost saucer-shaped fls. R.H. 1882, p. 509. G.C. III. 44:64. Var. *Hendersonii*, Hort., is often referred to var. *turbinata*, but is more robust; there is doubt as to its origin, *C. pyramidalis* or *C. alkarizifolia* possibly having played some part in it: lvs. ovate and ovate-cordate,  $1\frac{1}{2}$  in. long,  $\frac{3}{4}$  in. broad, slightly hairy on both sides, folded upwards, serrate; petioles 1- $1\frac{1}{2}$  in. long: fls. dark blue,  $1\frac{1}{2}$ -2 in. wide, in short, 6-9-fl. racemes. G.W. 8, p. 65; 14, p. 581. Var. *riversleae*, Hort. Fls. dark blue, 2-3 in. across: sts. 12-15 in. long but spreading; parts of corolla often 6 or 7. G.M. 43:627. Var. *compacta*, Hort., is a condensed dwarf form. *C. Stansfieldii*, Hort., is supposed to be a hybrid between *C. carpatica* and *C. Waldsteiniana* (No. 31).—This species is very variable in height and in shape of fls.

DD. Style exserted.

40. *isophylla*, Moretti (*C. floribunda*, Viv.). Perennial: st. suberect: lvs. all of same form, petiolate, roundish cordate, crenate-dentate: calyx-lobes acuminate, half shorter than the broadly bell-shaped or saucer-shaped corolla; fls. pale blue, 1 in. or more wide, corymbose; style exserted: caps. ovoid. Italy. B.M. 5745. Gn. 49, p. 483; 48, p. 297.—A desirable basket or rock plant in sun or half shade. The white form, Var.

*alba*, is most excellent: free-flowering. *C. Mayii*, Hort., is supposed to be a derivative of this species: lvs. soft and woolly. Choice.

BBB. Fls. bell-shaped.

C. Style exserted.

41. *Scutleri*, Hook. Perennial, 3-12 in.: st. simple or branched: lvs. acutely serrate, somewhat hirsute; lower ones ovate-acute, petioled; middle ones ovate-lanceolate; upper linear-lanceolate, sessile; calyx-lobes awl-shaped, erect, one-third shorter than the corolla: fls. pale blue, racemose, or more or less paniced; style exserted: caps. ovoid. N. Calif. to Puget Sound.—The capsular valves are a little above the middle, while

771. *Campanula rotundifolia*. (X1)

in *C. carpatica* and *C. persicifolia* they are near the apex.

CC. Style not exserted.

D. Color dark purple.

42. *pulla*, Linn. Fig. 770. Perennial, 3-8 in., tufted or in clumps, showy: st. normally 1-fl.: lvs. glabrous,

crenulate-dentate; lower ones short-petioled, ovate-rotund; upper sessile, ovate-acute: calyx-lobes long-acuminate, erect, a half shorter than the bell-shaped, nodding corolla. Mts. of Austria, 4,000-6,000 ft. In B.M. 2492 the calyx-lobes are short-acuminate, a sixth as long as the corolla. L. B.C. 6:554. Gn. 63, p. 440. *C. pulloides*, Hort., is a supposed hybrid between *C. pulla* and *C. turbinata*, with habit of former: 5 in.: fls. glistening purple-blue. Gn. 66, p. 203.

DD. Color not dark purple, but violet or blue (varying to white.)

43. *drabifolia*, Sibth. & Smith (*C. attica*, Boiss.). Annual, hispid, 3-4 in.: lower lvs. oblong or elliptic, dentate, tapering into a petiole: fls. large, blue and lighter on the tube, bell-shaped, on forking sts. Greece.

44. *rotundifolia*, Linn. HAREBELL. HAIRBELL. BLUE BELLS OF SCOTLAND. Fig. 771. Perennial, 6-12 in.: root-lvs. petiolate, orbicular or cordate, crenate-dentate: st.-lvs. linear or lanceolate, usually entire: calyx-lobes awl-shaped, erect, a third shorter than the bell-shaped bright blue corolla; fl.-buds erect. Eu., Siberia, N. Amer. Gn. 53:42; 62, p. 59. Gn. M. 14:10.—This is one of the most cosmopolitan of all campanulas, and the true harebell or bluebell of literature. In the wild it is usually slenderer and taller than in the garden. In shady woods it often grows 2 ft. high. The type has a white-fl. variety which is much less popular, but G.C. 1861:698 shows an excellent pot-plant of it. Var. *alaskana*, Gray. Dwarfier, leafy to the top: radical lvs. cordate, lowest st.-lvs. ovate and the upper ones becoming lanceolate: calyx-lobes attenuate, becoming deflexed; corolla  $\frac{1}{2}$ - $1\frac{1}{2}$  in. long. Alaska. Var. *arctica*, Lange. Rigid, 1- to few-fl.: corolla 1 in. long, the calyx-lobes very slender and soon spreading or deflexing. Canada north. Var. *velutina*, DC. Herbage whitish pubescent. Var. *Höstii*, Hort. (*C. Höstii*, Baumg.), has larger fls. than the type and stouter sts. The lower st.-lvs. are lanceolate, remotely dentate, the upper linear entire: calyx-lobes longer than in the type, a half shorter than the corolla. The white-fl. form is not so vigorous. G. 5:207. The most pronounced variant is var. *soldanelliflora*, Hort. (*C. soldanella*, Hort.). Fig. 772. With semi-double blue fls. split to the base into about 25 divisions. F.S. 18:1880. Gn. 60, p. 162. This curious variation is unique in the genus. The alpine soldanellas are famous among travelers for melting their way through the ice. They have fringed blue fls.—The name *C. rotundifolia* seems singularly inappropriate until one finds the root-lvs. in early spring. *C. stenocodon*, Boiss. & Reut., by some referred to *C. rotundifolia*, is more slender and with narrower st.-lvs.: fls. long and narrow, tubular, rich lilac-purple. Alps.

45. *Scheuchzeri*, Vill. (*C. linifolia*, Willd.). Perennial, 4-12 in.: st. 1-4-fl., usually 1-fl.: root-lvs. roundish, ovate, or cordate; st.-lvs. linear or narrowly lanceolate, sessile, denticulate, the lowest st.-lvs. spatulate: calyx-lobes slender, linear-awl-shaped, nearly as long as the bell-shaped dark blue corolla. Alpine and subarctic regions of Newfoundland, Labrador, Alaska, and Rocky Mts. to Colo., also in Eu. and N. Asia. F.S. 21:2205, not L.B.C. 5:485, which DeCandolle states is *C. rotundifolia*. Var. *alba*, Hort. Fls. white. Gn. 60, p. 164. The st.-lvs. of *C. Scheuch-*



772. *Campanula rotundifolia* var. *soldanelliflora*. (X $\frac{3}{4}$ )

*zeri* are distinctly serrate, while in *C. rotundifolia* they are entire; the fl.-buds nod in the former, but are erect in the latter. The calyx-lobes are relatively longer in *C. Scheuchzeri*, and perhaps the bell is deeper.

46. *cæspitosa*, Scop. (*C. pumila*, Curt. *C. pusilla*, Hank.). Perennial, 4-6 in.: root-lvs. tufted, short-petioled, ovate, glandular-dentate, shining; calyx-lobes linear, erect, a third shorter than the bell-shaped corolla: fls. nodding, blue; pollen violet-colored. B.M. 512. Gn. 43:24; 48, p. 297; 60, p. 161. G. 25:307. R.H. 1908, p. 223.—Dwarfer than *C. rotundifolia*, with root-lvs. never reniform, shorter-petioled, and lasting until after fls. have gone. Perennial, quickly forms a dense mat, and blooming from June till Oct. The European trade catalogues usually offer *C. cæspitosa* and *C. pusilla* separately, and doubtless plants of distinct horticultural value are passing under these names, but there seem to be no sufficient botanical characters to distinguish them. Correvon says that *C. pusilla* differs from *C. cæspitosa* only by its less stoloniferous character. Var. *alba*, Hort., has white fls. G.C. III, 48:96. Gn. 72, p. 143; 75, p. 368. G.M. 54:466. Var. *pallida*, Hort., has pale blue fls. G.M. 53:612.

47. *excisa*, Schleich. Perennial, glabrous, height 4-5 in.: sts. slender, 1-fld.: root-lvs. spatulate; upper lvs. linear; calyx-lobes bristly, spreading, at length reflexed, a third shorter than the bell-shaped corolla: fls. pale blue, divided to about half their depth, with a round hole at the base of each sinus, which easily distinguishes it from *C. pulla* and all other campanulas. Rare in Alps. B.M. 7358. L.B.C. 6:561. Gn. 60, p. 64.—A rare rock-plant. Likes cool, moist air, and not too full exposure to sun.

BBBB. *Fls. tubular, often long and narrow.*

48. *Zöysii*, Wulf. Perennial, 3-4 in.: plant tufted, glabrous: sts. few-fld.: root-lvs. entire, crowded, petioled, ovate-obovate, obtuse; st.-lvs. obovate-lanceolate and linear: peduncles 1-fld., terminal, rarely axillary; fls. azure-blue, large for the plant, terminated by a stellar process before expansion; calyx-lobes linear, awl-shaped, spreading, a fourth shorter than the corolla; corolla long-cylindrical, constricted at the apex, wider at the base, sharply angled, pale blue. Austrian Alps, 6,000-8,000 ft. Gn. 8, p. 173. G.C. III, 20:183; 38:228.—A rare and abnormal species.

49. *Erinus*, Linn. Annual: plant hispid: height 3-9 in.: lvs. small, glossy,  $\frac{1}{4}$ - $\frac{3}{4}$  in. broad, cordate, deeply cut, the pointed lobes conspicuous: fls. sessile, pale blue with a light center, tubular,  $\frac{1}{2}$  in. broad, with acute narrow lobes; style long, conspicuous, colored like corolla: racemes long, semi-prostrate, 10-12-fld. Medit.—Rare, short-lived rock-plant; also for edgings and pots.

*C. abietina*, Griseb. Rare tufted rockery plant, with slender, wiry sts. 9-15 in. high: fls. light blue, in loose branching spikes. July, Aug. E. Eu.—*C. acutangula*, Ler. & Lev. Dwarf, with trailing sts. from a rosette of ivy-like lvs.: st.-lvs. small, rounded and toothed: fls. solitary on each st., rather large and star-like, purple-blue. N. Spain. G.C. III, 50:220.—*C. ambilis*, Leicht.—*C. phytidocalyx*.—*C. Beeverdiana*, Fomine. Slender, to 2 ft., glabrous or finely hairy: lower lvs. oblong-ovate to broadly ovate, obtuse, crenate-serrate: fls. few or solitary, slender-pedicelled, blue,  $\frac{1}{4}$  in. across. B.M. 8299. Caucasus.—*C. calycanthema*, Hort.—*C. Medium* var. *calycanthema*.—*C. centisia*, Linn. A rare rock-plant from Mt. Cenis and other mts. of the Alps, with solitary deep blue fls. on sts. 2 in. high. Root-lvs. obovate, obtuse; st.-lvs. ovate-oblong; all lvs. sessile-entire: calyx hirsute, the lobes linear-lanceolate, a half shorter than the deeply 5-cut, spreading corolla.—*C. grandiflora*, Jacq.—*Platycodon*.—*C. hederacea*, Linn.—*Wahlenbergia*.—*C. imeretina*, Rupr. Dwarf, branching, resembling *C. sibirica*: lvs. small: fls. violet-blue, Caucasus.—*C. incurva*, Aucher.—*C. Leutweinii*.—*C. kolenatiána*, Mey. Perennial, 9 in. or less: lvs. mostly radical ovate, about 1 in. long: fls. in long-stalked raceme, bluish violet, 1 in. long, inside hairy. Caucasus.—*C. laciniata*, Linn. Robust much-branched biennial, 2 ft., somewhat pubescent: lower lvs. 8 in. long by  $2\frac{1}{2}$  in. broad, deeply cut: fls. about 2 in. across, upwards of 1 in. long, pale blue. Greece. G.C. III, 40:165.—*C. Leutweinii*, Heldr. (*C. incurva*, Aucher). Perennial, simple, 1 ft. or more: lvs. cordate, white-downy, crenate, rounded at apex: fls. pale blue,  $1\frac{1}{2}$  in. long. Greece.—*C. Mariesii*, Hort.—*Platycodon*.—*C. michauxoides*, Boiss. Tall-growing: fls. bluish white,

the segms. recurved. Asia Minor.—*C. Lamarckii*, D. Dietr.—*Adenophora* Lamarckii.—*C. nitida*, Ait.—*C. planiflora*.—*C. petraea*, Linn. Biennial, with ascending st., hairy, 6-12 in.: lower lvs. lance-oblong, narrowed to the base, toothed; upper lvs. ovate and sessile: fls. small, pale yellow, in dense terminal and axillary heads. N. Italy.—*C. phytidocalyx*, Boiss. & Noé (*C. amabilis*, Leicht.). Like *C. Rapunculus* in habit, 2-2½ ft.: lvs. lanceolate or cordate: fls. 10-12 in raceme, dark blue with black styles, resembling those of *C. persicifolia*. Armenia.—*C. planiflora*, Lam. (*C. nitida*, Ait.). Glabrous: height 3-9 in.: st. simple: lvs. sessile, leathery, shining; root-lvs. crowded in a dense rosette, ovate or obovate-obtuse, crenulate,  $1\frac{1}{2}$  in. long; st.-lvs. linear-lanceolate, acute, nearly entire: fls. blue or white, with double varieties, in spicate racemes; calyx-lobes ovate, acute, broad, erect, a third shorter than the broadly bell-shaped or saucer-shaped corolla. Not American, though commonly so stated. Habitat unknown. J.H. III, 33:283.—Rock-plant, for sunny position.—*C. primulaefolia*, Brot. St. hairy, simple, 1-3 ft.: lowest lvs. lanceolate, st.-lvs. oblong: fls. blue, downy at bottom, nearly rotate. Portugal. B.M. 14879.—*C. Raddeana*, Trautv. Perennial, glabrous, 1 ft.: lvs. cordate, long-stalked: fls. large, dark purple. Caucasus.—*C. speciosa*, Pourr., is a rare species. Most of the plants passing under this name are likely to be *C. glomerata*. B.M. 2649 is *C. glomerata* var. *speciosa*. *C. thyrsoidea*, Lapeyr., is referred here.—*C. Speculum*, Linn.—*Specularia*.—*C. spicata*, Linn. Biennial, 1-2 ft.: lvs. very narrow, nearly or quite entire: fls. 1-3, sessile, in a long interrupted spike, blue. Eu. J.H. III, 47:267.—*C. sulphurea*, Boiss. Annual: fls. size of those of *C. rotundifolia*, pale straw-color outside and sulfur-yellow inside. Palestine.—*C. urticifolia*. This name is now abandoned. Plants are likely to be *C. Trachelium*.

WILHELM MILLER.

L. H. B.†

**CAMPANUMÆA** (variant of Campanula). *Campanulacæ*. Twining or loose-growing perennial herbs, with rhizomes or tubers, rarely grown in greenhouses. Lvs. mostly opposite, simple and often cordate, petioled: fls. yellowish or greenish, broadly bell-shaped, 4-6-lobed: fr. a berry.—Five species occur in the Himalayan and E. Asian region and the Malay Archipelago. *C. javanica*, Blume, and *C. inflata*, Clarke, both with yellowish brown-veined fls. are mentioned in gardening literature: the fls. are about  $1\frac{1}{4}$  in.; in the former the calyx is nearly free from the berry, which is hemispherical; in the latter the calyx is adnate to the berry, which is ellipsoidal; both are twiners. *C. gracilis*, Hort., is of the genus *Leptocodon*, and *C. lanceolata*, Sieb. & Zucc., is a *Codonopsis*.

**CAMPHORA**: *Cinnamomum*.

**CAMPION**: *Silene*.

**CAMPSIDIUM** (alluding to its similarity to *Campsis*). *Bignoniacæ*. Ornamental vines grown for their bright orange flowers and also for their handsome evergreen finely pinnate foliage.

Evergreen shrubs, high-climbing, without tendrils and without rootlets, with odd-pinnate, opposite lvs. and tubular, orange, slender-pedicelled fls. in terminal, loose and short racemes: calyx turbinate, 5-toothed, glandless; corolla tubular, slightly ventricose, straight, with 5 short equal lobes; stamens, 4, the 2 longer with the anthers exserted; anther-sacs parallel; disk cupular, flat: fr. a narrow caps. with many winged seeds.—Two species in Chile and in the Fiji Isls.

They are adapted only for subtropical regions and do not seem to bloom readily, but even without flowers they are worth planting for their foliage alone. In Old World gardens, they are sometimes cultivated as stove plants, but *C. valdivianum*, judging from its habitat, might do better in the cool greenhouse. Propagated by greenwood cuttings under glass. For further culture, see *Campsis*.

*Campsidium filicifolium*, from the Fiji Islands, has never flowered in the writer's garden (in Florida) and is cut down by frost almost every winter, but it is a strong grower and worth planting for the foliage alone. *C. valdivianum* has proved to be a very poor grower and is very difficult to keep in health for any length of time. (H. Nehrling.)

*valdivianum*, Seem. (*C. chilense*, Reissek & Seem. *Tecoma valdiviana*, Phil.). Climbing, to 50 ft.: branches angular, glabrous: lvs. glabrous, 4-6 in. long; lfts. usually 11-13, sessile, elliptic-oblong,  $\frac{3}{4}$ - $1\frac{1}{2}$  in. long, serrate near the apex or almost entire: racemes pendulous, 6-10-fld.;



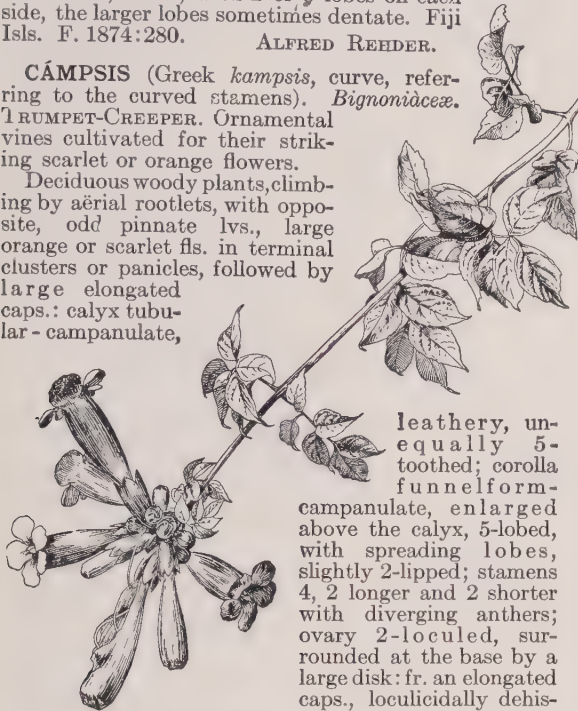
fls. about  $1\frac{1}{2}$  in. long, orange: caps. 3-4 in. long, narrowly elliptic-oblong. Chile. G.C. 1870:1182. B.M. 6111. F.S. 20:2142.

**filicifolium**, Van Geert (*Tecoma filicifolia*, Nichols.). Climbing evergreen shrub: lvs. odd-pinnate, 5 in. long; lfts. 19-25, ovate, with 2 or 3 lobes on each side, the larger lobes sometimes dentate. Fiji Isls. F. 1874:280.

ALFRED REEDER.

**CAMPSIS** (Greek *kampsis*, curve, referring to the curved stamens). *Bignoniaceæ*. TRUMPET-CREEPER. Ornamental vines cultivated for their striking scarlet or orange flowers.

Deciduous woody plants, climbing by aerial rootlets, with opposite, odd pinnate lvs., large orange or scarlet fls. in terminal clusters or panicles, followed by large elongated caps.: calyx tubular - campanulate,



773. Trumpet-vine—*Campsis radicans*. ( $\times \frac{1}{2}$ )

leathery, unequally 5-toothed; corolla funnelform-campanulate, enlarged above the calyx, 5-lobed, with spreading lobes, slightly 2-lipped; stamens 4, 2 longer and 2 shorter with diverging anthers; ovary 2-loculed, surrounded at the base by a large disk: fr. an elongated caps., loculicidally dehiscent, with the 2 valves separating from the septum to which the seeds

are attached; seeds numerous, compressed, with 2 large translucent wings.—One species in N. Amer. and one in China and Japan. By some botanists, *Bignonia* is considered the correct name for this genus, because the original description was chiefly based on *C. radicans*, while *Tecoma* is the proper name for the genus known as *Stenolobium*.

The hardest species is *C. radicans*, which may be grown as far north as Massachusetts, at least in sheltered positions, while *C. chinensis* is more tender; the hybrid is intermediate between the two in hardiness. *C. chinensis* and *C. hybrida*, as well as *C. radicans* var. *speciosa*, can be grown as bushy specimens and will bloom freely on the young shoots, even if cut back almost to the ground by frost. Such plants can be easily protected during the winter by laying them down and covering them with earth. *C. radicans* is particularly adapted for covering walls and rocks, as it climbs with aerial rootlets and clings firmly to its support. The species of *campsis* prefer rich rather moist soil and sunny positions. Propagated by seeds, by greenwood cuttings under glass, or by hardwood and also by root-cuttings and layers.

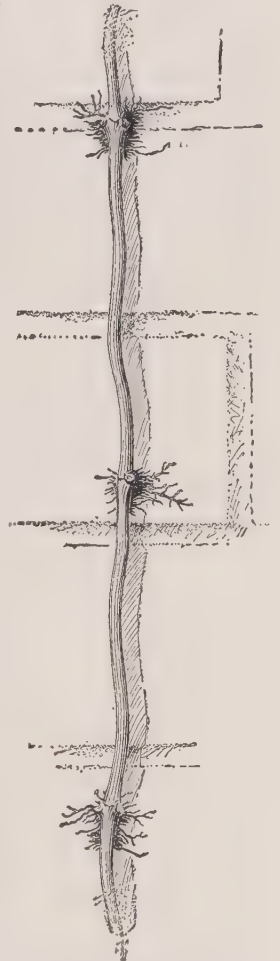
**Trumpet-vines in the South.**—The trumpet-vines are very successfully cultivated in Florida, being well adapted to the soil and climate, but to do their best need to be planted from the start in rich soil; and in addition they should be well fertilized at least once a year. They prefer a fertilizer rich in nitrogen; and a heavy mulch will also prove very beneficial. They should be grown on posts and tall stumps, or they may be trained over small oaks, persimmon trees or catalpas. Other bignoniads of similar culture are *Tecomaria capensis*, a half-climbing species with scarlet flowers effec-

tively used for decoration of the veranda, and *Tecoma stans*. That and *Campsis chinensis* are the two showiest bignoniads cultivated in Florida, the latter being a climber, flowering abundantly in May and June, while the first one is a large-growing bushy species opening its immense corymbs of vivid yellow flowers the latter part of November and early in December. The Chinese trumpet creeper, *C. chinensis*, is the most floriferous and gorgeous. In the writer's garden a large pine stump, about 16 feet high, in May and June is completely covered with masses of brilliant fiery orange-scarlet flowers which can be seen at a distance of half a mile. The flowers are much larger, more brilliant and much more abundantly produced than those of the native *C. radicans*. It is sometimes infested by a voracious caterpillar, which devours the leaves greedily. The lubber grasshoppers also attack the lower foliage. *C. chinensis* grows well in the poor sandy soil, perfecting luxuriant shoots 25 to 30 feet long in one season if well fertilized. The native trumpet creeper, *C. radicans*, is very common in the southern woodlands and fields. There is a great variety in the brilliancy of the blossoms. This is an excellent plant for covering the bare trunks of palmettos. (H. Nehrling.)

**radicans**, Seem. (*Tecoma radicans*, JUSS. *Bignonia radicans*, Linn.). TRUMPET-CREEPER. TRUMPET-VINE.

TRUMPET-HONEYSUCKLE. Figs. 773, 774. High-climbing shrub, clinging with rootlets: lvs. odd-pinnate; lfts. 9-11, oval to ovate-oblong, acuminate, serrate, dark green above, pale and pubescent beneath, at least along the midrib,  $1\frac{1}{2}$ - $2\frac{1}{2}$  in. long; fls. in terminal racemes; corolla tubular-funnelform, about 3 in. long, with 5 spreading lobes, usually orange with scarlet limb, tube almost thrice as long as the short-toothed calyx: fr. cylindric-oblong, keeled along the sutures, stalked and with a beak at the apex, 3-5 in. long. July-Sept. Pa. and Ill. to Fla. and Texas. B.M. 485. Gn. 22, p. 339. F. 1873, p. 220. A.F. 12:34. Mn. 2:9. Var. *atropurpurea*, Voss (var. *grandiflora atropurpurea*, Hort.). With large, deep scarlet fls. Var. *speciosa*, Voss. Scarcely climbing, usually forming a bush with long and slender branches: lfts. small, oval, abruptly narrowed into a slender point often  $\frac{3}{4}$  in. long; fls. orange-red, with rather straight tube; limb about  $1\frac{1}{4}$  in. across. Var. *præcox*, Schneid. Large scarlet fls. in June. Var. *aurea*, Hort. Fls. yellow.

**chinensis**, Voss (*Tecoma grandiflora*, Delaun. *T. chinensis*, C. Koch. *Bignonia chinensis*, Lam. *C. adrepens*, Lour.). CHINESE TRUMPET-CREEPER. Fig. 775 (adapted from Gardening). Climbing shrub, with few or no aerial rootlets: lvs. odd-pinnate;



774. The Trumpet-creeper climbs by means of aerial roots.—*Campsis radicans*.

fls. usually 7-9, ovate to ovate-lanceolate, serrate, glabrous beneath,  $1\frac{1}{2}$ - $2\frac{1}{2}$  in. long; fls. in terminal racemes; corolla funnelform-campanulate, shorter and broader than that of the preceding species, scarlet, about 2 in. across; calyx 5-lobed to the middle, about



775. *Campsis chinensis* on a clothes-post.

as long as the tube of the corolla: fr. obtuse at the apex. Aug., Sept. China, Japan. B.M. 1398; 3011. F.S. 11:1124-5. Gn. 27, p. 94; 33, p. 348; 47, p. 373. G.F. 3:393. F.R. 2:27. Gng. 4:195.—Less high-growing and sometimes shrubby; blooms when quite small and can be grown as a pot-plant, also suited for forcing. Var. *Thunbergii*, Voss (*Tecoma Thunbergii*, Sieb.). Fls. bright scarlet, with very short tube and reflexed lobes. Often a var. of *C. radicans* is cult. under the name *C. Thunbergii*. Var. *Princei*, Voss (*Tecoma grandiflora* var. *Princei*, Dipp.), probably belongs to the following hybrid.

*hýbrida*, Schneid. (*Tecoma hýbrida*, Jouin. T.

*intermedia*, Schelle. *T. radicans grandiflora atropurpurea*, Hort. *T. Princei grandiflora*, Hort. *T. chinensis aurantiaca*, Hort.). Hybrid between the two preceding species: somewhat climbing, often forming a bush with straggling branches: fls. 7-11, ovate to elliptic-ovate, usually pubescent along the veins beneath: fls. in terminal loose panicles; calyx divided for about one-third into ovate long-acuminate lobes much shorter than the corolla-tube; corolla funnelform-campanulate with orange-yellow tube and scarlet limb, about 2 in. across and 3 in. long. July-Sept. Garden origin. S.T.S. 1:47. M.D.G. 1904:123.—The fls. are almost as large and showy as those of *C. chinensis* and the plant is hardier.

ALFRED REHDER.

**CAMPTOSÔRUS** (Greek, *bent sorti*, alluding to the irregular arrangement). *Polypodiaceæ*. Two species of hardy ferns, with simple pointed lvs., which take root at the apex, and are hence known as "walking-leaf ferns." A single species is native mostly on lime-bearing rocks, and an allied species is known from Japan and N. Asia.

*rhizophýllus*, Link. Fig. 776. Lvs. evergreen, simple, tapering from a heart-shaped base, 4-12 in. long; veins forming meshes near the midrib; sori irregularly scattered, linear, straight or bent. Canada to Ala.—Sometimes grown in rockeries and wild gardens.

L. M. UNDERWOOD.

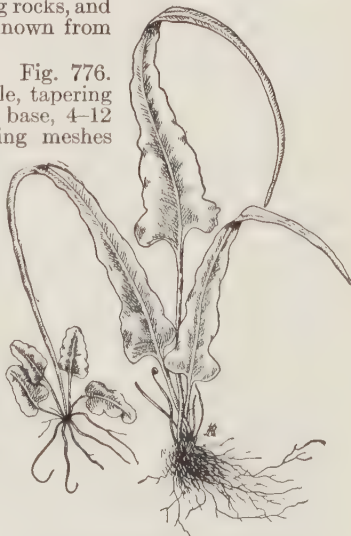
**CAMPYLOBÔTRYS:** *Hoffmannia*.

**CAMPYLONEÛRON:** *Polypodium*.

**CANADA:** *British North America*.

**CANAIGRE:** *Rumex hymenosepalus*.

**CANÁNGA:** *Canangium*.



776. *Camptosorus rhizophyllus*. ( $\times \frac{1}{3}$ )

**CANÁNGIUM** (Makassar, *kananga*; Malay, *kenanga*). *Annonaceæ*. Perfume-yielding tropical trees.

Closely allied to *Desmos* but differing in having the apex of the connectives of the stamens prolonged into a point, instead of being broadened into a hood-like covering for the pollen-sacs: sepals 3; petals 6 in 2 series, valvate, nearly equal, flat, linear; stamens many, closely crowded on the convex torus, the connective produced into a long tapering point; carpels indefinite,



777. *Canangium odoratum*. a, flowering branch; b, stamens; c, longitudinal section of fruit; d, fruit cluster.

clustered in the center of the mass of stamens; ovules in 2 columns or apparently in a single column; style linear or linear-oblong, terminating in an obtuse swelling; ripe carpels (fr.) several, pedicelled, ovoid or oblong and more or less constricted between the seeds. The name *Cananga*, usually applied to this genus, was used by Aublet in 1775 for an entirely different genus, and cannot therefore be valid for the present one. Baillon recognized this fact, and proposed the name *Canangium*, without, however, coupling it with specific names. It was taken up by Sir George King in his *Annonaceæ of British India*, 1893, and was applied by him to the celebrated ylangylang tree, *Canangium odoratum*.

*odoratum*, King (*Uvária odorata*, Lam. *Unóna odorata*, Dunal. *Cananga odorata*, Hook. f. & Thoms.). YLANGYLANG. ILANGILANG. ALANGILANG. MOSO'OI. MOTO-OI. Fig. 777. A tree bearing a profusion of greenish yellow fragrant fls. with long narrow petals, from which the celebrated ilangilang is made. The tree is found in S. India, Java, the Philippines, the Malay Archipelago, and many islands of the tropical Pacific. It occurs spontaneously as well as in cult., and its seeds are widely scattered by fruit-pigeons and other birds. In the Samoan Isls. it is much beloved by the natives, who make garlands of "moso'oi" with which to adorn themselves, and they celebrate its fragrance in their songs. The fls. yield a fragrant volatile oil known in commerce as the oil of ilangilang, usually obtained by steam distillation. The natives use a much simpler process in securing oil for anointing their heads and bodies. Fls. are put into coconut oil and, after remaining a short time, are replaced by fresh ones,



the oil being subjected to a gentle heat. "Macassar oil" is prepared in this way, fls. of *Michelia Champaca* being often added to those of the ylangylang.

**Brandisānum**, Safford (*Unōna Brandisāna*, Pierre. *Unōna latifolia*, Hook. f. & Thoms., not Dunal). A tree endemic in the forests of lower Cochin China and Cambodia, with very fragrant fls. resembling those of *C. odoratum* but with the petals relatively broader, constricted at the base, and thicker, and the lvs. usually cordate at the base and tomentose beneath, instead of rounded at the base and pubescent beneath: the fr. resembles that of the preceding species but with fewer seeds arranged almost in a single row, but on close inspection seen to be biseriate. The fls. yield a perfume similar to that of the true ylangylang of commerce.

W. E. SAFFORD.

**CANARĪNA** (from the Canary Islands). *Campanulacæ*. Cool-house tuberous-rooted herb closely allied to *Campanula*, but with the tubes of the calyx and corolla grown together, and the floral parts in 6's.—Three species. **C. Campānula**, Lam., is a tender perennial from the Canaries, about 6–8 ft. tall, with drooping, inflated buds and solitary, bell-shaped fls. more than 1 in. long and  $1\frac{1}{2}$  in. wide, dull yellow, flushed and veined with dull purplish brown: the lobes of the corolla strongly reflexed: lvs. hastate, coarsely repand-dentate: fr. a fleshy berry. B.M. 444.—Intro. by Franceschi in 1895.

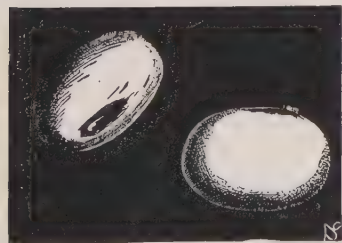
CANARY-BIRD FLOWER: *Tropæolum*.

CANARY GRASS: *Phalaris*.

**CANAVĀLIA** (an aboriginal name). Including *Malôchia*, *Leguminosæ*. Bean-like plants, some of them producing edible seeds and some more or less grown for ornament.

Prostrate trailing or twining herbs, with pinnately 3-foliate lvs.: fls. in axillary racemes or fascicles, often large, violet, rose or white, with bell-shaped, 2-lipped calyx, papilionaceous corolla, 5 stamens united and 1 free for all or part of its length: pods large and ribbed on edges.—A dozen species, widely distributed in warm countries.

**ensifórmis**, DC. (*C. gladiata* var. *ensifórmis*, DC.). JACK BEAN. CHICKASAW LIMA. Figs. 485 (Vol. I), 778. Glabrous or nearly so: lfts. ovate-oblong or ovate, mucronate: upper lip of calyx longer than the tube, recurved and notched; keel blunt, curved: seeds white, with a dark raphe.



778. Seeds of *Canavalia ensiformis*.  
( $\times 1$ )

Tropics of both hemispheres.—B. M. 4027. A.G. 14: 84.—Grown in the southern states for stock, but the pods make passable snap beans when not more than 4–6 in. long. In warm countries it is a bushy plant, with little tendency to climb. The pods reach a length of 10–14 in., the walls being very hard and dense when ripe; the halves of the pod, when split apart, roll up spirally often into an almost perfect cylinder. The large white turgid beans, bearing a very prominent brown seed-scar, are packed crosswise the pod, imbedded in a very thin white papery lining. The fls. are small and light purple, resembling those of the cowpea (but larger) and of various species of *Dolichos*. The lfts. are large and broad (5–8 in. long and half or three-fifths as broad), strongly veined and dull, dark green, abruptly pointed and smooth. Beans said to be used as a coffee substitute.

*C. bonariensis*, Lindl. Twining: lfts. ovate, with the long apex obtuse: fls. purple in drooping racemes that exceed the lvs., the standard large broad and notched. Uruguay and S. Brazil. B.R. 1199. H.U. 4, p. 129.—*C. obtusifolia*, DC. Prostrate or climbing: lfts. nearly orbicular to oval or obovate, rounded or cuneate at base: fls. pink, in racemes exceeding the lvs.: seed brown, oblong. Fla. and Texas south. Known as "mato de la playa" in Porto Rico.—*C. rustispérma*, Urban. Large and tall, ascending highest forest trees: seeds red. Known as "Mato colorado." W. Indies.

L. H. B.

CANDELILLO: *Euphorbia antispythitica*.

CANDLEBERRY, CANDLENUT: *Aleurites*.

**CANDÔLLEA** (A. P. DeCandolle, 1778–1841, famous botanist of Geneva, Switzerland). *Candolleacæ*; formerly referred to *Dilleniaceæ*. Herbs or woody plants sometimes grown under glass or in the open far South for the mostly yellow flowers.

Shrubs or undershrubs or herbs, mostly glabrous: lvs. simple, mostly narrow, sometimes with margins revolute: fls. few or solitary at the ends of the branches; sepals and petals 5; stamens many, united into 5 bundles or sets, each set bearing several anthers; carpels 2–3–5, with 1–3 ovules in each.—As now understood, probably 80–90 species, mostly W. Australian, but 1 in Trop. Asia and S. China and 1 in the E. Indies. Little known in cult., but the following Australian species are now offered.

**tetrándra**, Lindl. Shrub, with branches angular, pubescent: lvs. narrow-oblong to oblong-ovate, obtuse or short-acuminate,  $2\frac{1}{2}$  in. or less long, clasping, margins not revolute: fls. much larger, paler yellow, the petals 1 in. long and the acute sepals  $\frac{3}{4}$  in. long: fr. with orange aril. B.R. 29:50.—Offered as a green-house plant.

**cuneifórmis**, Labill. Erect shrub, 6 ft. and more, with short crowded branches that are somewhat hairy when young: lvs. oblong-cuneate to obovate, truncate or few-toothed at apex, 1 in. long: fls. bright sulfur-yellow, sessile in the crowded floral lvs.; sepals about  $\frac{1}{2}$  in., and the notched petals somewhat longer. B.M. 2711.—Offered in S. Calif., where it blooms March–June.

L. H. B.

CANDYTUFT: *Iberis*.

CANE-BRAKE: Species of *Arundinaria* (treated under Bamboo).

**CANÍSTRUM** (Greek, a basket). *Bromeliacæ*. Epiphytic or terrestrial hothouse plants, requiring the treatment of billbergias.

Leaves in a dense tuft, acute, spinulose on the margin: infl. compound, in a cup of lvs., on a very short st. as in *Nidularium*, or on a longer exserted st.; fls. usually green, rarely golden or blue.—A genus of about 10 species, natives of Brazil. They are sometimes referred to *Nidularium*.

**Lindenii**, Mez (*Æchmèa ebúrnea*, Baker. *Guzmânia frágans*, Hort. *Nidularium Lindenii*, Regel). Lvs. about 20, in a dense rosette, tomentose, green-spotted, the bract-lvs. cream-white: fls. white or greenish.

**amazónicum**, Mez (*Karátas amazónica*, Baker. *Nidularium amazonicum*, Lind. & André. *Æchmèa amazónica*, Hort.). Lvs. 15–20, 10–20 in. long, and rather wide at the middle, greenish brown above and light brown beneath, not spotted or scurfy, the bract-lvs. greenish brown: fls. white, with a green tube, in a dense head.

*C. aurantiacum*, E. Morr. (*Æchmea aurantiaca*, Baker). Plant vigorous: lvs. expanded in the middle: fls. yellow, 2 in. long. S. Amer. B. H. 1873: 15.

GEORGE V. NASH.†

**CÁNNA** (name of oriental origin, of no application). *Cannacæ*. Popular tall ornamental plants, prized for their stately habit, strong foliage and showy flowers; much used for bedding.

Stout, unbranched: fls. mostly red or yellow, in a terminal raceme or panicle, very irregular: caps. 3-lobed and several- to many-seeded (Fig. 779, p.); sepals

(s) 3 and small and usually green; petals (ccc) 3, mostly narrow and pointed, green or colored; style (e) single and long; the stamens are commonly petal-like, oblongate bodies or staminodia (aaab), 2 or 3 of which are usually much produced and broadened, and one is deflexed and narrower and forms the lip of the fl. (b); the pollen is borne in a single-loculed anther (f), borne on the side of a narrow and more or less coiled staminodium.—In the latest monograph, 1912 (Kränzlin, in Engler's *Pflanzenreich*, hft. 56), 51 species of *Canna* are described from subtropical and tropical Amer. and Asia.



779. The parts of the *Canna* flower.

A generation or two ago, cannas were grown for their foliage or mass-effect. They were tall and long-jointed, with small and late flowers (Fig. 780). An old-time garden race of tall cannas was *C. Annæi*, raised by M. Année, of France, from seeds of the true *C. nepalensis*, sown in 1848. The flowers from which the seeds were taken probably had been pollinated by some other species, most likely with *C. glauca*. In 1863, a new race appeared, as the result of the union of *C. iridiflora* with *C. Warscewiczii*. This hybrid was known as *C. Ehemanni* (and *C. iridiflora hybrida*). This was of intermediate stature, with showy foliage and better drooping flowers. Under this name plants are still sold, but they may not be identical with the original *C. Ehemanni*. This race has been variously crossed with other species and forms, and from innumerable seedlings there have been selected the dwarf and large-flowered cannas (Figs. 781, 782), which have now practically driven out

the old tall small-flowered forms. These dwarf cannas are often known as French cannas, from the country of their origin; also, as Crozy cannas, from a renowned breeder of them. Within recent years, another race of cannas has arisen from the amalgamation of our native *C. flaccida* with the garden forms and with *C. iridiflora*. These have come mostly from Italy and are known as Italian cannas; also as orchid-flowered cannas. The flowers are characterized by soft and flowing iris-like outlines, but they are short-lived. Of this class are the varieties Italia (Fig. 783), Austria, Bavaria, Burgundia, America, Pandora, Burbank and others. For a sketch of the evolution of the garden cannas, see J. G. Baker, *Journ. Roy. Hort. Soc.*, Jan., 1894; also, for the history of the Italian race, *Revue Horticole*, 1895, 516, and *Gardeners' Chronicle*, Dec. 14, 1895; Kränzlin, cited above.



780. Old-time *Canna*.

The culture of cannas is simple and easy. They demand a warm, friable, rich and moist soil. They are injured by frost, and therefore should not be planted out until the weather is thoroughly settled. For dense mass effects, set the plants not more than 1 foot apart each way, but if it is desired to show individual plants and their flowers at the best, give three times that amount of room to a single plant. Pick the flowers as soon as they wilt, to prevent the formation of seeds (which causes the plant to lessen flowering), and keep the plants in tidy condition. Give the soil and treatment that produce the best results with Indian corn.

New varieties are raised from seeds. The seeds usually germinate slowly, and sometimes not at all, unless the integument is cut or filed, or is softened by soaking in water; these precautions taken, they germinate quickly. Sow late in winter, in rather strong bottom heat, in flats or pots. Prick out, and give plenty of room. They should make blooming plants the first year.

Commonly, cannas are propagated by dividing the rootstock. This rootstock is a branchy mass, with many large buds. If stock is not abundant, as many plants

may be made from a rootstock as there are buds, although the weak buds produce weak plants. Leave as much tissue as possible with each bud. These one-bud parts usually give best results if started in pots, so that the plant is 6 to 12 inches high at planting time. The commercial *Canna* plants are grown mostly in pots. If one has sufficient roots, however, it is better not to cut so close, but to leave several strong buds on each piece (as shown in Fig. 784). These pieces may be planted directly in the ground, although more certain results are to be secured by starting them in the house in boxes or pots. If strong effects are desired, particularly in shrub borders, it is well to plant the entire stool. In the fall, when the plants are killed by frost and the tops have dried a few days, dig the roots, and let them dry, retaining some of the earth on them. Then store them on shelves in a cellar that will keep Irish or round potatoes well. Take care that the roots do not become too warm, particularly before cold weather sets in; nor too moist. Well-cured roots from matured plants usually keep without much difficulty. If they do not hold much earth, it is well to throw a thin covering of light soil over them, particularly if they are the highly improved kinds.

Cannas are commonly used only in formal beds, but most excellent effects may be secured by scattering them singly or in very small clumps in the hardy border or amongst shrubbery. Against a heavy background of green, the gaudy flowers show to their best, and the ragged effect of the dying flowers is not noticed. They also make excellent centerpieces for formal beds. The tall-growing cannas, with small and late flowers, have given way almost wholly to the modern race of Crozy or French dwarf cannas, which usually remain under 4 feet high, and give an abundance of large early flowers. The *Canna* always must be used for bold planting effects, because the flowers



781. Modern flowering *Canna*.



have not sufficient durability to be very useful as cut-flowers. As individual blooms, the flowers are not usually attractive, but they are showy and interesting in the mass and at a distance. The new race of Italian or Flaccida cannas has more attractive flowers, but even these are most useful when on the plant.

It is impossible for the gardener to determine species of canna in the common garden forms. In fact, the species are little known except in herbaria and as wild plants growing in their original habitats. The monographers do not agree as to the definitions of what have been described as original or wild species. The following account of species is included more for the purpose of showing the range within the genus and of making a catalogue of leading botanical names than to set specific limits or to indicate what species-forms are in cultivation. The Crozy experiments began with crossing *C. Warscewiczii* with a variety of *C. nepalensis* of gardens (*C. flaccida*?) having large yellow flowers and very long creeping tubers; and some of the progeny was crossed with *C. aureo-picta* (a garden form). The recent attractive orchid-flowered cannas spring largely from the *C. flaccida* forms.

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*mexicana*, 16.  
*Moritziana*, 5.  
*neglecta*, 23.  
*nepalensis*, 10.  
*orientalis*, 11.  
*pallida*, 5.  
*paniculata*, 1.  
*patens*, 17, 19, 21.

*pedunculata*, 15.  
*Poeppigii*, 22.  
*polyclada*, 12.  
*polymorpha*, 10.  
*portoricensis*, 19.  
*recurvata*, 19.  
*reflexa*, 15.  
*Reevesii*, 13.  
*rotundifolia*, 6.  
*rubra*, 18.  
*rubricaulis*, 20.  
*rubro-lutea*, 16.  
*sanguinea*, 10, 21.  
*saturata-rubra*, 10.  
*Schlechtendaliana*, 16.  
*Selloi*, 21.  
*speciosa*, 10.  
*spectabilis*, 17.  
*stolonifera*, 16.  
*sulphurea*, 7.  
*syvestris*, 19.  
*tenaxiflora*, 17.  
*Tinei*, 7.  
*variabilis*, 8.  
*variegata*, 19.  
*ventricosa*, 19.  
*violacea*, 16.  
*Warscewiczii*, 21.  
*xalapensis*, 23.

## A. Petal-like staminodia none.

1. *paniculata*, Ruiz & Pav. (*C. excelsa*, Lodd.). St. very tall, slender, glabrous: lvs. oblong or ovate and acute, green and glabrous above and pubescent beneath: racemes lax, disposed in a squarrose panicle, the fls. in 2's; sepals lanceolate,  $\frac{4}{5}$  in. long, obtuse; petals lanceolate, yellow-green, 2-3 in. long; lip rather longer than the petals, crimson. Subequatorial Andes.

## AA. Petal-like staminodia 2.

B. Plant woolly-pubescent on the sheaths and sometimes on the lf.-blades.

2. *compacta*, Roscoe. St. tall, stout, and green: lvs. many, oblong to ovate and acute: raceme simple and densely many-fld., the rachis 3-angled; sepals ovate, acute,  $\frac{1}{2}$  in. long; petals unequal, narrowly lanceolate and long-acuminate,  $1\frac{1}{2}$  in. long, red-yellow; staminodia oblanceolate, slightly emarginate,  $1\frac{1}{2}$ -2 in. long, scarlet or deep orange-red; lip broad-linear, emarginate, red-yellow. S. Amer.

3. *lanuginosa*, Roscoe (*C. Achiras*, Litt.). St. green, woolly, 4-6 ft., densely lvd.: lvs. ovate-oblong, acute, green: raceme long and contracted, many-fld., simple,

the bracts obtuse, small and green; sepals ovate-lanceolate, greenish red,  $\frac{1}{2}$  in. or less long; petals long-lanceolate,  $1\frac{1}{2}$  in. long, tinged with red; staminodia entire, red or red-yellow; lip the same color, and revolute. Brazil, Peru. B.R. 1358.

4. *lagunensis*, Lindl. Differs from *C. lanuginosa* in having long pale yellows fls., by some referred to *C. lutea*: plant of medium size, lightly lanate on the sheaths: lf.-blades ovate-oblong, short-acute and apiculate, pale-margined: petals linear-lanceolate and acuminate: lip strongly revolute, red-spotted. Mex., Cent. Amer. B.R. 1311, 1358. Aug.-Nov.

5. *pallida*, Roscoe (*C. Moritziana*, Bouché). Plant medium height: lf.-blade elongate-elliptic, acuminate and filamentous at end, sometimes white-margined: raceme simple and narrow, the bracts broadly oblong-cuneate; sepals ovate and obtuse, green; petals lanceolate and acuminate, greenish-sulfur-color; lip linear, 2-tipped, revolute, pale yellow, spotted. W. Indies and N. S. Amer.

BB. Plant glabrous on sheaths and lf.-blades.

c. Lvs. of 2 colors.

6. *discolor*, Lindl. (*C. rotundifolia*, André). St. stout, 6-10 ft., purple and glabrous: lvs. very broad-oblong, acute, the lower ones sometimes 3 ft. long, dark green and purple-margined, red-purple beneath: fls. in a deeply forked panicle of lax racemes, the bracts small and oblong; sepals lanceolate, obtuse,  $\frac{1}{2}$  in. long, green, tinted with purple; petals lanceolate, acuminate,  $1\frac{1}{2}$  in. long, pale green tinted with rose; staminodia entire,  $2\frac{1}{2}$  in. long, bright red, exterior yellow; lip lanceolate and emarginate, brick-red. Cent. and S. Amer. B.R. 1231. *C. concinna*, Bouché, is a related species with lanceolate lvs. narrowed at both ends. S. Amer.

cc. Lvs. unicolored, green.

d. Fls. narrow, the parts connivent.

7. *lutea*, Miller (*C. commutata*, *C. floribunda* and *C. densifolia*, Bouché. *C. maculata*, Link. *C. sulphurea*, Hort.). St. slender and green, 3-4 ft., distantly foliated: lvs. oblong or broad-lanceolate, acute: raceme lax, simple or rarely forked, the small green bracts oblong and obtuse; sepals oblong,  $\frac{1}{2}$  in., green, white-margined; petals lanceolate, pale yellowish white,  $1\frac{1}{4}$  in. long; staminodia pale yellow, often emarginate,  $1\frac{1}{2}$ -2 in. long; lip linear, pale yellow, emarginate. Mex. to Brazil. B.M. 2085. L.B.C. 7:646. *C. Tinei*, Tod., perhaps a hybrid, apparently is to be associated with this species.

Var. *aurantiaca*, Kränzl. Fls. orange; lip yellow.

8. *variabilis*, Willd. (*C. carnea*, Roscoe). St. green, 3-6 ft.: lvs. broad-lanceolate or elliptic, acute, bright green: raceme simple and lax, the small bracts oblong and obtuse; sepals lanceolate, green,  $\frac{1}{2}$  in. long; petals lanceolate, acuminate, concave,  $1\frac{1}{2}$  in. long, pale flesh-color; staminodia 2, spatulate-linear, mostly entire, variable in color but mostly orange or rose; lip linear or ligulate and entire: caps. small, globose. S. Brazil, the particular place unknown.



782.  
Flowering or  
French canna  
—Prince  
Hohenlohe.

DD. *Fls. ringent or gaping, or open-sprcading.*

E. *Infl. simple or only moderately branched.*

9. *humilis*, Bouché (*C. exigua*, Bouché). Low, 3 ft. or less, slender: lvs. short-petioled, the blade oblong, acute or short-acuminate, glabrous above and below, 10-16 in. long: raceme sub-simple (rarely paniculate), bearing fls. large for size of plant (about 3 in. long); sepals very unequal, ovate-oblong; petals long-lanceolate, concave, connate at base into a tube, scarlet; staminodia spatulate, more or less 2-lobed at apex; lip rather narrow, about  $2\frac{1}{4}$  in. long. Farther India, China, etc. *C. cinnabarina*, Bouché (*C. fulgida*, Bouché), is a related species but larger and with yellow and scarlet rather smaller fls. Mex., Cent. Amer., W. Indies.

10. *speciosa*, Roscoe (*C. leptochila* and *C. saturata-rubra*, Bouché. *C. polymorpha*, Loud. *C. sanguinea*, Hort.). Large: st. green, 5-6 ft.: lvs. broad-oblong, acute: fls. in an elongated raceme or sometimes paniculate; sepals lanceolate,  $\frac{3}{4}$  in. long, pale purple; petals linear-lanceolate,  $1\frac{1}{2}$  in. long, erect, pale purple; staminodia 3 in. long, emarginate, bright red; lip emarginate, yellow. Himalayas. B.M. 2317. B.R. 1276. *C. chinensis*, Willd. (*C. nepalensis*, Wall.), differs in having reflexed petals.

11. *orientalis*, Roscoe (*C. flavescens*, Link). St. slender, glabrous, 3-4 ft.: lvs. ovate-oblong, a foot or more long: raceme lax, simple or forked, the bracts oblong; sepals oblong-lanceolate, obtuse,  $\frac{1}{2}$  in. or less long, pale green and rose-tinted; petals lanceolate, acuminate,  $1\frac{1}{2}$  in. long, pale rose; upper staminodia  $2\frac{1}{2}$  in. or less long, bright red, often emarginate; lip red-yellow: caps. globose and very small. Malaysian tropics.

EE. *Infl. much-branched; fls. purple.*

12. *polyclada*, Wawra (*C. eximia*, Bouché. *C. cearensis*, Huber). St. tall and very slender: lvs. ovate or ovate-lanceolate, acute: fls. (often in pairs) in a long, much-branched panicle, the bracts nearly orbicular; sepals lanceolate,  $\frac{1}{2}$  in. long; petals long-lanceolate and unequal, acuminate, the longest about  $2\frac{1}{2}$  in., purple; staminodia acute, scarcely longer than the petals; lip oblanceolate, scarlet-spotted. Brazil.

AAA. *Petal-like staminodia 3 (exception in No. 18).*

B. *Lvs. lanceolate: fls. mostly yellow or orange.*

c. *Petals deflexed.*

13. *flaccida*, Salisb. (*C. glauca* and *C. angustifolia*, Walt.). St. green and glabrous, 4-6 ft., very leafy below: lvs. ovate-lanceolate to narrowly elliptic, acute, green: raceme simple, lax and few-fl., the bracts very small; sepals lanceolate or oblong, acuminate, 1 in. long, green; petals broadly linear-lanceolate to obovate and reflexed, to 3 in. long (as is also the tube); staminodia obovate, sulfur-yellow, 2-3 in. long by  $1\frac{1}{2}$  in. broad; lip large, yellow. Swamps S. C. to Fla., near the coast. L.B.C. 6:562. G.W. 12, p. 253.—Useful for its good habit and iris-like fls. *C. Reëvesii*, Lindl., of India and the Philippines, has the outside staminodia acute rather than all obtuse or emarginate as in *C. flaccida*, and fls. less than 4 in. across rather than about 6 in. across. B.R. 2004.

14. *Fintelmannii*, Bouché. St. green and glaucous, 4-5 ft.: lvs. oblong or ovate-elliptic and acute, bright green: raceme few-fl. and rather dense, the bracts green and oblong; sepals oblong,  $\frac{1}{3}$  in., green; petals

lanceolate, acuminate, greenish yellow,  $1\frac{1}{2}$ -2 in.; staminodia obtuse and entire (or 2-lobed at apex), 2-3 in., yellow; lip linear, strongly reflexed, yellow, mottled red: caps. large. Mex. and Cent. Amer.

15. *pedunculata*, Sims (*C. Buëkii*, Weinm. *C. reflexa*, Nees). St. tall, slender, green and glaucous, 5-6 ft.: lvs. oblong-lanceolate, green and glaucous, 1-2 ft. long and 3-4 in. broad: fls. in a many-fl. long raceme, with a hairy rachis and long-spreading pedicels, the bracts small, oblong and obtuse; sepals oblong, small and green; petals linear-lanceolate, greenish yellow, reflexed, 2 in. long; staminodia emarginate, about 2 in. long, pale yellow; lip oblanceolate, yellow: caps. globose, small. W. Indies, S. Amer. B.M. 2323. L.B.C. 7:622.

cc. *Petals erect.*

16. *glauca*, Linn. (*C. Schlechtendaliæna*, Bouché. *C. Annæi*, André. *C. mexicana*, and *C. stolonifera*, Bouché. *C. lanceolata*, Lodd.). St. green and glaucous, 5-6 ft., from a long and stoloniferous rhizome: lvs. green and glaucous, oblong-lanceolate and very acute, tapering both ways (the middle of the blade 4-6 in. wide), white-margined: raceme lax, simple or forked; sepals ovate-obtuse, green,  $\frac{1}{2}$  in. long; petals linear-lanceolate, yellow-green,  $1\frac{1}{2}$ -2 in.; staminodia entire,  $2\frac{1}{2}$ -3 in., yellow, not spotted; lip linear or obovate-oblong, emarginate, pale yellow: caps. oblong,  $1\frac{1}{2}$ -2 in. long. W. Indies, S. Amer. Var. *rubro-lutea*, Hort., has fls. deep yellow tinted red, or in some portraits represented as deep purple. B.M. 3437. *C. longifolia*, Bouché, from Mex. and Cent. Amer., has the petals all free, whereas they are united in a tube in *C. glauca*, and with curved sulfur-yellow fls. *C. leucocarpa*, Bouché, S. Amer., has petals united into a short tube, the fls. small, pale orange with broad leafy style. *C. violacea*, Bouché, habitat unknown, has petals united in short tube, fls. violet, strongly gaping, plant deciduous-woolly above.

BB. *Lvs. broadly oblong or elliptic: rhizome tuberous.*

c. *Plant low or medium in height (mostly 5 ft. or less).*

D. *Staminodia entire at apex.*

17. *indica*, Linn. (*C. patens*, Roscoe. *C. crœcea*, Hort. *C. tenuiflora* and *C. spectabilis*, Bouché. *C. coccinea*, Link). INDIAN SHOT. St. slender, glabrous, green, 3-5 ft.: lvs. oblong and acute, green, not glaucous, half as broad as long (1- $1\frac{1}{2}$  ft. long): racemes simple or very nearly so and lax, some of the fls. in pairs, the bracts green and nearly orbicular; fls. small; sepals oblong and green,  $\frac{1}{4}$  in. long; petals lanceolate, pale green, about  $1\frac{1}{2}$  in. long; upper staminodia bright red, entire, 2 in. long but narrow; lip linear, red-yellow, minutely spotted with red: caps. globose, 1 in. diam. W. Indies, Cent. and S. Amer. Naturalized in parts of southern states. B.M. 454. B.R. 776. L.B.C. 17:1693.

18. *coccinea*, Miller (*C. rubra*, Willd.). St. slender, green, 4-5 or sometimes 6 ft.: lvs. oblong, or oblong-lanceolate, and acute: raceme simple and lax, with small green, orbicular bracts; sepals lanceolate,  $\frac{1}{2}$  in. or less



783.

Italia canna.



long, green tinged with red; petals lanceolate, acuminate,  $1\frac{1}{2}$  in. long, pale scarlet; staminodia 2, long and narrow, mostly emarginate; lip yellow-spotted; caps. globose and small. W. Indies, Cent. and S. Amer. *C. formosa*, Bouché, Brazil, has 3 unlike staminodia.

DD. *Staminodia 2-lobed.*

19. *syvestris*, Roscoe (*C. portoricensis*, Bouché). Plant stout, 4–5 or 6 ft.: lvs. long-oblong or oblong-lanceolate, acuminate, bright green, to  $2\frac{1}{2}$  ft. long and one-third as wide; raceme slender, usually squarrose, rarely simple; fls. narrow and elongated, red; sepals lanceolate and acute,  $\frac{1}{2}$  in. long; petals much longer, lanceolate and very acuminate; staminodia sub-equal, narrow-spatulate; lip narrow, strongly revolute. W. Indies, Cent. Amer. *C. limbata*, Roscoe (*C. patens*, Hook. *C. aureo-vittata*, Lodd. *C. floribunda*, *C. variegata*, *C. recurvata*, *C. læta* and *C. ventricosa*, Bouché), of S. Brazil, has unlike staminodia, the largest being 2-lobed, the medium one emarginate, the other entire, all red with yellow margins. B.R. 771. L.B.C. 449.

CC. *Plant tall, often up to 17 ft. (No. 21 perhaps excepted).*

D. *Staminodia of medium length (3 in. or less).*

E. *The staminodia not united.*

20. *edulis*, Ker (*C. esculenta*, Lodd. *C. rubricaulis*, Link.). Rootstock thick and edible: st. stout, 8–12 ft., purple; lvs. large, oblong, or ovate-oblong, green or bronze, 1–2 ft. long; raceme lax, forked or simple; fls. red or brick-red, usually in pairs, the bracts orbicular or oblong; sepals oblong-lanceolate,  $\frac{1}{2}$  in. long, tinged with red; petals oblong-lanceolate,  $1\frac{1}{2}$  in.; staminodia entire or emarginate,  $2\frac{1}{2}$  in. long, bright red or orange; lip bright red or yellow-red; caps. large. W. Indies, S. Amer. B.M. 2498. B.R. 775.—Starch is procured from the roots, and for this purpose the plant is widely cult. in the tropics.

21. *Warszewiczii*, Dietr. (*C. sanguinea*, Warsc.). St. claret-purple and glaucous, 3–4 ft.: lvs. oblong and acute, more or less claret- or bronze-tinged,  $\frac{1}{2}$  ft. long and nearly one-half as broad; raceme simple and rather dense, with ovate, brown, glaucous bracts; sepals lanceolate,  $\frac{1}{2}$  in., glaucous purple; petals lanceolate, acuminate, nearly 2 in. long, reddish and glaucous; staminodia oblanceolate, entire,  $2\frac{1}{2}$ –3 in. long, bright scarlet; lip oblanceolate, emarginate, bright scarlet. Costa Rica, Brazil. B.M. 4854. C. Sellöi, Hort. (*C. patens*, Baker), of S. Brazil, is tomentose: sepals ovate; petals oblong-lanceolate, united into a tube; staminodia strongly reflexed, one 2-parted.

EE. *The staminodia united into a tube, or at least connate at base.*

22. *Lambertii*, Lindl. (*C. Péppigii*, Bouché). St. stout, very tall (to 10 or 11 ft.): green and glabrous, 12–14 ft.: lvs. oblong-lanceolate to elliptic, green, acute; raceme simple or forked, lax and few-flid., the bracts large and oblong, green; sepals lanceolate, pale purple or lilac,  $\frac{1}{2}$  in. long; petals lanceolate, acuminate,  $1\frac{1}{2}$  in. long, purple; staminodia unlike, obovate, entire, scarcely longer than the petals, connate at base, bright crimson; lip bright crimson-purple; caps. oblong, large. W. Indies, S. Amer. B.R. 470.

23. *latifolia*, Miller (*C. gigantea*, Desf. *C. macrophylla*, Hort. *C. neglecta*, Weinm. *C. gemella*, Nees. *C. Altensteinii*, Bouché). St. stout, very tall (10–16 ft.) pubescent: lvs. ovate or ovate-oblong, acute, green, but purple-margined when young, the lower ones often 3–4 ft. long; fls. in several racemes forming a panicle, the bracts oblong or the lower ones becoming several inches long; sepals oblong and green,  $\frac{1}{2}$  in. long, very unequal, petals lanceolate, acuminate, 2 in. long, scarlet; staminodia united into a tube, entire at apex or one of them 2-lobed, somewhat twisted, brick-red; lip brick-red; caps. large. S. Amer. L.B.C. 7:634.

—*C. heliconiifolia*, Bouché, Texas to Venezuela, has the staminodia more or less connivent: fls. orange-red: lvs. long-petioled, more or less woolly, oblong-acuminate; plant 7–8 ft. Var. *xalapensis*, Kränzl (*C. xalapensis*, Bouché), has narrower lvs. and smaller stature.

DD. *Staminodia large (5 in. or less long), united into a tube.*

E. *Fls. pendulous, rose-colored.*

24. *iridiflora*, Ruiz & Pav. St. green, 6–12 ft.: lvs. broad-oblong, bright green, slightly pubescent beneath: racemes paniculate, drooping; fls. large, beautiful rose-color; tube of corolla and staminodia as long as the blade; sepals lanceolate, 1 in. long; corolla-lobes lanceolate,  $2\frac{1}{2}$  in. long; 3 upper staminodia somewhat longer than the corolla-lobes, obovate, nearly or quite 1 in. broad, rose-crimson; lip narrow, deeply emarginate, rose-crimson. Andes of Peru. B.M. 1968. B.R. 609. L.B.C. 10:905. R.H. 1861:110.



784. Stool of canna, showing how it may be divided.

EE. *Fls. erect-spreading, white and red.*

25. *liliflora*, Warsc. St. robust, green, 8–10 ft.: lvs. many, oblong, green, 3–4 ft. long, spreading from the st. at a right angle; fls. in a corymbose panicle; sepals linear, as long as the tube of the corolla; corolla-lobes lanceolate, 2–3 in. long, pale green, the tube of equal length; 3 upper staminodia white, united into a tube for half their length, the blade obovate and spreading; lip oblanceolate, as long as the staminodia. Colombia. R.H. 1884:132. F.S. 10:1055–6.—A fine species. The white fls. finally become tinged with brown; lonicera-scented. L. H. B.

**CÁNNABIS** (the ancient Greek name). *Moraceæ*. HEMP. A widely cultivated fiber plant, and also used occasionally as an ornamental subject, being grown from seeds and treated as a half-hardy annual.

Hemp is dioecious: staminate fls. in axillary panicles, with 5 sepals and 5 drooping stamens and no petals; pistillate fls. in short spikes, with 1 sepal folding about the ovary: lvs. digitate, with 5–7 nearly linear, coarse-toothed lfts.: fr. a hard and brittle achene. *C. sativa*, Linn., probably native in Cent. Asia, is now escaped in many parts of the world: tall, rough and strong-smelling, 8–12 ft.: lfts. 5–11, linear-lanceolate, toothed, the upper lvs. alternate and the others more or less opposite. Only one species, but various forms have received specific names. In gardens, the form known as *C. gigantea* is commonest; this reaches a height of 10 ft. and more. The seeds are usually sown where the

plants are to stand; but if quick effects are wanted, they may be started indoors in pots or boxes. Hemp makes excellent screens in remote places. It thrives best in a rich rather moist soil. For field cult. for fiber (which is derived from the inner bark), see *Cyclo. Amer. Agric.*, Vol. II, p. 377.

L. H. B.

CANTELOUPE: *Muskmelon*.

CANTERBURY BELL: *Campanula Medium*.

CÁNTUA (from Cantu, Peruvian name). *Polemoniaceæ*. Showy flowering shrubs, with variable foliage, in greenhouses, and out-of-doors far South.



785. *Capparis spinosa*.  
( $\times \frac{1}{2}$ )

Flowers corymbose; calyx campanulate, of 5 (rarely 3) sepals, which are much shorter than the long tubular corolla; stamens inserted at the base of the corolla, but exceeding it in length.—Six species in S. Amer. One kind is recommended in Eu. as a coolhouse shrub. No tenderer than fuchsias. Prop. by cuttings in sand under a bell-jar.

*buxifolia*, Juss. (*C. dépendens*, Pers.). Much-branched shrub, about 4 ft. high; branches more or less downy: lvs. very variable, generally oblong-ovate, acute, tapering at the base, entire or serrate, downy or glabrous: fls. 5–8, drooping vertically, in a kind of leafy, terminal corymb; calyx pale, membranous, green-streaked, 5-toothed, a fourth shorter than the corolla-tube; corolla long-funnel-shaped, the tube  $2\frac{1}{2}$  in. long, red, usually streaked; limb of fringed, obcordate, crimson lobes which are much shorter than the tube; stamens included. Peru. Apr., May. B.M. 4582. F.S. 7:650. R.H. 1858, p. 294. R.B. 27:181.—One of the choicest of European greenhouse plants. Very liable to red spider.

*C. bicolor*, Lem. Distinguished from the above by the entire lvs. which are shorter, about 1 in. long, and the solitary fls. with a short, yellow tube, the limb not fringed. The fls. droop, but not vertically. Peru. B.M. 4729. F.S. 4:343. Probably less desirable than the above.—*C. pyrifolia*, Juss. Lvs. generally broader and more toothed than in *C. bicolor*: fls. as many as 17, in an erect, terminal, compound corymb; calyx red-tipped, nearly half as long as the yellow corolla-tube; corolla about  $1\frac{1}{4}$  in. long, with a white limb; stamens long, exserted. Peru. B.M. 4386. F.S. 4:383.

WILHELM MILLER.  
N. TAYLOR.†

CAOUTCHOUC TREE: *Hura*, *Manihot*, *Ficus elastica*, *Castilloa*, *Hevea*, *Landolphia*, and others, not treated here.

CAPE BULBS. A name applied to bulbous and bulb-like plants native to South Africa. They are dry-region plants, and often bloom with us in summer and autumn. Some of the leading genera are *Amaryllis*, *Brunsvigia*, *Nerine*, *Ixia*, *Tritonia*, *Watsonia*. See *Bulbs*.

CAPE CHESTNUT: *Calodendrum capensis*.

CAPE GOOSEBERRY: *Physalis*.

CAPE JESSAMINE: *Gardenia*.

CAPER: *Capparis*.

CAPE-SPURGE: *Euphorbia Lathyris*.

CÁPPARIS (Greek, *caper*, said by some to have been derived from the Arabic name of the plant). *Capparidaceæ*. CAPER-BUSH, or CAPER-TREE. Greenhouse plants North, and suited to the open in Florida and California.

Trees and shrubs, with simple lvs.: sepals 4, rarely 5; petals usually 4; stamens usually many, inserted on the receptacle, the filaments thread-like and free; ovary long-stalked, 1–4-celled, with many ovules.—More than 150 species distributed throughout the warm regions of the earth. Differing from *Cleome* and most other cult. genera of the family in having baccate, not capsular, fr.

Capers are pickles made by preserving the flower-buds of *C. spinosa*, a straggling shrub which grows out of old walls, rocks, and rubbish in Mediterranean regions and India. Also rarely cultivated as a greenhouse flowering shrub. Propagation is by cuttings of ripe wood, under a bell-jar, in greenhouses, and by seeds South.

*spinosa*, Linn. Fig. 785. Spiny shrub, 3 ft. high, often straggling and vine-like: lvs. roundish or ovate, deciduous: fls. borne singly, alternately, and fading before noon; sepals 4; petals 4, oblong, clawed, wavy, white,  $1\frac{1}{2}$  in. long; stamens 40–50; filaments purple above, perhaps the chief beauty of the plant. B.M. 291.—What seems to be the long style with a short unopened stigma, is really the elongated peduncle or torus topped by the pistil, which has no style and a minute stigma. Var. *rupéstris* (*C. rupéstris*, Sibth. & Smith) is a spineless form.

*Mitchellii*, Lindl. A much-branched shrub, usually very spiny, and more or less densely tomentose: lvs. ovate-oblong, 1– $1\frac{1}{2}$  in. long, narrowed into a short petiole: fls. few, axillary, white or yellowish, followed by a tomentose globular berry 2 in. diam. Sand plains of Austral.—Suitable for dry places outdoors in S. Calif.

*C. acuminata*, Lindl. St. shrubby, with flexuose, smooth branches: lvs. petiolate ovate-lanceolate, acuminate: fls. large, solitary, white, the conspicuous stamens 3–4 times as long as the petals. China. B.R. 1325.

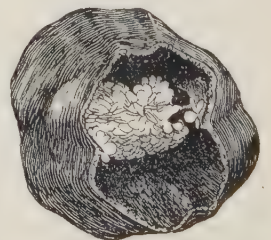
WILHELM MILLER.  
N. TAYLOR.†

CAPRIFOLIUM: *Lonicera*.

CAPRIOLA: *Cynodon*.

CÁPSICUM (name of uncertain origin, perhaps from *kapto*, to bite, on account of the pungency of the seed or pericarp; or from *capsa*, a chest, having reference to the form of fruit). *Solanaceæ*. RED PEPPER. CAYENNE PEPPER. Herbs or shrubs, originally from tropical America, but escaped from cultivation in Old World tropics, where it was once supposed to be indigenous.

Stem branchy, 1–6 ft. high, glabrous or nearly so: lvs. ovate or subelliptical, entire, acuminate: fls. white or greenish white, rarely violaceous, solitary or sometimes in 2's or 3's; corolla rotate, usually 5-lobed; stamens 5, rarely 6 or 7, with bluish anthers dehiscing longitudinally; ovary originally 2–3-loculed: fr. a juiceless berry or pod, extremely variable in form and size, many-seeded, and with more or less pungency about the seeds and pericarp. Fig. 786. The fr. becomes many-



786. Normal 2-loculed fruit of *Capsicum*, in cross-section.



loculed and monstrous in cult.—About 90 species have been named, most of which are now considered forms of one or two species. Monogr. by Irish, 9th Ann. Rept. Mo. Bot. Gard. For cult., see *Pepper*.

A. *Plant annual or biennial.*

**annuum**, Linn. Fig. 787. Herbaceous or suffrutescent, grown as annuals in temperate climates, but in warmer latitudes often treated as biennials. All of the leading commercial varieties in the U. S. readily find classification within the types or botanical varieties. The species has never been found wild. It is the pimento of Trop. Amer.

B. *Fr. oblong-linear.*

c. *Calyx usually embracing base of fr.*

**Var. conoides**, Irish (*C. conoides*, Mill.). Suffrutescent: lvs. numerous, rather small, 2–3 in. long,  $\frac{3}{4}$ –2 in. wide: peduncles slender, straight, erect; fls. small; calyx obconical or cup-shaped, usually embracing base of fr.; corolla greenish white, spreading,  $\frac{3}{8}$ – $\frac{5}{8}$  in.: fr. erect, subconical or oblong-cylindrical, about  $1\frac{1}{4}$  in. long or less, usually shorter than the peduncles and mostly borne above the lvs., very acrid. Coral Gem, Tabasco. Gn. 66, p. 381.

**Var. fasciculatum**, Irish (*C. fasciculatum*, Sturt.). RED CLUSTER PEPPER. Fig. 788. St. herbaceous, round or nearly so: branches few: lvs. clustered or crowded in bunches about the summit, elliptical-lanceolate, pointed at both ends: fr. also clustered, erect, slender, about 3 in. long by  $\frac{1}{4}$  in. diam., very acrid.

**Var. acuminatum**, Fingh. (*C. chilense*, Hort.). LONG CAYENNE. Herbaceous, very branching, about  $2\frac{1}{2}$  ft. high, bearing a dense mass of foliage: fl. medium size, spread  $\frac{1}{2}$ – $\frac{3}{4}$  in.: fr. larger than the preceding, either erect or pendent. Chile.

cc. *Calyx not usually embracing base of fr.*

**Var. longum**, Sendt. (*C. annuum*, Linn. *C. longum*, DC.). Plant herbaceous, about  $2\frac{1}{2}$  ft. high, with comparatively few branches: lvs. large, often 4 in. long by  $2\frac{1}{2}$  in. wide: fl. large; corolla spreading,  $\frac{1}{8}$ – $1\frac{1}{4}$  in., dingy white; calyx usually pateriform or funnelform, rarely embracing base of fr.: fr. often a foot long by 2 in. diam. at base; flesh thick and in some varieties very mild. Garden varieties are: Black Nubian, County Fair, Elephant's Trunk, Ivory Tusk.



787. A form of *Capsicum annuum*.

BB. *Fr. of various shapes, but not oblong-linear.*

**Var. grössum**, Sendt. (*C. grössum*, Linn.). Herbaceous, about 2 ft. high, with few branches: lvs. very large, often 3 by 5 in., sometimes coriaceous, lower ones usually pendent; petioles deeply channeled: peduncles stout, about 1 in. long; corolla large, spreading,  $\frac{7}{8}$ – $1\frac{1}{4}$  in.: fr. large, oblate, oblong, or truncated, 3–4 lobed, usually with basal depression, more or less sulcate and rugose; flesh thick, firm, and of a mild flavor. Emperor, Monstrous, Bell, Sweet Mountain, Golden Dawn, Ruby King, Golden King, Brazilian Upright, Golden Upright, Squash, and others, are garden varieties.

**Var. abbreviatum**, Fingh. (*C. umbilicatum*, Vell. *C. luteum*, Lam.). Suffrutescent: lvs. broadly ovate, 2–4 in. long; peduncles slender, straight or curved, as long as or longer than the berry: fr. about 2 in. long or less, varying much in the different horticultural varieties, in general ovate, quite rugose, except in one variety, sometimes turbinate. While this variety is used to some extent for pickling, it is noted more as an ornamental plant. Some garden forms are: Celestial, Etna, Kaleidoscope, Red Wrinkled, Yellow Wrinkled.



788. *Capsicum annuum* var. *fasciculatum*.

**Var. cerasiforme**, Irish (*C. cerasiforme*, Mill.). Suffrutescent: lvs. medium size, ovate or oblong-acuminate, about  $1\frac{1}{4}$ – $3\frac{1}{2}$  in.: calyx seated on base of fr.; corolla large, spreading,  $\frac{7}{8}$ – $1\frac{1}{2}$  in.: fr. spherical, subcordate, oblate, or occasionally obscurely pointed or slightly elongated, smooth or rarely minutely rugose or sulcate; flesh firm,  $\frac{1}{2}$ – $\frac{1}{8}$  in. thick, extremely pungent. Garden forms are: Cherry, Yellow Cherry, Oxheart.

AA. *Plant perennial.*

**frutescens**, Linn. Fig. 789. Shrubby perennial, 3–6 ft. high, with prominently angled or somewhat channeled st. and branches: branches loosely spreading or trailing: lvs. broadly ovate-acuminate, 3–6 in. long, 2– $3\frac{1}{2}$  in. wide: peduncles slender, 1–2 in. long, often in pairs, usually longer than the fr.; calyx cup-shaped, embracing base of fr.; corolla often with ochereous markings in the throat: fr. red, obtuse or oblong-acuminate,  $\frac{3}{4}$ – $1\frac{1}{4}$  in. long,  $\frac{1}{4}$ – $\frac{3}{4}$  in. diam., very acrid.—Cult. only S., as the seasons in temperate latitudes are not long enough to mature fr.

**Var. baccatum**, Irish (*C. baccatum*, Linn.). Plants not so tall, but more erect than the species: branches slender, fastigiate, flexuose: corolla small, spreading, about  $\frac{1}{2}$  in.: fr. ovate or sub-round, about  $\frac{1}{4}$  in. diam.

H. C. IRISH.

**CARAGANA** (*Caragan*, its Mongolian name). *Leguminosæ*. PEA TREE. Ornamental shrubs chiefly grown for their bright yellow flowers; some species are also used for hedges.

Leaves abruptly pinnate, often with persistent spiny-pointed rachis; lfts. small, entire; stipules deciduous or persistent and spiny: fls. papilionaceous; standard upright, like the wings with long claws; keel obtuse and straight; stamens 10, 9 connate, 1 free; ovary scarcely stipitate: pod linear, terete, straight, 2-valved, with several seeds.—More than 50 species from S. Russia to China, most of them in Cent. Asia. Monograph by Komarov in Act. Hort. Petrop. 29:179–388 (1908), with 16 plates.

The caraganas are deciduous unarmed or spiny shrubs



789. *Capsicum frutescens*.

with yellow, rarely whitish or pinkish flowers axillary and solitary or fascicled, followed by linear pods. The cultivated species are quite hardy, except a few Himalayan species. They grow in almost any soil, but best in a sandy soil and sunny position, and are well adapted for shrubberies. *C. arborescens* is the only one which grows into a small tree, and is of upright habit, like *C. frutex*, which is about half as high and more graceful; most of the other species are low shrubs, of usually spreading habit. *C. arborescens* is one of the best hedge shrubs for the prairies of the Northwest.

Propagation is by seeds sown in fall or in spring; if kept dry during the winter, soaking in tepid water for two or three days before sowing will be of advantage; also increased by root-cuttings and layers, or by grafting on seedling stock of *C. arborescens* in spring.

A. *Lfts.* 12-18,  $\frac{1}{6}$ - $\frac{1}{2}$  in. long: *rachis* deciduous.

*microphylla*, Lam. (*C. Altagana*, Poir. *C. arborescens* var. *arenaria*, Hort.). Fig. 790. From 4-6 ft.: *lfts.* 12-18, obovate, pubescent when young, grayish green,  $\frac{1}{2}$  in. long or shorter: *fls.* 1 or 2, yellow,  $\frac{3}{4}$  in. long; pedicel about as long as the fl. Siberia, China. L.B. C. 11: 1064.—Under this name a dwarf form of *C. arborescens* is often cult. Var. *megalántha*, Schneid. *Lfts.* bright green,  $\frac{1}{2}$  or sometimes  $\frac{1}{2}$  in. long: *fls.*  $1\frac{1}{4}$  in. long.

AA. *Lfts.* 8-14,  $\frac{1}{2}$ -1 in. long: *rachis* deciduous.

*arborescens*, Lam. Shrub or small tree, to 20 ft.: *lfts.* 8-12, obovate or oblong, sparsely pubescent beneath or glabrous at length: *fls.* 2-4, pale or bright yellow,

$\frac{3}{4}$  in. long; pedicels usually longer than the *fls.*: pods about 2 in. long. May, June. Siberia, Manchuria. G.O. H. 67. Var. *péndula*, Dipp., with pendulous branches, is the most remarkable; it should be grafted high. M.D. G. 1897:425. Var. *Lorbergii*, Koehne. *Lfts.* linear to linear-oblongate, about 1 in. long. A very peculiar and striking form.

*fruticosa*, Bess. (*C. Redóvskii*, Fisch. *C. arborescens* var. *arenaria*, Sims). Shrub, to 6 ft., very similar to the preceding: *lfts.* 10-14, oblong-elliptic to obovate, cuneate at the base, rounded at the apex; stipules herbaceous or somewhat spiny; pedicels and calyx puberulous, calyx-teeth very short: pods about 1 in. long; seeds brown. Amurland, Korea. B.M. 1886 (not good).

AAA. *Lfts.* 2-4.

B. *Rachis* of the *lvs.* deciduous: pedicels as long as or longer than the *fls.*

*frutex*, Koch (*C. frutescens*, DC.). Fig. 791. From 6-10 ft.: *lfts.* 4, approximate, nearly digitate, cuneate, obovate or oblong, rounded or emarginate at the apex,

glabrous,  $\frac{1}{2}$ -1 in. long: *fls.* solitary,  $\frac{3}{4}$ -1 in. long, yellow. May. S. Russia to China. Gt. 10:348. S.B.F.G. 3:227. Var. *grandiflora*, Koehne. *Fls.* somewhat longer than 1 in.: *lfts.* usually large and broad. Var. *latifolia*, Schneid. (var. *obtusifolia*, Hort.). *Lfts.* more than an inch long and about  $\frac{1}{2}$  in. broad: *fls.* as in the type.

BB. *Rachis* persistent, spiny: pedicels shorter than the *fls.*

*Chámلاغu*, Lam. Shrub, 2-4 ft.: spines long: *lfts.* 4, in 2 somewhat remote pairs, chartaceous, obovate, emarginate or rounded at the apex, glabrous,  $\frac{1}{4}$ - $\frac{3}{4}$  in. long: *fls.* solitary, reddish yellow,  $1\frac{1}{4}$  in. long. May. N. China. G.O.H. 30.

*pygmæa*, DC. (*C. gracilis*, Hort.). One to 3 ft.: spines short,  $\frac{1}{4}$  in.: *lvs.* nearly sessile; *lfts.* 4, approximate and almost digitate, cuneate, linear-elliptic or linear-lanceolate, glabrous,  $\frac{1}{2}$ - $\frac{1}{2}$  in. long: *fls.* solitary,  $\frac{3}{4}$  in. long, golden yellow. Caucasus to Siberia and Thibet. B.R. 12:1021.—Grafted high on *C. arborescens*, it forms a graceful standard tree, with pendulous branches.

*C. Altagana*, Poir.=*C. microphylla*.—*C. arborescens* *arenaria*, Hort.=*C. microphylla*.—*C. arenaria*, Dipp.=*C. aurantiaca*, Koehne. —*C. aurantiaca*, Koehne. Allied to *C. pygmæa*. *Fls.* orange-yellow; calyx as long as broad; ovary glabrous. Siberia.—*C. Boissii*, Schneid. (*C. microphylla* var. *crasse-aculata*, Boiss). Allied to *C. arborescens*. Shrub to 6 ft.: *lfts.* 10-12, obovate or narrowly obovate, about  $\frac{1}{2}$  in. long, silky pubescent beneath at least when young, whitish beneath; stipules spiny: *fls.* solitary. W. China. V.P. 57.—*C. brevispina*, Royle (*C. triflora*, Lindl.). Spines 2-3 in. long: *lfts.* 12-16, pubescent: *fls.* 2-4, on a common peduncle. Himalayas. P.F.G. 2: 184.—*C. decorticans*, Hemsl. Allied to *C. microphylla*. Shrub or small tree, spiny: *lfts.* 8-12, oval, less than  $\frac{1}{2}$  in. long: *fls.* 1-2. Afghanistan. H.I. 18:1725.—*C. frutescens*, DC.=*C. frutex*.—*C. Gerardiana*, Royle. Spines  $1\frac{1}{2}$ -2 in. long; stipules large, scarious: *lfts.* 8-12, densely pubescent: *fls.* 1-2, short-pedicelled. Himalayas.—*C. gracilis*, Hort.=*C. pygmæa*.—*C. grandiflora*, DC. Allied to *C. pygmæa*. *Lfts.* cuneate-oblong, glabrous or pubescent: *fls.*  $1\frac{1}{4}$  in. long; calyx gibbous at the base. Caucasus.—The plant sometimes cult. under this name is a variety of *C. frutex*.—*C. subata*, Pall. Sparingly branched shrub with very thick, spiny and villous branches: stipules large, scarious: *lfts.* 8-14, linear-oblong, villous beneath: *fls.* whitish, 1 in. long, short-pedicelled. Siberia. F.S. 19:2013. L.B.C. 6:522. Gt. 10:331. A very distinct and curious-looking species: hardy.—*C. sophoræfolia*, Bess. (*C. arborescens*  $\times$  *C. microphylla*. *C. cuneifolia*, Dipp.). *Lfts.* usually 12, oblong to elliptic, cuneate, acute: pods  $\frac{3}{4}$  in. long. Garden origin.—*C. spinosa*, DC. Spines 1 in. long: *lfts.* 4, rarely more, approximate, cuneate-lanceolate, glabrous: *fls.* solitary, short-pedicelled. Siberia.—*C. spinosissima*, C. Koch=*C. spinosa*.—*C. tragacanthoides*, Poir. Spiny: *lfts.* 4-8, cuneate, oblong, pubescent: *fls.* solitary, short-pedicelled; calyx villous-pubescent. Himalayas.—*C. triflora*, Lindl.=*C. brevispina*.—*C. vulgaris*, Hort.=*C. arborescens*.

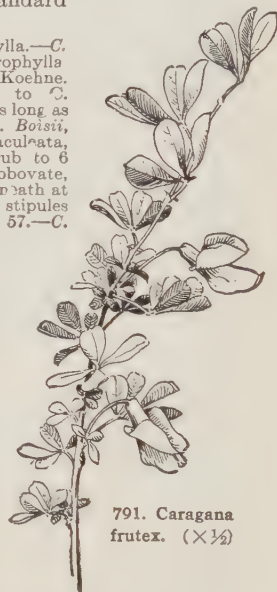
ALFRED REHDER.

**CARAGUATA.** By the latest monographer referred to *Guzmania*, which see.

**CARALLUMA** (aboriginal name). *Asclepiadaceæ*. Low succulents, sometimes seen in collections; about 40 species, from S. Spain and Afr. to Arabia and India. They resemble stapelias, and require similar treatment. The sts. are leafless, somewhat branched, erect, 4-sided and the angles toothed: *fls.* near the summit of the sts., more or less clustered, purple, brown and yellow, and other colors; corolla rotate and 5-parted: fr. long and slender follicles. The carallumas are probably not in the American trade. Some of the names that may be expected in collections are *C. adscendens*, R. Br.; *C. affinis*, Wildem.; *C. campanulata*, N. E. Br. (*Boucerosia campanulata*, Wight); *C. commutata*, Berger (sometimes grown as *C. Sprengeri*); *C. fimbriata*, Wall.; *C. inversa*, N. E. Br.; *C. Luntii*, N. E. Br.;



790. *Caragana microphylla*. ( $\times \frac{1}{2}$ )



791. *Caragana frutex*. ( $\times \frac{1}{2}$ )



*C. Sprengeri*, N. E. Br.; *C. Simonis*, Berger (*Boucerosia Simonis*, Hort.); *C. torta*, N. E. Br.

**CARAMBOLA:** *Averrhoa*.

**CARAWAY** (*Càrum Càrvi*, Linn.). *Umbelliferae*. A biennial or annual herb grown for its seeds, which are used in flavoring bread, cakes and cheese; also occasionally for the young shoots and leaves, which are eaten. It grows a foot or two high, has finely-cut, pinnately compound foliage, and small white flowers, in umbels. It is of the easiest culture. The seed is usually sown in spring and the crop of seed taken the following year. It thrives in any garden soil. The plant occasionally runs wild. See *Carum*.

**CARBÈNIA:** An incorrect or doubtful name for *Cnicus*, which see.

**CARDÁMINE** (Greek name of a cress). *Cruciferae*. Small mostly leafy-stemmed perennials (the annual species apparently not cultivated), growing in low rich land, blooming in spring or early summer.

Flowers sometimes large for size of plant, white or purple; petals obovate or spatulate; pods linear and straight, more or less flattened, the wingless seeds in 1 row, valves usually separating elastically from the base: lvs. simple or pinnate or lyrate: root often tuberous or rhizomatous.—About 50 species, largely in boreal or alpine regions. Of easy cult. Only *C. pratensis* is much known among growers.

*pratensis*, Linn. CUCKOO FLOWER. Fig. 792. Plant slender and usually glabrous, 12–20 in., somewhat branched: lvs. pinnately divided; lfts. of root-lvs. small and rounded ( $\frac{1}{2}$  in. or less across), those of the upper st.-lvs. oblong or even linear and entire or somewhat toothed: fls.  $\frac{1}{2}$  in. long, in a corymb, white or rose-color, pretty. Eu. and Amer., in the northern parts.—In the gardens it is chiefly known in the double-fl. form, which probably has been derived from European rather than American sources. There are other forms

792. *Cardamine pratensis*. Root-leaves not showing.

of it. It is an excellent little plant to grow in moist places, particularly along creeks and about springs. It is also useful in drier places, as in rockeries.

*trifolia*, Linn. Attractive spring bloomer, 6 in., creeping: lvs. ternate, the toothed parts or segms. irregularly roundish: fls. snow-white, on a naked scape. S. Eu. B.M. 452.

*angulata*, Hook. Erect, 1–2 ft. high: lvs. 3–5-foliate, the lfts. ovate or oblong, and the middle one usually coarsely toothed: fls. rather large, white, in short, few-fl. racemes. Mts. of Ore. and Wash.—Intro. 1881 by Gillett.

L. H. B.

**CARDAMON:** *Amomum* and *Elettaria*.

**CARDIÁNDRA** (Greek, *heart*, and *man* or *stamen*: alluding to the shape of the anthers). *Saxifragaceae*. Ornamental half-shrubby plants, rarely cultivated for their white, lilac or pink flowers.

Suffrutescent deciduous plants with alternate rather large lvs. and small pink, lilac or white fls. in terminal



793. Fruit of *Cardiospermum*. ( $\times \frac{1}{2}$ )

loose corymbs surrounded by large sterile fls.: calyx-tube cupulate, adnate to the ovary; petals 5; stamens numerous with filiform filaments and suborbicular anthers; ovary inferior, incompletely 3-celled; styles 3, short; sterile fls. with 3 large sepals: caps. loculicidal.—Three species in Japan and China. Tender plants, thriving in any good garden soil; best in a partly shaded and moist position. Prop. by greenwood cuttings under glass.

*alternifolia*, Sieb. & Zucc. One to 3 ft.: lvs. broadly elliptic to elliptic-lanceolate, tapering into a very short petiole, coarsely serrate, sparsely pilose, membranaceous, 3–7 in. long: fls. pink, lilac or white. Summer. S.Z. 66, 67. Gt. 14:486.

ALFRED REHDER.

**CARDINAL FLOWER:** *Lobelia cardinalis*.

**CARDIOSPÉRMUM**

(Greek, *heart-seed*, from the white heart-shaped spot on the round black seed; hence the plant was thought a cure for heart diseases). *Sapindaceae*. Tendril-climbing tropical herbs.

Leaves alternate, biterminate; lfts. coarsely serrate: fls. small, white, polygamous or dioecious, in axillary racemes or corymbs; sepals and petals 4, in pairs; stamens 8; ovary 3-celled, followed by a membranous caps.

—A dozen species widely distributed. The most popular is the interesting balloon-vine, which is a rapid-growing, woody perennial, behaving as an annual, curious for its inflated seed-vesicles. Fig. 793. Prop. by seeds.

**Halicacabum**,

Linn. Fig. 794.

**BALLOON-VINE.**

**HEART-SEED.**

**HEART-PEA.**

Height 10 ft.: st. and branches grooved: lvs. glabrous, oblong-acuminate, deeply dentate: balloons an inch or more thick. Trop. India, Afr., and Amer. B.M. 1049. —A general favorite, especially with children. Grown as a garden annual.

*hirsutum*, Willd. Creeping or ascending perennial vine with densely hairy grooved st. and lvs. as in the preceding, but usually hairy on the under surface: fls. not showy: fr. pointed, hirsute; the globular chocolate-brown seed is borne on the detaching parachute-like dissepiment. Afr.—A useful perennial in S. Calif. for covering arbors; evergreen and blooming continuously.

N. TAYLOR.†

**CARDOON** (*Cynara Cardunculus*, Linn.). A thistle-like plant of southern Europe, cultivated for the thick leaf-stalk and midrib.

It is thought to be of the same species as the artichoke, and to have been developed from it by long cultivation and selection. See *Cynara*. The plant has been



794. Balloon-Vine—*Cardiospermum Halicacabum*. ( $\times \frac{1}{4}$ )

introduced into South America, and has run wild extensively on the pampas. Darwin writes that "no cultivated plant has run wild on so enormous a scale as the cardoon." From the artichoke it differs in taller and more prickly growth and smaller heads. The cardoon is perennial, but it is not hardy, and is treated as an annual. Seeds are sown in spring, either in pots under glass or in the open where the plants are to stand. The later sowing is usually preferred. The plants are given



795. Leaf of Canada thistle.—*Carduus arvensis* or *Cirsium arvense*. ( $\times \frac{1}{2}$ )

rich soil and should have abundant moisture supply, for they must make continuous and strong growth. When the leaves are nearly full grown, they are tied together near the top, straw is piled around the head, and earth is banked against it. This is to blanch the plant, for it is inedible unless so treated. From two to four weeks is required for the blanching. The procedure is not very unlike that adopted for the blanching of celery or endive. If the plants are late, they may be dug just before frost and blanched in a storage pit. The plants are usually grown 2 to 3 feet apart, in rows which are 4 feet apart. They are sometimes grown in trenches, after the old way of growing celery. Cardoon is very little known as a vegetable in America except among foreigners.

L. H. B.

**CÁRDUUS** (the ancient Latin name of these plants). *Compósitæ*. THISTLE. Spiny-leaved annual, biennial or perennial herbs, sometimes grown in borders and rock-gardens for the interesting habit and the heads of purple or white flowers.

Carduus is sometimes united with *Cirsium*, but is here kept distinct, being separated chiefly by non-plumose or only indistinctly serrate pappus-bristles (see *Cirsium*). The common weedy thistles are referred either to *Carduus* or *Cirsium*, depending on the definition of the genus. Fig. 795 shows the spiny leaf of one of these. Under the restricted use of the name, *Carduus* comprises about 80 species, from the Canary Is. to Japan. For *C. benedictus*, see *Cnicus*.

*acanthoides*, Linn. A much-branched perennial about 18-24 in. high: lvs. bright green, pinnately parted, the nerves very prominent beneath, spinose margined: the solitary heads long-peduncled, the fls. purple and showy. S. Eu.—Scarcely known in Amer.

*C. Marianus*, Hort., is a *Silybum*, and *C. tabricum*, Hort., is a *Cirsium*. Both are advertised in England, but are unknown in Amer.

N. TAYLOR.†

**CÁREX** (name of obscure origin). *Cyperaceæ*. SEDGE. Grass-like perennials of very many kinds, a few of which are grown in bogs or as border plants.

Flowers unisexual, in spikes, the staminate naked and subtended by a bract or scale, the pistillate comprising a single pistil inclosed in a thin sac or perigynium; monœcious or rarely diœcious: sts. or culms solid, not jointed, mostly 3-angled: lvs. grass-like but 3-ranked. One large group has 2 styles and a lenticular achene, and the spikes are commonly androgynous or contain both sexes (Fig. 796); another division has 3 styles and a triangular achene, and the spikes are commonly unisexual, the staminate being above (Figs. 797, 798).

Carices are very abundant in cool temperate regions, both in species and in individual plants. There are more than 800 known species. Many of them grow

on dry land, but the largest species grow in low grounds and swales, and often form much of the bulk of bog hay. Carices cover great areas of marsh land in the upper Mississippi region and are employed in the manufacture of "grass carpets" or Crex fabrics. The species are difficult to distinguish because they are very similar, and the study of them is usually left to specialists. Some of our broad-leaved native species make excellent borders and interesting clumps in corners about buildings and along walls. Of such are *C. platyphylla*, *C. plantaginea*, *C. alburquina*. Many of the lowland species are excellent adjuncts to the pond of hardy aquatics. Others have very graceful forms, with drooping spikes and slender culms (Fig. 798). The following native species, and probably others, have been offered by collectors: *C. aurea*, *C. eburnea*, *C. flava*, *C. Grayi* (one of the best), *C. hystericina*, *C. lupulina* and its var. *pedunculata*, *C. lurida*, *C. paupercula*, *C. pennsylvanica*, *C. plantaginea*, *C. Pseudo-Cyperus*, *C. retrorsa*, *C. Richardsonii*, *C. riparia*, *C. Tuckermanii*, *C. utriculata*, *C. vulpinoidea*. The species present no difficulties in cultivation if the natural habitat is imitated. Propagated readily by seed sown in late fall (germinating in spring) or by division of the clumps.

**Môrowi**, Boott (*C. japonica*, Hort., not Thunb. *C. tenuissima*, Hort. *C. acutifolia*, Hort.). Fig. 799. Lvs. stiff and evergreen, long-pointed, in the common garden form with a white band near either margin: culm 1 ft. with a terminal staminate spike and 2 or 3 slender pistillate spikes (1 in. long) from sheaths: perigynium small and firm, somewhat excurved, 2-toothed, glabrous. Japan. G.C. III. 13:173. R.B. 20, p. 9.—A very handsome plant, suited for pots or the border. The stiff clean white-edged foliage keeps in condition for months, making the plant useful for decorations in which pot-plants are used. It is perfectly hardy in Cent. N. Y., holding its foliage all winter. A useful florists' plant.



796. *Carex* (*C. scoparia*), with androgynous spikes and lenticular achenes. ( $\times 1$ ). N. Amer.



797. *Carex* (*C. lurida*), with staminate terminal spikes and trigonous achenes. ( $\times \frac{1}{2}$ ). N. Amer.

*intumescens*, Rudge (*C. tenaria*, Hort. *C. tenera*, Hort.). Slender, but stiff, to 30 in.: lvs. narrow, rolling more or less when dry: staminate spikes long-stalked: pistillate spikes 1 or 2, short-stalked, short, with few large, turgid, tapering, shining perigynia and awl-like, rough-pointed scales. N. Amer.



cōmans, Berger (*C. Vilmorinii*, Mott. *C. Vilmoriniāna*, Hort.). Densely tufted, with many very narrow lvs., and filiform culms  $1\frac{1}{2}$  ft. or less high: spikes 5-7, the terminal staminate, linear and short-stalked, the lateral pistillate (or perhaps staminate at base), oblong, or cylindrical and dense-fld., about 1 in. long, and with aristate scales: perigynium 3-angled (stigma 3), lance-ovate, attenuate at base and with a 2-toothed scabrous beak. New Zeal.—A good hardy edging plant when a tufted grassy effect is desired.

**Buchánanii**, Berger (*C. lūida*, Boott, var. *Buchánanii*, Kuek.). Allied to the preceding: densely tufted: lvs. leathery, semi-terete, very narrow, brown-red: spikes 5-8, the terminal staminate and linear-cylindrical, long-stalked, the lateral pistillate and cylindrical,  $1\frac{1}{2}$  in. long, densely-fld.: perigynium plano-convex (stigma 2), produced into a long margined scabrous deeply bidentate beak. New Zeal.—Grown for its reddish foliage.

**Gaudichaudiāna**, Kunth (*C. vulgaris*, Fries, var. *Gaudichaudiāna*, Boott). Culms erect, 1-2 ft.: lvs. long and grass-like: staminate fls. in terminal spikes: pistillate fls. in 2-3 cylindrical, sessile or subsessile spikes: perigynium lenticular, small, very short-beaked, obscurely 2-toothed, finely nerved, longer than the narrow scale. Japan, Austral. New Zeal.—Useful for bog planting.

**Frāseri**, Andr. (*Cymophyllus Frāseri*, Mack.) Lvs. 1 in. or more broad, stiff, but with no midnerve, flat and thick, evergreen: culm 16 in. or less high-bearing at its summit a single whitish spike which is staminate at top: perigynium ovoid, thin and inflated. Rich mountain woods, Va. B.M. 1391 (as *C. Fraseriana*).—Rare, and a very remarkable plant.

*C. báccans*, Nees. Robust, with curving lvs. to 2 ft. long and  $\frac{1}{16}$  in. broad: fr. berry-like (whence the name), crimson or vermilion, in clustered spikes standing well above the lvs. India. G. 1:461. Useful for pots or for planting in a conservatory, for its ornamental fr., but probably not now in cult. commercially.—*C. gallica variegata* is offered abroad as a "very elegant, showy and charming" carex.—*C. riparia*, Curt., a rank-growing lowland species of wide distribution, is sometimes grown in a variegated-ld. form. The name has no botanical standing.—With the extension of wild gardening, and particularly of bog- and water-gardening, many other species of *Carex* may be expected to appear in the trade lists.

L. H. B.

**CÀRICA** (a geographical name). *Papayaceæ*. **PAPAYA**. Small, rapid-growing, unbranched trees, commonly grown in greenhouses as foliage plants and often bearing fruit under such conditions. Juice milky.

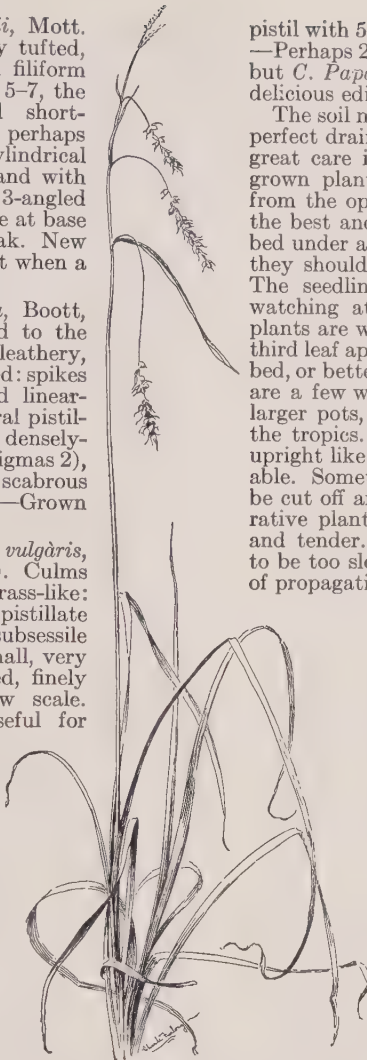
Leaves large, soft, long-stalked, in clusters at the top of the trunk: usually dioecious, the male fls. on long axillary peduncles, funnel-shaped, with 10 anthers in the throat, the pistillate fls. larger and with 5 distinct petals and a single

pistil with 5-rayed stigma, sessile in the axils of the lvs.—Perhaps 20 species, all native to the American tropics, but *C. Papaya* is cult. throughout the tropics for its delicious edible fruits. See *Papaya*.

The soil most suited for caricas is a rich loam, having perfect drainage. As the stem is succulent and tender, great care is necessary to avoid bruising, hence pot-grown plants are much to be preferred to seedlings from the open ground. Seeds should be selected from the best and largest fruits and sown in a well-worked bed under a slight shade. If seeds are quite dry or old, they should be soaked in warm water before sowing. The seedling plants are delicate, and require close watching at first to avoid damping-off. As soon as plants are well up remove the shading, and after the third leaf appears they may be pricked out into a larger bed, or better, potted off in fairly rich soil. After plants are a few weeks old, and have been shifted once into larger pots, they may be set permanently outdoors in the tropics. Caricas seldom branch, but usually grow upright like a palm, hence cuttings are not often available. Sometimes small branches form, and these may be cut off and as readily rooted as most tropical decorative plants, provided the cutting is not too young and tender. This method has been found in Florida to be too slow, and what is evidently a better method of propagation, by means of graftage, has been devised

by Edward Simmonds, of the Plant Introduction Field Station, Miami, Florida. Numerous shoots are formed by the buds at the leaf-scars when a papaya tree is topped, as many as fifty or more being produced. "One of these shoots is taken when a few inches long and about the diameter of a lead pencil, is sharpened to a wedge point, the leaf surface reduced, and inserted in a cleft in a young seedling which has been decapitated when 5 to 10 inches high, and split with an unusually sharp, thin grafting-knife. At this age the trunk of the young seedling has not yet formed the hollow space in the center. Seeds planted in the greenhouse in February produce young seedlings large enough to graft some time in March; these grafted trees, which can be grown in pots, when set out in the open ground in May or the latter part of April, make an astonishing growth and come into bearing in November or December; they continue bearing throughout the following spring and if it is advisable, can be left to bear fruit into the following autumn." Varieties of superior flavor and better size and shape for shipping, as well as

hermaphrodite varieties, may now be successfully maintained. For complete description of this method see "The Grafted Papaya as an Annual Fruit Tree," by David Fairchild and Edward Simmonds, Circular No. 119, Bureau of Plant Industry, 1913. In temperate climates, caricas have been found to be good decorative plants for both conservatory and summer bedding, the deeply cut, palmate leaves forming a striking contrast to ordinary vegetation. In bedding out, select open, sunny exposure, with perfect drainage, and make the soil rich and friable. Constant cultivation with a light hoe will cause a



798. *Carex (C. longirostris)*, with terminal staminate spikes and drooping pistillate spikes. ( $\times \frac{1}{2}$ ). N. Amer.



799. *Carex Morrowii*.

luxuriant growth under these conditions, and the planter will be amply repaid for his trouble by beautiful showy specimens as tropical-appearing as palms.

**Papaya**, Linn. (*Papaya Cárlica*, Gaertn.). **PAPAYA**. **PAWPAW**. The commonest species in cult., sometimes growing to a height of 20 ft., with large palmately 7-lobed lvs., sometime 2 ft. across, and fr. shaped like a roughly angled melon up to 12 in. long and half as thick, hanging, especially from the lower axils of the pistillate plant. B.M. 2898-9.—From the frs., which vary in size up to 15 lbs. and in number to the tree from 20-50, is extracted the papaya juice, which furnishes the papain of commerce. This is obtained by slashing the fr., and collecting the milky juice in porcelain-lined receptacles, where it is allowed to evaporate. When evaporated to a granular condition, it is ready for the market and brings from \$4-\$6 a lb. in the crude state. The papaya has of recent years become one of the commonest table frs. of the tropics. The flesh, which is usually of a salmon-pink or yellow color, is excellent when one becomes accustomed to its peculiar flavor, and resembles somewhat a most luscious muskmelon. From its large content of papain, it may be eaten without injury in considerable quantities and assists in the digestion of other foods. As the tree grows with great rapidity in tropical climates, it may be treated as an annual, the seeds being sown early in protected beds, well cared for and transplanted to their permanent places when well established. They will then bear fr. late in the succeeding autumn. The method of graftage described on p. 663 is preferable, however. The frs. have a considerable cavity, which, in the smaller rounded frs., is well filled with the small brownish or blackish seeds. The firm skin, the firmness of which may be increased by selection, will permit of shipping to a distance. The plant is sometimes polygamous, and from such plants in Hawaii there have been bred types which appear to have great promise as a shipping fr. The green frs. are frequently used as vegetables, and the lvs., if cooked with tough meat, are said to make it tender, due to the digestive principle.

**candamarcensis**, Hook. f. (*C. cundinamarcensis*, Lindl.). This is a more hardy ornamental species with numerous lvs., dark green above and pale beneath, rounded-heart-shaped, 1¼ ft. across, 5-lobed to the center with pinnatifid lobes; fls. green and pubescent; frs. small, pointed, 5-angled, golden yellow. B.M. 6198.—Hardy in S. Calif., but the frs. of no value as such.

**quercifolia**, Benth. & Hook. (*Vasconcellea quercifolia*, St. Hil.). Lvs. shaped like those of the English oak, palmately 3-lobed, and containing a greater percentage of papain than *C. Papaya*; frs. small.—Hardy in S. Calif.

**gracilis**, Solms. (*Papaya gracilis*, Regel). Habit of *C. Papaya*; trunk simple, 4-6 ft. high, slender, very glabrous; lvs. 5-digitate, the lobes sinuate-lobed, the middle one 3-lobed, the whole blade suborbicular in outline, petioled. Brazil. Gt. 1879:986.

S. C. STUNTZ.

**CARÍSSA** (aboriginal name). *Apocynaceæ*. Very branchy spinose shrubs of the tropics of the eastern hemisphere, cultivated for ornament or hedges, but here mainly for the edible berry-like fruits.

Flowers white, solitary or in cymes; lobes of calyx and corolla 5, the 5 stamens free and included in the throat, the ovary 2-loculed; lvs. opposite and thick, simple.—About 30 species. Used abroad as greenhouse plants but grown in this country only in S. Fla., and Calif. Prop. by seeds and cuttings of ripe wood.

**Carándas**, Linn. **CARAUNDA**. **CHRIST'S-THORN**. Evergreen shrub or small tree, with dark green ovate or elliptic mucronate entire lvs., strong axillary spines (which are often forked) and fragrant white fls. in clusters of 2-3, the corolla twisted to the left in the bud; fr. the size of

a cherry (1 in. diam.), reddish, pleasant-flavored. India. L.B.C. 7:663.—Reaches 20 ft. Half-hardy in Cent. Fla. The frs. are eaten from the hand or made into a jelly much like currants when ripe, and pickled when green.

**bispinosa**, Desf. (*C. arduina*, Lam.). **AMATUNGULU**. **MARITZGULA**. Spines strong, often 2 in. long; lvs. ovate and subcordate, mucronate, glabrous and entire; fls. white, the corolla twisted to the right in the bud. S. Afr.—A choice evergreen shrub, rather hardy, with thick camellia-like very glossy lvs.; fls. large, fragrant, white, and borne profusely and continuously; fr. dark red, size of a cherry, good. L.B.C. 4:387.—Closely resembles *C. grandiflora*, but fls. slightly smaller and frs. in clusters; seeds lanceolate.

**grandiflora**, DC. **NATAL PLUM**. Spiny shrub; lvs. ovate-acute, tapering to the base; fls. large, white, fragrant, solitary and terminal, twisted to the right, heterogonous; fr. red, 1-1½ in. long, resembling cranberries in flavor when cooked, and having a papery skin, milky juice and few small almost circular seeds. Sauce made from this fr. is almost indistinguishable in flavor from cranberry sauce, but the frs. ripen so irregularly, although almost continually, as to make the fr. suitable only for home-garden use unless handled on a large scale. Said to be the finest hedge plant in S. Afr. B.M. 6307.

**acuminata**, DC. Spines weak; lvs. smaller, ovate-acute, subcordate, mucronate; peduncles short, forked, axillary; fls. with lance-acuminate calyx-lobes, the corolla twisted to the right in the bud. S. Afr.—Perhaps not different from *C. bispinosa*.

*C. edulis*, Vahl. A straggling shrub with small purple edible fr. from Trop. Afr. Intro. from Abyssinia, but has not yet been thoroughly tested. The plant in the American trade under this name is described as much taller than *C. Carandas* and more vigorous; lvs. persistent, ovate-acuminate; fls. 10-25 in axillary clusters, white and pink, jasmine-scented; berries oval, red but turning black at maturity, 1-seeded.—*C. odata*, R. Br., from Austral., a more open shrub than any of the preceding, the small frs. of which are edible and used for jams, has been intro. by the Office of Foreign Seed and Plant Introduction as a possible stock for the more tender species, in the hope of extending the range of these frs.—*C. spinarum*, DC., a small edible-fruited evergreen shrub from India is said to be an important element in reforestation since it persists on the poorest and rockiest soils in spite of being greedily eaten by sheep and goats.

S. C. STUNTZ.†

**CARLINA** (said to have cured the army of Charlemagne [Carolinus] of the plague). *Compositæ*. Low rather coarse annuals, biennials or perennials, with thistle-like foliage, large white or purplish heads, a feathery pappus, and chaffy receptacle; outer involucreal bracts coriaceous, usually spiny, the inner ones colored or shiny and petal-like; fr. a silky-hairy achene.—Some 15 or 20 species in the Medit. region.

An open sunny place and ordinary garden soil are all they require. They are capital for the sunny part of a rockery. Propagated by cuttings or seeds.

**acaulis**, Linn. A very dwarf hardy perennial; height 3-6 in.; lvs. glossy, pinnatifid, divided, with spiny ends; fl. rising barely above the foliage, solitary, very interesting, the scales surrounding the fl.-head being long and narrow and ray- or petal-like, silky, shiny; head 6 in. across when expanded, white. June, July and late fall. G.C. II. 13:720-1. G.L. 19:178.

**acanthifolia**, Linn. A white-tomentose thick-lyd. biennial, the lvs. oblong, the upper pinnatifid and spiny; fl.-heads 4 in. wide, yellowish purple. S. Eu. July and later. G.C. III. 47:68.—Little known in U. S.

N. TAYLOR.†

**CARLUDOVICA** (Charles IV, and his Queen Louisa, of Spain). *Cyclanthaceæ*. Palm-like, sometimes merely herbaceous plants, of tropical America.

The plants are stemless, or sometimes with a lax creeping st., and usually have stalked, sometimes sessile, flabellate lvs.; fls. monocious, the two sexes being on the same spadix, which is included in a 4-lyd. spathe; staminate fls. with many stamens and many-



lobed calyx, 4 of them surrounding a pistillate fl.—the latter have a 4-sided ovary, 4 barren stamens, and 4-lobed calyx: fr. a 4-sided, many-seeded berry. The carludovicas are usually regarded and treated as stove palms by gardeners. They are useful for decoration. The family Cyclanthaceæ is exclusively tropical American, of about 45 species and 6 genera (*Stelestylis*, *Carludovica*, *Sarcinanthus*, *Ludovia*, *Evodianthus*, *Cyclanthus*); it is often united with the Pandanaceæ or screw-pine family.

The genus is an important economic one, as *C. palmata*, and perhaps other species, are the source of Panama hats. In making these, the leaves are cut young, the stiff veins removed, after which the leaves are slit into shreds, but not separated at the stalk end. It is said that hats of superior quality are plaited from a single leaf, without any joinings. U. S. Dept. Agric., Fiber Investigations. Rept. 9:112 (1897).



800. *Carludovica palmata*.

*Carludovica palmata* is the species most frequently met with under cultivation. Under favorable conditions it grows to a height of about 8 feet. All of the kinds need stove treatment during the winter months; in summer they may be used for subterranean bedding with good results. They have a certain palm-like appearance, but the leaves are of a softer texture than any of the palms. They may be propagated by division, choosing the early spring for the operation. *C. palmata* seeds freely. The fruit, when ripe, has an ornamental appearance for a short time after bursting open. The seeds are very small, and should be carefully washed free from the pulp, and sown on the surface of a pan of finely chopped sphagnum moss. Germination takes place in two weeks from sowing if kept in a brisk, moist heat. The species are not particular as to soil but the drainage must be perfect, as the plants require an abundance of water when growing. (G. W. Oliver.)

#### A. Lvs. 3-5-lobed.

*palmata*, Ruiz. & Pav. Fig. 800. No trunk: petioles 3-6 ft. long, glabrous, terete and unarmed; blades 4-lobed, the lobes again cut into narrow segms., dark green, gracefully spreading, and drooping at the margin. Peru. R.H. 1861, p. 36.—The common species, and a very useful plant.

*rotundifolia*, Wendl. Much like the last, but more compact under cult., owing to the shorter petioles, but growing much larger: petiole distinctly pubescent; lf.-blade large and orbicular, 3- or 4-lobed. Costa Rica. B.M. 7083.

*él-gans*, Williams. Blades with 4 or 5 lobes, which are very deeply cut into straight strap-like divisions. Probably of horticultural origin.

#### AA. Lvs. 2-lobed.

*atròvirens*, Wendl. Blades very deeply 2-lobed and very deep, rich green (whence the name, *dark green*), glabrous. Colombia.

*humilis*, Poepp. & Endl. Dwarf: blades angular, 2-lobed at the summit, the segms. more or less jagged but not divided, a foot or less broad. Colombia. R.H. 1869, p. 327.—One of the best.

*Plümerii*, Kunth (*C. palmifolia*, Sweet). Caudex erect: blades with 2 lanceolate and plicate divisions, bright green above and pale beneath: spadices pendulous. Martinique.

*imperiàlis*, Lind. & André. Caudex short and prostrate: blades with 2 ovate-lanceolate entire segms., with very prominent veins, the lobes about 5 in. wide and shining green; petiole purplish, canaliculate, tumid at the base. Ecuador. I.H. 21:166 (by error 165).

The following species are in cult. in this country but not as yet known to the trade: *C. funifera*, Kunth. Stemless or sometimes creeping and with a round, sparsely branched st.: lvs. alternate 1-2 ft. S. Amer.—*C. incisa*, Wendl. A much cut, low plant from Cent. Amer.—*C. macrospoda*, Klotzsch. St. scarcely 1 ft. long; lvs. faintly 3-nerved, deeply 2-parted, 1½-2 ft. Colombia.—*C. microcephala*, Hook. f. St. a few inches high: lvs. numerous, 10-18 in. long, split into 2-8-nerved segms.; petiole slender, purplish at base, Costa Rica. B.M. 7263.—*C. plicata*, Klotzsch. St. short: lvs. divided into 2-1-nerved segms.; petioles channeled: spadix about 6 in. long: the thick woody caudex may not rise more than 1 ft. Colombia.—*C. scandens*, Cowell. St. creeping, often 25 ft. long: lvs. several at the summit, about 18 in. long. St. Kitts.

N. TAYLOR.†

**CARMICHAELIA** (Capt. Dugald Carmichael, Scotch botanist, who wrote on the flora of the Cape and certain islands). *Leguminosæ*. Shrubs, leafless or usually becoming so, either erect or depressed, with reddish or purplish small fls., rarely cult. There are about 20 species in New Zeal., very difficult of delimitation. Lvs. 1- or 3-5-foliate, wanting or deciduous after the bloom has passed: fls. in lateral racemes; calyx cup-shaped or bell-shaped, 5-toothed; corolla papilionaceous, the standard orbicular and usually reflexed, the wings oblong and obtuse and somewhat falcate, the keel oblong and incurved and obtuse; upper stamen free: pod small, leathery, oblong to orbicular. *C. grandiflora*, Hook. f., is recently offered in S. Calif.: it is much-branched, to 6 ft. high, with compressed and grooved glabrous erect branches: lvs. pinnately 3-5-foliate, appearing in spring and early summer and then caducous, the lfts. glabrous and obcordate-cuneate: fls. about ¼ in. long, in drooping racemes of 5-12, white or lilac. *C. odorata*, Colenso, has pubescent drooping branches, and much smaller fls. in 10-20-fl. racemes: pod smaller (¼ in. or less long) and longer-beaked.

L. H. B.

**CARNATION** (*Dianthus Caryophyllus*, Linn.). *Caryophyllaceæ*. Choice and popular flower-garden and greenhouse plants of the pink tribe; in North America grown mostly under glass as florists' flowers. Pl. XXII.

The carnation is a half-hardy perennial, herbaceous, suffrutescent at base: height 2 ft.: st. branching, with tumid joints: lvs. linear, glaucous, opposite: fls. termi-

nal, mostly solitary; petals 5, flesh-colored, very broad, beardless, margins toothed; calyx cylindrical, with scaly bracts at base. June-Aug. S. Eu.; occasionally met in the wild state in England, where it was intro. through cult. A single-fl. and undeveloped carnation is shown in Fig. 801. A section of a single fl. is depicted in Fig. 802, showing the 2 styles and the 5 stamens; also the bracts at the bottom, in 2 series, beneath the calyx. In Fig. 803 some of the beginnings of doubling are shown.

*General development.* (By Geo. C. Butz.)

Theophrastus, who lived about 300 years B.C., gave the name *Dianthus* (Greek *dios*, divine; *anthos*, flower)

to the group, probably suggested by the delightful fragrance. The specific name *Caryophyllus* (Greek, *caryon*, nut; and *phylon*, leaf) has been applied to the clove-tree (*Caryophyllus aromaticus*), and because of the clove-like fragrance of the carnation this name was applied to it. The

name carnation (Latin, *carnatio*, from *caro*, *carnis*, flesh) has reference to the flesh-color of the flowers of the original type. This plant has been in cultivation more than 2,000 years, for Theophrastus (History of Plants, translation) says: "The Greeks cultivate roses, gillyflowers, violets, narcissi, and iris," gillyflower being the old English name for the carnation. It was not, however, until the beginning of the sixteenth century that the development of the carnation into numerous varieties made an impression upon its history. The original flesh-color of its flowers was already broken up into red and white. The gardeners of Italy, France, Germany, Holland and England, with their respective ideals of beauty in this flower, contributed so many varieties that in 1597 Gerard wrote that "to describe each new variety of carnation were to roll Sisyphus' stone or number the sands."

There have been many attempts at classification, but

most of them, like the varieties they serve, have disappeared. Two of them are as follows: A French scheme arranges all varieties into three classes: *Grenadins* (Fig. 801), including those with strong perfumes, flowers of medium size, either single or double, petals fringed, and of but one color; *Flamands*, including those with large flowers, round and double, rising in the center to form a convex surface, petals entire, either unicolored or striped with two or more colors; *Fancies*, including those with colors arranged in bands on light grounds, the petals toothed or not. The English classification of these varieties makes four categories: *Sels*, or those possessing only one color in the petals; *Flakes*, or those having a pure ground of white or yellow and flaked or striped with one color, as scarlet, purple or rose; *Bizarres*, or those having a pure ground marked as in the *Flakes*, but with two or three colors; and *Picotees* (Fig. 804), or those having a pure ground of

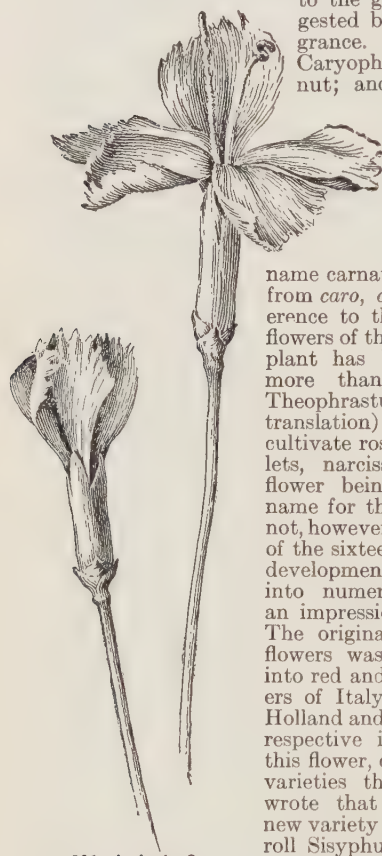
white or yellow, and each petal bordered with a band of color at the margin. This last class has been regarded with the distinction of a race.

In the early part of the nineteenth century, English gardeners exercised very great care in the growing of carnations to mature only perfect flowers. Imperfect and superfluous petals were extracted with forceps; petals appearing out of place were arranged in a perfect imbrication; the calyx-tube was cut partly down between the teeth, to prevent excessive splitting at one side and to give more freedom to the expansion of the flower. These and many more tedious details seem to have wrought the depreciation of this flower about the middle of the nineteenth century.

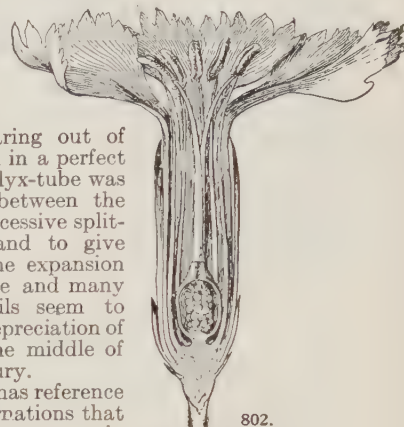
All the foregoing has reference to those types of carnations that are little known or grown in America at the present day; the varieties so common in Europe are usually kept in coldframes or coolhouses during the winter, and as spring approaches the plants are brought into their blooming quarters, for no flower is expected to appear until the month of July, when there is a great profusion of blossoms, but for a short season. Therefore, they can all be classed as a summer race. They are also grown permanently in the open.

*Development of the perpetual-flowering carnation (Remontant, Monthly, Forcing, or Tree).* Figs. 805-807.

The perpetual-flowering race of carnation, which has been brought to its highest state of perfection by American growers, and which is generally regarded as the "American carnation," really originated in France, and was grown in that country from its origin in 1840 until about the year 1856, before it was introduced to America. A French gardener, named M. Dalmais, obtained a constant-blooming carnation by crossing *Céillet de Mahon*, which bloomed in November, with pollen from *Céillet Biohon*, crossing again with the Flemish carnation, the first-named sort being disseminated under the name "Atim." By the year 1846 varieties in all colors had been secured and the type permanently fixed. These were taken up and improved upon in quality by other enthusiasts, among whom were M. Schmidt and M. Alphonse Alegatiere, of Lyons, France. The latter succeeded in securing varieties with rigid stems which in 1866 were given the name "tree-carnation." M. Schmidt's most prominent varieties were *Arc-en-ciel* and *Etoile Polaire*, which were grown for several years. But the strong rigid-stemmed varieties obtained by Alegatiere, which were termed tree-carnations in 1866, proved of greater value commercially, and became more generally cultivated. About the year 1852, a native of France who had settled near New York City, imported plants of this strain,



801. A single-flowered Grenadin carnation. ( $\times \frac{3}{4}$ )



802. Section of normal carnation flower.



803. The anthers are leafy, showing one process in doubling.



and cultivated several varieties for a number of years. About the year 1856 the firm of Dailledouze, Zeller & Gard imported plants of La Purité, a rose-colored variety, also Mont Blanc and Edwardsii, white, and Manteaux Royal, red-and-white variegated. These

were used for crossing, and the first variety produced in America, about the year 1858, proved to be a great improvement on existing varieties. It was named "Mrs. Degraw," and with another white variety named "Flatbush," was disseminated about the year 1864. Other varieties followed, and the work was taken up by other growers, among whom were M. Donati, who raised Astoria, a yellow which is conceded to be the ancestor of all the yellow varieties grown today; Rudolph Heintz, who raised Heintz's White in 1876; Chas. T. Starr, whose



804. Carnation, Picotee.

most famous variety was Buttercup, introduced in 1884; Jos. Tailby, whose Grace Wilder became and remained the standard rose-pink variety until the introduction of Wm. Scott in 1893; John Thorpe and W. P. Simmons, who introduced Portia, Tidal Wave, Silver Spray and Daybreak in the eighties; Sewal Fisher, whose Mrs. Fisher appeared in 1890 and became one of the leading whites; E. G. Hill, whose most notable productions were Flora Hill, the leading white for several years, and America, a scarlet; R. Witterstaetter, who obtained Estelle, Aristocrat, Afterglow and Pres. J. A. Valentine; John Hartje, who raised the scarlet Jubilee; Peter Fisher, whose Mrs. Thos. W. Lawson, Beacon, and Enchantress with its several sports, became leaders in their respective colors; C. W. Ward, who disseminated Governor Roosevelt, Harry Fenn and Mrs. C. W. Ward.

The late Frederick Dörner conducted the most systematic work in developing the carnation, and succeeded in producing a strain which is recognized as the highest development of the American carnation. His records, which cover a period of 22 years, contain a complete list of the many thousands of crosses made during that time. This strain is distinguished for its easy-growing habit, its freedom and steadiness in producing blooms, the diversity of colors and its adaptability to commercial growing. His labors produced such varieties as Wm. Scott, Mme. Diaz Albertini, White Cloud, Mrs. Geo. M. Bradt, G. H. Crane, Lady Bountiful, White Perfection, Pink Delight, White Wonder and Gloriosa, all leaders in their respective colors.

Through the rapid strides in its development, after being introduced in this country, the carnation established itself as one of the leading flowers for commercial growing and now stands second only to the rose in commercial importance. Not only does it share equally with the rose the bench space in most large growing establishments, but many large ranges are devoted entirely to the carnation. Growing methods have been perfected by the carnation specialists until the practices employed during its early history have been entirely superseded. Since its first arrival in America, over 1,200 varieties have been introduced, and the quality has been improved until the highest developed varieties produce blooms measuring  $4\frac{1}{2}$  inches in diameter and are carried on rigid stems 3 feet long.

In 1891 the American Carnation Society was organized to promote the interests of the carnation. By holding exhibitions annually it has assisted materially in popularizing the flower. A system of registering new varieties is in operation, which prevents confusion in nomenclature.

From this country, the improved strain of the perpetual-flowering carnation has returned to European countries, being grown in increased quantities each year and displacing all the older types of carnation for commercial growing.

*Culture of outdoor or flower-garden carnations.* Fig. 808.

Americans are not sufficiently aware of the excellence of some of the forms of the flower-garden or border carnation. While perennial, like the greenhouse carnation, many of them bloom profusely the first year from seed and are described as annuals. The Marguerite type is one of the most useful. These forms bloom by midsummer from early-sown seeds, and with some protection the plants will pass the winter in the open and bloom again the following spring. The Margaret strain, distinct from the Marguerite, bears double flowers, sulfur-yellow, and also blooms the first season from early-sown seed. The Chabaud strains behave similarly. The Grenadins (Fig. 801) bloom the first year from seed. They pro-



805. The modern florists' carnation. High-centered dark-colored bloom.

806. Modern florists' or forcing carnation.

duce fine singles, of simple form and strong fragrance, although more than half of any sowing from improved seed may produce various degrees of double bloom. Riviera Market and others bloom in autumn from spring-sown seeds. The culture of the hardy or flower-

garden carnations is very simple. Their profusion of summer bloom makes them desirable.

The Picotee class (Fig. 804) is little known in this country. It is a hardy perennial in England, and the fine strains are often propagated by layers (Fig. 809). They also do well from seeds, blooming freely the second year.

The Malmaison strain, which was the leading carnation in England before the advent of the Perpetual-flowering strain, has been found of little value in this country. On account of its large size it was used to some extent for breeding purposes, but with unsatisfactory results.

The border carnation is a more condensed and bushy plant than the long-stemmed few-flowered plant seen in the American greenhouses, although there are different families or groups of them as there are of phlox or snapdragons. Some forms are dwarf and some tall-growing.



807. Carnation,  
Little Gem.  
A striped flower.

*American methods of culture for indoor bloom.*

The modern method of propagating the carnation for commercial growing is by means of cuttings which are taken from either the blooming stock or from plants that are grown for cuttings alone. The old method of layering (Fig. 809) would prove too slow in increasing stock for present-day needs. Millions of cuttings are rooted each season for planting the houses for blooming purposes. So much depends on the quality of the cuttings in keeping up the vitality in the stock that expert growers have learned to discriminate in their selection. The best cuttings, if taken from the blooming stock, are those from near the middle of the flower-stems (Fig. 810). These will not only show greater vitality than those taken higher up or lower, but they will prove more floriferous. The tip cuttings are likely to give a flower-bud immediately and, if this is pinched out, develop into a weak plant. Those taken from the base develop a large spreading growth known as "grassy." The cuttings are severed by an outward pull

and are afterward trimmed of all surplus foliage before being inserted in the propagating sand. Have a sharp knife with which to trim and a pail of fresh water into which to throw the cuttings as they are trimmed. Make a smooth cut at the base, near the joint, so that the lower pair of leaves will peel off readily, leaving a half-inch of clear stem to go into the sand. Shorten those leaves which turn outward, leaving those which stand fairly upright. The removal of part of the foliage is to avoid crowding in the bench and also to prevent flagging while the cutting is giving off more moisture through its leaves than it is taking up through the stem. The cuttings are inserted in the sand about  $\frac{3}{4}$  inch deep in rows across the bench, placing the cuttings about  $\frac{3}{4}$  inch apart in the row and the rows about  $2\frac{1}{2}$  inches apart, according to the size of the cuttings. Use a putty knife for making the cut in the sand. The sand is kept constantly moist and the cuttings are protected from both the sun and drafts by means of muslin curtains. Frequent spraying should be avoided, though it must be resorted to at times to prevent flagging on warm windy days. The most favorable conditions for propagating are usually secured during the months of December, January, February and early March. During that period, ventilation is limited and a fairly even bottom-heat is easily maintained. Keep a bottom temperature of about  $60^{\circ}$ , while the overhead temperature should be about  $52^{\circ}$ . Any bench that can be protected from sun and drafts will prove satisfactory.

The bottom of the bench may be of wood or tile, the latter being preferred on account of more perfect drainage and a greater retention of warmth. The sand should be 3 inches deep after being packed down by means of a tool made from a 2-inch plank about 6 inches wide and



808. Flower-garden or outdoor carnation, showing the condensed bushy habit and short flower-stems.

12 inches long with an inverted V-shaped handle. In about four weeks the cuttings should be ready for potting (Fig. 811). Those that come out of the sand February 15 or earlier should be potted first into 2-inch pots and later on shifted into larger pots as needed. Those potted later may be placed directly into  $2\frac{1}{2}$ -inch



pots and left until planted out, the object being to keep the young plants growing steadily until they are planted in the field. Stunted, pot-bound plants will be slow in breaking and are likely to develop stem-rot in the field. Use a moderately light soil and only fairly rich.

When the young plants begin to run up to flower, they should be topped back to about four joints above the pot (Fig. 812). A low-branched plant will stand up better and will give less trouble in supporting later on. A second topping may be necessary before planting-out time, on early-propagated stock. A slight hardening-off of the young plants before planting out is beneficial, though not essential. This is usually done by placing the plants in coldframes about two weeks prior to planting them in the field. Late April or early May is the time for planting in the field, according to latitude and climate. A rich loam, inclined to sandiness, produces the finest plants in the shortest time. In a heavy soil the growth will be heavier, but slower and less branching. Set the plants about 8 inches apart in the rows, and if hand-power is to be employed in cultivating, space the rows about 16 inches apart. Space farther if horse-power is to be used.

When a large business is done in young plants or rooted cuttings, a part of the stock is grown especially for cuttings alone. These plants are benched the same as those for blooming, but are not allowed to



809. Layer of carnation. The parent stem was severed at s. This method is now employed only in special cases.

bloom. As the shoots begin to run up to flower, they are broken off a few joints higher up than is done when topping in the field. The young shoots which result from these breaks are taken off for cuttings, the very finest cuttings being secured in this way. These are trimmed and handled the same as those taken from the flower-stems.

When packing cuttings for shipping, moist sphagnum moss is used in which to pack the roots. Cut papers (newspapers are used mostly) into sheets about 10 by 18 inches. Lay a strip of moss about 3 inches wide across the middle of the paper lengthwise. Then lay the cuttings side by side with only the roots on the moss. When twenty-five have been laid on, begin to roll from one end until all the cuttings have been taken up. Then turn in the lower part of the paper and continue to roll until the end of the paper has been reached and tie around with any kind of cord. There is little difference in the returns from plants grown for cuttings and those grown for blooms, providing a fair market is found for each.

In shipping plants from the field, the soil is all shaken from the roots. The plants are then set upright in the shipping-cases with moist moss between the roots, a layer of damp moss having first been placed on the bottom.

Cultivate as soon as practicable after each rain, and in the absence of rain at least once each week. Shallow cultivating is recommended, just enough to maintain a loose mulch on the surface.

Do not water carnations in the field under any consideration. Cultivation will preserve moisture in the soil without causing soft growth. Keep topping back the young shoots as fast as they begin to run up, thus building up a shapely bushy plant.

If plants are to be placed inside during the summer, the benches should be refilled and made ready for planting as soon after May 1 as possible. It will be a great help to get the plants under way on the benches before hot weather sets in. Fill the benches the same as for field-grown plants and set the plants where they are to bloom. Indoor culture is practicable and profitable only when the benches can be spared by early May. If a good market can be found for the May and June cut, they will more than offset the slight advantage derived in the fall from indoor culture.

If the blooming plants have not made an exceedingly rank growth, they may be cut back sharp early in May, cleaned off, mulched with long manure and grown on for blooming the following year. This should not be attempted, however, unless the plants are free from disease or insects and in good condition to break freely from the lower part of the plant.

Carnations are grown successfully on both raised and solid benches. Perfect drainage is essential, and must be provided for, if solid beds are to be used. There will be no difference in the quality or the quantity if both are properly handled.

By the end of June the old blooming plants will become exhausted, and refilling the benches to receive the new plants from the field will be in order. Clean out the old soil, whitewash the inside of the benches with hot lime and allow to dry before refilling with the new earth. Four inches of soil is enough, and should be of equal depth all over the bench, especially along the edges. The soil should be fairly moist, but not wet when the plants are set, so that the roots may draw moisture from the soil rather than have the soil draw the moisture from the



810. a. Desirable cuttings. b. Weak cutting, too high up on stem. c. Too low on stem.



811. Strong cutting, well rooted.

roots. On the other hand, soil for potting or planting should never be handled while in a wet condition. If too dry at the time of filling the beds, water, and let stand long enough to dry to the proper state before planting.

Apply a light shade of lime or whiting to the glass, to break the fierceness of the summer sun until the plants become established. This shade should not be too heavy, nor intended to darken the house, else a softening and weakening of the growth will result. Lift the plants carefully by means of a spade and leave a ball of soil about the size of the fist on the roots. This ball of soil will greatly assist the plant in re-establishing itself in its new quarters. However, no serious harm will be done should all the soil crumble from the roots without breaking the roots to any considerable extent. Set the plants just about as deep into the soil as they stood in the field and space them about 9 by 12 inches, if plants are of ordinary size. Larger plants may need more, smaller plants less space. It should be borne in mind that the highest quality may be expected only when the plants are not crowded.

After setting a few hundred plants, water each plant individually, saturating the soil thoroughly around each plant, but do not soak the whole bed until the roots become active and the surface of the soil has been worked over and leveled off, which will be about ten days after planting. Spray the plants overhead several times during each day to prevent wilting. Keeping the walks wet will also help to maintain a humid atmosphere until the roots are able to supply the plants with moisture. This transplanting is an ordeal during which the plants are unable to draw on the roots for support until they have taken a new hold on the soil, and wilting must be prevented by artificial means during this time. To allow severe wilting means loss of foliage and a loss of vitality, which results in inferior quality in at least the early part of the season.

As soon as the soil has been leveled off, and most of the weeds gotten rid of, the supports should be put in place. Large growers use one of two styles of supports, or a combination of the two. Wires run lengthwise between the rows, with cotton strings crosswise, placing two or three tiers one above the other to suit the height of the plants is extensively used. Another device is the carnation support, consisting of a wire stake with wire rings to surround each plant.

*Yield of bloom.*—Plants that were benched in the latter part of July, or early August, which is the time to plant for best results, should begin to yield blooms early in September. If flowers are not desired so early, the stems may be broken off about the time the bud appears, but no

general topping should be done after the plants are housed, if a steady cut through the season is desired. Cut the blooms during the early part of the day. They are then fresh and retain their natural colors, much of which would be bleached out of the delicately colored sorts by the sun during a warm day. Place in water at once in a cool room as near 50° as possible. Sort the blooms in separate colors, making two or three grades of quality, tying them into bunches of twenty-five blooms. Cut the stems even at the bottom and replace in water. Avoid crowding the blooms while they are soaking up water, as they will increase 25 per cent in size during the first twenty-four hours in water.

During a season, running from September to the end of the following June, an average cut of twenty blooms per plant may be expected from most varieties. Varieties differ somewhat, according to the size of the blooms, the smaller-flowered sorts usually being the freer bloomers.

*The preparation of the soil for growing carnations is of the greatest importance.* Choose a piece of land which has not been tilled for some years, if possible. If covered with a heavy sod, all the better. The soil should be a loam of good substance, with an inclination toward sandiness. Break this sod in the fall and leave in a rough state during the winter. In the spring plow again and sow to cowpeas or some other leguminous crop. After plowing this under in the fall, manure heavily and leave until the following spring when it should be plowed again. This soil should be in first-

class condition for use the following summer. In working or handling soil, always bear in mind that to handle it while it is wet is to ruin it for immediate use. Only freezing will restore it again. If it will crumble readily, it is safe to handle. Soil which has been prepared in this manner will be rich enough to carry the plants until after the first of the year, when light feeding may be given. Feeding should be done judiciously during the short days of winter, to avoid softening the growth and bloom. Pulverized sheep-manure, dried blood and wood-ashes are used mostly for this purpose. The manure and blood improve the size and quality of the bloom, and the ashes strengthen the stem.

*Ventilation and temperature.*—The carnation being a cool-temperature plant, abundant fresh air and ventilation should be provided for. A steady temperature is essential to success in growing carnations. Splitting of



812. Showing where to top (a) or to head back.



813. Undeveloped five-petaled carnation.



814. Carnation flower showing the calyx which has split on account of poor shape.



the calyx may usually be traced to either irregular temperature or to overdoses of feeding. Any point between 48° and 52° will prove a satisfactory night temperature for most varieties, providing it is evenly maintained. The temperature should be 10° higher during the day. Care should also be exercised, when building, in plac-

ing the ventilators, so that the atmosphere in the house may be changed without causing cold drafts to strike the plants. By placing the ventilators alternately on both sides of the ridge, this may be accomplished. The side ventilators are used only during mild weather.

The modern type of carnation house runs east and west, is of even span and is 30 feet or more in width, having ventilators on both sides of the ridge and in the side walls, if houses are detached. Many ranges are connected by gutters 6 feet or more from the ground. When econ-

815. Carnation flower showing a well-shaped calyx that will seldom burst.

omy in ground is necessary, this is a good plan, but such ranges always contain some benches inferior for growing stock on account of the shade cast by gutters. The single detached house is ideal. See *Greenhouse*.

#### Varieties.

The leading varieties in cultivation in this country at this time are—*White*: White Perfection, White Enchantress, White Wonder, Shasta, Matchless. *Flesh-Pink*: Enchantress, Pink Delight, Mayday, Pres. Valentine. *Rose-Pink*: Rose-Pink Enchantress, Dorothy Gordon, Gloriosa, Mrs. C. W. Ward, Philadelphia Pink. *Dark Pink*: Rosette, Washington, Peerless Pink, Northport. *Scarlet*: Beacon, Victory, St. Nicholas, Herald, Commodore. *Crimson*: Harry Fenn, Octoroon, Pocahontas. *Yellow*: Yellow Prince, Yellowstone. *White Variegated*: Benora, Mrs. B. P. Cheney. *Any other color*: Gorgeous, Rainbow. New varieties are being registered with the American Carnation Society at the rate of about twenty-five each year. Few varieties remain in cultivation longer than ten years, so that the list changes continually.

#### Diseases.

Stemrot (*Rhizoctonia*) is the common wet stemrot which does perhaps more damage than all the other diseases combined, and it is also more difficult to control than any of the others. Its presence does not manifest itself until its damage is wrought, and the plant is seen to wilt and die. The cause of the disease is a fungus which exists in the soil, and which will lie dormant in the soil for several years if there are no plants to attack. Hence no carnations should be planted for several years in soil which is known to have this fungus present.

Species of *Fusarium* cause a slow rot of the heart of the plant; the treatment is same as above.

Carnation-rust (*Uromyces caryophyllinus*) is more common than stemrot, but not nearly so destructive. A slight swelling of the outer tissue of the leaf is the first sign of its presence. Later on this bursts open, releasing a brown-colored powdery substance, comprising the spores by which the fungus is propagated. Keeping the foliage dry and the atmosphere buoyant and bracing will prevent the appearance of this disease. Spraying with bordeaux mixture has been found effective in combating this disease after it has gained a foothold.

Fairy-ring (*Heterosporium echinulatum*) is perhaps the most destructive of

the spot diseases. It is brought on by a humid or foul atmosphere, and must be fought with remedies which will produce the opposite in atmospheric condition. Bordeaux is the standard remedy for all spot diseases.

Bench rot may be caused by any one of a number of organisms attacking the ends of the cuttings in the propagating-bench. It is frequently a very serious disease. The fungi most frequently causing the trouble are in the sand and under the ideal conditions of temperature and moisture of the propagating-bench spread very rapidly. The use of clean sand, free from all organic matter, and the securing of new sand for each lot of cuttings and cleanliness in the propagating-house will help to control this trouble.

#### Insect pests.

A green plant-louse (*Myzus persicae*) is frequently troublesome on carnations. It also attacks a large number of greenhouse and garden plants as well as several fruit trees. Nicotine applied in one of the many forms will destroy it. Spraying and vaporizing are both employed successfully as preventives of the attacks of aphids.

Thrips (*Heliothrips haemorrhoidalis*) are equally destructive and more difficult to control. The same treatment as for aphids is suggested. Sweetened paris green used as a spray is also effective (three gallons of water; two pounds of brown sugar; two table-spoonfuls paris green).

The punctures made by thrips and plant-lice cause yellowish spots on the leaves, a diseased condition known as *stigmose*.

Red-spider (*Tetranychus bimaculatus*) is found mostly where plants grow near steam-pipes, where ventilation is poor, or in houses kept too dry. Persistent syringing with water will usually destroy them if the spray is applied to the under surface. Use much force and little water to avoid drenching the beds. Sulfur as a dust or in water will also destroy them.

The carnation mite (*Pediculus graminum*) injures the buds by transmitting the spores of a fungus (*Sporotrichum poae*) which causes them to decay. The injured buds are easily recognized and should be promptly gathered and burned to prevent further spread of the trouble.

#### Raising new varieties.

It is a long way from the undeveloped five-petaled carnation (Fig. 813) of early days to the perfectly formed full bloom of today. This filling out of the bloom has evolved gradually, and has been assisted by cross-fertilization and selection by the carnation-breeders through the many years in which the flower has been cultivated. This crossing, which has been the means of perfecting the American strain of the perpetual-flowering carnation, has been prosecuted continuously ever since the arrival of the first plants in this country. Many men have found both pleasure and

profit in the work, and those with scientific inclination will find no subject more interesting. Not only have the blooms become larger, but the color has varied widely, the "substance" has been much improved, the calyx has been developed for non-bursting (Figs. 814, 815), the keeping qualities of the flowers have been improved, and the stems have been lengthened.

The operation of pollinating the bloom, or transferring the pollen from one flower to the stigma of another, is a simple matter, and is perhaps of less importance than other parts of the work of producing desirable new varieties.



816. Cross-section of carnation flower showing reproductive organs.



817. Carnation flower Pink Delight, showing nearly entire-edged petals.



The Fig. 816 is a section of a flower showing the reproductive organs; *a* shows the pod which encases the ovules or forming seeds, *b*. From the tip of the pod rises the style which has usually two, but frequently three curved ends, or stigmas, *c*. When the stigma is in the proper stage to be fertilized, which is indicated by the fuzzy appearance of the upper part, the pollen, which is the powdery substance released by the anthers,

*d*, is applied to the fuzzy parts. To prevent self-fertilization, these anthers should be removed from flowers intended to be pollinated, before the pollen is released. Within one to three days, if fertilization has taken place, the bloom will wilt, the ovary will begin to swell and within a week the seed-pod can be seen to increase in size. As soon as the bloom has



818. Carnation flower Radiance, showing deeply serrated petals.

wilted, the petals should be removed and the calyx slit down the sides to prevent water from standing inside the calyx and causing the pod to decay. In six to eight weeks the seeds will be ripe and should be sown at once. Each seed may prove to be the beginning of a variety which will be one of the milestones of progress in the improvement of the carnation. Not one should be discarded until it has bloomed.

The seedlings should be potted as soon as the first pair of character-leaves appears. Later on they may be shifted into larger pots and bloomed, or they may be planted in the field and marked as they bloom and only the promising ones housed in the fall. The selecting of the plants for further trial is of the very greatest importance and requires a thorough knowledge of the subject. There are many points in the make-up of a first-class carnation, and a combination of as many of these as is possible to get in one plant is the object sought. No carnation has ever been found which was perfect in every way. The hybridist must be able to judge correctly as to the relative value or loss represented in certain characteristics shown by a seedling plant. This discrimination between the desirable and undesirable calls for the clearest judgment, and a valuable variety might be discarded through the failure of the grower to see its good points.

Among the seedlings will probably appear variety of colors, shapes and sizes of bloom, different types of growth, perfect in some respects and faulty in others. From these the hybridist is to select those which most nearly represent his ideal of the perfect carnation. This ideal should be of a pleasing shade of color, pure in tone, so as to hold when the bloom ages. The form should be symmetrical, resembling as nearly as possible a half sphere with just enough petals to fill the bloom nicely without crowding. The petals may range from the smooth-edged, as seen in Fig. 817, to the deeply-serrated, as seen in Fig. 818. The texture of the petals should be such as will resist bruising. The odor should be strong clove. The size should be as near 4 inches across as possible under ordinary culture. The calyx should be strong and large enough to hold the petals firmly at all stages of development. The stem should be 30 to 36 inches long, and strong enough to hold the bloom erect. The plant should have a free-growing habit, throwing blooming shoots freely after a shoot is topped or a bloom is cut. It should also be healthy and disease-

resistant. The American Carnation Society uses the following scale of points for new varieties:

Color.....	25
Size.....	20
Calyx.....	5
Stem.....	20
Substance.....	15
Form.....	10
Fragrance.....	5
	100

The most uniform results have been secured by confining the breeding to separate colors; as, for example, crossing white with white, red with red or crimson, pink with pink, and so on. This method has been proved to produce the largest percentage of self-colors, which are considered the most valuable commercially in this country.

New varieties are frequently secured by sporting or mutation. A variety of a certain color may produce a bloom of another color, and by propagating the cuttings from the stem which carried the odd bloom a new variety is established. The securing of a new variety in this way is purely a matter of good fortune, as no method for causing the sporting is yet known.

Leading books on the carnation are: "The American Carnation," by C. W. Ward; "Carnations, Picotees and Pinks," by T. W. Sanders; "Carnations and Pinks," by T. H. Cook, Jas. Douglas and J. F. McLeod; "Carnation Culture," by B. C. Ravenscroft. The last three are English.

A. F. J. BAUR.

**CARNÉGIEA** (named for Andrew Carnegie, philanthropist). *Cactaceæ*. The giant tree cactus of Arizona, California and Mexico.

Large columnar plants, usually single, strongly ribbed, with numerous spines, those from flowering and sterile areoles quite different: fls. borne from the upper areoles, diurnal, funnelform; petals white: fr. an oblong edible berry; seeds black and shining.

*gigantæa*, Brit. & Rose (*Cereus gigantæus*, Engelm.). SUWARRO. (Plate III, Fig. 819.) A tree 20-60 ft. high, usually single, but sometimes with one or more branches: ribs in mature plants 18-21: fr. 2-3 in. long. B.M. 7222. A.G. 11:451, 528.—In rocky valleys and on mountainsides, S. Ariz. and Sonora, with 2 stations in Calif. [reported, but probably not to be found, in Lower Calif.]. This great cactus does not do well in cult., although large plants are often brought into greenhouses and grounds about railroad stations in the S. W. It is not suited for small collections. The fr. is gathered in great quantities by the Indians of Ariz. J. N. ROSE.

**CAROB:** *Ceratonia*.

**CAROLINEA:** *Pachira*.

**CARPENTÈRIA** (after Professor Carpenter, of Louisiana). *Saxifragaceæ*. Ornamental shrub cultivated for its large fragrant white flowers.

Evergreen: lvs. opposite, petioled, usually entire: calyx 5-parted; petals 5; stamens numerous; ovary almost superior, 5-7-celled; styles 5-7, connate at the base, with linear-oblong stigmas: fr. a many-seeded dehiscent caps. with numerous oblong seeds.—One species in Calif.

This is a highly ornamental evergreen plant, with rather large opposite leaves and showy white and fragrant flowers in loose and terminal corymbs. Hardy only in warmer temperate regions. It requires a well-drained, light and sandy soil, and sunny, somewhat sheltered position; it especially dislikes moisture during the winter, and its perishing is more often due to an excess of moisture than to the cold. Propagated by greenwood cuttings under glass in



819. Flower of Carnegiea gigantea. ( $\times \frac{1}{4}$ )



summer, and by suckers, which it produces freely; also, by seeds sown in spring.

**californica**, Torr. Shrub, 6–10 ft.: lvs. elliptic-lanceolate, entire or remotely denticulate, bright green above, whitish-tomentose beneath, 2–4 in. long: fls. pure white,  $2\frac{1}{2}$ –3 in. diam., fragrant; petals orbicular, concave. June, July. B.M. 6911. Gn. 31:100; 34, p. 75; 36, p. 26; 54, p. 248; 76, p. 376. G.C. II. 26:113; III. 40:6, 7; 44:112. R.H. 1884, p. 365. J.H. III. 29:251; 45:107; 59:61. M.D.G. 1913:121. G.M. 31:25; 40:300. G. 29:695. Gn.W. 4:569.

ALFRED REHDER.

#### CARPET-BEDDING: *Bedding*.

**CARPINUS** (ancient Latin name). *Betulaceæ*. HORNBEAM. Trees cultivated for their handsome foliage, assuming bright autumnal tints; also for the light green attractive fruit-clusters.

Deciduous trees or rarely shrubs: winter-buds conspicuous, acute with many imbricate scales: lvs. alternate, petioled, serrate, with deciduous stipules: fls. monœcious; staminate catkins pendulous, each scale bearing 3–13 stamens, 2-forked at the apex; pistillate catkins terminal, slender, each scale bearing 2 ovaries, the bracts and bractlets of which develop into a large, leafy, more or less 3-lobed bract, embracing the small, nut-like fruit at their base.—About 20 species, most of them in Cent. and E. Asia, 5 in Eu. and W. Asia and 1 in N. and Cent. Amer. Monogr. by Winkler in Engler, Pflanzenreich, *Betulaceæ*, hft. 19, pp. 24–43, quoted below as W. B.

The hornbeams are trees usually with dense round head, rarely shrubby, with medium-sized, bright green ovate to lanceolate leaves and rather insignificant flowers appearing with the leaves and followed by pendulous catkins consisting of large bracts bearing a small nutlet in their axils. The wood is very hard and close-grained, and much used in making tools and other small articles. The handsome foliage is rarely attacked by insects, and assumes a yellow or scarlet color in fall. The most beautiful are *C. cordata*, with large leaves, and *C. japonica*, of graceful habit and with elegant foliage. The European hornbeam bears severe pruning well, and is very valuable for high hedges; it was formerly much used in the old formal gardens for this purpose; it makes, also, an excellent game cover, as it retains its withered foliage almost throughout the winter.

The species are of comparatively slow growth and thrive in almost any soil, and even in dry, rocky situations; most of them are quite hardy North. Propagated by seeds, sown usually in fall, germinating very irregularly; if they do not appear the first spring, the seed-bed should be covered until the following spring with moss or leaf-mold, to keep the soil moist. If intended for hedges, the seedlings should be transplanted after the first year, and allowed sufficient space to prevent them from growing into slender tall plants, unfit for hedges. The varieties of rarer species are grafted in spring under glass, or in the open air on seedlings of one of the common species.

A. Lvs. with 7–15 secondary veins: mature catkins with spreading narrow bracts.

**caroliniana**, Walt. (*C. americana*, Michx. *C. virginiana*, Michx. f.). AMERICAN HORNBEAM. BLUE BEECH. Fig. 820. Bushy tree, rarely 40 ft.: lvs. ovate-oblong, usually rounded at the base, acuminate, sharply and doubly serrate, glabrous at length, except in the axils of the veins beneath, 2–4 in. long: fr.-clusters peduncled, 2–4 in. long: bracts ovate or ovate-lanceolate,  $\frac{3}{4}$ –1 in. long, with 2 broad and short unequal lateral lobes, and a much longer middle lobe, usually serrate only on one margin. E. N. Amer., west to Minn. and Texas; also, in Mex. and Cent. Amer. S.S. 9:447. Em. 1:199. Gn. 24, p. 418.—Bushy tree, with dense, but slender and

often somewhat pendulous branches, and dark bluish green foliage, changing to scarlet or orange-yellow in fall.

**Bétulus**, Linn. EUROPEAN HORNBEAM. Tree, to 60 or 70 ft.: lvs. similar to those of the former, cordate or rounded at the base, ovate or oblong-ovate, of somewhat thicker texture, and the veins more impressed above: fr.-clusters 3–5 in. long: bracts over  $1\frac{1}{2}$  in. long, with ovate, lateral lobes, and much longer oblong-lanceolate middle lobe, the margins almost entire or remotely denticulate. Eu. to Persia. H.W. 2:17, pp. 31–33. W.B. 29. F.S.R. 3, p. 153. Gn. 24, pp. 418, 419, 420.—The most remarkable of the garden forms are the following: Var. *incisa*, Ait. (var. *asplenifolia*, Hort.). Lvs. incised or lobed, smaller. Gn. 24, p. 419. Var. *pyramidalis*, Dipp. (var. *fastigiata*, Hort.). Of upright growth. Var. *purpurea*, Dipp. Lvs. purplish when young, green at length.—It grows into a taller tree than the American species, although the former is of more vigorous growth when young; the foliage turns yellow in fall, and remains on the tree throughout the winter.

AA. Lvs. with 15–25 pairs of veins: mature catkins with loosely appressed ovate and dentate bracts, of cone-like appearance.

**japonica**, Blume (*C. Carpinus*, Sarg. *Distocarpus Carpinus*, Sieb. & Zucc.). Tree, to 50 ft.: young branchlets pubescent: lvs. reddish brown when unfolding, oblong-ovate or oblong-lanceolate, 2–4 in. long, acuminate, rounded or subcordate at the base, unequally serrate, with 20–24 pairs of veins deeply impressed above, bright green and glabrous above, beneath brownish pubescent on the veins at first, finally glabrous or nearly so: mature catkins ovoid-oblong, 2 in. long, slender-peduncled; bracts inflexed at the base inclosing the nutlet. Japan. G.F. 6:365. R.H. 1895, p. 427. S.I.F. 1:24.—A very graceful species and quite hardy; sometimes cult. under the name *C. laxiflora*, which is an entirely different species with the lvs. having only 10–14 pairs of veins.

**cordata**, Blume. Tree, to 40 ft.: young branchlets hairy at first, soon glabrous: lvs. ovate or oblong-ovate, acuminate, distinctly cordate at the base, 3–6 in. long, unequally serrate, with 15–20 pairs of veins deeply impressed above, pubescent on the veins beneath or glabrous: mature catkins 2–3 in. long, slender-peduncled; bracts not inflexed at the base, but with an opposite bractlet about as long as the nutlet. Japan, Manchuria, Korea. G.F. 8:295. S.I.F. 1:24.—A very handsome species and quite hardy.

*C. americana*, Michx.=*C. caroliniana*.—*C. duinensis*, Scop.=*C. orientalis*.—*C. laxiflora*, Blume. To 50 ft.: lvs. ovate or elliptic-ovate, long-acuminate, 2–3 in. long, with 10–14 pairs of veins. Japan. S.I.F. 1:25.—Very attractive in fall, with its long and slender catkins. Var. *macrostachya*, Winkl. Lvs. ovate-oblong: fruiting catkins  $2\frac{1}{2}$ –3  $\frac{1}{2}$  in. long. W. China. H.I. 20:1989.—Recently intro.—*C. orientalis*, Mill. Bushy tree, to 15 ft.: lvs. ovate or oblong-ovate,  $1\frac{1}{2}$ –2 in. long, with about 10 pairs of veins. S.E. Eu. to Persia. Gn. 24, p. 418.—*C. Páxii*, Winkl.=*C. Turczaninowii*.—*C. polyneura*, Franch. (*C. Turczaninowii* var. *polyneura*, Winkl.). Small tree: young branchlets pubescent, soon glabrous: lvs. ovate-lanceolate, long-acuminate, usually rounded at the base,  $1\frac{1}{2}$ –2  $\frac{1}{2}$  in. long, with 15–20 pairs of veins; fruiting bractlets ovate to lanceolate, serrate. W. China. W.B. 39.—*C. Turczaninowii*, Hance (*C. Páxii*,



820. *Carpinus caroliniana*. ( $\times\frac{1}{2}$ )

Winkl.) Shrubby tree: lvs. ovate, acute, 1-2 in. long, with 10-12 pairs of veins. N. China.—*C. virginiana*, Michx. f.—*C. caroliniana*.—*C. yedoensis*, Maxim. Small tree: branchlets and lvs. beneath pubescent: lvs. ovate-elliptic or ovate-lanceolate, with about 12 pairs of veins, 2-3 in. long. Japan. S.I.F. 2:11. ALFRED REHDER.

**CARRIÈREA** (after E. A. Carrière, prominent French horticulturist and botanist, died 1896). *Flacourtiaceæ*. Ornamental tree chiefly cultivated for its handsome bright green foliage.

Deciduous: lvs. alternate, long-petioled, serrate: fls. dioecious; sepals 5, broadly ovate, pubescent outside; petals wanting; stamens numerous, shorter than the sepals; ovary 1-celled with numerous ovules, rudimentary in the staminate fls.; styles 3-4, 3-lobed, short and spreading: fr. a dehiscent caps.; seeds winged.—One species, or possibly two, in Cent. China.

This is a medium-sized tree very much resembling *Ilex* in appearance, the apetalous flowers with large white sepals in terminal corymbs or short racemes, the staminate usually many-flowered, the pistillate few-flowered, rarely solitary, and with large capsular long-pointed fruits. It has proved fairly hardy at the Arnold Arboretum. Propagated by seeds; can probably also be propagated like *Ilex* by greenwood and root-cuttings.

**calycina**, Franch. Tree, to 30 ft., with a wide-spreading flat fr. lvs. elliptic or ovate to oblong-obovate, 3-6 in. long, short-acuminate, rounded at the base,



821. Last year's umbel of wild carrot.

lustrous on both surfaces, glabrous, crenately-serrate: sepals broadly cordate-ovate about  $\frac{3}{4}$  in. long and nearly as broad, white: caps. 2-2 $\frac{1}{2}$  in. long, pubescent. Cent. China. R.H. 1896, p. 498. ALFRED REHDER.

**CARROT** (*Daucus Carota*, Linn.). *Umbelliferae*. Garden vegetable, grown for its elongated subterranean crown-tuber.

The carrot is native of Europe and Asia, and one of the bad introduced weeds of eastern North America (Fig. 821). The improved succulent-rooted garden varieties are thought to be descended from the same stock, though this has been denied. It seems probable that the horticultural improvement of the species was begun in Holland, and it is said that the cultivated forms were introduced thence into the gardens of England during the reign of Queen Elizabeth. The carrot is now very generally, though not extensively, cultivated everywhere, both for culinary purposes and for stock-feeding. It is sometimes forced under glass, but to no great extent. Carrots are most useful in culinary practice for soups, stews, and salads, and as this class of cookery has never been reasonably popular in America, this vegetable has not received the attention it deserves.

The carrot is hardy and may be planted as soon as the ground is in fit condition to be properly prepared for seeding. When grown as a market-garden or truck

crop, this early seeding is essential to maximum returns. The best soil for carrots is a medium to light loam, rich, friable and comparatively free from weeds. As the seed is slow to germinate, it is a good plan to sow some quick-germinating seed with the carrot seed so that the rows may be noticed in time to keep them ahead of weed growth. Lettuce serves well for this purpose. When the carrots are thinned, this lettuce is pulled out. The carrot seed is best sown in rows 12 to 15 inches apart, using enough seed to produce a plant every inch or two along the row. When the carrots are 3 to 5 inches high, they should be thinned to stand 3 inches apart in the row. The only further culture necessary is frequent tillage to conserve soil-moisture and to prevent weed growth. The early crop should be ready to pull and bunch for sale seventy-five days after sowing. Early carrots are an important crop on the market-garden and truck-farm. They are pulled as soon as they have attained sufficient size and tied into bunches of three, six or seven roots, according to the size of the roots and the market demands. The earlier the crop and the more active the demand, the smaller the roots which may be salable. A later sowing is made for the main or winter crop or for live-stock. This may be from four to six weeks after the first sowing. The crop is handled in the same manner as the early crop except that it is allowed to continue growth as long as the weather is suitable. It is then pulled, the tops cut from the roots and the roots placed in frost-proof storage for winter sale.

The expense of production of carrots is considerable, but the returns are usually satisfactory. The fall crop should yield 500 to 1,000 bushels to the acre. Truck-growers of the South ship many bunched carrots to the large northern markets in March, April and May, where they meet a ready demand at prices ranging from 35 cents to \$1 per dozen bunches.

There are several distinct market types of carrots, the variation being chiefly with respect to size and shape. The smaller varieties, as they mature more quickly, are used to some extent for the early bunching, while the larger kinds are always more popular in the general market.

The varieties of carrots differ chiefly in respect to size and grain, with differences in earliness closely correlated. The following are now favorite varieties:

**French Forcing** (Earliest Short Horn).—One of the smallest and earliest; root small, almost globular, orange-red.

**Oxheart** or **Guerande**.—Small to medium in size; root 2 to 4 inches long, growing to a blunt point, of good quality and popular in some sections for an early bunch carrot.

**Chantenay**.—Large to medium in size; root 3 to 5 inches long, more tapering than Oxheart; of good quality and a better carrot for the bunched crop than the above.

**Danvers Half-Long**.—Six to 8 inches long, 2 to 3 inches in diameter, at top tapering to a blunt point; the most popular garden carrot grown.

**True Danvers**.—A long carrot, 8 to 12 inches; tapering to a slender point like a parsnip; grown more for live-stock or exhibition purposes. The Half-Long has largely displaced it as a market sort chiefly because of the greater ease with which the latter strain is harvested.

**Half-Long Scarlet**.—Top small, roots medium size, cylindrical, pointed; much used for bunching.

**Early Scarlet Horn**.—Top small, roots half-long, somewhat oval, smooth, fine grain and flavor; a favorite garden sort.

**Large White Belgian**.—Of much larger size than the above-named varieties, of less delicate flavor and coarser texture; a popular variety for live-stock.



The variation in the different strains of carrot seed is marked and it is important to secure seed from carefully selected roots true to shape and color. Carrot seed may be produced in any location in which the crop of roots is grown successfully.

The carrot may be successfully forced under glass and is grown in this way to a limited extent. The small early varieties are used, such as French Forcing, Early Parisian, Early Scarlet Horn and Golden Ball. These will usually be grown as a catch-crop between tomatoes or cucumbers. When grown in this way, the carrot is one of the most delicious of all vegetables, and deserves much wider popularity. See *Forcing*.

The field cultivation of carrots for live-stock differs little from the garden or horticultural treatment except that earliness is not desired, and the longer-rooted later-maturing kinds are mostly used; and less intensive cultivation is employed. See Vol. II, *Cyclo. Amer. Agric.*, p. 540.

F. A. WAUGH and H. F. TOMPSON.

**CARTHAMUS** (Arabic name, alluding to a color yielded by the flowers). *Compósitæ*. Hardy annuals.

Plant 2-3 ft. high, with spiny lvs.: involucre with spreading and leafy outer scales and the inner ones more or less spiny; receptacle chaffy; corolla 5-fid, nearly



822. Garden carrots of the shorthorn type.

regular, smooth, expanded above the tube: achenes glabrous, mostly 4-ribbed, the pappus none or scale-like. —A genus of 20 species, from the Canary Is. to Cent. Asia. Of easiest cult., from seed.

**tinctórius**, Linn. (*Cárduus tinctórius*, Falk.). SAFFLOWER. FALSE SAFFRON. One to 3 ft. high, glabrous, branched: lvs. ovate, spiny-toothed, almost as broad as long: fl.-heads with upward-tapering involucre, and a globular crown of orange florets. Asia.—Florets used like saffron; they have diaphoretic properties and have also been used for dyeing, especially silks; and in making rouge.

N. TAYLOR.†

**CARUELIA:** *Ornithogalum*.

**CARUM** (probably from Caria, in Asia Minor). *Umbelliferae*. Glabrous annual or perennial herbs, some of which yield aromatic and edible garden products.

Leaves pinnate: fls. white or pinkish, small, in compound umbels with involucre and involucels, the calyx-teeth small: fr. ovate or oblong, more or less ribbed, glabrous, or sometimes hispid: root usually tuberous or filiform.—Twenty or more species, widely distributed in temperate regions. The genus is variously defined and understood. *C. Petroselinum*, the parsley, is here kept under the genus *Petroselinum*.

**Cárvi**, Linn. CARAWAY (which see). St. slender but erect, furrowed, 1-2 ft.: lvs. pinnately decompound, with thread-like divisions. Old World.—Sometimes runs wild.

**Gáirdneri**, Gray. St. solitary, 1-4 ft.: lvs. pinnate or the upper ones simple, with 3-7 linear lfts., the upper lfts. usually entire, but the lower ones often divided: fr. with long style. Dry hills, in Calif. and Nev. and to Brit. Col.—Intro. in 1881, by Gillett, as an ornamental plant. Roots tuberous and fusiform.

L. H. B.

**CARÚMBIUM:** *Homalanthus*.

**CÀRYA** (*Karya*, Greek name for the walnut tree). Syn., *Hicòria*. *Juglandaceæ*. HICKORY. Trees grown for their handsome foliage and strong habit, and some species for their edible nuts.

Deciduous: branches with solid pith: lvs. alternate, without stipules, with 3-17 serrate lfts.: fls. monœcious, apetalous, appearing with the lvs.; staminate fls. in axillary, slender, pendulous catkins, each fl. with 3-10 stamens, borne in the axil of a 3-lobed bract; pistillate fls. in a terminal, 2-10-fld. cluster or spike, consisting of a 1-celled ovary inclosed by a 4-lobed involucre: fr. globular to oblong, with a husk separating into 4 valves and a bony nut, incompletely 2-4-celled.—About 18 species of hickory, all in E. N. Amer. from Canada to Mex.; the Chinese species recently described by Dode from nuts only is probably not a *Carya*. See Rep. Mo. Bot. Gard. 7, pp. 28-42, pls. 1-23, and Rep. of U. S. Dept. Agric., Div. Pomol., Nut-Culture (1896), cited below as U. S. N. C. (the first number referring to the plate, the second and third to the figure). By some, *Hicoria* is considered to have priority, but *Carya* is retained as one of the "nomina

conservanda" of the Vienna code of nomenclature, because of its long-established usage.

The hickories are hardy ornamental, usually tall trees with rather large, deciduous odd-pinnate leaves, small greenish flowers, the staminate ones in conspicuous pendulous racemes, and with rather large green dehiscent fruits inclosing a mostly edible nut. The hickories are among the most beautiful and most useful trees of the American forest, and are all very ornamental park trees, with a straight, sometimes high and slender trunk and a large, graceful, pyramidal or oblong head of usually light green foliage, turning from yellow to orange or orange-brown in fall. They are hardy North except *C. Pecan*, *C. aquatica* and *C. myristicæformis*, but *C. Pecan* thrives rarely in Massachusetts in sheltered positions. Most of the species have heavy hard strong and tough wood, much valued for many purposes, especially for handles of tools, manufacture of carriages and wagons, also for making baskets and for fuel. The nuts of some species, as *C. Pecan* and *C. ovata*, also *C. laciniata* and some varieties of *C. glabra* and *C. alba*, are edible, and are sold in large quantities, mostly gathered from the woods, though in later years orchards of improved varieties have been planted. A large number of insects prey upon the hickory, attacking the wood, foliage and fruit, for which see the Fifth Ann. Rep. of the U. S. Entom. Com., pp. 285-329. There are also some fungi sometimes causing an early defoliation of the trees.

The hickories generally thrive best in rich moist soil, but some, especially *C. glabra*, *C. alba* and *C. ovata*, grow equally well in drier localities. They are of rather slow growth, and difficult to transplant if taken from the woods; therefore the seeds are often planted where

the trees are to stand, but if grown in the nursery and transplanted several times when young, trees 6–10 ft. high may be transplanted successfully.

Propagation is usually by seeds stratified and sown in spring in rows about 3 inches deep; named varieties may be grafted in spring in the greenhouse, on potted stock of *C. cordiformis*, which seems to be the best species for this purpose, veneer- or splice-grafting being usually employed; sometimes also increased by root-sprouts. For further horticultural advice, see *Hickory-nut* and *Pecan*.

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A. Scales of buds valvate, 4–6: fr. with winged sutures; nut usually thin-shelled: lfts. 7–15, usually falcate.

B. Nut mostly elongated, almost terete; husk thin, splitting to the base; kernel sweet; cotyledons entire or only notched at the apex.

1. *Pecán*, Engler & Graebn. (*Juglans Pecán*, Marsh. *Hicòria Pecán*, Brit. *C. illinoensis*, Koch. *C. olivæformis*,



823. Foliage and pistillate flowers of *Carya Pecan*.

Nutt.). **PECAN**. Fig. 823. To 170 ft., with branches pubescent when young; bark deeply furrowed, grayish brown: winter-buds yellow: lfts. 11–17, short-stalked, oblong-lanceolate, acuminate, serrate or doubly serrate, tomentose and glandular when young, usually glabrous at length, 4–7 in. long: staminate catkins almost sessile: fr. 3–10 in clusters or spikes, oblong,  $1\frac{1}{2}$ – $3\frac{1}{2}$  in. long; nut ovoid or oblong, smooth, brown, irregularly marked with dark brown, 2-celled at the base; kernel sweet. From Iowa and Ind. south to Ala. 2nd Texas; also in Mex. S.S. 7:338–9. A.G. 12:273–275. U.S.N.C.1, 8, 9.—This species is the most important as a fr. tree, and many named varieties are cult. in the southern states, but it is tender N. The wood is less valuable than that of the other species. Hybrids are known of this species with *C. cordiformis*, *C. alba* and *C. laciniosa*, for which see Rep. Mo. Bot. Gard. 7, pls. 20–23 and Gng. 2:226. See *Pecan*.

2. *myristicæformis*, Nutt. (*Hicòria myristicæformis*, Brit.). **NUTMEG HICKORY**. Tree, to 100 ft., with dark brown bark, broken into appressed scales: winter-buds brown: lfts. 5–11, short-stalked or almost sessile, ovate-lanceolate, the uppermost much larger and obovate, serrate, scurfy-pubescent beneath when young and with brown scales above, at length dark green above, silvery and lustrous beneath, 3–5 in. long: staminate catkins peduncled: fr. generally solitary, short-ovoid or obovate, about  $1\frac{1}{2}$  in. long; nut ovoid, reddish brown marked with irregular spots and stripes, thick-shelled, 4-celled below; kernel sweet. From S. C. to Ark. and Mex. S.S. 7:342–3.—A very decorative species on account of its handsome foliage, but not hardy N.

BB. Nut usually so broad as long, compressed, with irregularly angled or reticulate surface, thin-shelled, 4-celled below; kernel bitter; cotyledons deeply 2-lobed.

3. *aquatica*, Nutt. (*Hicòria aquatica*, Brit.). **WATER HICKORY**. **BITTER PECAN**. Usually small tree, rarely to 100 ft., with light brown bark separating into long, thin plates: winter-buds dark reddish brown: lfts. 7–13, sessile or short-stalked, lanceolate, long-acuminate, finely serrate, yellowish tomentose when young, glabrous at length: fr. 3–4, ovoid to broadly obovate,  $1\frac{1}{2}$  in. long; husk thin, splitting to the base; nut obovate, much compressed, irregularly angled and ridged, dull reddish brown; kernel very bitter. From Va. to Ill., south to Fla. and Texas. S.S. 7:344–5. U.S.N.C. 12, 7–8.

4. *cordiformis*, Koch (*Hicòria minima*, Brit. *C. amara*, Nutt.). **BITTERNUT**. **SWAMP HICKORY**. Tree, to 100 ft.: bark grayish brown, broken into thin scales: young branches and petioles glabrous: winter-buds bright yellow: lfts. 5–9, ovate-lanceolate to lanceolate, acuminate, densely serrate, pubescent when young and glandular, almost glabrous at length, 3–6 in. long: fr. 2–3, broadly obovate or subglobose, winged from the apex to the middle,  $\frac{3}{4}$ – $1\frac{1}{2}$  in. long; husk thin, splitting somewhat below the middle; nut slightly compressed, roundish, abruptly contracted into a short point, smooth, gray; kernel bitter. Que. to Minn., south to Fla. and Texas. S.S. 7:340–1. Em. 226.—A valuable park tree, with handsome rather broad head, growing in cult. more rapidly than other hickories.

AA. Scales of buds imbricate, more than 6: fr. not or slightly winged at the sutures; nut usually thick-shelled, 4-celled below: lfts. 3–9, not falcate, the uppermost larger and generally obovate.

B. Buds small,  $\frac{1}{4}$ – $\frac{1}{2}$  in. long; husk thin; nut slightly or not angled.

C. Lvs. glabrous or only slightly pubescent while young; nut not or only slightly angled, thin-shelled.

5. *glabra*, Sweet (*Hicòria glabra*, Brit. *C. porcina*, Nutt.). **PIGNUT**. Figs. 824, 825. Tree, occasionally to



120 ft., with usually dark gray fissured bark and slender, glabrous branchlets: lfts. 3-7, almost sessile, oblong to oblong-lanceolate, long-acuminate, sharply serrate, almost glabrous, 3-6 in. long: fr. usually ovoid or obovate, the sutures usually slightly winged toward the apex and the husk splitting mostly only half way



824. Characteristic growth of the pignut hickory, *Carya glabra*.

to the base; nut usually brownish, not angled; kernel mostly astringent. Maine to Ont. and south to Fla., Ala. and Miss. S.T.S. 2:179. A.G. 11:386-7. U.S.N.C. 12, 5.—A very handsome park tree, with rather narrow-oblong head, and slender often pendulous branchlets. A very variable tree.

6. *ovális*, Sarg. (*Juglans ovalis*, Wang. *Hicoria microcarpa*, Brit. *H. glabra* var. *microcarpa*, Trel.). SMALL PIGNUT. FALSE SHAGBARK. Figs. 826-829. Tree, similar to the preceding: bark close and furrowed on young trees, shaggy on old trunks: branches first hairy, soon glabrous: lfts. 5-7, sessile, oval, oblong or ovate, 3-6 in. long, acute or acuminate, rounded or narrowed and unequal at the base, coarsely and shallowly toothed, glabrous; terminal lfts. cuneate at the base, short-stalked: fr. subglobose to short-oblong,  $\frac{3}{4}$ -1 in. across, densely scaly and slightly winged, tardily splitting nearly to the base; nut slightly flattened, often broader than high and usually rounded at the apex, sometimes slightly angular, brownish, shell rather thin; kernel small and sweet. Mass. to Wis., south to Ga., Ala., and Miss. A.G. 11:381-383, 1, 2, 5, 8, 10. U.S.N.C. 12, 4, 6. Var. *obcordata*, Sarg. (*J. obcordata*, Muhl. *J. porcina* var. *obcordata*, Pursh. *C. microcarpa*, Darl.). Fr.



825. Ore form of pignut—*C. glabra*. (Natural size.)

nearly globose or ovoid; nut angled, broader than high, sometimes obcordate. S.S. 7:354, figs. 5, 6, 7, 9. Var. *odorata*, Sarg. (*Hicoria glabra* var. *odorata*, Sarg.). Lfts. generally broader, ovate or oblong-ovate, glandular: fr. subglobose or higher than broad, with distinctly winged sutures, splitting freely to the base; nut gray, very slightly ridged, slightly higher than broad. Conn. to Pa. and Mo. S.S.

7:354, fig. 8. Var. *obovalis*, Sarg. Fr. obovoid; nut much compressed, pointed or rounded at the apex, and rounded at the base. Mass. to Va. and Mo. Var. *borealis*, Sarg. (*Hicoria borealis*, Ashe. *C. borealis*, Schneid.). Bark scaly: lfts. usually 5, lanceolate: fr. ovoid, flattened, about  $\frac{3}{4}$  in. long, very narrowly winged and often incompletely splitting; nut ovoid, ridged, whitish; kernel sweet. Mich., Ont. B.T. 236.

cc. Lvs. hairy beneath: nut angled, thick-shelled.

7. *villösa*, Schneid. (*Hicoria villosa*, Ashe. *H. glabra* var. *villösa*, Sarg. *H. pallida*, Ashe). Tree, to 20 or sometimes to 50 ft.: branchlets slender, pubescent mixed with silvery scales, later glabrous: lfts. 5-9, usually 7, sessile or short-stalked, oblong to oblanceolate, 3-5 in. long, acuminate, narrowed at the base, coarsely serrate, when unfolding glandular above, hairy below and with silvery scales; petioles pubescent and with tufts of brownish hairs, finally often glabrous: fr. subglobose to pear-shaped,  $\frac{3}{4}$ -1  $\frac{3}{4}$  in. long, winged; husk thin, splitting to below the middle or nearly to the base; nut slightly angled, somewhat compressed, thick-shelled, pale or light brown; kernel small and sweet. N. J. to Fla., Miss. and E. Texas. S.S. 7:355. G.F. 10:305.



826. Fruit of *C. ovalis*, the false shagbark. (Natural size.)

BB. Buds large,  $\frac{1}{2}$ -1 in. long: nut angled; kernel sweet.

C. Bark not shaggy: branches and petioles tomentose: outer bud-scales falling in autumn: husk not separating quite to the base.

8. *alba*, Koch (*Hicoria alba*, Brit. *C. tomentosa*, Nutt. Not to be confounded with *C. alba*, Nutt., which is *C. ovalis*). MOCKERNUT. BIG-BUD HICKORY. Tree, rarely attaining to 100 ft.: lfts. 7-9, almost sessile, oblong-lanceolate, long-acuminate, usually finely serrate, glandular and tomentose beneath, very fragrant when crushed, 4-8 in. long: fr. globose to pear-shaped,



827. *Carya ovalis*, the false shagbark.

1½-2 in. long; nut light brown, globular to oblong, slightly compressed, angled, narrowed toward the apex, thick-shelled; kernel small, sweet. Mass. to Ont. and Neb., south to Fla. and Texas. S.S. 7:350-1. U.S.N. C. 12, 1-3. Em. 222.



828. Twig of *C. ovalis*.

cc. Bark shaggy, light gray; branches and petioles glabrous or pubescent; husk very thick, separating to the base; outer bud-scales persisting through the winter.

9. *laciniōsa*, Engler & Graebn. (*Hicoria laciniōsa*, Sarg. *H. acumināta*, Dipp. *C. sulcata*, Nutt.). BIG or BOTTOM SHELL-BARK HICKORY. KING-NUT. Tall tree, occasionally to 120 ft.: branchlets orange-red; lfts. 7-9, oblong-lanceolate, acuminate, serrate, pubescent when young, usually glabrous at length, 4-8 in. long; fr. generally oblong, 1¾-2½ in. long; nut yellowish white, oblong, but sometimes as broad as long, slightly compressed and obscurely 4-angled, pointed at both ends; kernel sweet. N. Y. to Iowa, south to Tenn. and Okla. S.S. 7:348-9. U.S. N.C. 11.

10. *ovata*, Koch (*Hicoria ovata*, Brit. *C. alba*, Nutt.). SHAGBARK HICKORY. Also LITTLE SHELLBARK HICKORY, although

the latter name by some is applied to the preceding. Figs. 830, 831. Tree, occasionally to 120 ft.: lfts. generally 5, sessile, oblong or oblong-lanceolate, acuminate, serrate, densely fimbriate, pubescent and glandular when young, glabrous at length, 4-6 in. long; fr. subglobose, about 1½-2½ in. long; nut white, oblong to broadly obovate, 4-angled; kernel sweet. From Que. to Minn., south to Fla. and Texas. S.S. 7:346-7. Em. 217. U.S.N.C. 10. A.G. 11:386, 6, 9; 387, 3; 388, 11. Gng. 7:51. A.F. 14:339.—Next to Pecan the best as a fruit tree, especially for northern states, where the pecan is not quite hardy. Several named varieties are in trade, of which probably var. *Halesii*, Hort., with large, thin-shelled nut, is the best known. An ornamental, often very picturesque tree; the stout branches forming a rather broad, usually somewhat open, head. Var. *Nuttallii*, Sarg. (*C. microcarpa*, Nutt. in part). Fr. smaller; nut rounded, usually obovate, much compressed and prominently angled, about ½ in. across. Mass. to Pa. and Mo. Nuttall, Silv. N. Am. 1:13. Var. *fraxinifolia*, Sarg. Lfts. lanceolate or



829. Habit of the small-fruited pignut, *Carya ovalis*.

nearly oblanceolate, the terminal one 5-6 in. long and 1¾-2 in. wide; fr. generally smaller, ovoid, pointed, 1¼ in. long; nut long-pointed. W. N. Y.

*C. arkansana*, Sarg. Allied to *C. glabra*. Tree, to 70 ft.: bark dark gray, scaly; branchlets pubescent. Lfts. 5-7, lanceolate, densely pubescent when unfolding, glabrous at maturity, 4-7 in. long; fr. ovoid or obovoid; husk usually splitting to the middle; nut slightly obovoid; shell very thick and hard; kernel sweet, small. Ark. and Okla. S.T.S. 2:181.—*C. Buckleyi*, Durand (*C. texana*, Buckl., not DC.). Allied to *C. alba*. Tree, to 50 ft., with dark, furrowed bark; lfts. 7, lanceolate or oblanceolate, pubescent on the veins below, 3-6 in. long; fr. subglobose or ovoid, 1½ in. across; husk thin, splitting to the base; nut reddish brown, veined; shell hard; kernel sweet. Texas to Okla. and Ark. S.T.S. 2:182.—*C. carolinæ-septentrionalis*, Engler & Graebn. (*Hicoria carolinæ-septentrionalis*, Ashe). Allied to *C. ovata*. Branchlets slender; lfts. 3-5, lanceolate, glabrous; fr. smaller; nut thin-shelled. N. C. to Ga. S.S. 14:720.—*C. floridana*, Sarg. Allied to *C. cordiformis*. Buds valvate, brownish yellow; lfts. usually 5, elliptic-oblong to lanceolate, densely scaly beneath, 2-3½ in. long; fr. obovoid, about 1 in. long, husk tardily splitting to the base; nut obovoid or subglobose. Fla. S.T.S. 2:177.—*C. megacarpa*, Sarg. Closely related to *C. glabra*. Bark close; buds larger:



830. Twig of *Carya ovata*.



831. Fruit of *Carya ovata*, the shagbark hickory. The cross-section is to show structure, not to show a good horticultural fruit. (Natural size.)

lfts. to 8 in. long; fr. broadly obovoid, to 1½ in. long; husk thick, tardily dehiscent to the middle; nut obovoid; kernel small, sweet. N.Y. to Mo. and Fla. S.T.S. 2:180.—*C. mexicana*, Engelm. Tree, with shaggy bark and tomentose-pubescent lvs.; fr. depressed, with rather thick husk and broad, sharply 4-angled, white nut. Mex. The only species not native to the U.S.—*C. texana*, DC. (*Hicoria texana*, Le Conte). Similar to *C. Pecan*, but lfts. broader, less falcate, almost sessile; nut smaller, much darker, with somewhat rough surface; kernel bitter. Texas. S. S. 14:719.—*C. texana*, Buckl. = *C. Buckleyi*.

ALFRED REHDER.

**CARYOCAR** (from the Greek word for nut). *Caryocaraceæ*; formerly included in *Ternstroemiaceæ*, and by some referred to *Rhizophoraceæ*. Trees, or rarely shrubs, of about 10 species in Trop. Amer., one of which is well known for its large edible nuts. Lvs. opposite, digitately 3-5-foliate, leathery, often serrate; fls. bractless, in terminal racemes; calyx deeply 5-6-parted, the lobes orbiculate and strongly imbricate; petals 5-6, imbricate; stamens many, somewhat joined at the base; ovary 4-6-celled; fr. drupaceous, with a hard stone or stones and very large seeds. *C. nuciferum*, Linn., produces the souari-nut or butternut of the American tropics. Although native of Guiana, it is cult. in some of the W. Indies isls.: tree, attaining 100 ft. or more, producing durable timber used chiefly in ship-building; lvs. trifoliate, the lfts. elliptic-lanceolate, glabrous; fls. large, purple, the stamens white and very numerous; fr. several inches in diam., nearly globular or becoming misshapen by abortion of the contents, containing 2-4 hard-shelled nuts the size of a hen's egg, and which are flat-kidney-shaped, warty and reddish brown; kernel or meat white, with a nutty or almond-like flavor, and yielding oil when subjected to pressure. B.M. 2727, 2728. The nuts now and then appear in northern markets. The closely allied *C. villosum*, Pers., of Guiana and Brazil, is reported as a notable timber tree; and the oily pulp surrounding the seed is eaten boiled and the kernel of the seed is eaten raw.

L. H. B.

**CARYOPHYLLUS**, the clove tree, is now referred to *Eugenia*.



**CARYOPTERIS** (Greek for *nut* and *wing*). *Verbenaceæ*. Ornamental woody plants grown for their lavender-blue flowers profusely produced in autumn.

Deciduous small shrubs: lvs. opposite, short-petioled, serrate: fls. in axillary cymes; calyx campanulate, deeply 5-lobed with lanceolate teeth, spreading and somewhat enlarged in fr.; corolla 5-lobed, with short cylindric tube and spreading limb, 1 segm. larger and fringed; stamens 4, exserted, 2 of them longer; style slender, 2-parted at the apex: fr. separating into 4 somewhat winged nutlets.—About 6 species in E. Asia.

These are glabrous, pubescent or tomentose shrubs with small blue or violet late flowers. Free-flowering and very valuable for their late blooming season; not hardy North; even if well protected they will be killed almost to the ground, but the young shoots, springing up freely, will flower profusely the same season. They require well-drained and sandy soil and sunny position; if grown in pots, a sandy compost of peat and leaf soil or loam will suit them, and they will flower in the greenhouse until midwinter. Propagated readily by cuttings of half-ripened wood in summer or fall under glass, and by seeds sown in spring.

*incana*, Miq. (*C. Mastacanthus*, Schauer. *C. sinensis*, Dipp.). Fig. 832. Suffrutescent, 1–5 ft.: lvs. petioled, ovate or oblong, coarsely serrate, pubescent above, grayish tomentose beneath, 2–3 in. long: cymes peduncled, dense-flld.; fls. small, violet-blue or lavender-blue. Aug.–Nov. China, Japan. B.R. 32:2. B.M. 6799. R.H. 1892:324. R.B. 19:273. G.C. II. 21:149; III. 42:409. Mn. 5:5. S.H. 2, p. 89. G.W. 6, p. 197. Gn. 24, p. 523; 76, p. 24. G.M. 43:7.—Known in the nursery trade as “blue spirea.” Var. *candida*, Schneid. has white fls.

*C. mongolica*, Bunge. Lvs. lanceolate, almost entire: cymes with fewer but larger fls. R.H. 1872:450. ALFRED REHDER.

**CARYOTA** (old Greek name). *Palmaceæ*, tribe *Arècææ*. FISH-TAIL PALM. Spineless monocarpic palms, with tall stout ringed trunks, at length bearing suckers.

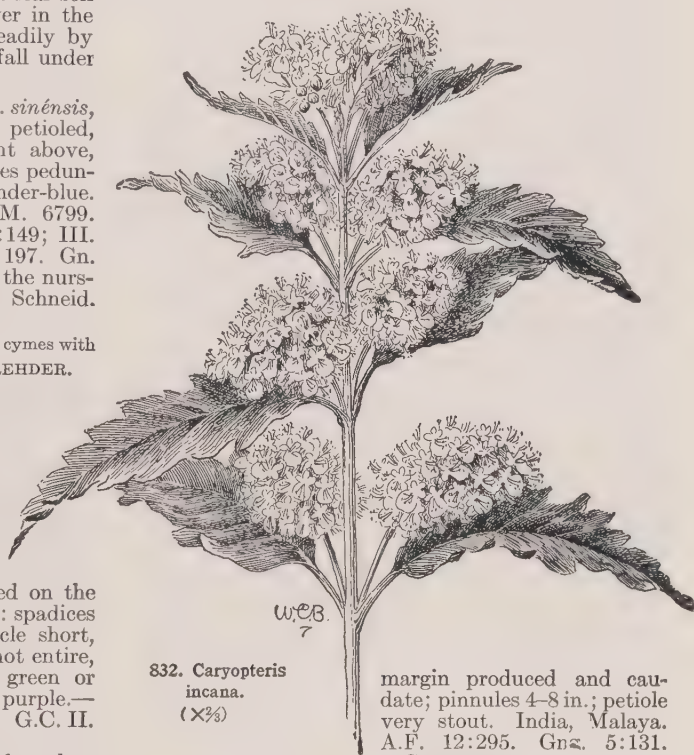
Leaves disposed in an elongated terminal fringe, ample, twice pinnately divided; segms. dimidiate-flabelliform, or cuneate, entire, or split, irregularly dentate, plicate, folded back in the bud; midnerves and primary nerves flabellate; petiole terete below; sheath keeled on the back, fibrous along the margins; ligule short: spadices usually alternately male and female: peduncle short, thick: branches long, pendent: spathes 3–5, not entire, tubular; bractlets broad: fls. rather large, green or purple: fr. the size of a cherry, globular, purple.—Species, 9. Malaya, New Guinea, Austral. G.C. II. 22:748.

These palms are remarkable for the delta-shaped or fish-tail-shaped leaflets, which make the graceful, spreading fronds very attractive. They are excellent warmhouse palms, very useful for decoration, particularly when young. They are frequently planted out in protected places for the summer. *C. urens*, the wine-palm of India, yields, when full grown, about twenty-four pints of wine in twenty-four hours. The beverage is very wholesome and a valuable article of commerce. There being so many different genera to choose from in selecting plants for moderate-sized conservatories, the members of this genus are not very popular for providing small specimens. In a high, roomy structure, however, they are among the most ornamental of the tribe. They are quick-growing, with large broad leaves, finely cut up, the small divisions resembling the tail of a fish; hence the name “fish-tail palm.” After reaching maturity the plant begins flowering at the top, and continues downward until the vitality of the stem is exhausted. Suckers are freely produced by some species, but these, as a rule, do not become so robust as the parent stem, owing probably to the soil becoming

exhausted. Seeds are offered by most dealers. The young plants should be grown in a warm, moist atmosphere, the soil consisting of loam with about one-third of its bulk leaf-mold and sand in equal parts. They sometimes lose their roots if kept too cool and wet in winter. Prop. is by seeds and suckers. (G. W. Oliver.)

*mitis*, Lour. (*C. sobolifera*, Wall. *C. furfuracea*, Blume). Caudex 15–25 ft. high, 4–5 in. diam., soboliferous: petioles, lf.-sheaths and spathes scurfy-villous: lvs. 4–9 ft.; pinnae very obliquely cuneiform, irregularly dentate, upper margins acute; pinnules 4–7 in. long. Burma to Malaya.

*urens*, Linn. WINE-PALM. TODDY PALM. Caudex stout, even in cult. specimens 60–80 ft. high and 18 in. thick, much higher in the wild, not soboliferous: lvs. 18–20 by 10–12 ft.; pinnae 5–6 ft., curved and drooping, very obliquely truncate, acutely serrate, the upper



832. *Caryopteris incana*. (X $\frac{2}{3}$ )

margin produced and caudate; pinnules 4–8 in.; petiole very stout. India, Malaya. A.F. 12:295. Gn. 5:131. A.G. 21:533.

*Rumphiana*, Mart. Lvs. 2-pinnate, several feet long, the pinnules thick, sessile, 6 in. long or nearly so, oblong. Malaya. Var. *Albertii*, Hort. (*C. Albertii*, Muell.), is in the trade. It is large and free-growing, the lvs. being 16–18 ft. long and two-thirds as broad; lf.-segms. fan-shaped and oblique, toothed.

*C. Blanci*, Hort., from the Philippines, has been listed in the American trade. It is probably a form of *C. urens*.

JARED G. SMITH.

CASAREEP: *Blighia*.

CASCARILLA: *Croton*.

CASHEW: *Anacardium occidentale*.

**CASIMIROA** (named in honor of Cardinal Casimiro Gomez de Ortega, Spanish botanist of the eighteenth century). *Rutaceæ*. Evergreen trees, one of which is grown for the edible fruits.

Leaves alternate, long-petioled, digitate, 3–7-foliate; lfts. petiolulate, lanceolate, entire or slightly serrate, smooth or pubescent beneath: fls. regular, poly-

gamo-dioecious; calyx 5-parted, small; petals 5, oblong, valvate, apex incurved; disk inconspicuous, circular; stamens 5, free; filaments subulate; anthers cordate; ovary sessile, on disk, globose, 5- or occasionally 6-8-lobed, 5-celled; stigma sessile, 5-lobed; ovules solitary in the cells, axillary; fr. a drupe, large, depressed-globose; pulp agreeable to taste, edible; seeds oblong, compressed, exalbuminose.—Four species in Mex. and S.

**edulis**, Llav. & Lex. **WHITE SAPOTE.** **COCHIL SAPOTA.** Large tree: trunk ashen gray, with warty excrescences; lvs. dark green, glossy; fls. greenish yellow, small: fr. greenish yellow when ripe, with strong, thick epicarp,  $\frac{1}{2}$  in. thick, about the size of an orange; seeds nearly 1 in. long and half as wide. Mex.—The fr. of this species has a delicious flavor, similar to that of a peach. It is used in Mex. as an aid in inducing sleep, and the lvs. as a remedy for diarrhea. It grows on the coast of Mex. to an altitude of about 7,000 ft. See *Sapote*, *White*.

H. J. WEBBER.

**CASSABANANA:** *Sicana*.

**CASSANDRA:** *Chamædaphne*.

**CASSAVA:** *Manihot*.

**CASSEBEËRA** (from a German botanist). *Polypodiaceæ*. Small Brazilian ferns allied to the maiden-hair, but rarely seen in cult. There are 3 species: sori terminal on the veins, oblong or nearly globular; indusium within the margin and distinct from it. They require hothouse conditions. *C. pinnata*, Kaulf., has fronds 6 in. long, pinnate, the pinnæ linear-oblong and crenate. *C. triphylla*, Kaulf., has 3-5-parted fronds, the parts linear-oblong and crenate. *C. gleichenioides*, Gardn., has twice-pinnate fronds, the pinnules 4-cornered.

**CÁSSIA** (ancient Greek name). *Leguminosæ*. **SENNA.** Herbs, shrubs or trees, a few of which are in cultivation in America, as border plants and under glass.

Leaves even-pinnate: fls. nearly regular (not papilionaceous), with the nearly equal calyx-teeth mostly longer than the tube; corolla of 5 spreading, nearly equal clawed spreading petals; stamens 5-10, frequently unequal and some of the anthers abortive, the good anthers opening at the top; fr. a stalked pod which is either flat or terete, containing numerous seeds and often partitioned crosswise.—Species nearly or quite 400 in the warmer parts of the globe, some of them in cool temperate regions. See page 3566.

The cassias delight in a sunny exposure. Most of those cultivated in the United States are herbs or herb-like shrubs, attractive for the finely cut foliage and the showy flowers. Some of them are cultivated only in the extreme South. *C. corymbosa* is probably the best garden subject. Cassias are summer bloomers, for the most part. Propagation is mostly by divisions and seeds, the annual species always by seeds.

Senna leaves, used in medicine as a cathartic, are derived from various species, chiefly from *C. acutifolia* of Egypt, and *C. angustifolia* of India and other Old World tropics. The "Cassia lignea" of pharmacopœas is the product of a *Cinnamomum*. Cassia pods of commerce, used in medicine, are the fruits of *C. Fistula*. Many of the species contribute to therapeutics. Some of them provide tanning materials.

**A. Hardy border plants: lfts. 5 or more pairs.**

**marylândica**, Linn. **WILD SENNA.** Perennial, glabrous or nearly so, sts. nearly simple: lfts. 5-10 pairs, oblong or lance-oblong and entire, short-acuminate or nearly obtuse: fls. in axillary racemes near the tops of the sts. and often appearing as if panicked, bright yellow, wide open: pods linear, flat. New England, west and south, mostly in wet soil.—Grows 3-4 ft. high, and has attractive light green foliage.

**Chamæcrista**, Linn. (*Chamæcrista nictitans*, Moench). **PARTRIDGE PEA.** Annual, erect or spreading, 2 ft. or

less high: lfts. 10-15 pairs, small, narrow-oblong, mucronate, sensitive to the touch: fls. large, 2-5 together in the axils, canary-yellow and 2 of the petals purple-spotted.—Dry soil, Maine, south and west. Sometimes known as Magothy Bay bean and sensitive pea, and formerly recommended as a green-manuring plant. See *Cyclo. Amer. Agric.*, Vol. II, p. 309, for account and picture.

**AA. Tender plants, grown far south, or under glass: lfts. few or many.**

**B. Tree, with woody indehiscent pods.**

**Fistula**, Linn. **PUDDING-PIPE TREE. GOLDEN SHOWER.** Lvs. large, the lfts. 4-8 pairs, and ovate-acuminate: fls. in long lax racemes, yellow, the pedicels without bracts: pods cylindrical, black, 3-furrowed, 1-2 ft. long, containing 1-seeded compartments. India, but intro. in W. Indies and other tropical countries. Sparingly cult. S.—Furnishes the cassia pods of commerce.

**grândis**, Linn. **PINK SHOWER.** Lfts. 10-20, oblong, abrupt at either end, more or less pubescent beneath and above: fls. in long drooping axillary racemes, rose-colored, without bracts subtending the pedicels: pod 3 in. or less long, compressed-cylindrical, glabrous, transversely rugose. Trop. Amer.; offered in S. Calif., and grown in many tropical countries.

**BB. Shrubs or herbs, with more or less dehiscent pods.**

**Sophëra**, Linn. (*C. schinifolia*, DC. *C. Sophëra*, Auth.). Shrub, 6-10 ft.: lfts. 6-10 pairs, lanceolate-acute: fls. yellow on many-fld. axillary and terminal peduncles, which are shorter than the lvs.: pod thin, tardily dehiscent. Oriental tropics. Intro. in S. Calif.

**corymbösa**, Lam. (*C. floribunda*, Hort.). Shrub, half-hardy in middle states, 4-10 ft.: lfts. 3 pairs, oblong-lanceolate and somewhat falcate, obtuse or nearly so: fls. yellow, in long-stalked, small axillary and terminal corymbs. Argentina. B.M. 633. G.C. III. 31:252. Gn. 50, p. 139. J.H. III. 61:139. G. 25:553. H.F. II. 3:252. G.W. 3, p. 421; 6, p. 391.—The best-known garden species, being an excellent conservatory plant for spring, summer and autumn bloom. It is an old favorite, now coming again into prominence (as *C. floribunda* and var. *A. Boehm*, corrupted apparently into *C. Boema*) as a pot-plant, as a tub specimen for lawns, or for plunging in the border; winters readily in a dormant state in a cellar; very free-flowering.

**tomentösa**, Linn. Shrub, 10-12 ft.: lfts. 6-8 pairs, oval-oblong and obtuse, white-tomentose beneath: fls. deep yellow. Mex.—Said to be a good winter bloomer in S. Calif., and naturalized in some parts.

**artemisoides**, Gaud. Bushy shrub, soft-canescens and gray all over: lfts. 3-4 pairs, very narrow-linear: racemes axillary, 5-8-fld., the fls. sulfur-yellow: pods flat, shining brown. Austral.—Intro. in S. Calif. Withstands drought.

**biflora**, Linn. Shrub, 4-8 ft.: lfts. 6-10 pairs, broad-oblong or obovate-oblong, very obtuse but mucronulate: fls. large, yellow, on 2-4-fld. peduncles, which are shorter than the lvs.: pod 3 in. or less long, oblong-linear or narrower, membranaceous. S. Amer. and W. Indies. B.M. 810.—Sparingly cult. in greenhouses.

*C. lævigata*, Willd. Shrub, glabrous: lfts. 3-4 pairs, ovate-oblong or ovate-lanceolate, acuminate: fls. yellow in terminal and axillary racemes: pod leathery, 2-3 in. long, nearly cylindrical. Tropics.—*C. occidentalis*, Linn. **HEDIONDA.** Annual or subshrubby, widely distributed in the tropics as a weed, the seeds used as a substitute for coffee; it is the "fedegosa" and "negro coffee" of Afr.: lfts. 4-12 pairs, ovate-lanceolate or lanceolate, acuminate, and a gland near the base of the petiole: racemes short and few-fld.: pod glabrous, oblong-linear compressed or nearly cylindrical; the small seeds produced abundantly—*C. splendida*, Vogel. Shrub, 6-10 ft., much branched: fls. bright yellow, very large. S. Amer. Recently catalogued in S. Calif.—Others of the numerous species of Cassia are likely to appear in cult., particularly some of the native kinds; but as a whole, the genus is not rich in horticultural subjects.

L. H. B.



**CASSINE** (a name said to have been used by the Indians in Fla.; see *Ilex Cassine*). *Celastraceæ*. Some 20 or less erect or climbing glabrous shrubs of the Cape region in Afr., apparently not known in cult. in this country. Lvs. opposite, thick, entire or serrate; fls. small, white, in axillary clusters; calyx 4-5-parted, minute; petals 4-5; stamens 4-5, on the disk, which encircles the ovary; fr. a 1-2-seeded drupe, with a hard pit or stone. *C. Colpoon*, Thunb. (or *C. capensis* var. *Colpoon*) is the ladlewood of the Cape, the wood being used in the making of small articles. *C. Maurocenia*, Linn. (now placed in a separate genus, *Maurocenia capensis*, Sond.) is the Hottentot cherry. H.I. 6:55 2.

**CASSIOPE** (Greek mythological name). *Ericaceæ*. Ornamental small shrubs sometimes cultivated for their handsome delicate flowers.

Evergreen: lvs. very small, usually scale-like and opposite, rarely alternate and linear: fls. solitary, axillary, or terminal; calyx small, 5-parted; corolla campanulate, 5-lobed or 5-cleft; stamens 10, the anthers with recurved appendages; style included; fr. a 5-valved caps. with numerous minute seeds.—Ten species in arctic regions and high mountains of N. Amer., N. Eu., N. Asia and Himalayas. Formerly included under *Andromeda*.

Cassiopeas are graceful, delicate plants, adapted for rockeries, flowering in summer. They are of somewhat difficult culture, and require peaty and sandy moist but well-drained soil and partly shaded situation, though *C. hypnoides* grows best in full sun, creeping amongst growing moss. Drought, as well as dry and hot air, is fatal to them. Propagated readily by cuttings from mature wood in August under glass; also by layers and by seeds treated like those of *Erica*.

*C. fastigiata*, Don (*Andromeda fastigiata*, Wall.). Ascending: lvs. imbricate, in 4 rows, with white-fringed margin; fls. axillary, white. Himalayas. B.M. 4796 G.C. III. 47:379 (habit). Gn. 43, p. 189. G. 15:709.—*C. hypnoides*, Don. (*Harrimania hypnoides*, Coville). Creeping: lvs. linear, alternate, crowded; fls. terminal, deeply 5-cleft. Arctic regions. B.M. 2936. L.B.C. 20:1946. G.C. III. 39:226 (habit).—*C. Mertensiana*, Don. Erect or ascending to 1 ft. high: lvs. imbricate in 4 rows, carinate on the back; fls. axillary, white or slightly tinged rosy. Sitka to Calif.—*C. tetragona*, Don (*Andromeda tetragona*, Linn.). Similar to the former, but lower, and the lvs. with a deep furrow on the back. Arctic regions. B.M. 3181. M.D.G. 1910:125, 137 (habit).

ALFRED REHDER.

**CASSIPOURÈA** (a native name in Guiana). *Rhizophoraceæ*. Perhaps a dozen or less species (if the African *Dactylopetalum* is included in the American *Cassipourea*) in Trop. Amer. and in Afr., one of which is now offered. Glabrous trees or shrubs: lvs. opposite or whorled, stalked, somewhat leathery, oblong or lanceolate, entire or somewhat crenate; fls. small or medium in size, white, solitary or fascicled in the axils; calyx 4-5-lobed; petals 4-7, fimbriate, linear or spatulate, inserted in the cup-like disk; stamens 10-30; ovary 2-4-celled: caps. ovoid, somewhat fleshy, tardily dehiscent, the cells 1-seeded. *C. verticillata*, N. E. Br., Natal, a handsome tree, with very shiny foliage: lvs. about 4 in. long and half as broad, in 3's or 4's, lightly crenate-serrate or almost entire; petals 5-7, exserted, very narrow; stamens 10-14.—A rare mangrove-like tree, found at considerable elevations away from the coast. Offered in S. Calif. L. H. B.

**CASTALIA**: *Nymphaea*.

**CASTANEA** (ancient Latin name). *Fagaceæ*. CHESTNUT. Fruit and ornamental trees, grown for their edible nuts and also for their handsome foliage and attractive flowers.

Deciduous trees, rarely shrubs: lvs. alternate, serrate, elliptic-oblong to lanceolate: fls. monœcious, the staminate ones with 6-parted calyx and 10-20 stamens, in long, erect, cylindrical catkins; the pistillate ones on the lower part of the upper catkins, usually 3 together in a prickly involucre; ovary 6-celled: fr. a large

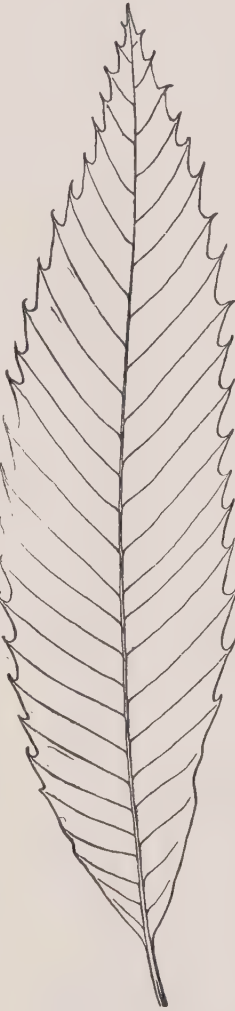
brown nut, 1-7 together in a prickly involucre or bur: winter-buds with 3-4 scales: branchlets without terminal bud.—About ten species in the temperate regions of N. E. Amer., Eu., N. Afr. and Asia.

The chestnuts are very attractive when in bloom. The handsome foliage is generally not injured by insects or fungi, but the whole tree is attacked by a serious disease known as the chestnut bark disease which has spread rapidly during the last years, chiefly in New York, Pennsylvania and the adjacent states. It was first discovered in 1904. It is caused by a fungus,

*Endothia parasitica*, which penetrates the bark, develops its mycelium in bark and sapwood, finally girdles the branch or trunk and causes the death of the portion above the infected place. The presence of reddish pustules on the infected area is a sure sign of the presence of this fungus. The cutting and destroying of the infected parts seems so far the only way of checking the spreading of the disease. This disease was without doubt imported with plants from eastern Asia, as the disease has been discovered recently in China on *C. mollissima*. The latter species and *C. crenata* seem much more resistant than the American and European varieties and there is much hope for a successful selection and breeding of resistant varieties and for keeping this disease under control, as it is done successfully in China.

*C. dentata* and *C. sativa* are large-sized trees, while *C. pumila* and *C. crenata* usually remain shrubby. The coarse-grained wood is much used for furniture, railway ties and fence-posts, as it is very durable in the soil. The chestnut is extensively cultivated in Europe and eastern Asia and also in this country for its edible fruit. It grows best in well-drained soil on sunny slopes, and even in rather dry and rocky situations, but dislikes limestone soil. The American species is perfectly hardy North, while the European species is somewhat tenderer.

Propagated by seeds, sown in fall where there is no danger of them being eaten by mice or squirrels; otherwise they should be stratified in boxes and



833. *Castanea dentata*.  
( $\times \frac{1}{2}$ )

buried 1 or 2 feet deep in a warm soil until early spring, when they are sown in rows about 3 inches deep. If growing well, they can be transplanted the following fall or spring 2 or 3 feet apart from each other, and planted after three or four years where they are to stand. They are also increased by layers in moist soil. Varieties are usually worked on seedling stock or on sprouts by whipgrafting above the ground when the stock is just beginning to push into leaf. Crown-grafting, root-grafting and budding are also sometimes practised, but no method gives wholly satisfactory results, and usually only one-half take well. See *Chestnut*.

A. Nuts 2 or more in one involucre and more or less compressed, usually broader than high.

B. Branchlets glabrous or at first with close white tomentum: lvs. usually glabrous at maturity, often with close white tomentum while young.

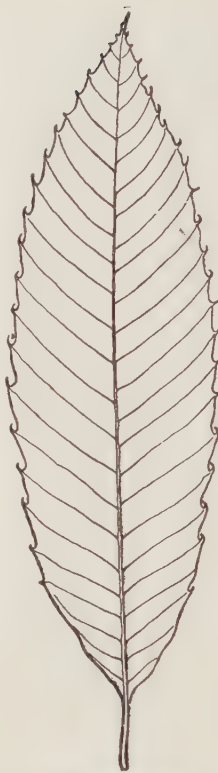
C. Lvs. glabrous or nearly glabrous even while young.

**dentata**, Borkh. (*C. americana*, Raf.). Fig. 833. Tree, occasionally 100 ft.: lvs. cuneate at the base, oblong-lanceolate, acuminate, coarsely serrate, nearly glabrous when young, 6-10 in. long and somewhat pendulous: fls. of heavy fragrance, in June or July: nuts about  $\frac{1}{2}$  in. wide. S. Maine to Mich., south to Ala. and Miss. S.S. 9:440-1. Em. 187. G.F. 10:373. F.E. 14, p. 30; 29, p. 895.—The tallest, most vigorous-growing and hardest species. The nuts, though smaller, have a better flavor than the European varieties. Lvs. said to have sedative properties; used in whooping-cough; bark astringent, tonic, febrifuge.

cc. Lvs. stellate-tomentose beneath while young.

**sativa**, Mill. (*C. vesca*, Gaertn. *C. Castanea*, Karst. *C. vulgaris*, Lam.). Fig. 834. Tree, 50-80 ft.: lvs. oblong-lanceolate, often truncate or rounded at the base, coarsely serrate, slightly pubescent or tomentose beneath when young, nearly glabrous at length, 5-9 in. long, erect: nut over 1 in. wide. June. From S. Eu. and N. Afr. to China. Gn. 27, p. 292; 50, p. 389. Gng. 3:209. G.W. 8, p. 350, 385.—There are some garden forms with variegated lvs., and others, of which var. **asplenifolia**, Lodd., with laciniately cut and divided lvs. is the most remarkable. Of several varieties cult. for their fr., Paragon, a precocious kind, and Numbo, a variety with very large fr., are the most extensively planted in this country. See *Chestnut*.

**crenata**, Sieb. & Zucc. (*C. japonica*, Blume. *C. sativa* var. *pubinervis*, Makino). Fig. 835. Shrub or tree, to 30 ft.: lvs. elliptic or oblong-lanceolate, usually rounded at the base, acuminate, crenately serrate, or the teeth reduced to a long, bristle-like point, slightly pubescent when young, glabrous at length or only pubescent on the veins beneath, 3-7 in. long, erect: nut over 1 in. wide. Japan, China. S. I. F. 1:34.—Shrubby and very precocious; it usually begins to fruit when about six years old. Hardy as far north as Mass.



834. *Castanea sativa*.  
( $\times \frac{1}{2}$ )

BB. Branchlets pubescent, with spreading hairs: lvs. soft-pubescent beneath, at least those toward the end of the shoots.

**mollissima**, Blume. Tree, to 40 ft.: lvs. oval-oblong to oblong-lanceolate, acuminate or short-acuminate, rounded or truncate at the base,  $3\frac{1}{2}$ -6 in. long, coarsely serrate, glabrous above, white-tomentose or nearly green, but soft-pubescent beneath, at least on the veins: petioles pubescent, with spreading hairs: nut about 1 in. wide; spines of the husk pubescent. N. and W. China.—Has proved perfectly hardy at the Arnold Arboretum and is to be recommended for its hardiness and large nuts.

AA. Nuts solitary, round, higher than thick.

**pumila**, Mill. CHINQUAPIN. Shrub or small tree, rarely 50 ft.: lvs. cuneate, elliptic-oblong or oblong-obovate, acute, serrate, teeth often reduced to bristle-like points, white-tomentose beneath, 3-5 in. long: fr. ovate, small, about  $\frac{1}{2}$  in. wide and  $\frac{3}{4}$ -1 in. long. May, June. From Pa. to N. Fla. and Texas. S.S. 9:442-3.—Useful for planting on dry and rocky slopes; attractive when in fl., and again in fall with its abundant light green burs among the dark foliage. The closely allied *C. alnifolia*, Nutt., in the southern states, grows only a few feet high, and has larger lvs. and fr.

**Vilmoriniana**, Dode. Tree, to 80 ft.: branchlets glabrous: lvs. oblong-lanceolate to lanceolate, long-acuminate, usually rounded at the base, the teeth mostly reduced to slender bristles, quite glabrous even while young, 4-7 in. long: fr. globose-ovate, about  $\frac{1}{2}$  in. thick and slightly longer. Cent. China.—A valuable timber tree. Recently intro. by the Arnold Arboretum.

ALFRED REHDER.

CASTANEA of commerce: The nuts of *Bertholletia*.

**CASTANOPSIS** (*Castanea* and *opsis*, chestnut-like) *Fagaceæ*. Ornamental trees or shrubs sometimes cultivated for their handsome evergreen foliage.

Closely allied to *Castanea*, but pistillate fls. usually on separate catkins, sometimes solitary; ovary 3-celled. fr. ripening the second year: involucre sometimes tuberculate; winter-buds with many scales; terminal bud present: lvs. evergreen, entire or dentate.—About 25 species, chiefly in the tropical and subtropical mountains of Asia, and 1 in W. N. Amer., which is the hardest, and is sometimes cult.; also several Chinese species have been recently intro. into cult., but their names have not yet been determined. For prop. see *Castanea*.

**chrysophylla**, DC. (*Castanea chrysophylla*, Hook.). Fig. 836 (adapted from Pacific R. R. Rep.). Tree, to 150 ft., shrubby at high elevations: lvs. ovate-oblong or oblong-lanceolate, narrowed at both ends, entire, dark green above, coated with minute golden yellow scales beneath, 2-6 in. long: nut about  $\frac{1}{2}$  in. wide, usually solitary in the spiny involucre. Summer. Ore. to Calif. S.S. 9:439. B.M. 4953. G.C. III. 22:411; 36:145. Gn. 76, p. 634. F.S. 12:1184. R.B. 7:240.—A highly



835.  
Japanese Chestnut—  
*Castanea crenata*.  
( $\times \frac{1}{2}$ )



ornamental tree with beautiful foliage, hardy only in the warmer temperate regions, but the shrubby form is much hardier.

ALFRED REHDER.

**CATANOSPÉRMUM** (*chestnut seed*, because of the taste of the seeds). *Leguminosæ*. A genus of 2 species, one of which is a tall Australian tree, with odd-pinnate lvs., the lfts. broad, thick, entire: fls. large, yellow-orange, in lateral or axillary loose racemes which are usually about 5 in. long; petals 4; stamens free; ovary long-stipitate, many-ovuled: pod 8-9 in. long with 4-5 seeds larger than Italian chestnuts, globular. *C. australe*, Cunn., is the species known locally



836. *Castanopsis chrysophylla*. ( $\times \frac{1}{4}$ )

as "Moreton Bay chestnut." The seeds are roasted and eaten. Intro. in S. Calif., but not common. The other species is New Caledonian, and apparently not in cult.

**CASTILLÈJA** (a Spanish botanist, D. Castillejo). *Scrophulariææ*. PAINTED-CUP. Herbs with showy bracts in a terminal head or spike, sometimes cultivated.

Flowers small, solitary, in terminal gaudy-bracted spikes; corolla tubular, sometimes flattened laterally, 2-lipped; lower lip smaller, more or less 3-toothed; stamens 4: lvs. alternate, entire or cut—Upwards of 30 species in U. S. and Mex., and 1 in N. Asia. Castillejas are little known in gardens. They are more or less root-parasitic.

*coccinea*, Spreng. Biennial or annual, 1-2 ft., hairy: radical lvs. clustered, ovate or oblong, mostly entire; st.-lvs. lacinate or cleft, and the middle lobe of the bright scarlet bracts dilated: corolla pale yellow, about the length of the calyx. Low grounds and grassy places, Canada, south.

*indivisa*, Engelm. Annual, 1-2 ft.: lvs. lance-linear and entire (or sometimes 2-3-lobed): bracts not lacinate, bright red and showy. Texas.—Blossoms early in spring.

*affinis*, Hook & Arn. Perennial, 1-2 ft.: lvs. narrow-lanceolate, entire or the upper ones toothed at apex: fl.-bracts becoming short and broad, red: spike lax below. Calif., in moist soils.—Intro. 1891 by Orcutt.

*foliolosa*, Hook. & Arn. White-woolly perennial, 1-2 ft., the base woody: lvs. small (1 in. or less long), narrow-linear, crowded or fascicled: bracts 3-parted; spike dense. Calif., in dry soils.—Intro. 1891 by Orcutt.

*integra*, Gray. Perennial, 1 ft. or less, tomentose: lvs. grayish, linear, 3 in. or less long, entire: bracts of the short spike linear-oblong or obovate-oblong, entire or sometimes incised, red or rose. Texas to Ariz. and Colo.—Has been offered in Germany.

L. H. B.

**CASTILLÒA** (for Castillejo, the Spanish botanist). *Morææ*. Laticiferous trees, of which *C. elastica* Cerv., is one of the important rubber-producing plants. There are 2 or 3 species, in Cuba and Cent. Amer. Lvs. alternate, short-petioled, often large, entire or toothed: plant monœcious, the sexes borne in the same cluster; sterile fl. with no perianth, stamens numerous and crowded, with scales intermixed; fertile fls. with 4-lobed perianth, including the short-styled ovary: fr. a crustaceous pericarp containing a pendulous seed. The cult. of *C. elastica* for rubber is described in *Cyclo. Amer. Agric.*, Vol. II, p. 557.

**CASTOR BEAN, CASTOR-OIL PLANT:** *Ricinus*.

**CASUARINA** (said to be derived from *Casuarus*, the Cassowary, from resemblance of the branches to the feathers). *Casuarinææ*. BEEFWOOD. SHE-OAK. Odd slender-branched leafless trees and shrubs grown in warm regions and rarely seen under glass. They are thintopped trees of striking appearance.

Casuarinas are usually classified near the walnut and hickory tribes, although very unlike them—other known plants—in botanical characters. They are jointed and leafless plants, somewhat suggesting equisetums in gross appearance. Flowers are unisexual; staminate in cylindrical terminal spikes, each fl. consisting of a stamen inclosed in 4 scales, 2 of the scales being attached to the filament; pistillate fls. in dense heads borne in the axils, and ripening into globular or oblong cones, composed of 1-ovuled ovaries subtended by bracts: fr. a winged nutlet.—About 25 species in Austral., New Caledonia and E. Indies. The species fall into 2 groups, those having cylindrical and verticillate branches, and those having 4-angled and only imperfectly verticillate branches. The species bear small toothed sheaths at the joints.

Beefwood is planted in the extreme South for its very odd habit, and also to hold sands of the seacoast. The wood burns quickly, and is very hard and durable. The redness of the wood has given the popular name, beefwood.—The species are remarkable for rapid growth. They grow well in brackish and alkaline soils. Propagated by seeds and by cuttings of partly ripened wood.

*equisetifolia*, Linn. Fig. 837. Tree, becoming 150 ft. high in favorable climates, and a most rapid grower: branches drooping, pale green, simple, terete or nearly so, the internodes very short (less than  $\frac{1}{4}$  in.); sheath-teeth 7 (6-8) lanceolate and appressed: staminate cone nearly terete; pistillate cone short-peduncled, ellipsoid, about  $\frac{1}{2}$  in. diam. Widely distributed in the farther Old World tropics, and the best-known species in this country (in S. Fla. and Calif. and south). Gn. M. 7:21. L.B.C. 7:607.—The wood is valuable for many purposes. The casuarinas are known as "oak" in Austral.



837. *Casuarina equisetifolia*. ( $\times \frac{1}{2}$ )

**Cunninghamiana**, Miq. Tree with slender branches, much like *C. equisetifolia*, but cones smaller, about  $\frac{1}{3}$  in. diam., globular and very irregular, with prominent valves. Austral.—Described as a rapid-growing tree in Calif., with strong and dense growth and numerous fine branches with very short internodes.

**stricta**, Dry. (*C. quadrivalvis*, Labill.). Becoming 20–30 ft. high: branches erect, simple, 6–7-angled, scarcely green, internodes short, as in the latter: sheath-teeth usually 7, ovate-lanceolate and appressed: staminate cone slender; pistillate cone nearly sessile, oblong (sometimes staminate above), about 14-sided, 1 in. diam. Austral. Gn.M. 7:21.

**torulosa**, Dry. (*C. tenuissima*, Sieber). Reaches 70 or 80 ft.: branches erect, capillary, mostly terete, internodes short: sheath-teeth 4, very short, triangular appressed: staminate cones filiform; pistillate cones ellipsoidal, 8–10-sided. Austral.

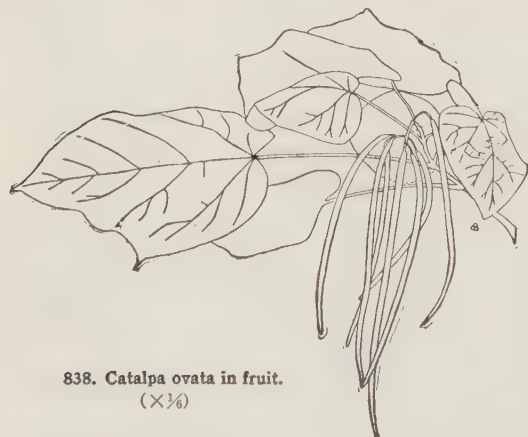
**sumatrana**, Jungh. Shrub with dense very slender branches which are sharply angled, the internodes often very short, the sheath-teeth short: cone large, elliptical or globose, the valves thick and concave-truncate at apex. Sumatra.—Offered in England, and the branches said to be useful for bouquets; very much branched.

L. H. B.

**CATÁLPA** (the Indian name of *C. bignonioides*). *Bignoniaceæ*. Ornamental trees, often cultivated for their handsome flowers appearing in large and showy panicles in summer, and for their heavy foliage.

Leaves usually deciduous, opposite, long-petioled, entire or coarsely lobed: fls. in terminal panicles; calyx splitting irregularly or 2-lipped; corolla campanulate, 2-lipped, with 2 smaller upper and 3 larger lower lobes; fertile stamens 2, curved, with diverging anther-sacs, not exceeding the tube of the corolla; style 2-lobed at the apex, slightly longer than the stamens: fr. a very long cylindrical caps., separating into 2 valves, with numerous small oblong compressed seeds bearing a tuft of white hairs on each end.—About 10 species in N. Amer., W. India and E. Asia, of which 6 are hardy in the northern temperate regions.

Catalpas are deciduous or rarely evergreen trees with opposite or sometimes whorled, long-petioled, large



838. *Catalpa ovata* in fruit.  
( $\times \frac{1}{6}$ )

and simple leaves emitting in most species a disagreeable odor when bruised, and with white, pinkish or yellowish flowers in large and showy panicles followed by very long and narrow cylindrical pods.

The coarse-grained and soft wood is very durable in the ground, and, therefore, much valued for fence-posts and railway ties. *Catalpa bignonioides* and particularly *C. speciosa* are sometimes planted as avenue trees. For formal gardens, if low round-headed trees are desired, *C. bignonioides* var. *nana* is to be recommended. They

grow in almost any somewhat moist soil, and are hardy as far north as New England. Propagated by seeds sown in spring, in the North, best with slight bottom heat, or by cuttings from ripe wood, the varieties often by softwood cuttings in early summer or by grafting on seedlings or on roots under glass in spring; also increased sometimes by layers and root cuttings.

A. Infl. paniculate: lvs. usually pubescent, with simple-hairs.

B. Fls. yellow, striped inside orange and spotted dark violet, less than 1 in. long.

ovata, Don

(*C. Kaempferi*, Sieb. & Zucc. *C. Henryi*, Dode).

Fig. 838. Tree, to 20 ft.: lvs. broadly cordate-ovate, abruptly acuminate, often 3–5-lobed, nearly

glabrous at length, with reddish spots in the axils of the veins beneath, 5–8 in. long; panicles many-fl'd., 4–7 in. long, fragrant. June. China, much cult. in Japan. B.M. 6611. I.H. 9:319. L.I. 10. S.I.F. 2:71.—Hardier than the American species.

BB. Fls. white, with 2 yellow stripes inside, and spotted purplish brown,  $1\frac{1}{2}$ –2 in. long.

**bignonioides**, Walt. (*C. Catalpa*, Karst. *C. syringifolia*, Sims). **CATALPA. INDIAN BEAN.** Tree, 20–50 ft.: lvs. often whorled, cordate-ovate, abruptly acuminate, sometimes with 2 lateral lobes, pubescent beneath, 5–8 in. long, of unpleasant odor: panicles many-fl'd.; fls. about 2 in. diam., thickly spotted inside: pod 6–20 in. long,  $\frac{1}{4}$ – $\frac{1}{3}$  in. thick. June, July. Southern states, north to Tenn., often naturalized elsewhere. B.M. 1094. L.B.C. 13:1285. S.S. 6:288–9. Gng. 6:118–9. G.F. 3:537, 539. J. H. III. 32:121. G.C. III. 21:298; 29:167; 44:10, 312. F.E. 23:479. G.W. 7, p. 88. G. 23:481. G.M. 37:627. Gn. 22, p. 74; 26, p. 164–5; 33, p. 393; 36, p. 239; 66, p. 205.—Usually low tree, with very wide-spreading branches. Not much used medicinally, but pods and seeds said to possess antispasmodic, cardiac, and sedative properties: bark anthelmintic, alterative. There are some garden forms. Var. **alba**, Lav. Lvs. yellow. G.M. 53:709. Var. **nana**, Bur. (*C. Bungei*, Hort., not C. A. Mey.). Forms a dense, round bush, often grafted high. Gng. 3:195. M.D.G. 1903:616. F.E. 14, p. 31.

**speciosa**, Warder. Figs. 839, 840. (*C. cordifolia*, Jaume, partly). **WESTERN CATALPA.** Tree, to 100 ft.: lvs. cordate-ovate, long-acuminate, pubescent beneath, 8–12 in. long; panicles comparatively few-fl'd.; fls. about  $2\frac{1}{2}$  in. diam., inconspicuously spotted inside: pod  $\frac{1}{2}$ – $\frac{3}{4}$  in. thick. June. From S. Ill. and Ind. to La. and Miss. S.S. 6:290–1. R.H. 1895:136. M.D.G. 1903:229–30 (habit).—A very desirable ornamental tree, closely allied to the former, but taller and hardier. Properties similar to *C. bignonioides*. Var. **pulverulenta**, Paul & Son. Lvs. freely dotted with white or cream color. G.M. 53:30. G. 30:289. F.E. 31:319.

**hybrida**, Spaeth (*C. Teasii*, Penhall. *C. Teasiana*, Dode). **HYBRID CATALPA.** Hybrid between *C. bignonioides* and *C. ovata*. Large tree, intermediate between the parents: the lvs. resemble more those of *C. ovata*, and are purplish when unfolding, but much larger and slightly pubescent beneath, while the fls. are more like *C. bignonioides*, but smaller and with the infl. often twice as long. Originated at J. C. Teas' nursery at Baysville, Ind. G.F. 2:305. Gt. 47:1454. G.W. 3, p. 569.—A very valuable tree, flow-



839. *Catalpa speciosa*. ( $\times \frac{2}{3}$ )



ering profusely; of rapid growth and hardy. Seedlings usually resemble *C. ovata*. Var. *japónica*, Rehd. (*C. japónica*, Dode). Lvs. broader and more abruptly acuminate, nearly glabrous beneath. Var. *purpurea*, Rehd. (*C. hybrida* var. *atropurpurea*, Spaeth. *C. bigonioides* var. *purpurea*, Hort.). Lvs. dark purple when young, green at length.

AA. Infl. racemose; pedicels very slender, 1-1½ in. long, occasionally the lower ones with 2 or 3 fls.

B. Lvs. pubescent or tomentose beneath, with branched hairs.

**Fárgesii**, Bur. Tree, to 60 ft.: lvs. ovate, acuminate, rounded at the base, entire, slightly pubescent above, densely beneath, 3-6 in. long: racemes pubescent, 7-10 fld.; fls. about 1½ in. long, rosy pink with purplish brown dots in throat: pod to 2 ft. long, ¼-½ in. thick. W. China. Nouv. Arch. Mus. Paris III. 6:3.

BB. Lvs. quite glabrous.

**Ducloëxii**, Dode (*C. sulchuentensis*, Dode). Tree, to 80 ft.: lvs. ovate, acuminate, usually rounded or subcordate at the base, with purple spots in the axils of the veins beneath, 5-8 in. long and often 4 or 5 in. broad: racemes 5-15 fld., the lower branches sometimes with 2 or 3 fls.; fls. rosy pink with orange markings in throat, 1½-1¾ in. long: pod about 2 ft. long and ¼-½ in. thick. Cent. China.

**Búngei**, C. A. Mey. Small tree: lvs. narrowly triangular-ovate, entire or with 1 or few pointed teeth near the base, long-acuminate, truncate or sometimes broadly cuneate at the base, with purple spots in the axils beneath, 3-6 in. long and not over 3 in. wide: racemes 3-12 fld.; fls. white with purple spot, 1-1½ in. long: pod 12-15 in. long. N. China. Nouv. Arch. Mus. Paris III. 6:4.—Has proved perfectly hardy at the Arnold Arboretum. Var. *heterophylla*, C. A. Mey. (*C. heterophylla*, Dode). Lvs. with several pointed teeth near the base: racemes 3-5 fld.

*C. longissima*, Sims. Tree to 50 ft.: lvs. oblong-ovate, coriaceous: fls. small, white. W. Indies; often planted as shade tree in Cuba.

ALFRED REHDER.

**CATANÁNCHÉ** (Greek name, referring to ancient custom of using the plant in making love-philters). *Compositæ*. Annual or perennial garden herbs, grown for the bloom.

Leaves crowded at the base of the st., and linear or lanceolate: head long-peduncled, blue or yellow: achene oblong, ribbed and usually villous or setose: pappus of 5-7 lanceolate long-acuminate scales.—A half dozen species in the Medit. region. Of easiest cult. in any garden soil, particularly if light. Prop. by seeds and division. Useful for cutting.

**cærulea**, Linn. Perennial, 2 ft.: lvs. tomentose, lanceolate and few-toothed, 3-nerved: fl.-heads 2 in. across, with wide flat-toothed blue rays, on long slender sts. Blooms in June, July and Aug. S. Eu. B.M. 293. R.H. 1890, p. 523. G. 28:541. Gn. 42, p. 25; 55:368. Var. *álba*, Hort., has white fls. Gn. 55:368. Var. *bicolor*, Hort., has white margin and blue center. Often used as everlastings. L. H. B.

**CATASÈTUM** (Greek for *downward* or *backward*, and *bristle*). *Orchidaceæ*. Epiphytic or terrestrial orchids, requiring hothouse conditions.

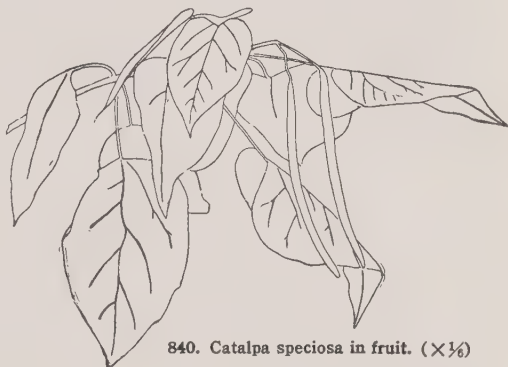
Stems short fusiform: lvs. plaited, membranaceous: scapes basal; fls. in racemes, globose or expanded; labellum fleshy; column erect, provided with sensitive appendages which, when touched, cause the pollen-masses to fly out; pollinia 2. The genus includes *Monachanthus* and *Myanthus*.—There are about 50 or 60 species in the American tropics.

The flowers are in racemes or spikes, firm in texture, and white or in shades of green, yellow, brown or purple. Catasetums are not much cultivated, since most of the species are not showy, but they are interesting to

the botanist and amateur because of the striking ejection of the pollen-masses. Gardeners often have trouble with catasetums, but they are not difficult to grow if given good care. They need a high temperature, long period of rest, and free supply of water during the growing season. They are grown in both pots and baskets. Readily propagated by dividing the plants at the base; also from very ripe pseudobulbs cut in pieces and put in sand. For culture, see *Orchids*.

A. Fls. white.

**Bungerðthii**, N. E. Br. Sts. 8-9 in. tall: sepals larger than the petals, nearly 2 in. long; labellum tending toward concave, roundish; appendages thickish. Ecuador. B.M. 6998. G.C. III. 1:142. I.H. 37:117; 34:10. Gn. 33:388. A.F. 6:633.—A striking plant.



840. *Catalpa speciosa* in fruit. (×¼)

AA. Fls. yellowish, more or less marked with brown or red.

**macrocarpum**, Rich. (*C. Claveringi*, Lindl. *C. tridentatum*, Hook.). Fls. large, nearly 3½ in. across; petals and sepals yellow, verging on green, spotted with reddish brown; labellum yellow. Guiana. B.M. 2559, 3329. I.H. 33:619. Var. *rùbrum*, Hort. A red-fld. form.

**fimbriatum**, Lindl. & Paxt. Pseudobulbs 2-3 in. long: raceme pendulous, 8- or more-fld.; fls. 2½ in. across; sepals whitish or pale yellow, closely barred with red. Brazil. B.M. 7158. A.F. 6:609. Var. *aùreum*, Hort. Fls. pale green, slightly marked with rose, center of lip deep golden yellow.

**longifolium**, Lindl. Pseudobulbs deflexed: lvs. narrow and glaucous, reaching 3 ft.: fls. on drooping, compact spikes; sepals and petals greenish yellow tipped with dull red; lip helmet-like, orange-yellow. Guiana.—Epiphyte.

AAA. Fls. essentially red or brownish.

**decipiens**, Reichb. f. Fls. 1½ in. across; sepals and petals lanceolate, red-brown and spotted; lip saccate, yellowish outside and red-brown inside. Venezuela. A.F. 6:609.

AAAA. Fls. many-colored, grotesque.

**Gnòmus**, André. Pseudobulb oblong-ovate and alternate, articulated: fls. in a long loose raceme on slender pedicels; sepals greenish and purple-barred; 2 lateral petals spreading, concave, purple; lip bluntly conical, olive-green spotted outside, ivory-white within, fringed above. S. Amer. I.H. 24:270. A.F. 12:293.

*C. barbàtum*, Lindl. Fls. green, blotched with purple. Guiana.—*C. callòsum*, Lindl. Odd: fls. with chocolate-brown, narrow-lanceolate sepals and petals; lip greenish, speckled with red. Venezuela. B.M. 4219, 6648.—*C. Christyànum*, Reichb. f. Sepals and petals usually chocolate; lip greenish yellow, purple fringed. S. Amer. (?) G.C. III. 18:617. B.M. 8007.—*C. Claessianum*, Lindl. & Cogn. Fls. greenish yellow; lip fringed along sides. Brazil. G.C. III. 44:211.—*C. Cliftonii*, Hort. Probably a form of *C. Bungerothii*. G.M. 54:593 (desc.).—*C. Còlmanizæ*, Hort. Fine yellow fl. with 3-lobed lip stained with deep crimson.—*C. discolor*, Lindl. Fls. purple. An old sort, now rarely seen. Brazil.—*C. eburneum*, Rolfe.

**Fls.** ivory-white; sac of lip deep yellow. Colombia.—*C. Garnettianum*, Rolfe. Allied to *C. barbatum*. Fls. small; sepals and petals very narrow, green, with large bars of red-brown; lip white, fringed. Amazon. B.M. 7069.—*C. imperiale*, Lind. & Cogn. Sepals and petals ovate-acute, white, purple-spotted; lip orbicular-cordate, purple in center and white-margined. G.C. III. 17:329. S.H. 1, p. 369. J.H. III. 30:25.—*C. labiatum*, Rodr. Scapes  $1\frac{1}{2}$  ft. long, the male 10-fld., female 2-fld. Organ Mts. *C. Lindeni*, Cogn. Fls. large (as of *C. Bungeirothii*); sepals and petals yellow, with purplish spots and bars; lip yellow, spotted at base. G.C. III. 17:329. S.H. 1, p. 369.—*C. maculatum*, Kunth. Sepals acuminate, spotted with claret; petals broader, red-blotched; lip yellowish green outside, dark brown within. Colombia and Nicaragua.—*C. mirabile*, Cogn. Fls. very large, the sepals and petals oblong-lanceolate, and yellowish, with purple spots and bars; lip kidney-shaped, bright yellow with 2 purple spots, toothed. G.C. III. 17:329. S.H. 1, p. 369.—*C. monodon*, Kränzl. Spike long with 6-8 greenish fls.; lip flat, with fringes along border. Brazil. G.C. III. 35:354 (desc.).—*C. pileatum*, Reichb., var. *aureum*, Hort. Fls. creamy white, shaded with greenish yellow. G.M. 47:829, 831.—*C. quadridentis*, Rolfe. Fls. with pair of short, acute teeth situated at lower angles of abortive stigma.—*C. Rhamphastos*, Hort. Raceme few-fld., up to 10 in. long; fls. pale green. Andes of Colombia.—*C. Scirra*, Reichb. f. Compact: fls. fragrant, yellowish white, green-veined; lip 3-lobed. Guiana. G.C. II. 7:304-5.—*C. spinosum*, Lindl. (*Myanthus spinosus*, Hook.). Lip spreading, with succulent hairs, bearing on upper side at base an erect 3-partite spine and a much larger one below the acumen. Brazil. B.M. 3802.—*C. splendens*, Cogn. Intermediate between *C. Bungeirothii* and *C. macrocarpum*. Sepals greenish white with purplish center; petals white with many purple spots; lip cream-color, purple-marked. Runs into many forms: var. *album*, Lind. & Cogn., white or nearly so. Var. *Aliciae*, Lind. & Cogn. Fls. large; sepals and petals purplish; lip white, toothed. Var. *aureo-maculatum*, Bossch. Yellow. I.H. 43:54. Var. *atropurpureum*, Hort. Blackish purple.—*C. tenebrosum*, Kränzl. Fls. almost black, very spreading. Peru. G.C. III. 48:229 (desc.).—*A. Tracayanum*, Hort. A provisional name for a distinct species with whitish green fls.—*C. viridi-flavum*, Hook. Fls. green, the lip conic, yellow inside. Cent. Amer. B.M. 4017.—*C. Warscewiczii*, Lindl. & Paxt. From Panama. Now rarely seen.

OAKES AMES.

L. H. B.†

CATCHFLY: *Silene*.CATECHU: *Acacia Catechu*; *Areca Catechu*.

**CATERPILLARS.** The worm-like pods of *Scorpiurus vermiculata*, Linn., *S. subvillosa*, Linn., and others (*Leguminosæ*), are sometimes used as surprises in salads and soups; and for that purpose they are cultivated in parts of Europe, and seeds are sold in this country. They are sometimes catalogued as Worms. They are annuals of the easiest culture. The pods of *Medicago scutellata*, Mill., and others are known as Snails. The pods are not edible. European plants. A.G. 13:681.

L. H. B.

**CATESBÆA** (Mark Catesby, 1679-1749, author of natural histories of parts of N. Amer.). *Rubiaceæ*. Spiny shrubs of the W. Indies and one (*B. parviflora*) reaching the coast of Fla., of 6 species, one of which is offered in the trade: lvs. small, opposite or fasciculate, mostly ovate or oblong: fls. axillary and solitary, white, sometimes showy, 4-merous; corolla funnel-shaped, with short lobes; stamens 4, inserted deep in the tube: fr. a globular berry. *C. spinosa*, Linn., offered in Fla., is a slow-growing evergreen shrub from the W. Indies: lvs. ovate to obovate, nearly as long as the straight spines: fls. yellow, large and conspicuous, the corolla-tube tapering down to the middle and then very narrow or filiform, the segms. much shorter than the tube: berry ovoid, yellow, edible.—Recommended for hedges.

L. H. B.

**CĀTHA** (Arabian name). *Celastraceæ*. One evergreen spineless shrub of Arabia and Afr., and cult. in warm countries for the lvs., which are said to possess sustaining and recuperative properties and which are eaten by the Arabs or used in the preparation of a beverage. *C. edulis*, Forsk. (*Celastrus edulis*, Vahl). KHAT. CAFTA. Glabrous, to 10 ft.: lvs. opposite, or on the leafy shoots alternate, thick, narrowly elliptic or oval-oblancoate, serrate, narrowed to the short petiole, 4 in. or less long: fls. small, white, in short axillary clusters; calyx 5-lobed; petals 5; stamens 5, borne on a disk: fr. an oblong or clavate caps., 3-valved, 1-3-

seeded,  $\frac{1}{3}$  in. long.—Recently offered in this country. The twigs and lvs. are an object of commerce in Arabia.

L. H. B.

CATMINT or CATNIP: *Nepeta*.

**CATÓPSIS** (Greek compound, of obscure application). *Bromeliaceæ*. Fifteen or more species in Trop. Amer., with strap-shaped or lanceolate mostly rosulate lvs. and spikes or racemes of white or yellow fls. terminating a scape, very little known in cult.: sepals and petals separate to base; stamens shorter than the calyx; stigma subsessile. They require the cultural conditions of the erect tillandsias. *C. nitida*, Griseb. (*Tillandsia nitida*, Hook.), from W. Indies and S., is 6-18 in. tall, with oblong-mucronate shining green lvs. in rosettes, and white fls. in slender spikes. *C. penduliflora*, Wright, from Peru, is recently intro., with oblong-elliptic lvs. (6 in. long) in a rosette and with thin denticulate margins, and white pendulous short-stalked fls. on a racemously branched scape  $1\frac{1}{2}$  ft. high.

CAT-TAIL: *Typha*.

**CATTLEYA** (William Cattley, an early English horticulturist and naturalist). *Orchidaceæ*. Epiphytic orchids, requiring intermediate temperatures.

Pseudobulbs ovoid, clavate, fusiform or cylindric, short or elongated, smooth or furrowed, bearing 1-3 lvs.: lvs. coriaceous: fls. single or in clusters, borne usually at the apex of the pseudobulb, rarely on a leafy st. arising from the base of the pseudobulb, showy; sepals and petals similar or the petals much broader, membranous or fleshy; lip usually 3-lobed; lateral lobes commonly forming a tube inclosing the column, rarely the lateral lobes small; column clavate, fleshy; pollinia 4.—A genus of about 40 species, natives of continental Trop. Amer., especially numerous in Brazil and in the Andean region. Innumerable hybrids and horticultural forms have been named, those of the labiata group alone running into hundreds. Showiest of all orchids, and of great commercial value.

The growing of cattleyas.

The cattleyas are indigenous to the western hemisphere only, Central and South America being the regions in which they abound, particularly in the latter, from the different countries of which large quantities are imported yearly. During the last few years the collecting and importing of cattleyas into the United States has assumed large proportions, owing to a continually and steadily increased demand, not only by amateurs but also by the trade in general. There are two particular reasons for this increased demand: first, the exquisitely beautiful flowers, combined with size and marvelous colors adapted for decorations at all sorts of functions, are never out of place; second, their easy culture. Florists and amateurs alike are beginning to realize that, after all, orchids are plants, and if only treated in a commonsense way they are by far easier to grow than a good many other plants, and especially so the cattleyas, provided some attention is paid to their requirements.

Cattleyas, as a whole, delight in a genial atmosphere, with all the air possible when the outside temperature will permit. In summer, from May on to the end of October, air should be admitted day and night; thus there are no temperatures to be prescribed for these months. Later, when artificial heat has to be depended on, 50° to 55° at night is the best, bearing in mind that the earliest species to flower may be kept at the warmer end, and the later summer-blooming species, such as *C. Mossiæ* and *C. gigas*, may be wintered at the cooler end of the structure; thus beginning in autumn with *C. labiata*, *C. Percivaliana*, *C. Trianae*, *C. Schraederæ*, *C. Mossiæ*, *C. Mendelii*; and, last of all, *C. gigas*, in their regular order of bloom, these may be treated according to their season of flowering. One cannot change the





XXIII. *Cattleya Lawrenceana*.





time of blooming of a cattleya, that is to say force it as other plants may be forced, without injury to the plants and a poor quality of bloom, but they are often retarded by systematic cooler treatment.

The best potting material is the soft brown osmundine, used alone with no sphagnum moss unless it is possible to make this moss live, and even then it is of no value to the plants except as an index to the presence of moisture. Moss that is dead and inert is a detriment in the potting material of all orchids. The one imperative thing in the potting of cattleyas is that they be made perfectly firm in their receptacles; if loose potting is practised, the young roots are injured each time the plant is handled, and the material is like a sponge, holding too much moisture in suspension for the plants to do well, and, given a time when the roots do not dry out quickly, all will soon die.

Newly imported cattleyas, as they arrive from South America, are usually much dried up, due to the treatment given before shipment to avoid loss by decay or fermentation on the way. If the plants are washed well with soap and water, placed in an airy shaded house for a few weeks and allowed to plump up again, roots will soon be seen starting. At this time, pot each piece in a receptacle suitable to the size of the plant (never let it be too large, but always err on the minimum when in doubt), fill the pots half full of drainage if common flower-pots are used, and fill up with osmundine to the top, pressing this material in with a blunt-pointed stick so that the plant will be firm. Moisture from this time on for weeks may be applied by spraying overhead during bright days. If the pieces are large, baskets are preferable to pots, as there is more aëration through the material and the plants may be suspended and space economized. Newly established plants often bloom the first year, and one may get an idea of the infinite variety found among the plants, as no two are alike. Some districts known to collectors produce better forms than others, in fact, in certain localities, the plants found produce flowers of very inferior quality. It is becoming more difficult to collect orchids, especially cattleyas from their native habitats, transportation not having improved and the distance to travel being greater each time. In consequence of this, hybridizers are now turning their attention to the reproduction of fine forms true to themselves, with considerable success, and should the supply of wild plants fail, there cannot now, in view of the well-understood and successful methods of raising cattleyas, be a time when the plants will be unobtainable. Considering the variation found among the wild plants, it is to be expected that home-raised seedlings will vary; but if the best-known forms are used, and these only are worth the trial, one may expect a large measure of success.

In our climate there is no period when the cattleyas should be kept dry at the roots. The plants are either getting ready to bloom, in crop, or recuperating therefrom, and these three periods cover the year. One does not have to resort to drying to attain ripening as do the European cultivators, and failure here is often traceable to foreign training or text-books.

Established plants should be repotted at least every second year. This is as long as the osmundine will remain suitable for the roots to ramify in, and if the plants are grown in pots, immerse the same a day before if the roots are dry, or most of them will remain attached to the pots. Remove all decayed portions of material and roots, wash with clean water, and repot as with newly imported plants, remembering always that a size too large often proves fatal to success. Plants that have been newly potted must not be placed among others that have not received attention, but all should be put in a situation in which they can be treated to little water at the roots for several weeks until the weather is such that there is no danger of their becoming overwatered. Cattleyas should be attended to in

this respect in the winter months, taking first *C. labiata*, as it is the first to start growing, then *C. Trianae*; the later kinds may be potted before flowering with less injury than afterwards, if done with care.

In hot weather, cattleyas should always be watered in the evening or latter part of the day. A generous spraying overhead will supply the moisture at a time when the roots get most of it, as may be seen by an examination in early morning. There is no danger of injury if an abundance of air is supplied. One has only to be careful during such times as the atmosphere outside is surcharged with moisture, then it is wise not to use any moisture inside even for a week at a time. This is when the dreaded "black spot" disease is often seen. It usually begins at the union of leaf and bulb, and when first seen, amputation must be practised to a point below infection, and dry sulfur and powdered charcoal applied at once as an absorbent. A small can of this ought always to be ready to hand, for if the disease gets down to the rhizome, several bulbs will be affected at once, and it is often difficult to save the plant. The disease is also highly infectious and may easily be transmitted to a healthy plant by means of a knife used to cut off diseased parts of another.



841. *Cattleya Mendelii*.

Apart from seeds, the propagation of cattleyas is a slow process to be accomplished only by the cutting of the rhizome between the bulbs, leaving at least three of the leading ones and separating the older ones according to their strength or the dormant buds at the base that are visible. A clean cut or notch that almost severs the rhizome is the best, leaving the parts where they are until new growth and roots are made, then potting in small receptacles, wiring or staking the little pieces firmly. Apart from the three last-made bulbs on the rhizome, the older ones are a source of weakness to the plants and are better removed, and in the case of valuable forms utilized as above. This is the way all duplicates of the many albino varieties have been obtained. There are many white cattleyas bearing the same name, as *C. Trianae alba* or *C. Mossiae Wagneri*, for many have appeared among importations, but these differ in each individual and unless a plant is increased by division one cannot be sure of the same thing.

Opinions are divided as to the "feeding" of orchids. It is certain that when rain-water is saved in cisterns for the plants, and these happen to be in the vicinity of cities where soot collects on the roofs of the houses, the

plants show unusual vigor and in consequence of this, many have practised the use of fertilizers in exceedingly dilute proportions in all the water used on the plants, and some have had surprising results. The temptation, however, is always present to feel that if a little is good, more would be better, and herein lies the danger. When plant-foods are used in solution, they should be considered only as sufficient to make the difference between rain-water and that which comes out of a pipe.

The best twelve varieties of cattleyas for commercial purposes, and, indeed, for amateurs also, are the following: *C. Trianae*, fls. Jan.-March; *C. Schroederæ*, fls. March, Apr.; *C. Mossiæ*, fls. April, May; *C. Mendelii*, fls. Apr., May; *C. Warneri*, fls. May, June; *C. gigas*, fls. June, July; *C. aurea*, fls. June, July; *C. Gaskelliana*, fls. Aug., Sept.; *C. Harrisoniana*, fls. Sept., Oct.; *C. labiata*, fls. Oct., Nov.; *C. Bowringiana*, fls. Oct., Nov.; *C. Percivaliana*, fls. Dec.

With a number of plants of each of the above kinds, it will be seen that it is possible to have a succession of flowers from one end of the year to the other.

E. O. ORPET and JOHN E. LAGER.

The following American trade names belong to Lælia: *C. crispa*, *C. lobata*, *C. marginata*, *C. pumila*. See, also, the list of hybrids at the close of *Cattleya*. For *C. aurantiaca*, see *Epidendrum*.

The cattleyas enter into various generic hybrids: consult, for example, *Brassocattlælia*, *Brassocattleya*, *Brasso-Lælia-Cattleya*, *Epicattleya*, *Læliocattleya*.

Of several of the following species, there are named varieties in the American trade, varying in stature, habit and particularly in the color of the flowers.

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#### KEY TO THE SPECIES.

- A. Infl. terminal.  
B. Lateral lobes of lip small or wanting, the column exposed.  
C. Peduncles 1-2-fl., from a very short spathe or naked: pseudobulb fusiform, short..... 1. Aclandiae  
CC. Peduncles many-fl., from a large spathe: pseudobulbs long..... 2. bicolor  
BB. Lateral lobes of lip large.  
C. Corners recurved, exposing column. 3. dolosa  
CC. Corners not recurved, concealing column.  
D. Pseudobulbs 1-lvd.  
E. Plants large: pseudobulbs fusiform or clavate: fls. large.  
F. Sepals and petals yellow; lip ample, rich purple, beautifully veined and reticulated with gold..... 4. Dowiana  
FF. Sepals and petals not yellow.  
G. Petals about twice as broad as the sepals which are markedly undulate.  
H. Tube narrowly cylindric, the limb not striped.... 5. Lawrenceana  
HH. Tube cylindric-funnelform, the limb bordered with white and streaked with darker color, with a median yellow line.... 6. maxima  
GG. Petals 3 times or more as broad as the sepals which are not undulate or but slightly so.  
H. Lip with a large orange blotch in the center, surrounded by circles of white and purple in order..... 7. Eldorado  
HH. Lip with other color arrangement.  
I. The lip about as wide as or wider than the petals.  
J. Tube of lip yellow; sepals and petals white..... 8. Rex  
JJ. Tube white or colored other than yellow.  
K. Border of limb white, the center bright purple variegated with violet..... 9. Mossiæ  
KK. Limb without white border.  
L. Throat with a yellow or white eye on each side..... 10. Luddemanniana  
LL. Throat without eye.  
M. Color of tube white, or the same as petals; limb purple-crimson.... 11. Mendelii  
MM. Color of tube and limb bright purple; throat with 2 yellow spots... 12. Warszewiczii  
N. The lip narrower than petals.  
J. Limb much shorter than the tube, the margin relatively but little crisped..... 13. Trianae  
JJ. Limb about as long as the tube, the margin much crisped.  
K. Throat with a golden eye on each side.... 14. labiata  
KK. Throat without eye.  
L. Margin of limb different in color from the center.  
M. Petals longer than the sepals and lip; fls. 4½-5 in. across..... 15. Percivaliana



## KEY TO THE SPECIES, continued

- MM. Petals about as long as sepals and lip; fls. 6-7 in. across.....16. *Gaskelliana*
- LL. Limb not margined...17. *Warneri*
- EE. Plants small: pseudobulbs ovate or oblong; fls. small, yellow...18. *luteola*
- DD. Pseudobulbs 2-3-lvd.
- E. Peduncle pendent, bearing usually a single yellow fl.; lip entire.....19. *citrina*
- EE. Peduncle erect, bearing 2-10 fls. or more; lip usually 3-lobed.
- F. Ground-color of sepals and petals not green nor brown.
- G. With large purple spots....20. *amethysto-*
- GG. Not spotted
- H. Fls. 5-10; sepals and petals not fleshy.
- I. Lip emarginate; blooms in fall.....21. *Bowringiana*
- II. Lip acute; blooms in spring.....22. *Skinneri*
- HH. Fls. 2-5; sepals and petals fleshy.
- I. Middle lobe of lip much broader than tube....23. *Victoria-*
- II. Middle lobe of lip not broader than tube. *regina*
- J. Color of sepals and petals pale or white; petals the same width as dorsal sepal....24. *intermedia*
- JJ. Color of sepals and petals marked; petals broader than dorsal sepal.
- K. Lateral lobes of lip and petals acute....25. *violacea*
- KK. Lateral lobes of lip and petals obtuse.
- L. Lip distinctly 3-lobed, the nerves of the disk smooth....26. *Loddigesii*
- LL. Lip indistinctly 3-lobed, the nerves of the disk rugose-thickened.....27. *Harrisoniana*
- FF. Ground-color of sepals and petals brown.....28. *Leopoldii*
- FFF. Ground-color of sepals and petals green.
- G. Lip warty or papillate.
- H. Claw long.....29. *granulosa*
- HH. Claw short or wanting....30. *guttata*
- GG. Lip not warty nor papillate.
- H. Middle lobe much broader than the tube; sepals and petals spotted.....31. *Schilleriana*
- HH. Middle lobe not broader than the tube; sepals and petals not spotted.....32. *Forbesii*
- AA. Infl. from the base of the pseudobulb.
- B. Pseudobulbs 1-lvd.: lateral lobes of lip separated, exposing column....33. *Walkeriana*
- BB. Pseudobulbs 2-lvd.: lateral lobes of lip forming a tube, concealing column.....34. *nobilior*

1. *Aclándiæ*, Lindl. Sts. 4-5 in. tall, bearing 2 or 3 lvs. 2-3 in. long; peduncle with 1 or 2 fls. 3-4 in. across; sepals and petals similar, obtuse, greenish yellow, marked with spots of black-brown; lip fleshy in the middle, somewhat fiddle-shaped, the lateral lobes small, curved over the column, the middle lobe large, broadly reniform, undulate, rose-purple with darker veins. Brazil. B.M. 5039. C.O. 23. There is a var. *nigréscens*.

2. *bicolor*, Lindl. Pseudobulbs cylindric, deeply striate, 1-3 ft. tall, 2-lvd.: lvs. 4-6 in. long, oblong-lanceolate; peduncle with 2-6 fragrant fls. 3-4 in. across; sepals oblong, acute, usually olive or bronze-green, the lateral falcate; petals like the sepals but undulate;

lip crimson-purple, sometimes white-margined, the lateral lobes wanting, the middle lobe recurved, oblong-cuneate, bilobed, channeled in the center. Brazil. B.M. 4909. C.O. 10. O.R. 10:305.

3. *dolôsa*, Reichb. (*C. Walkeriana* var. *dolôsa*, Veitch). Pseudobulbs 4-6 in. long, usually 2-lvd., the lvs. oblong; peduncle 1- or 2-fld.; sepals and petals acute, rose-purple to lilac, the sepals oblong-lanceolate, the petals cuneate-ovate; lip 3-lobed, the lateral lobes erect, the middle lobe reniform, emarginate, amethyst-purple. Brazil. G.C. II. 5:430-1. V.O. 2:49. A.G. 11:159.

4. *Dowiâna*, Batem. (*C. labiata* var. *Dowiâna*, Veitch). Pseudobulbs up to 1 ft. tall, furrowed, 1-lvd.: lvs. up to 1 ft. long; peduncle 2-6-fld.; fls. 6-7 in. across; sepals and petals nankeen-yellow, the sepals lanceolate, acute, less than half as wide as the undulate petals; lip ample, about as long as the petals, the tube yellow, striped with purple, the limb crisped, velvety, dark purple, finely and beautifully veined with golden lines which radiate from the median lines. R.H. 1869:30. A.F. 25:593; 21:838; 30:1078. C.L.A. 11:45; 19:343. Costa Rica, where it was discovered by Warszewicz.—It was rediscovered in 1864 by Mr. Arce, who sent plants to Eu., where they were purchased by Messrs. Veitch & Son, in whose establishment they flowered for the first time. Var. *aûrea*, Williams & Moore (var. *chrysotôxa*, Hort.), has the sepals and petals of a deeper yellow and the golden veins on the lip more copious and anastomosing. Colombia. A.F. 6:563; 12:10. F.R. 1:76. C.O. 2a. O.R. 19:17. Var. *jenseniana*, Hort. A large and handsome form. Var. *rosita*, Hort. Sepals creamy white, tinged with purple; petals rose-purple, tinged with yellow.

5. *Lawrenceana*, Reichb. Pseudobulbs 12-15 in. tall, fusiform-clavate, compressed, furrowed, 1-lvd.: lvs. oblong, 6-9 in. long; peduncle 5-8-fld.; fls. 4-5 in. across; sepals and petals pale rosy purple to almost white, the sepals linear-oblong, the petals elliptic-oblong, undulate, about twice as wide as the sepals; lip with a narrowly cylindric tube, colored externally like the sepals and petals, the limb purple with a maroon blotch. Brit. Guiana. B.M. 7133. R. 1:12.

6. *máxima*, Lindl. Pseudobulbs about 1 ft. tall, claviform, furrowed, compressed, 1-lvd.: lvs. oblong, 5-10 in. long; peduncle 3-6-fld.; fls. 4-5 in. across; sepals and petals lilac or pale rose, acute, the sepals lanceolate-ligulate, the petals about twice as broad as the sepals, undulate or crisped; lip as long as petals, the limb crisped, pale rose or crimson-purple with a median yellow stripe, from which radiate darker lines, the border white. Ecuador and Peru. B.M. 4902. F.S. 20:2136. F.R. 1:298. C.O. 13.

7. *Eldorâdo*, Lind. (*C. labiata* var. *Eldorâdo*, Veitch). Pseudobulbs 6-8 in. tall, stout, 1-lvd.: lvs. oblong, 8-12 in. long; peduncle with 1-3 fragrant fls. 5-6 in. across; sepals and petals pale rosy lilac passing to white, the sepals lanceolate, acute, the petals oval-rhomboid, obtuse, undulate; lip longer than lateral sepals, externally the same color as petals, the limb crisped, emarginate, a large central orange blotch surrounded by zones of white and purple. Brazil. F.S. 18:1826. C.O. 26. Var. *crocata*, Hort. Sepals and petals white or pale rose, the orange spot of lip extended in a broad line to the base. Var. *Wallisii*, Rand. (*C. Wallisii*, Lind.). Fls. pure white except golden spot on lip. C.O. 26a.

8. *Rêx*, O'Brien. Pseudobulbs 8-14 in. tall, claviform or fusiform, furrowed, 1-lvd.: lvs. up to 1 ft. long, oblong; peduncle with 3-6 fls. 6-7 in. across; sepals and petals cream-white, the sepals acutish, linear-oblong, the petals obtuse, as long as sepals but 3 times their width, oval-rhomboid, undulate; lip about as long as lateral sepals, the tube yellow, veined with purple, the limb crisped, the front part margined white surround-

ing a crimson center veined with a lighter shade. Peruvian Andes. B.M. 8377. R.H. 1894:228. C.O. 22.

9. *Móssiæ*, Hook. (*C. Carrièrei*, Houll. *C. labiata* var. *Móssiæ*, Lindl. *C. Peetersii*, André). Pseudobulbs fusiform, compressed, furrowed, 12–15 in. tall, 1-lvd.: lvs. 6–8 in. long, oblong; peduncle with 3–5 fls. 6–7 in. across; sepals and petals rose, of equal length, the sepals lanceolate, the petals oval-elliptic, crisped, especially on upper margin; lip with the tube colored like petals, the limb ample, emarginate, strongly undulate-crisped, the center purple, variegated with violet, the margin white, the throat yellow lined with purple-crimson. La Guayra. B.M. 3669. R.H. 1857, p. 322. S.H. 1:149. O.R. 18:241. C.O. 9. A.G. 14:70. A.F. 6:563. Var. *cærùlea*, Cogn., has the sepals and petals and spot on the limb a pale blue-violet. C.O. 9e. Var. *Reineckiana*, O'Brien (*C. Reineckiana*, Reichb.), has the sepals, petals and external of tube white, the limb a mauve-lilac, bordered white, the throat yellow, veined purple-violet. C.O. 9b. Var. *Wágeneri*, Veitch (*C. Wágeneri*, Reichb.), has fls. white except the small yellow spot on lip. O.R. p. 24. Var. *rouseleana*, Hort., has rosy fls. Var. *oundoniénsis*, Hort. Fls. large and richly colored. Var. *dúlcis*, Hort. Fls. rose-tinted; lip orange in center, rich rose-crimson in front, finely crimped. Var. *boelénsis*, Hort. Dark-colored form. Var. *coeléstis*, Hort. Fls. lavender-tinted. Var. *fúlgens*, Hort. Fine fls. in shape and color. Var. *Alexándræ*, Hort. Fls. pure white with tinge of rose-pink on lip. Var. *álba*, Hort. Fls. white. Var. *Goosensiana*, Hort. Lip deep reddish violet, with white crimped margin; sepals and petals white. Var. *aureòla*, Hort. Fls. large, white. Var. *Flóryæ*, Hort. Fls. pure white.—A variable group.

10. *Luddemanniæ*, Reichb. f. (*C. labiata* var. *Luddemanniæ*, Reichb. f. *C. Dawsonii*, Warner. *C. speciosissima*, Hort. *C. Roëzlii*, Reichb. f. *C. Malouana*, Lind. *C. Bassetii*, Hort.). Pseudobulbs clavate, 8–12 in. tall, 1-lvd.: lvs. oblong, 6–10 in. long; peduncle 2–5 fld.; fls. 5–6 in. across; sepals and petals rose-purple, suffused with white, the sepals oblong, acute, the petals elliptic, undulate; lip with the tube of same color as petals, the front lobe crisped, emarginate, amethyst-purple, the throat with 2 yellow or white blotches, separated by lines of amethyst-purple. Venezuela. C.O. 21. Var.

*álba*, Hort. Fls. white. O.R. 16:201. Var. *Stánleyi*, Hort. Fls. white, disk of lip yellow, front lobe lined with purple.

11. *Méndelii*, Backh. (*C. labiata* var. *Méndelii*, Reichb. f. *C. Mórghanæ*, Williams). Fig. 841. Pseudobulbs 12–16 in. tall, compressed, furrowed, 1-lvd.: lvs. oblong, 6–10 in. long; peduncle with 2 or 3 fls. 7–8 in. across; sepals and petals white, or often tinted pale rosy mauve, the sepals oblong-lanceolate, the petals obliquely oval, obtuse, crisped; lip with the tube white or colored like petals, the front lobe much crisped, rich crimson-purple abruptly passing into the yellow throat which is reddish streaked. Colombia. O.R. 1:273; 10:233. S.H. 2:413. C.O. 19. Var. *Blúntii*, Hort., has the fls. white, except a small yellow spot on lip. Var. *Maùdeæ*, Hort. White with rose markings on the lip. Var. *gigantæa*, Hort., has a very large lip. Var. *hackbridgensis*, Hort. Petals blotched with crimson. Var. *Bértii*, Hort. Fls. white tinted with rose. Var. *leucoglóssa*, Hort. Sepals bluish tinted. Var. *Lôwíæ*, Hort. Lip white, pale purple at apex. Var. *wisetónensis*, Hort. Lip rich rose-purple, delicately veined; throat yellow veined with reddish purple. Var. *macroziána*, Hort. Fls. very large. R.H. 1903, p. 253 (desc.). Var. *Láchneri*, Hort. Lip curiously colored, front lobe having a broad marginal band of dark purple sparingly blotched with white and an inner band of lighter purple. Var. *Piëtíæ*, Hort. Fls. nearly white; lip marked with pink. Var. *majéstica*, Hort. Fls. large, white. Var. *Díxonæ*, Hort. Attractive bluish-pink form. Var. *Lambeanæ*, Hort. Fls. white.

12. *Warscewiczii*, Reichb. f. (*C. labiata* var. *Warscewiczii*, Reichb. f. *C. gloriòsa*, Carr. *C. imperialis*, Wallis). Pseudobulbs 1 ft. or more tall, stout, compressed, furrowed, 1-lvd.: lvs. oblong, 8–10 in. long; peduncle with 2 or 3 fls. 7–9 in. across; sepals and petals rosy mauve, the sepals lanceolate, acute, the petals oval, obtuse, undulate; lip entirely bright purple except 2 yellow spots and lines of the same color in the throat, crisped, the front lobe ample. Colombia. O.R. 12:241. G.C. III. 22:163; 42:312. Gn. 33, p. 18. C.O. 1. Var. *gigas*, Hort. (var. *Sanderiana*, Hort. *C. gigas*, Lind. & André. *C. Sanderiana*, Hort. *C. labiata* var. *Sanderiana*, Hort.). Fig. 842. A noble form, the sepals and petals dark rose, with a deep purple-magenta lip, the fls. larger than those of any other form of the *labiata* group. Colombia. I.H. 21:178. Gn. 45, p. 445. G.F. 1:437. A.G. 19: July 23, suppl. F.R. 1:77, 674. F.E. 10:892. C.L.A. 11:42, 44. The following forms of this variety occur: *álba*, fls. pure white, the rarest of all cattleyas (O.R. 18:232); var. *albescens*, sepals and petals white, with faint blush, the lip rose-purple, fringed; var. *atropurpurea*, of deeper color; var. *rochellensis*, sepals and petals white, the lip with the faintest trace of color. Var. *saturata*, Hort. Fls. bright rose, with ruby-crimson lip.

13. *Triànæ*, Lind. & Reichb. f. (*C. labiata* var. *Triànæ*, Duch. *C. Leànæ*, Sander. *C. Rollissoniana*, Moore. *C. quadricolor*, Batem. *C. Massangeana*, Reichb. f. *C. bogoténsis*, Lind.). Fig. 843. Pseudobulbs about 1 ft. tall, clavate, 1-lvd.: lvs. oblong, 6–8 in. long; peduncle bearing 2 or 3 fls. about 6 in. across; sepals and petals a delicate rose to white, the sepals oblong-lanceolate, the petals much broader than sepals, obtuse, oval-rhomboid, crisped; lip narrower than in the other related forms, the tube rose, the front lobe purple, less crisped than in most of the related species, emarginate, the throat yellow, often streaked with deeper color. Colombia. O.R. 6:145. B.M. 5504. R.H. 1860, pp. 406–7. A.G. 17:177. Gng. 3:151. A.F. 6:607; 13:715. F.E. 9:325. F.R. 1:672–3. C.O. 5.



842. *Cattleya Warscewiczii*  
var. *gigas* ( $\times \frac{1}{2}$ ).



S.H. 1:11, 27; 2:403, 405. Var. *álba*, Hort. Fls. white, except yellow blotch in throat. C.O. 5a. Var. *atropurpurea*, Hort. Fls. crimson-purple. Var. *Backhousiána*, Hort. Sepals and petals rose-purple, the petals strongly marked with amethyst-purple at the apex, the tube of lip rose-purple, the front lobe purple-magenta. C.O. 5e. Var. *chocoénsis*, Hort. Fls. very fragrant,

not fully expanding, the sepals and petals white, sometimes flushed pale lilac. I.H. 20:120. A.F. 6:563. Var. *delicata*, Hort. Sepals and petals white, faintly flushed pale amethyst-purple, the deeper lip with a pale yellow spot. F.M. 1:8. Var. *Schröderæ*, Hort. (*C. Schröderæ*, Reichb. f.). Fls. fragrant, the sepals and petals a delicate blush, faintly suffused with white, the petals and broader lip much more crisped than in other forms of this species. G.C. III. 20:73. A.G. 15:211. O.R. 11:177. C.L.A. 11:45. F.E. 9:331. The following forms of this variety occur: *álba*, the fls. pure white; *albescens*, the fls. nearly white; *cærulea*, the lip a bluish color; *Méta*, sepals and petals pink, the throat bright yellow; *lilacina*, lilac; *refulgens*. Var. *grataxiána*, Hort. A large and richly colored form. Var. *cándida*, Hort. Fls. snow-white; lip with faint violet spot. Var. *coundoniénsis*, Hort. Purple-rose sepals and petals. Var. *Márieæ*, Hort. Silvery white sepals and petals veined with pink; front of lip deep magenta-crimson, with 2 yellow blotches on throat. Var. *triúmphans*, Hort. Sepals and petals rose-colored; lip rich purple with an orange-yellow tube. Var. *enfieldiénsis*, Hort. Fls. white; tip of lip blush-pink. Var. *boetzelaériénsis*, Hort. Rose-colored form. Var. *tessellata*, Hort. Large rose-colored form curiously marked.

Var. *Brandneriána*, Hort. Anterior part of lip dark purple-violet. Var. *Höltzei*, Hort. Lip dark. Var. *Wélesleyæ*, Hort. A pretty white form. Var. *Mooreána*, Hort. Sepals and petals light rosy lilac; lip ruby-claret color, orange at base. Var. *Hölmessii*, Hort. Broad petals and rich rose-purple lip. Var. *brunoyénsis*, Hort. Sepals and petals mauve. Var. *Goodsónii*, Hort. Richly colored; petals flushed with deep rose.

14. *labiata*, Lindl. (*C. Lemoinei*, Lindl. *C. Naldereána*, Reichb. f. *C. Perrinii*, Endl. *C. labiata vera*, Veitch. *C. labiata autumnális*, L. Lind. *C. labiata* var. *Warocqueána*, Rolfe. *C. Warocqueána*, L. Lind.). Pseudobulbs claviform, compressed, furrowed, 4-8 in. tall, 1-lvd.: lvs. 5-7 in. long, ovate or oblong; peduncle, from a double spathe, bearing 3-5 fls. about 6 in. across; sepals and petals usually rose-lilac, the sepals lanceolate, the petals undulate; lip with the tube colored usually like the petals, the front lobe deeply emarginate, undulate-crisped, commonly a violet-purple with deeper veins, the color running in streaks to the yellow throat which has an orange spot each side. The color-variations of this species are numerous. Brazil. B.R. 32:35; 1859. O.R. 16:281. B.M. 3998. Gt. 5:146. F.S. 1893-4. P.M. 4:121. A.G. 17:65; 19:811. G.C. III. 19:13. A.F. 6:607. F.R. 1:8; 2:531.—Intro. from the Organ Mts. in S. Brazil in 1818. Var. *álba*, Hort. Fls. white, except yellow throat. C.O. 3. Var. *Amesiána*, Hort. Sepals and petals white, the lip lilac. Gn. 62, p. 401. Var. *Cooksóniæ*, Hort. Fls. white, except the

crimson-purple lip with a narrow white margin. Var. *superba*, Hort. Sepals and petals deep rose, with a deep crimson-purple lip.

15. *Percivaliána*, O'Brien (*C. labiata* var. *Percivaliána*, Reichb. f.). Pseudobulbs up to 1 ft. tall, clavate, strongly furrowed when old, 1-lvd.: lvs. oblong; peduncle bearing 2 or 3 fls. 4-5 in. across; sepals and petals commonly rose-lilac, tinted purple-amethyst, the sepals linear-lanceolate, the petals longer than the sepals, crisped; lip rather small, shorter than the petals, the tube of the same color as petals, tinged with yellow, the front lobe purple-crimson, shaded with maroon, the undulate border lilac, the throat yellow to orange, streaked with purple. Venezuela. C.O. 7. F.R. 1:297. J.H. III. 32:179. Var. *grandiflora*, Hort. Fls. larger, the sepals and petals bright rose, the petals strongly crisped above, the lip with the tube yellow-orange variegated with rose, the front lobe maroon-purple with a bright rose border, the throat orange-yellow. C.O. 7a. Var. *summiténsis*, Hort. Sepals and petals a pale delicate pink.

16. *Gaskelliana*, Reichb. f. (*C. labiata* var. *pallida*, Williams. *C. labiata* var. *Gaskelliana*, Sander.). Pseudobulbs 8-12 in. tall, oblong-fusiform, compressed, furrowed, 1-lvd.: lvs. 8-12 in. long, oblong; peduncle bearing 2 or 3 lfts. 6-7 in. across; sepals and petals of equal length, commonly purple-violet, suffused with white, the color sometimes deeper and more uniform, rarely marked with a median band of white, the sepals lanceolate, the petals oval, undulate; lip as long as the petals, the tube of same color as petals,

the front lobe emarginate, undulate, purple-violet, with a pale border, the throat yellow streaked with darker yellow, bordered on each side with a zone of yellowish white. Brazil and Venezuela. I.H. 33:613. A.F. 6:185; 30:662. Var. *álba*, Williams. Sepals and petals pure white, the lip cream-white, the throat a pale yellow streaked with darker yellow. C.O. 20a. Var. *cærulea*, Hort. Fls. pure white with bluish spot on base of lip. Var. *Hédgkinsonii*, Hort. Sepals and petals white; front of lip crimson.

17. *Wärneri*, Moore (*C. trilabiata*, Rodr. *C. labiata* var. *Wärneri*, Veitch). Pseudobulbs 4-8 in. tall, cylindrical or fusiform, furrowed, 1-lvd.: lvs. oblong, 6-7 in. long; peduncle with 3-5 fls. 6-8 in. across; sepals and petals rosy mauve, the sepals lanceolate, the petals oval; lip shorter than lateral sepals, the tube the color of the petals, the front lobe strongly crisped, emarginate, bright purple-violet, the throat yellow-orange, streaked with white or pale lilac. Brazil. C.O. 12. A.F. 6:563.—Very like *C. labiata*, but flowering in late spring and early summer. Var. *álba*, Hort. Fls. white, except the pale yellow throat, streaked with orange-yellow. C.O. 12a.

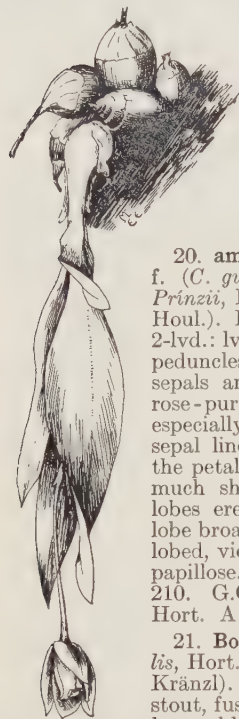
18. *lutæola*, Lindl. (*C. Hölfordii*, Hort. *C. flavida*, Klotzsch. *C. Meyeri*, Regel. *C. modesta*, Mey.). Dwarf: pseudobulbs 2-3 in. long, ovoid, 1-lvd.: lvs. 3-4 in. long, elliptic-oblong; peduncles bearing 2-5 fls. about 2 in. across; sepals and petals similar, yellow, oblong-lanceolate; lip nearly orbicular when spread



843. *Cattleya Trianae* (× 1/2)

out, yellow, the middle lobe crisped, whitish on margin, the side lobes sometimes streaked purple inside. Brazil. B.M. 5032. F.S. 23:2479.

19. *citrina*, Lindl. (*C. Karwinskii*, Mart.). Fig. 844. Pseudobulbs 2-3 in. long, ovoid, 2-3-lvd.: lvs. 4-7 in. long, ligulate, acute, glaucous; peduncle pendent, bearing usually a single fragrant fl., rarely 2 or 3 fls., yellow except the white border of front lobe of lip; sepals oblong, acute, the petals cuneiform-oblong; lip longer than the petals. Mex. B.M. 3742. J.H. III. 30:399. Gn. 33, p. 535. C.O. 6. F.S. 16:1689. Gt. 27:931. R.1:20. Var. *gigantæa*, Hort. Fls. large and intensely colored.



844. *Cattleya citrina*. (× 1/4)

20. *amethystoglôssa*, Lind. & Reichb. f. (*C. guttata* var. *Prinzii*, Reichb. *C. Prinzii*, Hort. *C. guttata* var. *Keteleerii*, Houl.). Pseudobulbs 1½-3 ft., cylindric, 2-lvd.: lvs. 6-12 in. long, elliptic-oblong; peduncles 5-8-fl.; fls. 3½-4½ in. across; sepals and petals white, suffused with rose-purple, spotted amethyst-purple, especially on the upper half, the dorsal sepal linear-oblong, the lateral falcate, the petals obovate, rounded at apex; lip much shorter than petals, the lateral lobes erect, purple at apex, the middle lobe broader than long, emarginate or 2-lobed, violet-purple, the radiating ridges papillose. Brazil. B.M. 5683. R.H. 1869:210. G.C. III. 38:105. Var. *Sänderæ*, Hort. A creamy white form.

21. *Bowringiana* Veitch (*C. autumnalis*, Hort. *C. Skinneri* var. *Bowringiana*, Kränzl). Pseudobulbs 10-20 in. tall, stout, fusiform above, 2-lvd.: lvs. 6-8 in. long, oblong; peduncle bearing 5-12 fls. 2½-3 in. across; sepals, petals, and tube of the lip rose-purple, the sepals acute, oblong, somewhat undulate, the petals oval-oblong, obtuse, undulate; lip shorter than the lateral sepals, the front lobe emarginate, the throat with a large white spot, surrounded by a zone of bright maroon and bordered with deep purple. Honduras. R.B. 21:37. R.H. 1890:300. G.C. III. 39:114. A.F. 19:651; 34:804. C.O. 24. O.R. 12:361; 16:337. Var. *triumphans*, Hort. Fls. rich purple.

22. *Skinneri*, Lindl. (*Epidendrum Hügelianum*, Reichb.). FLOWER OF ST. SEBASTIAN. Pseudobulbs 5-10 in. tall, 2-lvd.: lvs. 6-8 in. long, oblong-oval; peduncle bearing 5-10 fls. 3½-5 in. across, rose-purple except the white throat of the lip, the sepals elliptic-lanceolate, acutish, the petals oval-oblong, broader than the sepals; lip with the front lobe acute. Guatemala to Costa Rica. B.M. 4270. P.M. 11:193. R.B. 22:201. G.C. III. 20:6. G.F. 3:201. C.O. 30. Var. *alba*, Hort. Fls. white.

23. *Victória-regina*, O'Brien. Pseudobulbs 1-1½ ft. tall, somewhat compressed and clavate, 1-2-lvd.: lvs. 3-6 in. long, oblong or elliptic-oblong; peduncle bearing 2-5 fls., rarely more, 5-6 in. across; sepals purple a little tinged with yellow, striated with darker purple, oblong-lanceolate, obtuse, the petals purple tinged with violet, obliquely striated with darker purple, elliptic-oblong, obtuse, undulate; lip distinctly 3-lobed, the lateral lobes exteriorly white or flushed with rose, violet-purple at the obtuse apex and inside, the front lobe reniform, bright rose-violet, crisped, the disk yellow streaked purple. Pernambuco. G.C. III. 11:808. O.R. 3:17; 8:361. R. 2:85. C.O. 3.—Said to grow wild in company with *C. labiata* and *C. Leopoldii*

var. *pernambucensis*, and considered by some a natural hybrid between the two. The variability of 1 or 2 lvs. on a pseudobulb points in this direction.

24. *intermedia*, Graham (*C. amethystina*, Morr. *C. ovata*, Lindl. *C. maritima*, Lindl. *C. Loddigesii* var. *amethystina*, Lem. *C. Aquinii*, Rodr.). Pseudobulbs up to 1½ ft. tall, cylindric, somewhat furrowed, 2-lvd.: lvs. 5-6 in. long, oblong; peduncle bearing 3-5 fls. 4-5 in. across; sepals and petals equal, pale rose or white, acute, oblong, the lateral deflected, the petals somewhat falcate; lip a little shorter than the lateral sepals, distinctly 3-lobed, the tube the same color as the petals, the lateral lobes rounded, the front lobe bright rose-purple, orbicular, strongly crisped. S. Brazil. B.M. 2851. O.R. 8:73; 15:156. P.M. 1:151. J.F. 4:379. C.O. 8. B.R. 1919. V.O. 2:39. Var. *Parthénia*, Reichb. f. Fls. pure white. C.O. 8a. Var. *punctatissima*, Sander. Sepals and petals spotted and dotted with deep rose. C.O. 8b.

25. *violacea*, Rolfe (*C. superba*, Schomb. *C. Schomburgkii*, Lindl. *C. odoratissima*, P. N. Don). Pseudobulbs 8-12 in. tall, clavate, somewhat compressed, 2-lvd.: lvs. 3-5 in. long, oval or oval-oblong; peduncle bearing 3-5 fragrant fls. 4-5 in. across; sepals and petals bright rose-purple, the sepals oblong-lanceolate, acute, the petals oblong-rhomboid, acutish, undulate, broader than sepals; lip fleshy, distinctly 3-lobed, deep purple-violet except the yellow disk streaked with purple, the lateral lobes triangular, acutish, the front lobe nearly orbicular, crisped. N. S. Amer. B.M. 4083. P.M. 9:265. J.H. III. 31:321. A.F. 11:1351. C.O. 28. Var. *spléndens*, Hort., has paler fls.

26. *Loddigesii*, Lindl. (*C. Arembérgii*, Scheidw. *C. intermedia* var. *variegata*, Hook.). Pseudobulbs 8-12 in. tall, cylindric, 2-lvd.: lvs. 4-5 in. long, oblong-elliptic; peduncle bearing 2-5 fls. 3-4½ in. across; sepals and petals rose-lilac, oblong-elliptic, the lateral sepals somewhat falcate, the petals a little broader than the sepals, undulate; lip shorter than the lateral sepals, distinctly 3-lobed, the tube externally colored like petals, internally whitish, the lateral lobes rounded, undulate, the front lobe nearly orbicular, pale amethyst, strongly crisped, the disk whitish passing into yellow at the base. Brazil. C.O. 18. O.R. 15:145.—There is a white form. Var. *alba*, Hort. Var. *delicatâ*, Hort. Fls. bluish white. Var. *innocens*, Hort. Fls. milky white. Var. *spléndens*, Hort. Fls. with bright purplish rose sepals; lip white inside, pale lilac outside; disk and side lobes pale yellow.

27. *Harrisoniana*, Batem. (*C. Harrisonæ*, Paxt. *C. Papeiansiana*, Morr. *C. Harrisonii*, Beer. *C. Loddigesii* var. *Harrisonæ*, Veitch. *C. Loddigesii* var. *Harrisoniana*, Rolfe). Pseudobulbs 8-16 in. tall, cylindric, 2-lvd.: lvs. 4-6 in. long, oblong-lanceolate; peduncle bearing 2-5 fls. 4-4½ in. across; sepals and petals similar, oblong, bright rose-lilac, the lateral sepals falcate, the petals undulate, a little broader than sepals; lip shorter than lateral sepals, 3-lobed, the tube the same color as the petals, the front lobe crisped, rose-purple, the disk yellow-orange. Brazil. P.M. 4:247. C.O. 17. Gn. 48:380. Var. *alba*, Beer. Fls. white, or sometimes faintly tinged with rose or yellow. C.O. 17a. Var. *cândida*, Hort. Fls. white except yellow disk of lip. Var. *gigantæa*, Hort. A large form. Var. *maculata*, Hort. Fls. purple-dotted. Var. *superbissima*, Hort. Fls. large, the sepals and petals dark rose, the lip creamy white. Var. *violacea*, Hort. Fls. deeper colored.

28. *Leopoldii*, Versch. (*C. guttata* var. *Leopoldii*, Lind. & Reichb. f.). Pseudobulbs 15-30 in. tall, fusiform, 2-3-lvd.: lvs. 6-8 in. long, oblong-elliptic; peduncle bearing 10-25 fls. 3-4 in. across; sepals and petals brown, oblong-cuneate, purple-spotted, the lateral sepals somewhat falcate, the petals undulate and a little broader than the sepals; lip strongly 3-lobed, the



lateral lobes acute, the front lobe broadly cuneate-obcordate, undulate, bright amethyst-purple, the tube paler, the disk covered with small tubercles and elevated papillate lines. S. Brazil. C.O. 15. F.S. 14:1471-2.

29. *granulosa*, Lindl. Pseudobulbs 1-2 ft. tall, rather stout, cylindric, 2-lvd.: lvs. 5-6 in. long, lanceolate-oblong; peduncle bearing 5-9 fls. 3-4 in. across; sepals and petals obtuse, olive-green, red-spotted, the lateral sepals strongly falcate and deflected, the petals obovate-oblong, a little wider than sepals, undulate; lip deeply 3-lobed, the tube white externally, internally yellowish or rose, the lateral lobes acute, the terminal lobe white, crimson-papillate, undulate, round-reniform, emarginate, the long claw yellow, marked with crimson. Guatemala. B.R. 28:1. Gn.M. 9:30. C.O. 14. Var. *Du Buysoniana*, Hort. (*C. Dubuysoniana*, Hort.). Sepals and petals yellow, often spotted with rose. Var. *Russelliana*, Lindl. Lvs. broader: fls. larger with broader sepals and petals, the lateral lobes of lip orange-yellow internally, the front lobe spotted with small crimson-purple papillae. Brazil. B.R. 31:59. B.M. 5048. Var. *Schofieldiana*, Veitch. (*C. Schofieldiana*, Reichb. f.). Sepals and petals yellow-brown, densely spotted with crimson-purple, the lateral lobes of lip cream-white externally, yellow, purple-marked internally, the front lobe with numerous purple-magenta papillae, and a broad white border. Brazil. C.O. 14a.

30. *guttata*, Lindl. (*C. elatior*, Lindl.). Pseudobulbs 18-30 in. tall, cylindric, 2-lvd.: lvs. 5-9 in. long, oblong-elliptic; peduncle bearing 5-10 fls. 3-4 in. across; sepals and petals yellowish green, spotted deep purple, the sepals obtuse, the lateral somewhat falcate, the petals undulate, broader than sepals; lip 3-lobed, the lateral lobes white externally, acute, the front lobe amethyst-purple, obcordate, papillate. S. Brazil. B.R. 1406.

31. *Schilleriana*, Reichb. f. (*C. Regnellii*, Warner. *C. Aclandiae* var. *Schilleriana*, Jenn.). Pseudobulbs 5-6 in. tall, clavate, furrowed, 2-lvd.: lvs. 2½-6 in. long, oblong-elliptic; peduncle bearing 1-3 fls. 4-5 in. across; sepals and petals olive-green tinted with brown and spotted with black-purple, oblong-ligulate, undulate, especially in the petals; lip a little shorter than the lateral sepals, deeply 3-lobed, the lateral lobes whitish outside, pale yellow marked with purple inside, the front lobe reniform, sessile, crimson, lined and margined with white, undulate, the disk yellow with 5 sunken lines. Brazil. B.M. 5150. F.S. 22:2286. A.F. 6:563. C.O. 16.

32. *Förbesii*, Lindl. (*C. vestalis*, Hoffm.). Pseudobulbs 8-12 in. tall, cylindric, 2-lvd.: lvs. 4-5 in. long, oblong; peduncle bearing 2-5 fls. 3-4 in. across; sepals and petals a pale yellowish green, obtuse, undulate, sepals oblong-ligulate, the petals oblong-lanceolate; lip distinctly 3-lobed, the tube pale yellow outside, inside a bright yellow streaked with red, the terminal lobe small, sessile, orbicular, undulate, pale yellow, with a bright yellow center marked with purple. S. Brazil. B.M. 3265. C.O. 11. B.R. 953.

33. *Walkeriana*, Gardner (*C. bulbosa*, Lindl. *C. Gardneriana*, Reichb. f. *C. princeps*, Rodr.). Pseudobulbs 2-5 in. tall, oval-fusiform, furrowed, 1-lvd.: lvs. 2-5 in. long, oblong-elliptic; fls. 1-3, very fragrant, 3-5 in. across, on a scaly st. arising from the base of the pseudobulb; sepals and petals pale rose-lilac or a deep purple-rose, the sepals oblong-lanceolate, acute, the petals about twice as wide, oval-rhomboid, undulate; lip a little shorter than sepals, fleshy, 3-lobed, the lateral lobes rose, separated, exposing the column, the front lobe nearly orbicular, emarginate, crisped, violet-purple, the disk yellow, streaked with bright purple. Brazil. B.R. 33:42.

34. *nobilior*, Reichb. f. (*C. Walkeriana* var. *nobilior*, Veitch). Pseudobulbs 3-5 in. tall, ovate-fusiform or nearly clavate, furrowed, 2-lvd.: lvs. 2-4 in. long,

elliptic-ovate: fls. 1 or 2, on a scaly st. arising from the base of the pseudobulb, very fragrant, 3-4½ in. across; sepals and petals purple-lilac, acute, the sepals oblong, the petals ovate-rhomboid, about twice the width of the sepals; lip fleshy, about as long as lateral sepals, deeply 3-lobed, the tube the same color as the petals, the front lobe broadly reniform, emarginate, scarcely undulate, the disk yellow, many-costate. Brazil. G.C. II. 19:729. I.H. 30:485.

The following are some of the many hybrid forms: *C. Adula* = *C. bicolor* × *C. Hardyana*; *C. Albertii* = *C. intermedia* × *C. violacea*; *C. atalanta* = *C. Leopoldii* × *C. Warscewiczii* gigas; *C. Ballantiana* = *C. Trianae* × *C. Warscewiczii*; *C. blesensis* = *Laelio-cattleya*; *C. Brabantiae* = *C. Aclandiae* × *C. Loddigesii*; *C. Brymeriana* = supposed natural hybrid between *C. violacea* × *C. Eldorado* (C. O. 1); *C. Casandra* = *Laelio-cattleya*; *C. Chamberlainiana* = *C. Leopoldii* × *C. Dowiana*; *C. Dietrichiana* = *C. Schilleriana* × *C. Trianae*; *C. Dormaniana* = *Laelio-cattleya*; *C. Dichesnei* = *C. bicolor* × *C. Harrisoniana* (R.B. 30:3); *C. Dusseldorffii* var. *Undine* = *C. intermedia* × *C. Mossiae* alba (O.R. 18:369); *C. exoniensis* = *Laelio-cattleya*; *C. fasta* = *Laelio-cattleya*; *C. Fowleri* = *C. Leopoldii* × *C. Hardyana* (C. O. 5); *C. germanica* = *C. granulosa* × *C. Hardyana*; *C. Hardyana* (C. O. 5); *C. Warscewiczii* (C.O. 2). O. R. 4:241; 5:363; 8:248; 11:336; 33:7; *C. Harrisoni* = *C. Leopoldii* × *C. Mendelii*; *C. Heldiae* = *C. Forbesii* × *C. Mossiae*; *C. hybrida picta* = *C. guttata* × *C. Loddigesii*; *C. interglauca* = *C. amethystoglossa* × *C. intermedia*; *C. Krameriana* = *C. Forbesii* × *C. intermedia*; *C. Louryana* = *C. Forbesii* × *C. intermedia*; *C. Manglesii* = *C. Loddigesii* × *C. Luddemanniana*; *C. Martini* = *C. Bowringiana* × *C. Dowiana* (C.O. 7). O.R. 10:337; *C. Mardellii* = *Laelio-cattleya*; *C. Marstersonia* = *C. labiata* × *C. Loddigesii*; *C. Medaurensis* = *C. Luddemanniana* × *C. velutina*; *C. Minucia* = *C. Loddigesii* × *C. Warscewiczii* gigas; *C. mollis* = *C. Gaskelliana* × *C. violacea*; *C. O'Brientiana* = considered by some a natural hybrid between *C. Loddigesii* × *C. dolosa* (C.O. 8); *C. Pittii* = *C. Dowiana* × *C. Harrisoniana*; *C. Pittiana* = *C. Dowiana* × *C. granulosa* (C.O. 28); *C. Portia* = *C. Bowringiana* × *C. labiata*; *C. Thayeriana* = *C. intermedia* × *C. Schroederæ* (O.R. 12:49); *C. weodoniensis* = *C. granulosa* × *C. Mendelii*; *C. Whitei* = *C. Schilleriana* × *C. Warneri* (B.M. 7727); *C. Zenobia* = *Laelio-cattleya*.

*C. Abeliana*, Hort. Fls. creamy yellow, speckled with purple on the lip. Peru.—*C. Forgetiana*, Rolfe. Somewhat resembling *C. Lawrenceana*. Scape bearing 2 fls.; sepals and petals rose-purple. Brazil.—*C. Grossii*, Hort., var. *pallida*. A nearly white form; sepals slightly tinged with green; lip pale rose.—*C. Hardyana*, Hort., var. *alvea*. Lip deep yellow.—*C. Jenmanii*, Rolfe. Allied to *C. Gaskelliana*, but lvs. broader and fls. smaller. British Guiana.—*C. marginata*, Paxt. = *Laelia pumila*.—*C. velutina*, Reichb. Ss. slender, the fragrant fls. with the sepals and petals orange, spotted purple, the lip orange and white, veined yellow. Brazil. G.C. III. 24:333. C.O. 29a.

GEORGE V. NASH.

**CAULIFLOWER** (*Brassica oleracea*, Linn., var. *botrytis*, DC.). A form of the common cabbage species, producing an edible head of malformed and condensed flowers and flower-stems (the word cauliflower means stem-flower); it will hybridize with the cabbage and form some very interesting freaks. See *Forcing*.

A perfect "curd" or head of cauliflower is one in which the parts are so adjusted to one another that it looks almost homogeneous. This condition is most often found in the young or partly developed heads. As soon as segmentation begins to take place, the curd has reached full development and maturity from the market-gardeners' standpoint. The breaking-up of the curd is an indication of the formation of floral parts. The value of the curd depends upon its symmetry and form; and the length of time that it will hold without beginning to break up into distinct parts.

Not all plants produce perfect curds. Growers recognize a peculiar form which is known as the "ricy" curd illustrated at *a* in Fig. 845. Another form, which is equally undesirable is a segmented curd between the segments of which leaves appear, known as a "leafy" curd shown at *b*. A head in perfect condition is shown at *c*. Segments are apparent in *c*, but the development of the curd is almost ideal and the head as a whole is very nearly perfect. It is the aim of the seed-grower as well as of the gardener to produce plants which will return curds of the type shown at *c*.

Cauliflower is the most fastidious and exacting member of the cabbage family. It is less tolerant of adverse soil and climatic conditions than any of its near relatives. This accounts, in a great measure, for its limited cultivation and the fact that it is grown only in certain localities. When well grown, however, it is one of the most profitable market-garden crops. Because of its

intolerance to heat, it is grown in the open so as to take advantage of the cool seasons of early spring and autumn. It is one of those crops, therefore, which is less adaptable than those having a greater range of heat-endurance. If the season happens to be favorable the amateur may have good luck, but if the season proves severe the most expert grower may fail.

A rich loamy soil, thoroughly charged with available plant-food is suited to this plant. Light thin sandy soils or those extremely heavy and retentive are, as a rule, not well suited for this crop. The soil should be one which does not dry out quickly but which will furnish the plants a constant supply of moisture. High-grade cauliflower is quite as dependent upon careful handling of the plants and a constantly available supply of moisture as high-grade celery. Among the fertilizers, none is better than well-decomposed manure from the horse-stable, thoroughly incorporated with the soil at the time of preparing it for the crop.

If commercial fertilizers are necessary, quick-acting ones are most desirable, except it is thought that sulfate of potash is preferable to muriate. The nitrogen-content of the fertilizer, however, should be in the form of nitrate of soda or sulfate of ammonia rather than in a slow-acting form. If a fertilizer is to be used, a portion of it should be scattered over the field before the plants are set. An application of 500 pounds to the acre at this time, applied broadcast, and a side dressing about the time "buttons" begin to form, will prove an advantage. The side dressing may be at the rate of 500 pounds, making a total application of 1,000 pounds to the acre. A good fertilizer is one carrying 3 to 4 per cent of nitrogen, 6 to 8 per cent of phosphoric acid and about 10 per cent of potash.

Cauliflower plants in northern latitudes are handled so as to prepare them either for an early or a late crop. The early crop should be started at the same time as early cabbage, or a few days later. Cauliflower plants cannot, however, be started in the autumn and successfully wintered in coldframes, as can early cabbage plants. Plants so handled are less likely to give a desirable product. The best early-crop plants are produced from hotbed or greenhouse propagated stock started in a mild temperature and grown so as to produce a sturdy broad-leaved plant to be set in the field a few

The early crop is usually grown on a smaller scale than the autumn crop. Plants grown in the hotbed are usually transplanted and the transplanted plants carried and set in the field by hand. The distance between the rows should be sufficient to permit of cultivation with horse-power implements, but the plants need not be set more than 18 inches apart in the row.

The late crop, however, is frequently transplanted during the drier parts of the season and, largely on this account, growers prefer to use a transplanting machine so as to water the plants at the same time they are set. A convenient distance between the rows is 3 feet, with the plants 20 to 24 inches apart in the row, depending upon the variety grown.

The old adage that "cabbage should be hoed every day" applies with equal force to cauliflower. Cultivation should be of such character as to prevent the formation of a crust and to discourage the development of weeds. The maintenance of a soil-mulch by shallow cultivation which shall not disturb or severely prune the roots of the plants is desirable.

Cauliflower is subject to the same enemies and diseases as cabbage. Clubroot and mildew are two of the most annoying diseases. The aphid, root-maggot and both the green cabbage-worm and the cabbage-looper are annoying pests. The delicacy of the curd requires that the plants be kept perfectly free from insects which devour any portion of the plant.

Cauliflower requires more careful field attention than that required by any other garden crop except those that are blanched either by tying or banking. The young curd of the cauliflower, as soon as it has reached the size of a hen's egg, should be carefully protected from the elements by adjusting the leaves in such a manner as to prevent discoloration by the action of sun or rain. The expert growers accomplish this and at the same time indicate the stage of maturity of the plants by different methods of folding the leaves together over the curd or by tying them with different tying materials, a different method being used each time the field is gone over. To illustrate: the earliest developed curds may be protected by tying the leaves together with rye straw, the next later size may be indicated by folding the leaves together over the plant, while the third may be indicated by tying the leaves with raffia. Usually three operations will be sufficient to care for the entire season's crop. As soon as the curds have reached the desired market size, which varies greatly with different producers and somewhat also with different varieties and is to a degree dependent upon the season and fertility of the land, the plants are harvested by cutting the heads with at least two or three whorls of leaves attached.

After the heads have been cut and a sufficient number assembled in one place to justify packing, they are trimmed by using a large knife to sever the leaves just above the edge of the curd so as to form a border or "ruche" of leafstalks with a part of the blade attached about the curd. This border of stiff green leafstalks about the white curd gives it a very attractive appearance.

After the curds have been properly trimmed, which varies somewhat with different operators, they are protected by the use of tea paper, either white or brown, placed over the head in such a manner as to protect it from dirt and contact with its neighbors. The curds are then packed in crates or barrels, the California and Florida product being largely packed in crates holding one dozen heads in a single layer. If the heads are to be packed in barrels, a layer of excelsior is first placed in the barrel and the wrapped heads, curd down, are carefully placed so as to form a layer resting upon the excelsior over the bottom of the barrel. The next row of curds is placed stem end down and curds up; on top is placed another cushion of excelsior and the operation repeated until the barrel is filled in such a manner as to



845. Types of cauliflower heads: *a*, ricy; *b*, leafy; *c*, perfect.

days later than the early crop of cabbage. Young cauliflower plants are less hardy than young cabbage plants and, for this reason, planting in the open must be somewhat delayed.

For the late cauliflower crop in the North, seed-beds are prepared on the shady side of a building or in a partially shaded situation and handled in same manner as seed-beds for late cabbage, the late crop in the Long Island region being placed in the open the last days of June or early in July.



leave the last row with the stem end upward, over which a cushion of excelsior and a burlap cover are placed. Ventilated barrels are ordinarily used for this purpose, but for long-distance shipment the smaller crates holding a single layer of heads have proved most advantageous.

During late years, the marketing of this crop has been very greatly facilitated and the returns to the growers considerably enhanced by a coöperative method of sale which has taken into consideration a more extended distribution of the crop than formerly. In this the Long Island Cauliflower-Growers' Association and the California Vegetable-Growers' Union have both been very helpful.

One of the handicaps in the cultivation of cauliflower has been the entire dependence of the American growers on foreign seed, little or no cauliflower seed having been produced in this country and that in the open only in the Puget Sound region. The seed has been expensive and not always to be depended upon. The greatest care should be given to securing a perfectly reliable stock of seed.

#### Broccoli.

Broccoli, which is a long-season cauliflower, is in all respects like cauliflower except that its vegetative parts are somewhat coarser, the heads somewhat smaller, and it does not form an edible curd early in its life as does cauliflower.

Broccoli is cultivated only in climates having a mild winter, when it can be planted the summer before and carried through the winter to form heads early the following spring. It is a popular plant in all parts of France and particularly in England. It is undoubtedly the parent type of the cauliflower, the cultivated varieties of cauliflower being short-season forms.

For best results, the seed should be sown at the same time as that of autumn cabbage and the plants transplanted to the field about the same time, so that they will make their vegetative growth during the late summer and autumn. Where winters are mild, the plants can be left in the open, but in more rigorous climates at the approach of cold weather, a small number of plants can be lifted with earth adhering to the roots, stored in a suitable root-cellar, and the following spring transferred to the open to form heads.

L. C. CORBETT.

**CAULOPHYLLUM** (Greek, *stem-leaf*). *Berberidaceæ*. **BLUE COHOSH.** Two species of perennial herbs (sometimes combined with *Leontice*), one in E. Amer. and the other in Asia, the former sometimes removed from the woods to cult. grounds. Rhizomatous: sts. erect, very smooth: lf. 1, large, tritermately compound and sessile: fls. small, yellow-green, panicle; sepals 6, subtended by 3 or 4 bracts; petals 6, much smaller than the sepals and appearing like glands or scales; stamens 6; ovary soon bursting, freeing the 2 ovules which develop into depressed-globular berry-like seeds (without pericarp). *C. thalictroides*, Michx., Fig. 846, is the American species, a smooth or glaucous plant of rich woods from Canada south, 2-2½ ft. high. The plant is always attractive because of its trim growth and interesting habit; in Sept. and later, when the foliage is dead, the drupe-like seeds stand erect on the dry stalks and afford one of the richest and best of deep blues.

L. H. B.

**CAUTLÈA** (Sir P. Cautley, 1802-1871, British naturalist). *Zingiberaceæ*. About a half-dozen Himalayan species closely allied to *Roscoea*, differing in the spherical rather than narrow fr., and the spicate infl. Probably not in cult. in this country. *C. lutea*, Royle (*Roscoea lutea*, Royle. *R. gracilis*, Smith). Erect or leafy perennial herb, 1½ ft. or less: lvs. narrow-lanceolate, slender-tipped, reddish underneath: fls. 2 in. or less long; corolla yellow; calyx reddish purple, the linear

segms. prominent, the lateral ones spreading or reflexed and the dorsal one erect and with an incurved erect staminode under it.—Treatment of *Alpinia* and *Roscoea*.

**CAVAN:** *Acacia Caventa*.

**CAYENNE PEPPER:** *Capsicum*.

**CAYRÁTIA JAPÓNICA:** *Cissus japonica*.

**CEANOTHUS** (ancient Greek name). *Rhamnaceæ*. Ornamental woody plants grown for their profusely produced white, blue or pink flower-clusters.

Deciduous or evergreen shrubs or trees: lvs. alternate or sometimes opposite, short-petioled, serrate or entire, usually 3-nerved, with small stipules: fls. perfect, small, 5-merous, in small umbels forming panicles or racemes; sepals often incurved, colored; petals clawed, spreading or recurved; filaments slender; disk annular; ovary partly adnate to the calyx-tube, 3-celled; style 3-cleft: fr. a 3-celled drupe, dry at length and separating into 3 one-seeded dehiscent nutlets.—Nearly 50 species in N. Amer., chiefly in the Pacific coast region.

These are free-flowering shrubs, some especially valuable for their late flowering period. Many of them are hardy only in the warmer temperate regions, but *C. americanus*, *C. ovatus*, and *C. Fendleri* are hardy North, while the numerous hybrids of *C. americanus* are only half hardy, and even if protected they are killed to the ground in the North, but the young shoots will usually flower the same season. The safest way, however, to have good free-flowering plants of these beautiful hybrids will be, in the North, to dig them up in fall, store them away in a frost-proof pit or cellar, and plant them out again in spring. Pruning of the late-flowering species will be of advantage; about one-half of last year's growth may be taken away. They grow in almost any soil, but best in a light and well-drained one, and most of the Californian species prefer a sunny position. Propagated by seeds sown in spring and by cuttings of mature wood in autumn, inserted in a cold-frame or greenhouse; softwood cuttings also grow readily if taken in early spring from forced plants. Sometimes increased by layers, and the varieties and hybrids by grafting on roots of *C. americanus* under glass in early spring; the cions must be fresh and with leaves, taken from plants kept in the greenhouse during the winter.



846. Seed-berries of blue cohosh, *Caulophyllum thalictroides*. (×½)

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A. *Lvs. alternate.* (Nos. 1–13.)

B. *Margin of lvs. serrate or crenate.*

C. *Foliage glabrous beneath or slightly pubescent.*

D. *Fls. white; lvs. thin, deciduous.*

E. *Peduncles slender, at the end of the new growth.*

1. *americanus*, Linn. Fig. 847. Low, erect shrub, to 3 ft.: lvs. ovate, usually acute, finely and irregularly serrate, bright green and dull above, paler and pubescent or nearly glabrous beneath,  $1\frac{1}{2}$ –3 in. long: fls. in terminal and axillary panicles on slender peduncles, forming large, corymbose panicles. July–Sept. From Canada to S. C. and Texas. B.M. 1479. Gt. 61, p. 92. Gn. 56, p. 137.—Common in dry woods and making a profusion of bloom, which, however, is short-lived. Many hybrids have been raised from this species in Eu. (see *C. hybridus*). Var. *intermedius*, Trel. (*C. intermedius*, Pursh), has smaller, ovate or ovate-lanceolate lvs. and the fls. in small, very slender-peduncled, short racemes or panicles. Tenn. to S. C.



847. *Ceanothus americanus*. ( $\times \frac{1}{4}$ )

tuse or acute, crenulate-serrate, nearly glabrous, glossy above, 1–2 in. long: infl. like the former, but usually smaller. New England to Colo. and Ala.

EE. *Peduncles usually stout, from lateral buds of the old wood.*

3. *sanguineus*, Pursh (*C. oreganus*, Nutt.). Tall shrub, with purple or reddish glabrous branches: lvs. orbicular to ovate or obovate, obtuse, serrate, nearly glabrous, 1–3 in. long: fls. in rather long, narrow panicles, on stout, leafless peduncles, axillary, from branches of the previous year. May, June. Brit. Col. to Calif. B.M. 5177.

DD. *Fls. blue or pink, rarely white; lvs. usually half-evergreen.*

4. *híbridus*, Hort. Hybrids of garden origin, chiefly between *C. americanus* and *C. thyrsiflorus*, between *C. ovatus* and *C. thyrsiflorus* and between *C. americanus* and *C. azureus*; the hybrids of the first group may be classed under *C. roseus*, Koehne, of the second under *C. pallidus*, Lindl., and those of the third group under *C. Arnouldii*, Hort. Some of the most distinct are: *albo-plenus*, with double white fls.; *atrocaeruleus purpureus*, fl. blue, foliage purple when young; *Arnouldii*, fls. sky-blue, in large panicles; *Gloire de Versailles*, with bright blue, large panicles (M.D.G. 1903:485); *Gloire de Plantières*, fls. dark blue, in large panicles; *Victor Jouin*, fls. deep blue, darker than in the preceding, one of the hardest hybrids; *Ciel de Provence*, fls. deep blue, profusely produced (R.H. 1903:332); *Marie Simon*, fls. flesh-colored; *roseus*, fls. pink (R.H. 1875:30); *pallidus*, fls. pale blue, lvs. green and pubescent below (B.R. 26:20).

5. *thyrsiflorus*, Esch. Shrub or small tree: lvs. oblong, obtuse, crenate-serrate, nearly glabrous, 1–1½

in. long: fls. blue, rarely white, in narrow panicles, about 3 in. long. May–July. Ore. to Calif. B.R. 30:38. S.S. 2:64. G.C. III. 20:363; 37:179; 41:221. Gn. 74, p. 303. G.M. 50:430.—A very fine, free-flowering species of beautiful blue color. Probably natural hybrids of this species are: *C. Veitchianus*, Hook. (*C. thyrsiflorus*  $\times$  *C. rigidus*), with deep blue fls. in dense panicked clusters (B.M. 5127; F.S. 13:1383), and *C. Lobbianus*, Hook. (*C. thyrsiflorus*  $\times$  *C. dentatus*), with deep blue fls., in oval, peduncled, solitary clusters. B. M. 4810 (4811 by error). F.S. 10:1016.

cc. *Foliage tomentose or densely pubescent beneath: half-evergreen or evergreen (see also C. hybridus).*

D. *Branchlets and the veins beneath nearly glabrous: lvs. very obtuse; fls. white.*

6. *velútinus*, Douglas. Tall shrub: lvs. persistent, broadly elliptic, mostly subcordate, obtuse, serrate, dark green and glabrous above, canescent beneath, but the veins glabrescent, 2–3 in. long: fls. in large, compound panicles at the ends of the branches. June, July. Brit. Col. to Colo. and Calif. B.M. 5165.

DD. *Branchlets and the veins tomentose or pubescent: lvs. mostly acute; fls. usually blue.*

E. *The lvs. glabrous or puberulous above, whitish or tawny tomentose beneath.*

7. *arboreus*, Greene (*C. velútinus* var. *arboreus*, Sarg.). Small tree, with whitish bark: branchlets at first angled and pubescent, later glabrescent and glossy: lvs. elliptic-ovate, obtusish or acutish, rounded or subcordate at the base, closely serrate, with close white tomentum beneath,  $1\frac{1}{2}$ –3 in. long: fls. pale blue to white in panicles 2–3 in. long. Spring. Isls. off the Calif. coast. S.S. 2:65.

8. *azúreus*, Desf. (*C. bicolor*, HBK. *C. caeruleus*, Lag.). Tall shrub: branchlets terete, densely tomentose: lvs. oblong-ovate or oblong, acute or obtuse, rounded at base, serrate, with villous tawny tomentum beneath, 1–3 in. long: fls. deep blue, in slender panicles 2–4 in. long. Spring. Mex. L.B.C. 2:110. B.R. 4:291. P.M. 2:74. Gn. 61, p. 223.—Under this name, a hybrid species with *C. americanus* is often cult.

EE. *The lvs. villous or hirsute on both sides, usually green beneath.*

9. *hirsútus*, Nutt. Shrub or small tree, with villous branches: lvs. broadly elliptic or ovate, rounded or cordate at the base, obtuse or acute, with glandular teeth,  $\frac{1}{2}$ –2 in. long: fls. deep blue to purplish, in narrow panicles 1–2 in. long. April, May. Calif.—Called “wild lilac” in Calif. Var. *Órcuttii*, Trel. (*C. Órcuttii*, Torr.). Fls. blue, paler: fr. loosely villous.

BB. *Margin of lvs. entire or nearly so (sometimes serrate on vigorous shoots).*

C. *Shrub prostrate; fls. white.*

10. *Féndleri*, Gray. Low, prostrate and spiny shrub: lvs. oval, rounded or nearly acute at both ends, entire, rarely finely serrulate, grayish green, minutely tomentose beneath,  $\frac{1}{2}$ –1 in. long: fls. white, in short racemes, terminal, on short, lateral branchlets. June, July. From S. D. to New Mex. and Ariz. R.H. 1901, p. 423. M.D.G. 1908:208; 1912:499.—A very graceful and free-flowering shrub of almost creeping habit, well adapted for covering dry, sandy banks; half evergreen and hardy N.

cc. *Shrubs tall, upright.*

D. *Branchlets terete or slightly angled, rarely spiny.*

11. *integérrimus*, Hook. & Arn. Tall, erect shrub, with glabrescent branches: lvs. broadly elliptic or ovate, obtuse, sparingly hairy or glabrous, bright green beneath, 1–3 in. long: fls. blue, sometimes white, fragrant, in 3–6 in. long, narrow panicles. April–June. Wash. to Calif. and S. E. Ariz. B.M. 7640.



12. *divaricatus*, Nutt. Tall, erect shrub, with usually glaucous branches and often spiny: lvs. ovate, obtuse or nearly acute, glaucous and glabrous or grayish tomentose below,  $\frac{1}{2}$ –1 in. long: fls. pale blue, sometimes whitish, in 2–3 in. long, narrow panicles. April–June. Calif. Gn. 74, p. 425 (habit).

DD. Branchlets angled, spiny.

13. *spinosus*, Nutt. Tall shrub, sometimes arborescent: branchlets glabrous: lvs. elliptic to oblong, thinly coriaceous, rounded or broadly cuneate at the base, very obtuse or emarginate, scarcely 3-nerved, glabrous,  $\frac{1}{2}$ –1½ in. long: fls. light blue to almost white in large terminal panicles 4–6 in. long. Spring. Cent. and S. Calif., Coast Range and down to sea-level. S.S. 13:621.

AA. Lvs. opposite, persistent.

14. *cuneatus*, Nutt. Tall, much-branched shrub: lvs. spatulate or cuneate-obovate, mostly obtuse, entire, minutely tomentose beneath,  $\frac{1}{4}$ –1 in. long: fls. white, in small clusters along the branches. March–May. Ore. to Calif. B.H. 8:170.

15. *prostratus*, Benth. Procumbent shrub: lvs. cuneate, obovate or spatulate, coarsely and pungently toothed, sometimes only 3-pointed at the apex, often minutely silky when young,  $\frac{1}{2}$ –1 in. long: fls. blue, in clusters, terminal on short branchlets. Spring. Wash. to Calif.

*C. africanus*, Linn. = *Noltea africana*. — *C. dentatus*, Torr. & Gray. Low shrub: lvs. oblong, penninerved, dentate, glandular-papillate above, loosely hairy: fls. blue, in peduncled clusters. Calif. F.S. 6:567, 2. B.H. 3:101. — *C. dentatus* var. *floribundus*, Trel. (*C. floribundus*, Hook.). Fl.-clusters numerous, nearly sessile: lvs. smaller. B.M. 4806. F.S. 10:977. I.H. 7:238. B.H. 5:129. — *C. foliosus*, Parry. Low shrub: lvs. small, broadly elliptic, glandular-toothed, slightly hairy, pale or glaucous beneath: fls. deep blue, in numerous small clusters. Calif. — *C. laevigatus*, Douglas. Tall shrub: lvs. broadly elliptic, serrate, glabrous, glaucous beneath: fls. yellowish white, in large panicles. Calif. — *C. microphyllus*, Michx. Low shrub: lvs. very small, obovate or elliptic, nearly glabrous: fls. white, in small, short-peduncled clusters. — *C. papillosus*, Torr. & Gray. Low shrub: lvs. narrow-oblong, dentate, glandular-papillate above, villous beneath: fls. deep blue, in peduncled, axillary oblong clusters. Calif. B.M. 4815. F.S. 6:567, 1. P.F.G. 1, p. 74. R.H. 1850:321. — *C. Parryi*, Trel. Large shrub: lvs. elliptic or ovate, denticulate, cobwebby beneath: fls. deep blue, in peduncled, narrow panicles. Calif. — *C. rigidus*, Nutt. Rigid, much-branched shrub: lvs. opposite, cuneate-obovate, denticulate, usually glabrous, small: fls. blue, in small, nearly sessile, axillary clusters. Calif. B.M. 4660 (as *C. verrucosus*) and 4664. J.F. 3:316; 4:348. — *C. verrucosus*, Nutt. Low shrub: lvs. mostly alternate, roundish obovate, emarginate, denticulate, nearly glabrous: small: fls. white, in small, axillary clusters along the branches. Calif. — *C. verrucosus*, Hook. = *C. rigidus*.

ALFRED REHDER.

CEARA RUBBER: *Manihot*.

CÉBATHA: *Cocculus*.

CECRÒPIA (from Greek word referring to use of the wood of some species in making wind instruments). *Moraceæ*. Milky-juiced trees, with peltate leaves, sometimes planted in grounds in tropics and warm countries.

Leaves large, alternate, long-petioled, the blade circular in outline; segms. or lfts. 7–11: dioecious; fls. very small, sessile in cylindrical heads or receptacles, which are arranged in umbels; calyx tubular and petals 0; sterile fls. with 2 stamens; fertile fls. with free ovary and divided stigma: frs. small 1-seeded nuts combined into short spikes. — Species about 40, from Mex. to Brazil. *C. peltata*, Linn., is the trumpet-tree of the W. Indies and S. It is a middle-sized tree with lvs. 1 ft. across; hollow branches used for the making of wind instruments. The juice of some species yields rubber. The hollow stems are often perforated by ants, which nest and rear their young in them.

*palmata*, Willd. Fig. 848. A characteristic tree of the farther W. Indies (and planted somewhat in S. Fla.), with a single long weak thin trunk and at the top a few horizontal or deflexed awkward branches bearing at their ends large palmate lvs. with divisions like thumbs, the trunk and branches partitioned at the

nodes: lvs. 7–11-lobed to the middle, white-tomentose beneath, the lobes oblong-obovate and blunt. — The tree attains a height of 50 ft.; wood soft; branches more or less hollow; grows rapidly, like an herb; often covering areas that have recently been burned over.

L. H. B.

CEDAR: *Cedrus*, *Juniperus*.

CEDAR, WHITE: *Thuja*, *Chamaecyparis*.

CEDAR, WEST INDIAN: *Cedrela*.

CÉDRELA (from *Cedrus*, the wood resembling that of *Cedrus*). *Meliaceæ*, including *Toona*. Ornamental trees, grown for their handsome foliage; some are valuable timber trees.

Trees with alternate, usually abruptly pinnate lvs., without stipules: lfts. petioled, entire or slightly serrate: fls. inconspicuous, whitish, usually perfect, 4–5-merous, in large, pendulous, terminal panicles; calyx short, 4–5-parted, the petals forming a tube with spreading limb, below partly adnate to the disk; stamens shorter than petals; ovary 5-celled; style simple, with capitate stigma, somewhat longer than the stamens: fr. a caps., dehiscent, with 5 valves not splitting to the base, with many flat, winged seeds. — Nine species in Trop. Amer. and 8, forming the subgenus *Toona*, in E. India and Austral. *Toona* is often considered a distinct genus, distinguished from *Cedrela* by the disk being much longer than the ovary and by the seeds being winged above or at both ends, while in *Cedrela* the disk is as long or shorter than the ovary and the seeds are winged below. The first 3 species below belong to the subgenus *Toona*, the others are true *cedrelas*.

*Cedrelas* are tall ornamental trees with large pinnate foliage, well adapted for avenues: *C. sinensis* is hardy as far north as Massachusetts; the others are hardy only in southern California and in the Gulf states except *C. odorata*, which is tender even there. The wood of some species, particularly of *C. odorata*, is known as cedar wood, and much valued for making furniture and boxes. They thrive best in rich loam, and are propagated by seeds or by cuttings of mature wood, and, also, by root-cuttings, all with bottom heat.



848. *Cecropia palmata*.

A. *Lfts.* 10-25.B. *Lvs.* quite glabrous.C. Margin of *lvs.* more or less serrate; panicles very long, pendulous: seeds winged above.

*sinënsis*, Juss. (*Toöna sinënsis*, Roem. *Ailanthus flavëscens*, Carr.). Tree to 50 ft.: *lvs.* long-petioled, 10-20 in. long; *lfts.* 10-22, oblong or oblong-lanceolate, acuminate, slightly and remotely serrate, light green beneath, 4-8 in. long; *fls.* white, in very long, pendulous panicles; ovary glabrous; 5 subulate staminodes alternating with the stamens: fr. oblong or obovate, about 1 in. long. June. China. R.H. 1891, p. 574-5; 1875, p. 87. Gng. 4:1. M.D.G. 1902:495. F. 1876, p. 175. F.E. 13, p. 1.—Ornamental tree, with large feathery foliage; very valuable for avenues; similar to *ailanthus*, and nearly of the same hardiness, but of more regular and dense growth, and without the disagreeable odor when flowering. *Ailanthus* can be easily distinguished by the few coarse teeth near the base of the *lfts.*, each bearing a large gland beneath (Fig. 849).



849. Leaflets of *Cedrela* and *Ailanthus*. *Cedrela* on the right. ( $\times \frac{1}{5}$ )

*serrata*, Royle (*Toöna serrata*, Roem.). Tree, to 70 ft.: *lvs.* usually odd-pinnate, 15-20 in. long; *lfts.* 15-25, ovate-lanceolate or ovate-acuminate, irregularly serrate, glaucous beneath: panicles longer than the *lvs.*, pendulous; *fls.* fragrant, often 6-merous; ovary glabrous. Himalayas, to 8,000 ft. altitude. Royle, Ill. 25. Collett, Flor. Siml. 82.—This is probably the hardiest of the tropical species. Sometimes united with *C. Toona*.

cc. Margin of *lvs.* entire: panicles shorter than the *lvs.*

*Toöna*, Roxbg. (*Toöna ciliata*, Roem.). Tree, to 70 ft., nearly evergreen: *lvs.* abruptly pinnate; *lfts.* 10-20, usually opposite, lanceolate or ovate-lanceolate, sometimes undulate, 3-6 in. long; *fls.* white, honey-scented, 5-merous; ovary hairy; seeds winged at both ends. Himalayas. Wight., Icon. 161. Brandis, Forest Fl. 14.

*odorata*, Linn. WEST INDIAN CEDAR. Tree, to 100 ft.: *lvs.* 10-20 in. long; *lfts.* 12-20, ovate-lanceolate, acuminate, entire, bright green on both sides, 4-6 in. long; panicles shorter than the *lvs.*: fr. oblong,  $1\frac{1}{2}$  in. long; seeds winged below. W. Indies.—The cedar wood comes mostly from this species. Wood brown, fragrant, the source of the cigar-box wood of commerce. It is a very durable wood,

and is much prized in the W. Indies in the manufacture of cabinets, furniture, canoes, and other articles. In the W. Indies known as "cedar."

BB. *Lvs.* densely pubescent beneath.

*fissilis*, Vell. Tree: *lvs.* 10-15 in. long, abruptly pinnate; *lfts.* 18-24, opposite, nearly sessile, oblong-lanceolate, acuminate: panicles pubescent, longer than the *lvs.*; calyx pubescent outside; petals fulvous tomentose; ovary glabrous. Brazil, Paraguay. St. Hilaire, Fl. Brazil. 2:101.—According to Franceschi it does better at Santa Barbara than any other species of this genus.

AA. *Lfts.* 6-10, finely ciliate.

*Dugësii*, Wats. Tree: *lvs.* 10-15 in. long; *lfts.* cuneate, ovate-lanceolate, long and slender acuminate, nearly entire, shining above, pale green and glabrous or nearly so beneath, 4-6 in. long; panicles rather compact, much shorter than the *lvs.* Mex.

ALFRED REHDER.

**CEDRONÉLLA** (a little cedar, from the odor of *C. triphylla*, a species from the Canary Islands sometimes called "Balm of Gilead"). *Labiataë*. Herbs or shrubs, sometimes planted in borders in the middle and southern parts of the United States.

Four species allied to *Dracocephalum*, to which the first 2 belong according to Benth. Engler and Prantl consider the genus monotypic, containing only the third species below. The 2 native kinds described below are compact, free-flowering border perennials, with aromatic *lvs.* and numerous showy purplish pink *fls.* with blue stamens, and borne in dense whorls on long racemes or spikes: calyx a trifle oblique, 5-toothed; corolla-tube exerted, the limb 2-lipped; stamens 4, the anthers 2-celled.—They are not quite hardy N., and should have a sheltered sunny position, or some winter protection. The first 2 prop. by division of the root, the last by cuttings.

*cana*, Hook. Height  $2\frac{1}{2}$ -3 ft.: sts. hard, square, subshrubby; branches numerous, especially at the base, opposite, hoary with a minute pubescence: upper *lvs.*

small,  $\frac{1}{2}$ - $1\frac{1}{2}$  in. long, entire, hoary, numerous near the *fls.*, ovate; lower *lvs.* larger, cordate-ovate, dentate-serrate: spikes numerous; whorls dense, 15- or more-flid.; corolla 1 in. long, limb 5-cleft, the lowest lobe largest, crenate, revolute. June-Oct. Mex. and New Mex. B.M. 4618.

*mexicana*, Benth. (*Gardôquia betonicoides*, Lindl.). Height 1-3 ft.: root creeping: *lvs.*  $1\frac{1}{2}$ - $2\frac{1}{2}$  in. long, ovate-lanceolate (the lower ones cordate), crenate-dentate, becoming purplish below, petioled: *fls.* very like the above, bright pink. Mex., Mts. S. Ariz. B.M. 3860.—Rarer in cult. than above; *lvs.* larger, longer and fewer. Intro. into cult. in 1839.

*triphylla*, Moench (*Dracocephalum canariense*, Linn.). BALM OF GILEAD. Shrubby, 3 to 4 ft.: *lfts.* 3, oblong or lanceolate: *fls.* purple or



850. *Cedrus atlantica*.



white, in loose spicate whorls. Aromatic plant from Canary Isls.

*C. pallida*, Lindl. Similar to *C. mexicana*, but differing in having shorter, pale red fls. B.R. 1846:29. It is sometimes confused with *C. mexicana*.

N. TAYLOR.†

**CÉDRUS** (*Kedros*, ancient Greek name). *Pináceæ*. CEDAR. Trees grown for their persisting foliage and striking habit; they are also valuable timber trees.

Large evergreen trees, with quadrangular, stiff,

fasciculate lvs.: fls. monœcious, the staminate forming cylindrical catkins: cones ovate or ovate-oblong, thick, 3-5 in. long, with broad, closely imbricate, bracts, attaining maturity in 2 or 3 years; seeds winged.—Three closely allied species in N. Afr., Asia Minor and Himalayas.

The cedars are large ornamental conifers, with wide-spreading branches, very distinct in habit from most other conifers. They are usually considered tender, but a hardy race of *Cedrus Libani* has been recently introduced by the Arnold Arboretum from the highest elevation where the species occurs in Asia Minor; the plants have stood all the winters since 1902 unprotected at the Arnold Arboretum and have proved perfectly hardy. It is very gratifying that one is now able to grow so far north the famous cedar of Lebanon which, aside from its beauty, is of peculiar interest for its historic and religious associations. The race of *Cedrus Libani* commonly cultivated is rather tender, more tender than *C. atlantica* which may be grown as far north as New York in sheltered positions, while *C. Deodara* can be grown safely only in California and southern states. The very durable and fragrant wood of all species is highly valued.

The cedars prefer well-drained, loamy soil, and will also grow in sandy clay, if there is no stagnant moisture. Propagated by seeds sown in spring; the varieties by veneer grafting, in late summer or in fall, on seedlings of *C. atlantica*; or, in warmer regions, on *C.*

*Deodara*; they grow also from cuttings, if the small shoots are selected which spring occasionally from the old wood. Plants of this genus are the true cedars; but trees of other genera are often called cedar. See *Chamæcyparis*, *Juniperus*, and *Thuja*; also *Cedrela*.

A. Branches stiff, not drooping: cones truncate, and often concave at the apex.

*atlantica*, Manetti. Fig. 850. Large, pyramidal



851. Cedars on Mt. Lebanon, *Cedrus Libani*.

tree, to 120 ft., with upright leading shoots: lvs. mostly less than 1 in. long, usually thicker than broad, rigid, glaucous green: cones 2-3 in. long, light brown. N. Afr. Gng. 2:163. G. F. 9:417. R.H. 1890, p. 32. G. W. 6, p. 498. Gn. 37, p. 195. Gt. 61, p. 449. Var. *glauca*, Carr. Foliage glaucous, with silvery hue; a very desirable and vigorous form. Gng. 8:275. Var. *fastigiata*, Carr. Of upright columnar habit. R.H. 1890, p. 32.

*Libani*, Loud. Fig. 851. Large tree, with wide-spreading, horizontal branches, forming a broad head when older, leading shoot nodding: lvs. 1 in. or longer, broader than thick, dark or bright green, sometimes bluish or silvery: cones 3-4 in. long, brown. Lebanon, Taurus, S. Anatolia and N. Afr. Gng. 5:65.

Mn. 1:39. G.F. 8:335; 2:149 (adapted in Fig. 851). Gn. 48, p. 237; 66, pp. 124-5, 178. G.C. III. 34:265. F.S.R. 2, pp. 291-4. Var. *brevifolia*, Hook. With shorter lvs. and smaller cones. Cyprus. Var. *glauca*, Carr. (var. *argentea*, Veitch). Foliage of blue or silvery hue. Var. *nana*, Loud. Dwarf form.

AA. Branches and leading shoot pendulous: cones obtuse.

*Deodara*, Loud. Tall tree, of pyramidal habit, to 150 ft.: lvs. 1-2 in. long, dark bluish green, rigid, as thick as broad: cones  $3\frac{1}{2}$ -5 in. long, reddish brown. Himalayas. Gng. 2:8. G.C. III. 25:139; 34:400. F. 1876, p. 103. Gn. 28, p. 223. V. 20:185. Var. *robusta*, Carr. Lvs. about 2 in. long, rigid. Var. *pendula*, Beissn. (var. *recurvata pendula*, Hort.). With long pendulous branches



or prostrate if not supported. G.W. 14, p. 413. Var. *fastigiata*, Carr. Of columnar habit. Var. *verticillata*, Rehd. (var. *verticillata glauca*, Tutenberg). A compact form with the lvs. whorled at the base of the shoots: foliage bluish white: the hardiest form of the species. G.W. 11, p. 89. Var. *viridis*, Knight. Lvs.

oblong-obtuse, hairy outside: caps. 4-8 in. long, 5-valved, bearing many woolly seeds. Tropics of Asia, Afr., and Amer. B.M. 3360.—One of the characteristic and well-known trees of tropical countries. The wings of some of the old trees run far in all directions, sometimes being prominent 30 ft. or more; note the

picture (fig. 852) of the well-known tree at Nassau on the island of New Providence. The wood is used to some extent in interior construction, but is soft, white and brittle. The cotton-like material in the pods is used in beds and pillows and for stuffing life-buoys, but it cannot be spun into threads; it is the "kapok" of commerce. Offered in S. Calif. and Fla., as a tree of rapid growth.

*grandiflora*, Rose. Tree, 15-20 ft., 8-12 in. diam., the branches with short prickles: petioles 2-4 in. long; lfts. 3-5, glabrous, oblong, cuneate at base, entire or slightly serrulate, 2-3½ in. long; petals white, silky, 4-5 in. long, strap-shaped; stamens 5, the filaments 3½ in. long and each with 2 anthers: caps. oblong, 4½ in. long. Trop. W. Mex.—The fls. are fleshy; they change to brown. Listed in S. Calif.

L. H. B.



852. *Ceiba Casearia*, the great silk-cotton tree at Nassau.

bright green. Var. *argentea*, Carr. Foliage of silvery hue. Var. *nivea*, Annesley. Young growth white. G.C. III. 25:399. Var. *albo-spica*, Annesley (var. *albo-spicata*, Beissn.). Young growth green, becoming later white at the tips. G.W. 11, p. 89. Var. *aurea*, Beissn. Foliage golden yellow. G.W. 11, p. 87.

ALFRED REHDER.

**CÈIBA** (aboriginal name). *Bombacaceæ*. **SILK-COTTON. KAPOK. CEIBA.** Trees, one of which is widely known in the tropics for its great size as a shade tree, and for the "cotton" of its seed-pods. *Eriodendron* is a more recent name.

Leaves digitate, with 5-7 entire lfts.: fls. medium to large, rose or white, on 1-fl. peduncles, solitary or fasciated; calyx cup-shaped, truncate or irregularly 3-5-lobed; petals oblong, pubescent or woolly; staminal tube divided at the apex into 5 or 10 parts, each part bearing a stamen; ovary 5-celled: fr. a coriaceous caps., pubescent within and bearing obovoid seeds embedded in a wool-like or cotton-like fiber.—Allied to *Bombax* and *Adansonia*, from which it differs in having 5 parts in the staminal body or column, rather than a much more divided column bearing many stamens on each division. Ten or more species, mostly in Trop. Amer., extending to Asia and Afr.

*Casearia*, Medic. (*C. pentandra*, Gaertn. *Bombax pentandrum*, Linn. *B. guineense*, Schum. & Thoun. *Eriodendron anfractuosum*, DC. *E. occidentale*, Don. *E. orientale*, Kostel. *Xylon pentandrum*, O. Kunze.). **SILK-COTTON TREE. CEIBA. POCHOTE.** Figs. 852, 853. Great tree, reaching 100 ft. and more, and having immense horizontal far-spreading branches and wide-lying thin buttresses or flanges: trunk spiny when young; branches verticillate: lfts. 7, arising from a nearly circular plate or disk at the top of the petiole, lanceolate-acuminate, undulate, smooth, each 4-6 in. long: fls. white or rose, the corolla 2-3 in. long; petals

**CELÁSTRUS** (*Kelastros*, ancient Greek name). *Celastraceæ*. Woody plants grown chiefly for their brightly colored fruit; some also for their handsome foliage.

Shrubs, usually climbing, with alternate, petioled, usually deciduous and serrate glabrous lvs.: fls. polygamous, 5-merous, inconspicuous, greenish white, in axillary or terminal panicles or racemes; calyx 5-parted; petals small, oblong-ovate; disk entire or crenate; stamens short; ovary superior; style short with 3-lobed



853. Leaves and fruits of *Ceiba Casearia*, the silk-cotton tree. ( $\times \frac{1}{4}$ )



stigma: fr. a caps. dehiscent into 3 valves, each containing 1 or 2 seeds, inclosed in a fleshy crimson aril. —More than 30 species in S. and E. Asia, Austral. and Amer. The species with perfect fls. in axillary cymes and with evergreen lvs., being rigid and often spiny shrubs, are now included under *Gymnosporia*, which see.

These shrubs are hardy and ornamental, very effective with their bright-colored fruit remaining usually throughout the winter; *C. angulatus* is also worth growing for its large handsome foliage. They are very valuable for covering trelliswork, trees or rocks and walls: they grow in almost any soil and situation, and as well in shaded as in sunny positions. Propagated by seeds, sown in fall or stratified, and by root-cuttings or layers; suckers are freely produced, and become sometimes a nuisance in nurseries; they also can be increased by cuttings of mature and of soft wood.

A. Under side of lvs. green.

B. Lvs. 2-4 in. long: branchlets terete.

c. Fls. and fr. in axillary few-fl. cymes along the branches.

**orbiculatus**, Thunb. (*C. articulatus*, Thunb.). Fig. 854. High-climbing shrub: lvs. cuneate, suborbicular to oblong or obovate, acute or acuminate, crenate-serrate, 2-3 in. long: fr. globular, orange-yellow, with crimson seeds. Japan, China. B.M. 7599. G.F. 3:550 (adapted in Fig. 854). A.F. 9:534. G.C. III. 23:29; 43:242. Gng. 5:119. M.D.G. 1902:306. Var. **punctatus**, Rehd. (*C. punctatus*, Thunb.). A less vigorous grower, with smaller, elliptic lvs.—*C. orbiculatus* is of more vigorous growth than the following species, and fruits very profusely, but the frs. are hidden by the foliage, and are not very conspicuous until the lvs. have fallen, while *C. scandens* bears its frs. above the lvs.

cc. Fls. and fr. in terminal panicles.

**scandens**, Linn. FALSE BITTER-SWEET. WAX-WORK. Fig. 855. High, climbing to 20 ft.: lvs. cuneate, ovate to ovate-lanceolate, acuminate, crenate-serrate, glabrous, 2-4 in. long: fls. in terminal, many-fl. panicles or racemes 2-4 in. long: fr. about  $\frac{1}{2}$  in. diam., orange-yellow, with crimson seeds. Canada to S. D. and New Mex. Em. 545. A.G. 11:29, 31. G.F. 5:569 (adapted in Fig. 855). Gng. 5:119. A.F. 9:534. V. 3:315. Gn. 33, p. 393 (habit).



854. *Celastrus orbiculatus*. ( $\times \frac{1}{2}$ )

**paniculatus**, Willd. (*C. dependens*, Wall.). Branches brown with numerous small white lenticels, pendulous: lvs. ovate-oblong or obovate, sometimes to 5 in. long: fls. in terminal pendulous panicles 4-8 in. long. Himalayas.—Not hardy N.



855. *Celastrus scandens*. ( $\times \frac{1}{2}$ )

BB. Lvs. 4-6 in. long and 3-5 in. broad: branchlets angular.

**angulatus**, Maxim. (*C. latifolius*, Hemsl.). Glabrous shrub, climbing to 20 ft.: branchlets angular, finely lenticellate: lvs. broadly ovate or roundish, abruptly short-acuminate, crenately serrate: terminal panicles 4-6 in. long: fr. subglobose, nearly  $\frac{1}{2}$  in. thick, on thick short stalks, yellow with orange seeds. N.W. and Cent. China. H.I. 23:2206.—Even without fr. effective on account of its large foliage; has proved hardy at the Arnold Arboretum.

AA. Under side of the lvs. bluish white.

**hypoleucus**, Warb. (*C. hypoglauca*, Hemsl. *Erythrospermum hypoleucum*, Oliver). Glabrous shrub with terete brown branches scarcely lenticellate: lvs. elliptic or oblong-elliptic, 2-4 in. long, short-acuminate, remotely serrulate: terminal panicles 2-5 in. long, loose: fr. about  $\frac{1}{2}$  in. thick on slender stalks,  $\frac{1}{4}$ - $\frac{1}{2}$  in. long. Cent. China. H.I. 19:1899.

*C. flagellaris*, Rupr. Allied to *C. orbiculatus*. Branches with persistent spiny stipules, sometimes rooting: lvs. ovate or oval, small, finely serrulate, slender-petioled: fr. axillary, small. N. China, Korea, Japan. Quite hardy, but not so handsome as *C. orbiculatus*.—*C. nitans*, Hort. Reasoner, not Roxbg.=*Quisqualis indica*.—*C. Orixia*, Sieb. & Zucc.=*Orixia japonica*.

ALFRED REHDER.

**CELERIAC** (*Apium graveolens*, Linn., var. *rapaceum*, DC.). *Umbelliferae*. Fig. 856. An offshoot of the celery species, producing an edible root-part instead of edible leaves.

Celeriac is very little grown in this country, and to Americans is almost unknown, but it is much prized in Europe. Here it is cultivated chiefly where there is a foreign population. Fifteen or twenty varieties are mentioned in the seed catalogues, but there is very little difference in the various sorts, some seedsmen even making no distinction between varieties, but cataloguing the plant simply as celeriac.

In general, the culture is the same as for celery, except that no blanching is required, since it is the enlarged root that constitutes the edible part. Sow the seed during the spring in a well-prepared seed-bed, preferably in a more or less shaded location. A coldframe or a spent hotbed is a good place. The seed is slow



856. Celeriac trimmed for market ( $\times \frac{1}{2}$ ); also an untrimmed root, on a smaller scale.

to germinate, and must be kept well watered. When the plants are 2 or 3 inches tall, they ought to be transplanted; about 3 inches apart each way is a good distance to place them at this handling. Later, again transplant them to the open ground, in rows about 2 feet apart and 6 or 8 inches distant in the row. The soil should be a rich light loam well supplied with moisture. (The seed may be sown where the plants are to remain, and thinned to the required distance, but stronger, more stocky plants are secured by transplanting as directed.) Plants thus treated will be ready for fall and winter use.

If they are desired for earlier use, the seeds may be sown in a mild hotbed and transplanted to the open.

Aside from frequent tillage, celeriac requires but little attention during growth. It is a frequent practice with growers to remove a little of the earth from about the plants after the root has become well enlarged, and to cut off the lateral roots. This tends to make the main root grow larger, smoother and more symmetrical in shape. For winter use, the plants may be protected with earth and straw to keep out frost, or packed in moist sand and placed in a cool cellar.

The principal use of celeriac is for the flavoring of soups and stews, but it is also served in several other ways. It may be boiled and eaten with a white sauce, like cauliflower; as a salad, either first being cooked as beets or turnips, or else cut up into small pieces and used raw; when boiled, sliced and served with oil and vinegar, it forms the dish known as "celery salad." An extract may be obtained from it which is said to have medicinal properties.

Just how long celeriac, or turnip-rooted celery, has been in cultivation is unknown. Its history as a garden vegetable can be traced definitely as far back as the middle of the seventeenth century, although writers for a century or more previous to this time made references which would seem to relate to this vegetable, but the identity is obscure. Its origin was probably the same as that of the common garden celery, of which it is doubtless a state wherein the root has become enlarged and edible. This form is supposed to be the one most remotely removed from the wild state.

H. P. GOULD.

**CELERY** (*Apium graveolens*, Linn.). *Umbelliferae*. A major garden vegetable, grown for its blanched leaf-stalks which are eaten raw and also used in cookery.

Biennial, sometimes annual, plants: lf-stalks 6-15

in. long, bearing 3 pairs and a terminal lft. coarsely serrated and ternately lobed or divided. The fl-stalks are 2-3 ft. high, branched and leafy; fls. white, inconspicuous and borne in compound umbels; seeds very small, flattened on the sides, broader than long. An acrid, pungent flavor characterizes the wild plants.

The genus *Apium* is variously understood. As mostly accepted, it comprises some 15 or 20 species of annual or perennial glabrous herbs with pinnate or pinnately compound lvs., and small greenish white fls. in compound umbels; calyx-teeth wanting; petals ovate or rounded. The species are distributed widely in temperate regions and in the mountains in the tropics. *A. graveolens* is the one important species to the horticulturist. Var. *rapaceum* is celeriac, a form or race in which the crown of the plant is thickened and turnip-like (see *Celeriac*). The wild celery plant is not stout, nor are the lf-stalks thickened, as they are in the domesticated races. It grows 1-2 ft. high when in bloom, in marshy places near the sea, on the coasts of Eu., Afr., and Asia; and it has run wild from cult. in some parts of N. Amer.

Celery probably was not cultivated until after the Middle Ages, and the varieties now grown so extensively have been developed within the past thirty-five years. It is not many years since this vegetable was regarded as a luxury and sold at prices that could be paid only by the wealthy, but today it is one of the standard vegetables and is produced in enormous quantities for the city markets. The industry is often highly profitable on muck areas, and thousands of acres of this land are used for celery-culture in Michigan, Ohio, New York, Florida and California. Intensive market-gardeners of the North regard it as one of their most profitable crops, and results are especially satisfactory if the land can be irrigated. When good markets are available, celery is an excellent crop to follow early garden crops, such as peas, beans, beets, bunch onions, radishes and other vegetables that mature in ample time to allow the after-planting of celery to mature. Soils that have been previously cropped the same season should be manured liberally before celery is planted.

#### Types and varieties.

The methods of cultivation and handling of celery depend so much on the variety that this part of the subject should be discussed at the outset. Celery may be classified into two general groups—green varieties, and the so-called self-blanching varieties. Formerly, the green kinds were grown almost exclusively, but commercial growers soon discovered that the self-blanching varieties possess certain cultural advantages that make them highly desirable from a business point of view. They are more easily blanched, and this is probably the most important consideration when the crop is to be grown for commercial purposes. This is particularly advantageous in the summer crop, and equally appreciated by those who plant large areas for the late market. When boards are used for blanching, more than twice as many plants may be set on an acre as when green varieties are employed and the crop bleached with earth. It is



857. The Boston ideal.



universally conceded, however, that the light-colored varieties are somewhat inferior in quality to the green sorts. For this reason it is a mistake to rely wholly on self-blanching varieties in the home garden. Many home gardeners plant the light-colored kinds for summer use only, and green varieties for fall and winter use.

In some regions, a plant with a much-branched base is desired as in Fig. 857; but in general a less spreading or a lighter plant is grown, as in Fig. 858. These differences are mostly matters of the way in which the plants are grown, as to room in seed-bed and field.

*White Plume* is one of the best known of the self-blanching varieties. It is vigorous in growth and attains a greater height than Golden Self-blanching and, for this reason, does not meet with as great favor among commercial growers. The quality is also inferior to Golden Self-blanching.

*Golden Self-blanching* is by far the most popular of American varieties. It is a favorite with amateurs and constitutes probably 90 per cent of all the celery grown in the United States. The plants attain a height of 14 to 20 inches, and are compact and stocky. The stems are short, thick, easily blanched to a creamy white, and the foliage is abundant.

*Rose-ribbed Golden Self-blanching* has a tinge of rose-color on the ribbing of the stems, which makes the variety attractive for the home garden. It is not grown largely for commercial purposes.

*Giant Pascal* is an old green-stem variety that is not surpassed in quality. In rich moist soils the plants attain a height of 30 inches or more. It is a favorite of home gardeners who take pride in producing tall, tender stalks of the highest quality.

*Winter Queen* is a more popular green variety among commercial growers than *Giant Pascal*. It does not attain such a great height and grows more compactly, so that less space is required between rows, and the crop is more convenient to store.

*French Success* is a very stocky compact winter variety that possesses excellent keeping qualities.

*Boston Market* is famous for its excellent quality. It is grown extensively about Boston in the home gardens and for commercial purposes. It is low, compact, crisp, tender and of the best flavor.

Many other varieties are planted to some extent, but the most important have been mentioned.

#### Soils.

As previously stated, great commercial plantations are on muck soils, although the business is not confined to such lands. The mucks usually provide ideal conditions for the culture of celery. The plant thrives in soils abounding in vegetable matter, and as mucks contain 60 per cent or more of organic matter this requirement is fully met. A Kalamazoo (Michigan) muck soil, used extensively for celery, analyzed as follows:

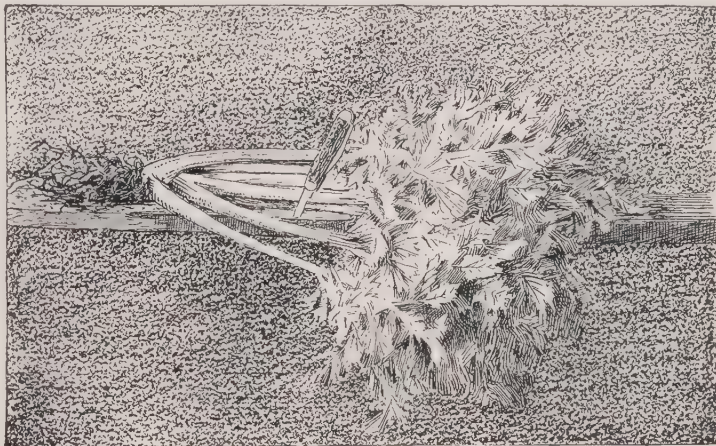
	Per cent
Sand and silicates.....	19.16
Alumina.....	1.40
Oxide of iron.....	3.94
Lime.....	6.09
Magnesia.....	0.81
Potash.....	0.34
Soda.....	0.38
Sulphuric acid.....	1.31
Phosphoric acid.....	0.88
Carbonic acid.....	1.95
Organic matter (containing 2.53 per cent of nitrogen).....	63.76
Water.....	6.51

Properly prepared mucks are loose and friable, and this is a great advantage in transplanting and in performing all tillage operations. The land is easily plowed, harrowed, leveled, marked and cultivated, and the work of ridging the plants is accomplished with the greatest ease. The depth of the water-table in muck lands varies greatly, but about 3 feet is considered most favorable; at this depth the plants never suffer from drought.

While it is universally conceded that muck soils provide the best conditions for the extensive cultiva-

tion of celery, the crop is grown with entire success on a great variety of soil types. In fact, the plants thrive in any friable soil which is adequately provided with moisture, plant-food and vegetable matter. Near all the northern cities of the United States may be found plantations of limited area that return excellent profits. This is particularly true in sections devoted to the most intensive types of market-gardening, when stable manure and commercial fertilizers are used almost lavishly. With this system of soil-management, the ground soon changes its physical properties and in some cases approaches the muck soils in mechanical composition. It is not uncommon to find small areas on various types of soil, cultivated intensely, which make a gross return of \$1,000 or more to the acre. These results indicate the great possibilities of the home garden for the production of celery. There is no reason why every gardener, whatever his type of soil, should not be fully successful in growing a bountiful supply of the choicest celery for the home table.

The reclaiming of new muck lands is often an expensive undertaking. The land must be cleared of brush and sometimes timber. Drainage must be provided



858. A good celery plant in the general market.

by means of tile or open ditches. The land is often acid, and lime should be employed to correct the acidity. For a year or two other crops than celery should be planted to get the land in the proper physical condition. The first plowing should be done in the fall so that the land will be exposed to frost during the winter. Corn is an excellent crop to plant the following spring. There should be repeated cultivation throughout the summer to destroy any other vegetation that may start.

Other types of soil should be prepared as in the usual way for the small garden crops. Fall plowing, after large quantities of manure have been added, is often desirable when an early crop is to be started the following spring. Smoothing harrows and plank drags should be used to make the soil fine and smooth preparatory to planting. All preparatory tillage operations should be conducted with a view to conserving soil-moisture, which is exceedingly important to celery throughout the period of growth.

#### Fertilizing.

As previously stated, it is important for land that is to be planted in celery to abound in vegetable matter. There must also be an abundance of available plant-food in order to secure a rapid and vigorous growth. When applying either manure or commercial fertilizer, the grower should bear in mind that this is a shallow-

rooted plant and the materials should not be placed at great depths.

All classes of growers, whether they are producing on a garden or field scale, and whatever their type of soil may be, recognize stable-manures as the best fertilizer that can be applied for this crop. Stable-manures are the most satisfactory because they furnish both organic matter and plant-food. It is often desirable to supplement stable-manures with commercial fertilizers, but the success of this crop will be far more certain if reliance is placed on barn-manures rather than chemical fertilizers.

An effort should be made to have the manures near the surface of the ground, and this can be accomplished by applying rotten or composted manure after plowing and working into the soil with a disc-harrow. If coarse fresh manure must be used and partially decayed manure is not available, it is preferable to apply it before plowing. Market-gardeners often apply thirty to forty tons to the acre, although smaller quantities give excellent results, especially if fertilizers are used in addition to the manure. Ten tons of manure on muck land is a decided advantage over no manure, even when fertilizers are used in large quantities.

Probably no commercial grower of celery should attempt to produce this crop without the use of at least some commercial fertilizer. When stable-manures are used lavishly, a little acid phosphate, nitrate of soda or potash will often give increased profits.

When stable-manure is not used at all, or perhaps in very small amounts, commercial fertilizers should be used with freedom. Two tons of a high-grade fertilizer to the acre is not an unusual application, and some of the most intensive growers use larger amounts. In the smaller areas, from which a gross return of \$800 to \$1,200 to the acre is expected, there should be no hesitancy in spending \$100 to \$125 an acre for manure and fertilizer. Celery requires much nitrogen and the mixed fertilizer applied before planting, or afterwards as a side-dressing, should contain not less than 4 per cent of this element. There should also be an abundance of potash and phosphoric acid. A fertilizer containing 4 per cent of nitrogen, 8 per cent phosphoric acid and 10 per cent potash should meet the requirements of this crop in all soils, when applied in sufficient quantity.

Some growers have found it highly desirable to apply nitrate of soda or complete fertilizer as side-dressings after the crop is well started. These applications may vary from 100 to 200 pounds to the acre and should be made at intervals of about three weeks.

#### *Starting the plants.*

The greatest care should be exercised in procuring seed, for inferior seed may result in pithy or hollow

seed directly from foreign producers, which, however, is unnecessary if the proper precautions are taken in the selection of a responsible seedsman. Practically all of the seed of the self-blanching varieties is grown in France, while most of the seed of green varieties is produced in California. As there is never absolute

certainly of securing entirely satisfactory seed, some growers follow the excellent practice of buying in large amounts, sufficient to last several years. Only a small

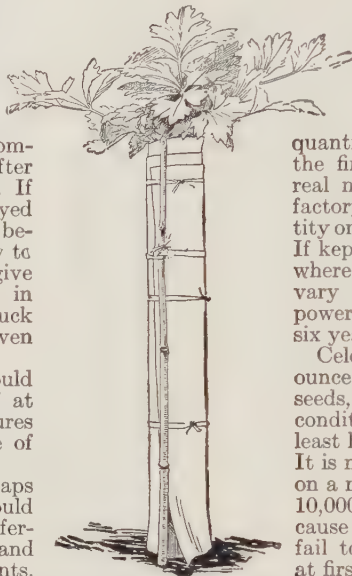
quantity of the seed is planted the first year to determine its real merit, and if found satisfactory there is sufficient quantity on hand to last several years. If kept in sealed jars in a room where the temperature does not vary greatly, the germinating power will be retained at least six years.

Celery seed is very small. An ounce contains about 70,000 seeds, and with the very best conditions should produce at least half this number of plants. It is not safe, however, to count on a much greater number than 10,000 plants to the ounce, because many of the seeds usually fail to germinate and the plants at first are very small and easily perishable. The seeds are slow to germinate. They should be planted in fine soil which, if possible, should be kept constantly moist but never wet.

Seed for the early crop is seldom sown before the first of March. If checked in growth at any time, there is great danger of the plants producing seed shoots which renders them unsalable. Plants started the first of March will, with proper care, be ready for market in August. Earlier sowing is possible and sometimes desirable, but adequate facilities must be provided to avoid crowding the plants, which invariably results in checking the growth. Some gardeners have found it to be profitable to start the plants the latter part of February, finally transplanting into frames, where the crop is matured.

Seed for the early crop may be sown in the beds of the artificially heated frame or greenhouse. Many growers use flats or shallow plant-boxes, which are placed in the hotbed or greenhouse. While broadcasting of the seed is often practised, it is better to sow in drills 2 inches apart. The furrows should be very shallow, as the seeds should not be covered with more than  $\frac{1}{8}$  inch of earth. Muck mixed with a small amount of sifted coal-ashes, sand and a little bone-meal, is most excellent for starting plants under glass. After sowing and lightly covering the seed, place a piece of burlap over the bed, and water it. Keep the bed covered with burlap or a piece of cloth until the plants begin to come up. Do not water more than necessary to keep the bed moist. When the plants appear they will need plenty of light, sunshine and fresh air. A temperature of 70° to 75° is most favorable to germination, but 10° lower should be maintained if possible after the plants are up. Higher temperatures, however, will do no harm if the proper attention is given to ventilation.

When the rough leaves appear, the seedlings should be transplanted into beds or preferably flats, spacing the plants 1½ inches apart each way. Stronger plants will be developed if they are set 2 inches apart. The flats may be about 2 inches deep and half filled with



860. Blanching celery by wrapping it with paper.



859. Celery planted thick, and the patch edged with boards. The "new celery-culture."

stalks, a poor stand of plants in the seed-bed, seedlings of low vitality, or a large percentage of seed shoots. Only the most reliable dealers, those who have a reputation for furnishing first-class seed of the varieties desired, should be patronized. To make certain of securing good seed, some careful growers import their



rotten manure, the remainder of the space being filled with good rich soil. The manure will furnish ideal conditions for the roots of the young seedlings and make it possible to transplant them to the open ground with blocks of earth and manure so that there will be practically no check in growth. If earliness is an important consideration, this method of treatment is highly important. Young celery plants require considerable nursing, and it will not do to take them from warm greenhouses or hotbeds to coldframes before the season is well advanced. They will suffer even more than tomato plants from low temperature. One of the most successful of our American growers invariably plants from the greenhouse to the open ground, beginning about May 10.

Spraying the seedlings several times with bordeaux mixture may be the means of avoiding loss from fungous diseases.

Seed for the late crop should be sown in the open ground or in protected beds as soon in the spring as the soil can be prepared. Delay in starting the plants is often responsible for a failure of the late crop. It is not so easy to control moisture in the outdoor seedbeds. If overhead irrigation lines are available, there will be no difficulty in this matter. The beds are often shaded with brush or lath screen. Small beds may be kept covered with moist burlap. When starting on a large scale, the rows may be a foot or more apart. Thinning is often necessary to secure stocky plants. The plants may be set where they are to mature any time after they have attained a height of about 3 inches. Ordinarily seedlings started out-of-doors are transplanted directly to the permanent bed or field without an intermediate shift, although this is an advantage in developing stronger plants with better roots. If the plants attain a height of 5 inches or more before they are set in the field, the tops should be cut back before transplanting.

#### *Planting in the field.*

As previously indicated, plants for the early crop should not be set in the open ground until about May 10 in the latitude of Philadelphia and New York. There is danger of injury from hard frosts if transplanted before this time, and such injury may result in a large percentage of the plants producing seed shoots, thus rendering them unsalable. Seedlings for the late crop may be transplanted in permanent quarters any time after June 20.

The time of planting in the field will depend largely on the varieties to be used. For example, Golden Self-blanching may be set out three or four weeks later than Giant Pascal and have time to mature fully before hard freezing weather is likely to occur. Many commercial growers do not transplant the late crop until nearly the first of August. In most parts of the North, it is better to transplant early in July. The date of transplanting, however, is not so important as to have the plants, as well as the ground, in proper condition before transplanting is started. Plants that are 3 to 5 inches high are much more likely to live and thrive than taller ones. The ground should be smooth, fine and moist. It is exceedingly important to have the rows perfectly straight and this can be accomplished by the use of a marker. A line may be used for this purpose, but transplanting may be accomplished much more rapidly by using a rope-and-peg marker.

There is the greatest variation in the planting distances for celery. Some of the most intensive growers plant 7 or 8 inches apart each way. Others prefer to space the rows about a foot apart and have the plants stand 4 inches apart in the row. When such close planting is followed, it is known as "the new celery-culture" (Fig. 859). The plants stand so close together

when this method is used that they blanch themselves and it is unnecessary to use boards or other devices. "The new celery-culture" is better adapted to greenhouse and coldframe use, where the plants can be watered by sub-irrigation. When plants stand so close together, there is little circulation of air and heart-rot or other diseases are likely to occur in hot moist weather. The possibilities of a small area by use of this method are very large and the system appeals to growers who have only small tracts of land to cultivate.

A more common practice is to space the rows 18 inches to 2 feet apart and to set the plants 4 or 5 inches apart in the row. This method is now almost universally employed for Golden Self-blanching when boards are to be used for blanching the crop. When transplanted 4 by 24 inches apart, about 60,000 plants are required to set an acre. If horse implements are to be used in planting, it is better to allow at least 28 inches between rows.

Some growers prefer to plant Golden Self-blanching in double rows 6 inches apart, placing the plants 4 or 5 inches apart in the row. This plan is not universally popular because it is not favorable to the full development of every plant. Boards are also used for blanching when this system of planting is followed.

When soil is to be used for blanching, more space



861. The last earthing-up or banking of celery.

must be allowed between rows. Formerly the almost universal practice was to allow 5 feet between rows. With tall-growing varieties, such as Giant Pascal, this is not too much space to provide sufficient soil for blanching. When lower-growing varieties, such as Winter Queen, are used, the rows need not be more than 4 or 4½ feet apart to give sufficient space for blanching with earth. The larger varieties of the green type should not be planted quite so close together in the row as Golden Self-blanching; for the best development of the plants, it is better to space them 5 or 6 inches apart in the row.

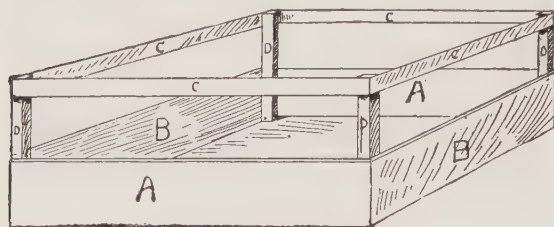
Growers who plant both early and late varieties often alternate the rows. The early variety is removed first, of course, and then there is 4 feet or more of space between the rows of late varieties which are blanched with earth. Transplanting should proceed as rapidly as possible without undue exposure of the roots to the air. If the plant-beds are watered twenty-four hours in advance of transplanting, the plants may be removed with less injury.

#### *Subsequent tillage practice in the North.*

Celery is often inter-cropped with other vegetables. One of the most common plans is to plant five rows of onions about a foot apart as early in the spring as the ground can be prepared. The fifth rows are pulled for bunching, and celery is planted instead of the onions. This is a most excellent combination for muck soils where good markets can be found for both crops. Radishes are also excellent to precede celery. If desired, the small button-shaped varieties may be

used, every fifth row to be planted in celery and later-maturing varieties of radishes in the four rows between.

Frequent tillage is necessary for the best results with celery. As it is a shallow-rooted plant, tools that run at considerable depth should be avoided. For horse tillage, there is nothing superior to the spike-tooth cultivator in general use. If the plants are small, great care should be exercised to avoid throwing dirt on top of the hearts. If the ground contains many



862. Water-holding celery crate.

weeds, more or less hand work will be required between the plants in the rows.

The mulching of soils with horse-manure has been a very popular and profitable practice in recent years. It has been shown in the laboratory as well as in field practice that a fine mulch of 3 or 4 inches of horse-manure conserves moisture more perfectly than the most thorough tillage. The mulching of celery in the field not only conserves moisture but it reduces the labor of tillage and also furnishes nourishment to the plants. The rains carry liquid food to the roots and a more rapid growth invariably follows. Considerable hand labor is required, of course, to place the manure between the rows, but this is probably no greater than the labor needed to till the crop when a mulch is not used. It is customary to use fresh horse-manure, which has been aerated in thin layers for a few days before making application. The ground is completely covered, although the manure is not allowed to touch the plants. The mulch may be applied immediately after planting or, as some prefer, the plants may be tilled for ten days or two weeks and the mulch then applied. Very few weeds will appear if 3 or 4 inches of horse-manure is used.

Irrigation makes the crop more certain, and it is also a means of securing larger and more vigorous growth and consequently better quality. Most of the intensive growers of the East are prepared to irrigate. Various methods are employed. Some who cultivate very small areas use the hose or other sprinkling device. The method that is now in most common use is the overhead system of irrigation, providing for parallel pipe lines about 50 feet apart (see *Irrigation*). These are turned at will by means of levers at the ends and the water is thrown out at any desired angle through small nipples placed about 4 feet apart on the lines. It is important to do the watering if possible in the evening or at night so that the foliage may be as dry as possible during the day. It is also important to make thorough applications, as it is not advisable to water more frequently than absolutely necessary.

#### *Blanching.*

All American markets demand celery with creamy white stalks. This light color is secured by causing the plants to grow with the stalks in the dark, or nearly so, which prevents the development of chlorophyll. When boards, earth, paper, tile or other means are used, most of the leaves are not covered, and growth is not hindered in the least.

Green varieties are blanched almost exclusively by the use of earth. There should be no ridging until the weather is cool and, therefore, this operation is

not usually undertaken until early in September at the North. At first the ridging should be only a few inches high, but later should extend to the full height of the stems. Finally, the rows are ridged so that only the tops protrude above the ridges, as shown in Fig. 861. Special tools are available for this operation and the work may be done very rapidly.

The early crop is blanched mostly by means of boards, although paper (Fig. 860) and other devices are sometimes used. Hemlock, pine and cypress lumber are used for this purpose in various parts of the country. The boards need not be more than 10 inches wide, although 12-inch boards are commonly used. They may be of any convenient length, say 14 to 16 feet long. To prevent warping and splitting, cleats about 3 inches wide and  $\frac{1}{2}$  inch thick should be nailed at each end and in the middle of the boards. The boards are placed on edge, one on each side of the row and brought as close together as convenient at the upper edge and secured by means of wire hooks. Sometimes stakes are driven at the sides, although wire hooks are more convenient. The hooks should be 6 or 7 inches long and may be made of heavy fence wire. From ten days to two weeks is required for proper blanching with boards. As the crop is sold, the boards are shifted from place to place so that they may be used several times during the season. When not in use, the boards should be stored under cover or stacked in piles with strips between them. With good care, boards that are sound when purchased will last fifteen years.

#### *Harvesting and marketing.*

The harvesting of the celery crop when grown in coldframes usually occurs in the month of July. If the climate is not too severe, it is possible to have celery ready for market the latter part of June. The late crop, which is produced without the use of boards, is not usually ready for market until August. It is lifted with forks or perhaps cut with a sharp knife just beneath the surface and conveyed to the packing-house where it is prepared for market. In some sections the roots are not trimmed at all, the plants being tied in bunches of a dozen and packed in a standard crate such as is shown in Fig. 862. These crates are 24 by 24 inches at the base, and contain six to sixteen dozen plants, depending on the size of the celery. The height of the crate may be varied to suit the height of the celery. Another form of celery crate is shown in Fig. 863. In some regions, the roots are trimmed into tapering cubes as shown in Fig. 864. A very convenient method of bunching is to place three plants side by side, tapering the roots as indicated, tying the tapering roots tightly and then securing the tops. Formerly twine was used almost entirely for bunching, while in recent years many growers have found it desirable to use either blue or red tape, which gives the celery a more attractive appearance on the market. Michigan growers and other producers of celery in the Great



863. Celery crate.

Lake district use small crates of very thin lumber. These vary in size and range about as follows: 6 by 12 by 24 inches; 6 by 16 by 24 inches; 2 by 20 by 24 inches; 6 by 26 by 24 inches and 6 by 30 by 24 inches. The number of bunches in the crates depends on the size of the celery and of the crate, but varies from four to twenty-four dozen. For local markets, the plants may be tied in bunches of the most popular size and packed in any crate of convenient form and size.



*Storage.*

A large percentage of the late celery crop is placed in city cold-storage houses. It is packed with the roots on, and there is very little trimming. Golden Self-blanching keeps fairly well in cold storage, or at least the hearts are presentable when they come out of storage. This is the product that now meets the general demand of the large cities until celery begins to arrive from Florida.

In the North, this crop is very commonly stored in trenches. The trenches are dug in well-drained ground and must be deep enough to accommodate the plants so that the tops will not extend more than about 2 or 3 inches above the trenches. The celery will keep better if the trenches are not too wide. Ordinarily they are dug 10 to 14 inches wide. The plants are lifted and stood as close together in the trench as possible. Some growers prefer to place a little earth over the roots, although this is not necessary. If the tops

of the plants are dry when stored, and if the plants are not permitted to wilt by being in the sunshine, they should keep in perfect condition in the trenches. Boards are nailed together in the form of a trough and placed over the trenches as rapidly as they are filled. Early in the season, and especially if the weather is quite warm, it is an advantage to provide additional ventilation by placing stones or blocks under the edges of the trough. As the season advances and the weather becomes colder, these should be

removed and when necessary, earth, or, better, manure, thrown over the boards to give additional protection. Four or 5 inches of manure will protect the crop thoroughly in most sections until Thanksgiving and perhaps Christmas, depending on the weather. Two kinds of trench storage are shown in Figs. 865, 866.

The late crop is often stored in coldframes of sufficient depth to receive the plants. The frames are usually covered with boards lapped in roof fashion, and straw or marsh hay is placed over the boards when necessary to give additional protection.

Ordinary house cellars, which are well ventilated and not too warm, may be used for storing a limited quantity of celery. Various types of houses have been built for keeping the crop. Cement or brick structures are perhaps the most serviceable. It is important to provide ample ventilation in structures of this kind. In some regions, as around Boston, pits are constructed. The sides of these should be about 2 feet high and the roof may be constructed in an even-span form or simply a shed roof against some other building. Boards are also used for the roofs and covered with straw or hay to give protection during cold weather.



864. Celery plant trimmed for market.

*Enemies.*

Celery does not have any serious insect enemies. Diseases are much more destructive and difficult to control. The most important diseases are the blights (*Cercospora apii* and *Septoria petroselinii* var. *apii*), leaf-spot (*Phyllosticta apii*), and rust (*Puccinia bulbata*). The application of bordeaux mixture in the seed-bed will help to control some of these diseases. Many growers also find it necessary to make frequent applications of bordeaux mixture in the field in order to prevent serious losses. The complete control of diseases in the field may be the means of avoiding loss in storage. The earlier applications of bordeaux mixture are regarded as the most effective. Rotation is also desirable in preventing losses from disease.

R. L. WATTS.

*Celery-growing in the South.*

The method of raising celery seedlings is not the same in the South, and especially in Florida, as it is in the North. Sowing is done in July, August, and September, at a time of the year when there is continued warm weather, and frequent beating rain.

A place is chosen for the seed-bed near the celery field,—usually a plot at the edge. The size of the field to be planted will determine the extent of the seed-bed. The width of the seed-bed varies from 18 to 36 inches. Rows are sown across it, making it possible to weed and keep the earth worked from both sides. Immediately after sowing, pieces of heavy burlap (usually old fertilizer sacks) are placed over the beds to conserve the moisture, cool the soil, and to protect the seeds against the beating of heavy rains. The seed-beds are sprinkled as often as is necessary to keep the surface moist.

After the seeds have germinated and the seed-leaves have pushed their way through the ground, the sacking is removed and a screening of cheese-cloth is placed over the bed. Some beds may be covered with cheese-cloth parallel to the surface of the soil. In other cases, a wire is run lengthways over the middle of the bed, and the cheese-cloth is placed over the wire and secured at the sides like a roof. The covering is about 8 to 12 inches above the bed, which gives room for the circulation of air. The beds are kept moist by repeated watering, applied directly through the cheese-cloth.

As soon as the plants are 2 or 3 inches high and are well greened, they will be strong enough to stand direct sunlight and will shade the ground sufficiently to keep it from drying out rapidly.

*The best variety.*

Formerly nearly all varieties of which seeds were offered by seedsmen were planted. In recent years, however, all have been nearly eliminated except the Golden Self-blanching. The seed of this variety is very high in price and, in years of scarcity, seed supplied under this name is often found to be more or less untrue to type. Seed of low-germinating quality is often found to contain many plants that will make unwelcome vegetables, probably because the undesirable green and red strains that may occur in the Golden Self-blanching variety are more resistant to deterioration than the true type.

*Planting and blanching.*

Blanching is secured entirely by the boarding-up method. For this purpose, second- or third-grade cypress boards are used; these low-grade boards usually have defective parts or are filled with worm-holes so as to be obtainable rather cheaply. The expense of the lumber, notwithstanding, is so great that it becomes necessary to plant the celery in double rows. Two rows are planted 8 or 10 inches apart, and the plants set 6 or 8 inches apart in the row. By alternating the settings in the two rows, additional space is secured for the plants.

A space of 30 to 40 inches is allowed between the sets of double rows. As soon as the celery has reached the proper stage of growth, or the market has arrived at a condition in which it is thought wise to ship the celery, the boards are placed alongside the plants and held in place by stakes driven into the ground. Further to exclude the air and light, a small quantity of soil is plowed against the bases of the boards, although this



865. An old method of growing celery in trenches. It is yet sometimes stored for winter in such trenches.

is unnecessary when the soil is sufficiently mellow. The tops of the boards are placed firmly together so that only a part of the foliage extends above them.

With the Golden Self-blanching variety, it is only a few days until the celery is sufficiently blanched and crisp to make a good vegetable.

#### Fertilizer.

In the preparation of the field, large quantities of fertilizer are used. Stable manure is not a favorite, unless it can be applied to the land early enough to become thoroughly rotted before the plants are set out. The quantity obtainable, however, is usually so small and the price so high in the South that commercial fertilizers have largely replaced it. The quantity of fertilizer applied may range up to \$80 or even \$125 worth per acre (of the formula given on page 704.)

#### Irrigation.

In the most productive celery regions, sub-irrigation systems (as described under *Irrigation*) are established. The laterals are laid 15 to 25 feet apart, according to the contour of the land, and the notion of the grower. The irrigation system at the same time serves as a drainage system. This makes it especially convenient, since abundant artesian water is present in nearly all the celery-growing sections far south. The system has been found so convenient that a large amount of damage has been done by over-irrigation, not only in carrying off much soluble fertilizer, but also by water-logging the soil and thus driving the roots of the celery plants so near the surface as to be constantly liable to injury. In the hands of careful celery-growers, however, the system is the best that has been invented.

P. H. ROLFS.

#### Celery-growing in California.

There are two principal celery-growing districts in California,—Orange County, which is situated in the swamp lands south of Los Angeles; and the northern district, which includes the peat or swamp lands along the Sacramento and San Joaquin Rivers between Sacramento

and Stockton.

Several varieties of celery have been tested in this state, but the Golden Self-blanching is most popular and profitable.

#### Seeding.

In California the seed is sown in the open ground, but, owing to its extremely small size, it is difficult to get a good stand unless the ground is well pulverized. It is commonly estimated that enough plants may be grown on 1 acre of seed-bed to plant 20 acres in the field. To produce healthy, vigorous plants, heavy

watering is the rule at first, but as soon as the plants have begun to grow the quantity of water is reduced, and it should never be allowed to stand on the surface of the bed. In order to accomplish this the land must be well drained. The seed is usually sown in March, April or May.

#### Irrigation and drainage.

Although not nearly so much water is required for the plants in the field as in the seed-bed, celery plants cannot stand drought at any stage of their growth; a well-controlled irrigation system is imperative, except where the water-table is close to the surface.

Good drainage is as important as irrigation, for, if water is allowed to stand in the field even for a short time, the plants will suffer seriously. As most of the California celery land is low and the ordinary drainage is poor, an extended system of tile drainage has been laid in nearly all celery fields, especially in Orange County, to prevent losses from standing water.

#### Subsequent tillage.

When the plants are large enough to be transplanted, they are pulled from the seed-beds, placed in tin pans and hauled to the field, where they are planted 6 inches apart in the furrows  $3\frac{1}{2}$  feet apart. The depth of the furrows in which the plants are set is somewhat varied, depending on the soil-moisture, and the size of the plants. The average depth is from 3 to 5 inches.

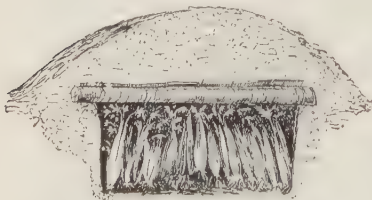
After the plants have been set in the field for about three weeks or a month and have recovered from the transplanting, the field is "crowded." This operation consists in moving the earth away from the young plants so that they will have more air around them and to kill what weeds have grown so close to the plants that it is impossible to reach them with the cultivator.

As the earth between the rows of plants is left in a ridge after the plants have been "crowded," a large wooden roller, which extends across several rows, is now used to flatten down these ridges and to pack the soil more firmly. The roller is used only when the plants are small, otherwise they would be injured by being crushed. If the plants have grown so large that there is danger of injury by this rolling of the middles, the ridges are smoothed down by the cultivator.

When the plants are 12 to 15 inches tall, earth from between the rows is drawn up to them. This is termed "splitting." This should be done carefully, for, if the earth is put too close or too high up on the plants, they will become tender and weak, especially if the weather is hot. The object of "splitting" is gradually to encourage the plants to grow tall and straight instead of spreading out. This operation is repeated twice in the season, the first time when the plants are 14 to 16 inches tall and the second time just before banking. This last "splitting" also aids blanching.

#### Blanching.

Practically all the celery grown in California is banked with earth for blanching. Banking is done when the celery is reaching its maturity and is nearly ready for shipment. This is the last field operation before the crop is cut. When the celery is banked for the first time, the earth is not drawn very high on the plants, but each time the field is banked the soil is drawn higher so as firmly to hold the leaves together and in an upright position. If celery that has been banked for the last time is not harvested shortly, it will soon become "punky." The length of time that it can safely be left in the bank depends upon the character of the soil, the weather conditions, and upon the condition of the plants themselves. Celery on sandy soil will keep much longer in the bank than on heavy clay loam or peat soil. If the celery has not matured or if the weather is hot or moist, its keeping quality



866. A good form of trench storage.



will be injured. Holding too long in the bank will result in a wilted and "punky" product.

#### Harvesting and shipping.

When the celery is ready to harvest, a cutting machine is used which cuts off the plants just below the crown, leaving a few roots attached. The plants are then lifted and shaken from soil, trimmed and thrown in piles by laborers, who are usually Japanese. Another gang of men then place the plants in crates, marking on each crate the number of dozens it contains. More men follow, nail the crates securely, load them on wagons which transport them to the railroad siding, where they are ready for shipment and distribution to the various markets in the United States and Canada.

The celery is packed in the fields in crates 22-by-24-inch base and 18 to 24 inches in height, according to the quality. One of these crates holds from five to ten dozen celery plants. An ordinary car holds from 160 to 165 of these crates. The shipping of the crop starts in October and continues through March, but the bulk of the crop is harvested during November, December and January. The earlier shipments come into competition with celery from Michigan and other middle western states, and the later shipments come into competition with celery from Florida. A very efficient system of marketing has been developed by means of various associations of the growers which have representatives in the leading markets in the United States so that the celery is shipped to points of greatest demand.

#### Enemies.

The most important disease in California is the late blight (*Septoria petroselinii* var. *apii*), which has done an immense amount of damage in the past but is now handled successfully by most of the growers. Spray with bordeaux mixture. For early blight (*Cercospora apii*) keep plants growing thriftily and spray with bordeaux. (For a detailed account of the diseases of celery in California see Bulletin No. 208, published by the University of California.) STANLEY S. ROGERS.

**CELMÍSIA** (a name in mythology). *Compósitæ*. More than 40 New Zealand perennial herbs, and 1 in Austral. and Tasmania, some of which may be expected in botanic gardens and collections. Lvs. radical and in rosettes, or densely imbricated if borne on the sts., usually tomentose; heads large and solitary on a long or short scape, with imbricate pubescent or glandular bracts in several or many series; rays in a single row, always white. The celmisias are characteristic plants of New Zeal., covering the mountain slopes and valleys, especially in the South Isl., with the showy daisy-like fls. Probably none is regularly in cult.

L. H. B.

**CELÒSIA** (Greek, *kelos*, burned; referring to the burned look of the flowers in some species). *Amarantaceæ*. **COCKSCOMB**. Popular garden annuals, grown for the showy agglomerated flower-heads and sometimes for colored foliage.

Alternate-leaved annual herbs, the lvs. entire or sometimes lobed, mostly narrow; fls. in dense terminal and axillary spikes, the spikes in cult. forms becoming densely fascicled and often the sts. much fasciated; perianth very small, 5-parted, dry, the segms. oblong or lanceolate, erect in fr.; stamens 5, the filaments united at base: fr. a circumscissile utricle, with 2 to many seeds.—About 35 species, all tropical, in Asia, Afr. and Amer.

There are two main types of celosias, the crested form and the feathered or plummy ones. The crested cockscomb is very stiff, formal and curious, while the feathered sorts are less so, and are used to some extent in dried bouquets. The plummy sorts are grown abroad for winter decoration, especially under the name of *C.*

*pyramidalis*, but to a small extent in America. The crested cockscomb is less used as a summer bedding plant than formerly, but it is still commonly exhibited in pots at small fairs, the object being to produce the largest possible crest on the smallest plant.

For garden use, the seeds are sown indoors in early spring, and the plants set out May 1 to 15. If the roots dry out, the leaves are sure to drop off. The cockscomb is a moisture-loving plant, and may be syringed often, especially for the red-spider, which is its greatest enemy. A light, rich soil is needed.

#### A. Spikes crested, monstrous.

**cristata**, Linn. **COCKSCOMB**. Fig. 867. Height 9 in. or more: st. very glabrous: lvs. petiolate, ovate or somewhat cordate-ovate, acute, glabrous, 2–3 in. long, 1 in. wide: spikes crested, subsessile, often as wide as the plant is high: seeds small, black, shining, lens-shaped. Tropics. Gn. 13, p. 231. R.H. 1894, p. 58.—There are 8 or 9 well-marked colors in either tall or dwarf forms, the chief colors being red, purple, violet, crimson,



867. *Celosia cristata*.

amaranth and yellow. The forms with variegated lvs. often have less dense crests. *A. japonica*, Mart., little known to botanists, is said to be a distinct garden plant with branching, pyramidal habit, each branch bearing a ruffled comb.

#### AA. Spikes plummy, feathery, or cylindrical.

**argentea**, Linn. Taller than the above: lvs. shorter-stalked, narrower, 2–2½ in. long, 4–6 lines wide, linear-lanceolate, acute: spikes 1–4 in. long, erect or drooping, long-peduncled, pyramidal, or cylindrical. India.—This species is considered by Voss (in Vilmorin's *Blumengärtner*) to be the original one from which the crested forms are derived. He makes 9 botanical forms, to one of which he refers *C. cristata*. The range of color is even greater in the feathered type than in the crested type. The spikes are very various in form and habit. Various forms are shown in Gn. 6, p. 513; 9, p. 149; 17, p. 331 (all as *C. pyramidalis*). R.H. 1857, p. 78, and 1890, p. 522 (as *C. pyramidalis*).

**Húttoni**, Mart. Height 1–2 ft.: habit bushy, pyramidal: st. sulcate-striate: lvs. reddish or crimson, lower ones lanceolate, subsessile: spikes red, cylindrical, oblong, obtuse, 1½ in. long; perianth-segms. oblong (not lanceolate, as in *C. argentea*). Java.—A foliage plant, and less common than the 2 species above.

*C. spicata*, Hort.=(?). Not the *C. spicata*, Spreng.; perhaps some form of *C. cristata*.—*C. Thompsonii magnifica*, Hort., is a trade name and apparently without botanical standing.

WILHELM MILLER.

**CÉLSIA** (Olaus Celsius, 1670–1756, a Swedish orientalist). *Scrophulariaceæ*. Herbs, with yellow fls. in terminal racemes or spikes, closely allied to *Verbascum*, but has only 4 stamens, and they are of 2 sorts. About 40 Old World species, mostly from the Medit. region.

Only *C. crética*, Linn. f., is known in Amer., and that very sparingly. It is a hardy or half-hardy biennial, with alternate lvs., of which the lower are slightly pinnate and lanceolate, and the upper ovate-lanceolate, toothed and clasping: fls. large (nearly 2 in. across), and somewhat as in *Antirrhinum*, yellowish, with dark markings in the center and conspicuous deflexed stamens. Stout hairy plant, 3-6 ft. high, from Crete. B.M. 964.—A very showy plant well worth much wider cult. See page 3566.

*C. pónica*, Hort. Has whitish lvs. and pure white fls.

N. TAYLOR.†

**CÉLTIS** (ancient Latin name). *Ulmaceæ*. NETTLE-TREE. Woody subjects grown chiefly as shade or lawn specimens.

Trees or rarely shrubs, sometimes spiny: lvs. alternate, petiolate, stipulate, deciduous or persistent, usually oblique at the base and 3-nerved: fls. polygamous-monoecious, inconspicuous, apetalous, 4-5-merous, axillary, the staminate in small clusters on the lower part of the branchlets, the fertile solitary in the axils of the



868. *Celtis occidentalis* ( $\times \frac{1}{2}$ ). (Detail  $\times \frac{1}{4}$ )

lvs. on the upper part of the branchlets, with a 1-celled superior ovary crowned by a 2-parted style and with 4-5 short stamens: fr. a 1-seeded, small drupe, edible in some species; embryo with broad cotyledons.—Seventy species in the temperate and tropical regions of the northern hemisphere, of which a few hardy ornamental species are cult.

The nettle-trees are valuable as shade trees or as single specimens on the lawn, mostly with wide spreading head and light green foliage, which is rarely seriously injured by insects or fungi; they thrive in almost any soil and even in dry situations; they are of vigorous growth when young, and are easily transplanted. The straight-grained wood is light and elastic, easily divided, and much used for the manufacture of small articles and for furniture; that of *C. australis* is valued for carving. Propagated by seeds, sown after maturity; also by layers and cuttings of mature wood in fall; rarer kinds are sometimes grafted on *C. occidentalis*.

A. Lvs. entire, or rarely with few teeth, thin, at length glabrous.

*mississippiensis*, Bosc (*C. laevigata*, Willd. *C. integrifolia*, Nutt.). Tree, 60-80 ft.: lvs. unequally rounded or

cuneate at the base, oblong-lanceolate or ovate, acuminate, usually falcate, smooth above, 2-4 in. long: fr. orange-red, nearly globular,  $\frac{1}{4}$  in. thick, on slender pedicel, longer than the petiole; stone pitted. From S. Ill. to Texas and Fla., west to Mo. S.S. 7:318. G.F. 3:41, figs. 9-11. Mn. 7:225, 227.

AA. Lvs. serrate, sometimes entire and pubescent.

B. Ovary and fr. glabrous.

C. Branchlets usually and lvs. more or less pubescent, at least when young.

D. Fr.-stalks slender, longer than petioles: lvs. usually rough above: stone pitted.

E. Under surface of lvs. glabrous at maturity.

*occidentalis*, Linn. Fig. 868. Large tree, occasionally 120 ft.: branchlets glabrous or slightly pubescent: lvs. oblique and rounded at the base, ovate-acuminate, pubescent when young, usually rough above, sometimes smooth at maturity, usually entire toward the base, light green, 2-6 in. long: fr. orange-red,  $\frac{1}{2}$ - $\frac{1}{2}$  in. long, on slender pedicel, longer than the petiole. S.S. 7:317. G.F. 3:40 (adapted in Fig. 868) and 43. Em. 304. Mn. 7:231, 233. A.G. 20:240, 531.—Very variable species. Var. *crassifolia*, Koch (*C. crassifolia*, Lam.), has firm, very rough and large lvs., to 5 in. long, usually cordate at base and more strongly serrate. Michx. Hist. Arb. 3:228.

EE. Under surface of lvs. pubescent.

*australis*, Linn. Tree, to 60 ft.: lvs. oblique, broadly cuneate or rounded at the base, ovate-oblong, long-acuminate, pubescent beneath,  $2\frac{1}{2}$ -5 in. long: fr. over  $\frac{1}{2}$  in. long, dark purple, sweet; pedicels 2-3 times longer than the petioles. Medit. region to Persia. H.W. 3:40, p. 11.—Not hardy N.

*Héleri*, Small. Tree, to 30 ft.: branchlets pubescent: lvs. ovate or ovate-oblong, obtuse or acute, truncate to subcordate at the base, rough above, grayish and pubescent or tomentose, and reticulate below, 2-3 in. long: fr.  $\frac{1}{2}$  in. thick, light brown, on pubescent pedicels about  $\frac{1}{2}$  in. long and rather stout. Texas.—Sometimes planted as a street tree in Texas.

DD. Fr.-stalks rather stout, as long or slightly longer than petioles: lvs. grayish green beneath: stone smooth.

*sinensis*, Pers. (*C. japonica*, Planch.). Tree, to 30 ft.: lvs. usually rounded or cordate at the base, broadly ovate to oblong-ovate, acuminate, serrate-dentate, pubescent when young, pale or glaucescent and prominently reticulate beneath, 2-4 in. long: fr. dull orange-red; pedicels rather stout, not much longer than the petioles. China, Japan. S.I.F. 1:36.—Has proved hardy at the Arnold Arboretum.

CC. Branchlets and lvs. quite glabrous: stone smooth.

D. Foliage bluish or grayish green.

*Tournefortii*, Lam. (*C. orientalis*, Mill., not Linn.). Tree, to 20 ft., or shrub: lvs. ovate, acute, usually rounded or subcordate at the base,  $1\frac{1}{2}$ -3 in. long, of firm texture, not reticulate, sometimes pubescent: fr. reddish yellow, about  $\frac{1}{2}$  in. across, its stalk about as long as petiole,  $\frac{1}{2}$  in. long or somewhat less. Greece, Sicily and Asia Minor.—Not quite hardy N.; attractive on account of its bluish green foliage.

DD. Foliage bright green, lustrous.

*Bungeana*, Blume. Tree: lvs. usually rounded at the base, ovate, acuminate, crenate-serrate, nearly glabrous when young, green and shining on both sides,  $1\frac{1}{2}$ - $2\frac{1}{2}$  in.: fr. purplish black, small; pedicels longer than the petioles. N. China.—Hardy, and a very distinct species, with dark green and glossy foliage.

BB. Ovary and fr. pubescent; subtropical, tender tree.

*Kraussiana*, Bernh. Tree: lvs. oblong-ovate, usually rounded at the base, acuminate, crenate-serrate, pubes-





XXIV. *Cœlogyne cristata*, one of the popular and easily grown orchids.





cent on the veins beneath, semi-persistent: ovary tomentose: fr. mostly pubescent, slender pedicelled. S. Afr. to Abyssinia. Sim, Forest Fl. Cape Colony, 134. —Hardy only S.

*C. Biéridii*, Pampanini. Lvs. broader than in *C. Bungeana*, grayish below: frs. dark blue, small. Cent. China.—*C. caucásica*, Willd. Allied to *C. australis*. Lvs. broadly rhombic-ovate, somewhat smaller: fr. smaller, reddish brown. Caucasus, N. Persia.—*C. Davidiana*, Carr. Allied to *C. Bungeana*. Small tree: lvs. ovate-oblong or elliptic-oblong, often sparsely hairy on the veins below, 2-5 in. long. N. China. Incompletely known.—*C. georgiana*, Small. Allied to *C. occidentalis*. Shrub or small tree: branchlets pubescent: lvs. ovate, acute, entire or sharply serrate, 1-2 in. long: fr.  $\frac{1}{4}$  in. across, short-stalked. Md. to Fla., Ala. and Mo.—*C. orientalis*, Linn. = *Trema orientalis*.—*C. orientalis*, Mill. = *C. Tournefortii*.—*C. reticulata*, Torr. (*C. mississippiensis* var. *reticulata*, Sarg.). Small tree, to 50 ft.: branchlets pubescent. lvs. ovate, usually cordate, entire or serrate, rough above, pubescent and reticulate below,  $1\frac{1}{2}$ -3 in. long: fr.  $\frac{1}{4}$  in. thick, orange-red. Colo. to Texas and Ariz.—*C. Smillii*, Beadle. Allied to *C. mississippiensis*. Lvs. lanceolate or oblong-lanceolate, thin, sharply serrate, 2-4 in. long: fr.  $\frac{1}{4}$  in. thick, slender-stalked. N. C. and Tenn. to Ga. and Ala.

ALFRED REHDER.

**CEMETERY GARDENING.** Treated under Landscape Gardening.

**CÉNCHRUS** (an ancient Greek name). *Gramineæ*. Mostly annual grasses with simple racemes of burs that become detached and adhere readily to clothing and animals. Spikelets as in *Panicum*, but 2-6 together in a spiny involucre or bur. *C. carolinianus*, Walt. (*C. tribuloides* of American authors), SAND-BUR, is a common weed in sandy soil. Dept. Agric. Div. Agrost. 20:40.

A. S. HITCHCOCK.

**CÊNIA** (Greek for *empty*, in allusion to the hollow receptacle). *Compósitæ*. Low herbs from S. Afr., with the aspect of mayweed. Head small and rayed, the ray-fls. pistillate, the disk-fls. compressed and 4-toothed, the receptacle gradually enlarged from the top of the peduncle, and hollow. About 8 species, none of which are of much horticultural value. *C. turbinata*, Pers. (*C. pruinosa*, DC.), is a common weed in Cape Colony, and it is occasionally seen in American gardens. It is annual, diffusely branched, and a foot or less high, with finely dissected, soft, almost moss-like foliage, and long-peduncled, small, yellow heads. Of easy cult. United with *Cotula* by Hoffmann in Engler & Prantl.

L. H. B.

**CENTAURËA** (a *Centaur*, famous for healing). *Compósitæ*. CENTAURY. DUSTY MILLER. BACHELOR'S BUTTON. CORNFLOWER. Knapweed. Annuals or hardy and half-hardy perennials with alternate leaves, useful for bedding, vases, baskets and pots, and for borders and edgings; species many and various.

Involucre ovoid or globose, stiff and hard, sometimes prickly: receptacle bristly: marginal florets usually sterile and elongated, making the head look as if rayed. Differs from *Cnicus* in having the achenes obliquely attached by one side of the base or more laterally.—Species about 500, much confused, mostly in Eu., Asia and N. Afr., 1 in. N. Amer., 3 or 4 in Chile. Several Old World species have become weeds in this country. J.H. 43:76. The species are of simple cult., coming readily from seeds. Many of the perennial species make excellent border plants, and their blue and purple heads are welcome additions to the horde of yellow-flowering composites.

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A. DUSTY MILLER.—*White-tomentose low plants, used for bedding or for the sake of their foliage.*

1. *Cineraria*, Linn. (*C. candidissima*, Lam.). Fig. 869. Perennial: sts. erect, 3 ft., branched, the entire plant white-tomentose: lvs. almost all bipinnate (except the earliest), the lower petioled, all the lobes linear-lanceolate, obtuse: scales of the ovate involucre appressed, with a membranous black margin, long-ciliate, the apical bristle thicker than the others: fls. purple. S. Italy, Sicily, etc.—Much used as a bedding plant, not being allowed to bloom. The first lvs. of seedlings are nearly entire (as shown in Fig. 869), but the subsequent ones become more and more cut. Grown both from seeds and cuttings. Seedlings are very apt to damp off unless care is taken in watering.

2. *depressa*, Bieb. A flat, almost prostrate perennial: st. floccose-tomentose and much branched: lower lvs. scarcely denticulate, the upper oblong-linear, entire: bracts of the involucre white- or black-margined: fls. showy, the blue rays about  $\frac{1}{2}$  in. long. Persia, Caucasus. July.

3. *gymnocarpa*, Moris & DeNot (*C. argentea*, Hort. *C. plumosa*, Hort.). Fig. 870. Perennial: entire plant covered with velvety white pubescence: sts.  $1\frac{1}{2}$ -2 ft. high, erect: lvs. bipinnatisect; segms. linear, entire, acute: fl.-heads small, in a close panicle, mostly hidden by the lvs.; fls. rose-violet or purple. Caprea. V. 4: 337.—Very ornamental on account of its velvety finely cut lvs. Much used, like No. 1, for low foliage bedding: lvs. more compound, and usually not so white.



869. Lower leaf from a young plant of *Centaurea Cineraria*. ( $\times \frac{1}{2}$ )



870. Radical leaf of *Centaurea gymnocarpa*. ( $\times \frac{1}{2}$ )

4. *Clementei*, Boiss. Perennial, the entire plant densely white-woolly: sts. erect, branching, with few lvs.: root-lvs. petioled, pinnate, the lobes ovate-triangular, sharp-pointed; st.-lvs. sessile: fl.-heads terminal on the branches, globose; involucre scales with scarious, ciliate margins, scarcely spiny; fls. yellow. Spain.

AA. CORNFLOWER, OR BACHELOR'S BUTTON.—*Tall-growing annual, with very narrow lvs., grown for the showy fls.*

5. *Cyanus*, Linn. (*Cyanus arvensis*, Moench.) BLUE-BOTTLE. BLUET. BACHELOR'S BUTTON (see also *Gomphrena*). CORNFLOWER. RAGGED SAILOR. FRENCH PINK. Fig. 871. Annual, slender, branching, 1-2 ft. high, woolly-white when young: lvs. linear, entire or the lower toothed, sometimes pinnatifid: fls. blue, purple, pink or white, the heads on long, naked sts.: involucre bracts rather narrow, fringed with short, scarious teeth. S. E. Eu. Gt. 38, p. 641; 39, p. 537. V. 5, p. 44; 13:361.—One of the most popular of garden fls., variable. It is perfectly hardy, blooming until frost

and coming up in the spring from self-sown seed. The following are varieties of this: *Pure White*; *Victoria*, a dwarf, for pots and edgings (Gn. 40, p. 147); *Emperor William*, fine dark blue; *flore pleno*, with the outer disk-fls. converted into ray-fls.; *nana compacta*, dwarf. (Gt. 44, p. 150.) *Centaurea Cyanus* is one of the "old-fashioned flowers," everywhere well known and popular. It often escapes from gardens.

AAA. SWEET SULTANS.—*Straight-growing smooth annuals or perennials, with dentate lvs., grown for the large fragrant heads.*

6. *moschata*, Linn. (*C. suaveolens*, Linn. *C. odorata*, Hort. *C. Amberbøii*, Mill. *Amberbøa moschata*, Less.).

SWEET SULTAN. Fig. 872.

Annual: sts. 2 ft. high, branching below, erect: whole plant smooth, bright green: lvs. pinnatifid, the lobes dentate: fl.-heads long-peduncled; involucre round or ovate, smooth, only the innermost of the involucreal scales with scarios margins: fls. white, yellow or purple, fragrant. Orient. Mn. 4, p. 149. Gn. 54:372. I.H. 42, p. 106. Gng. 4:147. G. 5:289; 16:267; 25:71.

Var. *alba*, Hort. (*C. Margaritæ*, Hort.). Fls. white. Gn. 19, p. 337; 54:372. A.G. 13:607. This form, known as *C. Margaritæ*, is pure white and very fragrant. It was intro. by an Italian firm in 1891. Var. *rùbra*, Hort. Fls. red. Gn. 54:372.—A popular, old-time garden fl., with long-stalked heads; of easy cult. It does not bear transplanting well.—*C. imperialis*, Hort., is said to be the offspring of *C. moschata* and *C. Margaritæ*, intro. into the American trade in 1899. Gn.M. 13:74. Plants are said to inherit the vigorous free growth of *C. moschata*, being of the same easy cult. and forming clumps 3–4 ft. high. The fls. resemble *C. Margaritæ*, but are twice as large and abundantly borne on long sts. from July until frost. They range through white, rose, lilac and purple, are fragrant, and if cut when first open will keep 10 days. *C. Máriae*, Hort., intro. 1899, resembles *C. imperialis*, but the fls. open sulfur-yellow, become lighter, and are tipped with rose. All sweet sultans do best if the bloom is secured before very hot weather.

7. *glastifolia*, Linn. A strong-growing border perennial with a rough much-branched and winged st.: lvs. oblong, entire, decurrent, the basal lvs. petiolate, sometimes divided: fls. yellow, the heads solitary, without bracts, and quite smooth. Cent. Eu. B.M. 62. June–Sept.

AAAA. OTHER CENTAUREAS of various kinds, occasionally grown in hardy borders, for their fls. or imposing stature. See page 3567.

B. *Foliage green on both sides.*

C. *Lvs. pinnate or bipinnate.*

8. *spléndens*, Linn. (*C. Margaritæcea*, Ten.). Perennial: sts. erect, branched: lvs. smooth, the lowest bi-

pinnate, the upper pinnate, all with very narrow, linear, entire, acute lobes: fl.-heads subglobose; scales of the involucre with a rounded almost entire rather lax tip; fls. purple. Spain, Italy.

9. *ruthénica*, Lam. Hardy perennial about 3 ft.: st. erect, branching, smooth: lvs. pinnatisect, the lobes linear-toothed, sharply narrowed at both ends, the base often somewhat decurrent: fl.-heads usually solitary, the pale-yellow rays about  $\frac{3}{4}$  in. long; pappus double: achenes glabrous. Cent. Eu. July. G. 26:630.

CC. *Lvs. entire or dentate, not pinnatisect.*

10. *americana*, Nutt. (*Plectocéphalus americanus*, Don). BASKET FLOWER. Fig. 873. Hardy annual,

nearly smooth: sts. stout, simple or sometimes a little branched, 2–5 ft., thickened under the naked head: lvs. mostly entire, oblong-lance-shaped, mucronate: involucre  $\frac{1}{2}$ –1 $\frac{1}{2}$  in. diam., its bracts all with fringed scarios appendages: fls. rose or flesh-colored, sometimes purplish; disk 1–3 in. diam.; narrow lobes of the ray-fls. often 1 in. long. Mo. and Ark. to La. and Mex. F.S. 4:327. S.H. 2:223. A.F. 16:1644 (*alba*). Gng. 9:341 (*alba*).—Very attractive.

11. *macrocéphala*, Puschk. Perennial: sts. simple, erect, swollen below the fl.-head, leafy, 2 $\frac{1}{2}$ –3 ft. high: lvs. ovate-lanceolate, slightly decurrent, scabrous, acute, somewhat serrate, gradually diminishing upwards to the base of the single terminal head: head subglobose, larger than a hen's egg, often 3–4 in. diam.; involucre of 8–12 rows of appressed, scarios-margined, rusty, fringed scales; fls. yellow, the marginal and disk alike. Armenia. B.M. 1248. J.H. III. 33:331; 52:547; 63:319.—Often grown from seeds.

12. *nigra*, Linn. KNAPWEED. HARDHEADS. Perennial, 1–2 ft. high: sts. branching, rough pubescent: lvs. lance-shaped and entire or lower sparingly toothed or lobed, but not pinnatifid: involucreal bracts with pectinate-ciliate-fringed black appendages: fls. all alike, the disk and marginal ones of the same size. Eu. Var. *variegata*, Hort. Lvs. edged with creamy white, tufted. A very striking

border plant; useful in dry or open places.

BB. *Foliage white or tomentose, at least beneath (often green above).*

C. *Sts. low, weak, not strict.*

13. *leucophylla*, Bieb. (*C. declinata*, Bieb.). Perennial: sts. short, decumbent, with very few lvs.: root-lvs. petioled, tomentose-woolly on both sides, pinnate, the ovate lobes undulate, sparsely cut-lobed or sinuate-toothed: fl.-head with few bracts, solitary, terminal; scales of the ovate involucre lanceolate, acuminate, brown, long-ciliate; fls. purple. Caucasus.

14. *montana*, Linn. MOUNTAIN BLUET. Perennial: sts. low, stoloniferous, unbranched, 12–16 or rarely 20



871. *Centaurea Cyanus*. ( $\times \frac{1}{2}$ )



in. high: lvs. decurrent, the young ones silvery white, oval-lance-shaped: involucre of 4 or 5 rows of scales, black-ciliate along the margins: fls. blue, the marginal ones 1 in. long; disk-fls. very short, becoming purple. Eu. B.M. 77. G.M. 47:243. Var. *álba*, Hort. Fls. white. G. 25:71; 29:109. G.M. 51:162. Var. *rósea*, Hort. Fls. rose-colored. Var. *citrina*, DC. (var. *sulphúrea*, Hort.). Disk-fls. brown, rays yellow. Armenia. B.M. 1175 (as *C. ochroleuca*).

cc. Sts. erect, simple or branched.

15. *dealbata*, Willd. Perennial: sts. sub-erect, 8-24 in. high: lvs. white-villous beneath, glabrous above, the lower ones 1-1½ ft. long, petioled, pinnate, the obovate lobes coarsely cut-toothed or auricled at the base; st.-lvs. sessile, pinnate, with oblong-lance lobes: fl.-head solitary, just above the uppermost lf.; fls. red, those of the disk rosy or white; outer scales of the involucre with lanceolate tips, the middle rounded, deeply fringed, ciliate. Asia Minor, Persia. J.H. III. 46:515.

16. *nervosa*, Willd. A stout perennial about 2-2½ ft. tall with a simple unbranched rough st.: lower lvs. glandular, usually slightly toothed, the st.-lvs. clasping by the auriculate base; heads solitary, the rays deep purple. A branched and numerous-fl. form is known in the wild but not to the trade. Cent. Eu. July., Aug.

17. *atropurpurea*, Waldst. & Kit. (*C. calocéphala*, Willd.). Perennial: sts. erect, branched, about 2-3 ft. high, the branches white-woolly at the summit: lvs. bipinnate, lobes linear-lanceolate, acuminate; lowest lvs. petioled, uppermost pinnatifid: fl.-heads without bracts; involucral scales with fringed ciliate white lanceolate tips, the innermost ones rounded, scarious-margined; fls. black-purple. Hungary.

18. *babylónica*, Linn. Silvery white perennial: sts. simple, stout, erect, 6-10 or 12 ft. high: lvs. long, coriaceous, strongly decurrent on the st., the radical lyrate, the lower st.-lvs. oval or oblong-acute, entire or undulate, the upper lance-acute: fls. yellow, the globular heads almost sessile in the axils of narrow bract-like lvs.; one-third to half of the st. fl.-bearing; involucre-scales with a short, recurved tip. Asia Minor, Syria. Gn. 2, p. 73; 8, p. 263. R.H. 1859, pp. 540-1.—Tall, stout and striking plant.

*C. alpina*, Linn. Lvs. downy beneath, prickly: fl.-heads yellow; scales of involucre ovate, obtuse: hardy herb, 3 ft., from Eu., sometimes seen in collections.—*C. eriophora*, Linn. A low plant with a spiny calyx and silvery lvs., is cult. in England. Not known in Amer.—*C. pulcherrima*, Willd. (*Etheopappus pulcherrimus*, Hort.). A stout hardy perennial about 2½ ft. with brilliant rose fls. is known in the trade.—*C. rigidifolia*, Hort. Stout perennial, 2½ ft., with crimson heads is apparently *C. orientalis*, Linn.—Not much known in U. S.

N. TAYLOR.†

CENTAURIDIUM: *Xanthisma*.

CENTAURY: *Sabatia*.

CENTRADÈNIA (Greek for spurred gland, alluding to the anther glands). *Melastomaceæ*. Tropical herbs or sub-shrubs grown in greenhouses for their showy-colored leaves and pretty flowers.

Branches angled or winged: lvs. petiolate, opposite,

lanceolate or ovate, entire, ribbed: fls. with 4-lobed calyx, 4 petals, 8 stamens, and a 4-lobed ovary, pink or white, in axillary or terminal clusters.—Species 4-6, in Mex. and Cent. Amer. They fall into 2 groups,—those with very unequal stamens, and *C. floribunda* with nearly equal stamens.

Centradenias are very showy and desirable plants. The stems are often colored. They like rich leaf-mold with sharp sand, and brisk heat. Give a light but shady position. Strong plants are much benefited by liquid manure, and such applications give better colors in both flowers and fruit.

*grandifolia*, Endl. Branches 4-winged: lvs. ovate-lanceolate, strongly 3-nerved, brilliant red beneath, long-pointed and curving at the end: cymes many-fl., shorter than the lvs., the fls. light rose, rotate, the petals very obtuse, the stamens unequal. Mex. B. M. 5228.—The plant grows 2 ft. high, and blooms in winter. Very showy, and the species usually cult. The cut branches hold their color a long time, making the plant useful for decorations.

*inæquilatèralis*, Don (*C. rósea*, Lindl.). Lvs. ovate-lanceolate, unequal-sided, entire, ciliate, reddish beneath: fls. pink, in terminal corymbose racemes: dwarf. Mex. B.R. 29:20.

*ovata*, Klotzsch. Lvs. ovate-acute, smooth and shining, pale beneath, 3-nerved: fls. pink in large terminal clusters. Cent. Amer.

*floribunda*, Planch. Branches obscurely angled, pubescent, red: lvs. narrow-lanceolate, tapering below, 3-nerved, red-nerved below: fls. pink, in terminal panicles. Mex. F.S. 5:453.

L. H. B.†

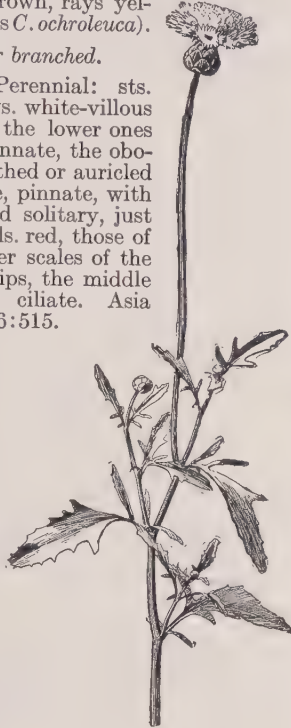
CENTRÁNTHUS (Greek, spurred flower). *Valerianaceæ*. CENTRANTH. Annual and perennial herbs, one of which is frequent in old gardens.

Leaves opposite, entire, dentate, or pinnatisect: fls. in dense clusters, small, red or white, terminating the branches; calyx cut into 5-15 narrow divisions, enlarging after flowering; corolla slender-tubed, 5-parted, spurred at the base; stamen 1; fls. with a pappus-like crest.—About a dozen species in the Medit. region, some of them sometimes half shrubby. *C. ruber*, the common garden species, sometimes escapes and becomes more or less spontaneous.

*ruber*, DC. RED VALERIAN. JUPITER'S BEARD. Perennial, 1-3 ft., smooth and glaucous, forming a compact and floriferous bushy plant: lvs. ovate to lanceolate, some of them toothed at base but mostly entire: fls. numerous, deep crimson to pale red, fragrant. Eu., E.—A very handsome old garden plant, too much neglected; blooms all summer; excellent for cutting. Increased by division; also by seeds. There is a white-fl. form (var. *albus*).

*angustifolius*, DC. Perennial, glaucous, to 2 ft., simple or somewhat branched: lvs. linear-lanceolate or linear, very entire, nearly perfoliate: fls. clear rose, fragrant. S. Eu.—There is a white-fl. form (var. *albus*).

*macrosiphon*, Boiss. Annual, of easy cult. in any good soil: 1-2 ft.: lvs. ovate, glaucous, toothed: fls. larger than in the last, deep



872. *Centaurea moschata*. (×¼)



873. *Centaurea americana*. (×¼)

rose. Spain.—There are white-fl'd. (var. *albus*) and dwarf (var. *nanus*) forms. Excellent for rockeries and borders; also for lawn vases. L. H. B.

**CENTROPÏGON** (Greek *kentron*, spur, and *pogon*, beard, referring to the fringed stigma). *Campanulacæ*. Sub-shrubs or shrubs, often scandent, grown under glass.

Plants with alternate mostly dentate lvs., and axillary, long, tubular fls. which are violet, purple, red, or orange, and usually borne singly on long peduncles: corolla 2-lipped, the tube incurved: bracteoles very small or wanting.—More than 100 species in Trop. Amer. Warmhouse perennials useful for hanging-baskets, prop. by cuttings which it is better to put under a bell-jar.

**Lucyânus**, Houll. Height 1-2 ft.: st. somewhat woody: lvs. short-petioled, finely toothed: fls. rose, hemispherical, with lanceolate segms. recurved at the tips. R.H. 1868:290. Native country unknown.—Described from a cult. specimen and said to be a hybrid of *C. fastuosus* and *Siphocampylus betulæformis*, but seems to show little influence of the latter, which has longer petioles and peduncles, more coarsely toothed lvs., longer calyx-segms., and a yellow-tipped corolla.

**fastuosus**, Scheidw. Lvs. peach-like, oblong, acute, bordered with glandular teeth, very glabrous, short-petioled: fls. rose-colored, winter; calyx hemispherical, with 5 lanceolate denticulate segms. Mex. R.H. 1853: 181.

WILHELM MILLER.

**CENTROSÈMA** (Greek, *spurred-standard*). *Leguminosæ*. BUTTERFLY-PEA. Twining or trailing herbs, one of which is sometimes cultivated.

Leaves pinnate, 3-7-foliolate: fls. in the axils, showy, white or reddish, papilionaceous, the standard spurred on the back, the keel broad, and the style bearded at the apex: pod long and narrow, many-seeded, with 2 thick-edged valves.—Species about 30 in Trop. Amer. and 2 in U. S. *Centrosema* is a more recent name than *Bradya* of Rafinesque, but it is thoroughly established in usage and is retained in the "nomina conservanda" of the Vienna Congress.

**virginiânum**, Benth. (*Bradya virginiana*, Kuntze). Roughish, climbing, 2-6 ft.: lfts. ovate to linear, shining, stipitate: fls. 1-4 in the axil, 1 in. long, violet and splashed, showy: pod straight and long-pointed, 4-5 in. long. N. J. and S., in sandy lands. A.G. 13:649.—Intro. to cult. many years ago, but again intro. in 1892 (as *C. grandiflorum*), and much advertised. It is a hardy and desirable perennial vine, blooming the first season from seed; easily grown. There is a white-fl'd. form.

L. H. B.

**CENTURY PLANT:** *Agave*.

**CEPHAËLIS** (Greek-made compound, referring to the fls. being borne in heads). *Rubiaceæ*. Tropical shrubs, sub-shrubs or herbs, one of which yields ipecac; some of them sometimes rarely seen in growing collections. As the genus is commonly delimited, it comprises perhaps 75 species of both the eastern and western hemispheres. Engler & Prantl and others, however, unite it with the Linnæan *Uragoga*. Lvs. opposite, usually ovate, oblong or obovate: fls. mostly small, white, collected in an involucrate head; calyx 4-7-toothed and persistent; corolla trumpet-shaped or salver-shaped, the short limb 4-5-lobed; stamens 4 or 5, inserted in the throat of the corolla: fr. a dry or fleshy 2-seeded drupe. *C. Ipecacuânha*, Willd. (*Psychotria Ipecacuânha*, Muell.-Arg. *Uragoga Ipecacuânha*, Baill.), from the root of which the commercial ipecac is produced, is a low creeping herb (4-8 in. high) with oblong-ovate entire lvs. which are pubescent beneath: heads becoming pendulous: root slender, knotty; it is exported in large quantities from Brazil.

L. H. B.

**CEPHALANDRA:** *Coccinia*.

**CEPHALANTHÈRA** (Greek for *head* and *anther*). *Orchidacæ*. About 10 species of small temperate-region terrestrial orchids, allied to *Epipactis* and *Pogonia*. Some of them are western N. American, and others are European. Sepals 3; petals small, ovate; lip saccate: lvs. (sometimes wanting) lanceolate or oblong: fls. mostly small (sometimes showy), in an open spike. The species are scarcely known in cult., but 2 Japanese species have been offered by importers. These are *E. falcata* Blume, yellow, and *E. erecta*, Blume, white.

**CEPHALANTHUS** (Greek, *head* and *flower*; flowers in heads). *Rubiaceæ*. BUTTON-BUSH. Bush grown for its attractive white flower-heads appearing in summer.

Shrubs with opposite or whorled entire stipulate lvs.: fls. small, tubular, white or yellowish, 4-merous, with included stamens and long exserted style, in globular heads; ovary 2-celled: fr. dry, separating into 2 nutlets.—Five species in Amer. and Asia, of which only the one N. American species is cult: hardy ornamental shrub, with handsome glossy foliage and very attractive with its fl-

balls appearing late in summer. It thrives in any good garden soil, best in a sandy, somewhat moist one; naturally it grows in swamps and on the borders of streams and ponds, often with the sts. partly submerged. Prop. by seeds or by cuttings of ripened wood in fall, and also by greenwood cuttings taken from forced plants early in spring.



874. *Cephalanthus occidentalis*. ( $\times \frac{1}{2}$ )

**occidentâlis**, Linn. Fig. 874. Shrub, 3-12 ft., sometimes tree-like: lvs. long-petioled, ovate or oval, acuminate, glossy above, glabrous or slightly pubescent below, 3-6 in. long: heads about 1 in. diam., long-peduncled, 3 or more at the end of the branches. July-Sept. From New Brunswick south, west to Ont. and Calif. Em. 394. R.H. 1889, p. 280. S.S. 14:711. Var. *angustifolia*, André. Lvs. oblong-lanceolate, usually in 3's. R.H. 1889, p. 281.

*C. natalensis*, Oliv. Branchlets hairy: lvs. ovate, acuminate, 1 in. long: fls. green, in solitary heads: fr. edible. S. Afr. B.M. 7400.

ALFRED REHDER.

**CEPHALÀRIA** (Greek for *head*, alluding to the capitate flower-clusters). *Dipsacæ*. Coarse annual or perennial herbs planted to some extent in herbaries. Much like *Dipsacus*, but the heads less spiny and mostly smaller: heads terminal, ovoid or globular, bearing many 4-parted yellowish, whitish or bluish florets; stamens 4, perfect; style filiform: fr. a 4-ribbed achene, the calyx-border often remaining on its summit.—About 30 species in the Medit. region, N. and S. Afr. and W. Asia; also in Abyssinia. Lvs. entire, dentate, or lobed. They are not much planted in Amer., but they make striking subjects for summer bloom, and the long sts. make them useful for cut-fls. The bloom is something like that of *scabiosa*. Of simple cult.; grown readily from seeds.

**alpina**, Schrad. Perennial: tall and widely branched, 5 or 6 ft.: lvs. pubescent and pinnatifid, the segms. cut



and decurrent: fl.-heads sulfur-yellow; involucre with 8 aristate teeth. S. Eu.—A good coarse plant for summer bloom. Hardy N.

*leucantha*, Schrad. Perennial: lvs. pinnate-parted, the lobes linear or oblong: fls. in subglobose heads, creamy white, in autumn. S. Eu. Variable.

*transylvanica*, Schrad. Annual, slender, 2–3 ft.: lower lvs. lyrate; the segms. serrate and the terminal one large; upper lvs. pinnate-parted into linear-lanceolate divisions: fls. in globular heads on long peduncles, the ray-corollas bluish and disk-corollas whitish (fls. said to be yellow, in trade lists, to bloom June–Aug. and plant perennial). Greece and eastward.

*tatarica*, Schrad. Perennial, 6 ft., rank, with striate sts., suited to the rear border, where strong effects are desired, with showy cream-white, flat heads in July and Aug.: lvs. pinnate, the lfts. broad-lanceolate and serrate. Russia, Asia Minor and E.—Grows readily, and is increased by seed or dividing the clumps.

L. H. B.

**CEPHALOCÈREUS** (referring to the crown of long hair). Syn. *Pilocèreus*. *Cactaceæ*. Mostly large columnar plants, single or branched, usually characterized by an abundance of wool or long white hair developing at the top or on one side near the top: fls. nocturnal, small, thick, fleshy, naked: fr. small, globular berry, naked: seeds black.—Some 16 or more species are known.

The culture of the species is similar to that of the arborescent species of *Cereus*. The species of *Cephalocereus* are well suited only for large collections and are rarely seen elsewhere, except in the case of *C. senilis*, of which enormous quantities are shipped to Europe by commercial dealers. See *Succulents*.

*senilis*, Pfeiff. (*Pilocèreus senilis*, Lem.). OLD MAN CACTUS. Columnar, reaching a height of 35 ft. and a diam. of 1 ft., branching at the very base, the branches becoming parallel with the parent: ribs 20–30, very little elevated; areoles bearing 20–30 white, wavy bristles 2–5 in. long; later appear also, at first 1, then 3–5 strong, yellowish spines: fls. very numerous in the cephalium, nearly 4 in. long, red outside, reddish white within: fr. violet, 2 in. long. Cent. Mex. R.H. 1889, p. 568; 1890, p. 128.

*Sartoriânus*, Brit. & Rose (*Pilocèreus Houlettii*, of authors, not of Lem.). Tree-like, attaining 40 ft. in height: branches divaricate: cult. plants usually 3–4 in. diam.: ribs 6–8, rounded, glaucous: radial spines 7–9, spreading,  $\frac{1}{2}$  in. long, honey yellow; central twice as long and stronger: areoles of the sterile st. with more or less hairs, which in the fruiting area are very numerous, making a shaggy tract sometimes 1 ft. long: fls. 3 in. long, imbedded in the wool, turbinate, greenish-red outside, rose-red within: fr. dark red, depressed-globose. Mex. R.H. 1862, pp. 427–30.

*Röyenii*, Brit. & Rose (*Pilocèreus Röyenii*, Rümpl. *P. floccosus*, Lem.). Columnar, branching, reaching 15 ft. height, 2–3 in. diam.: ribs 9–10, obtuse, bluish, pruinose: spines 12–16, rigid, divaricate, bright amber-yellow, the inner ones larger, nearly an inch long: on the sterile branches long hairs are found on areoles, on the fertile bract these are more numerous and aggregated: fls. and fr. as in the last species, but lighter in color. Isl. of St. Croix.

*Hoppenstédii*, Schum. (*Pilocèreus Hoppenstédii*, Web.). Columnar, simple, slender, reaching a height of 30 ft.: ribs numerous, more than 16: radial spines 14–18, very short; centrals 5–8, the lower longest one reaching 3 in.; all the spines at first yellowish, then white: cephalium of 1–2 in. long tufts of yellowish hairs, forming a narrow bract on the north side of the plant: fls. 3 in. long, bell-shaped, whitish, with rosy tips. Mex.

*polylophus*, Brit. & Rose (*Pilocèreus polylophus*, Salm-Dyck. *Cereus Nickelsii*, Hort.). Columnar,

attaining a height of 50 ft. and a diam. of  $1\frac{1}{2}$  ft., rarely branching: ribs 10–22, sharp-angled, shallow, the old sts. perfectly cylindrical: spines small and bristle-like, less than  $\frac{1}{2}$  in. long; radials 5–6; central usually 1; spines of the flowering area 2–3 in. long, crowded: fls. large, trumpet-shaped, dark red: fr. red, scaly. Mex.

*scoparius*, Brit. & Rose (*Pilocèreus scoparius*, Poselg.). Tree-like, richly branched, 25 ft. high, 1 ft. diam.: radial spines 12–15, very short; centrals 7–8, not much longer; in the flowering branches the spines change to longer stout bristles and the areoles are closer together, forming a bristly cephalium: fls. small, bell-shaped, reddish: fr. size of a hazelnut. Near Vera Cruz, Mex.

*exërens*, Rose (*Pilocèreus exërens*, Schum. *P. virens*, Lem.). Branching at base, 3–4 ft. high, 2–3 in. diam., tapering above: ribs 4–6, obtuse, the sterile shoots with short, sparse, woolly hairs at the top: spines commonly 7: radials, very short, 1–3: centrals 4 times as long; woolly hairs much more abundant on the blooming plant: fls. about 3 in. long, trumpet-bell-shaped, without wool or spines. Brazil.—Not common, if occurring at all, in cult. in U. S.

The following species have been reported or may be expected in cult., but none is as yet at all common. *C. chrysocanthus*, Brit. & Rose; *C. comètes*, Brit. & Rose; *C. lanuginosus*, Brit. & Rose; *C. Russellianus*, Rose (*Cereus Russellianus*, Rümpl.). *C. nobilis*, Brit. & Rose.

J. N. ROSE.

**CEPHALOSTACHYUM** (Greek, *head* and *spike*). *Gramineæ*. A few species of grasses of the bamboo tribe in E. Indies and Madagascar, one of which (*C. pergracile*) has been offered in this country. Tall shrubs: spikelets in dense solitary heads at the ends of the branches or in scattered glomerules, the heads bristly with the subtending lvs.; stamens 6; empty glumes 1–2; style long, 2–3-cleft: fr. elongated and beaked. *C. pergracile*, Munro. Forty ft., sts. 2–3 in. thick: lvs. 14 in. or less long; an elegant species, growing in clumps. Burma. It is offered in S. Calif. In Fla., it loses most of its lvs. in winter, but the new growth in spring and summer is very attractive; it is said not to do well there on high dry pine land, preferring moderately moist soil; it needs much water in summer, and responds readily to fertilizer.

L. H. B.

**CEPHALOTÁXUS** (Greek, *head*; *Taxus*-like plant, with fls. in heads or clusters). *Taxaceæ*. Yew-like plants, grown for their handsome evergreen foliage.

Trees or shrubs, with evergreen linear pointed lvs. with 2 broad, glaucous lines beneath, arranged in 2 rows: fls. dioecious, staminate in 1–8-fl., short-stalked clusters, pistillate consisting of a small cone with several bracts, each bearing 2 naked ovules: seed inclosed in a fleshy envelope, drupe-like, about 1 in. long, reddish or greenish brown. From allied genera it may be easily distinguished by the resin-canal in the center of the pith; and by the glaucous lines beneath from *Taxus*, which has the lvs. yellowish green beneath; and from *Torreya* by the glaucous lines being broader than the 3 green lines, while in *Torreya* the glaucous lines are narrower than the green ones.—Six closely allied species from Himalayas to Japan.

These are ornamental evergreen shrubs, in appearance very like a yew, but of more graceful habit. Not hardy North, or only in very sheltered positions. They thrive best in a somewhat moist but well-drained sandy loam, and in partly shaded situations. Propagated by seeds, stratified and sown in spring; imported seeds usually do not germinate until the second year; increased also by cuttings in August, under glass, and by veneer-grafting in summer, on one of the species or on *Taxus baccata*. For cions and cuttings, terminal shoots should be chosen, which form regular plants with whorled branches like seedlings, while cuttings from lateral branches grow into irregular, low, spreading shrubs.

A. *Lvs.* 2-3 in.: branchlets yellowish green, pendulous.

**Fórtunei**, Hook. *Lvs.* tapering gradually into a sharp point, usually falcate, dark green and shining above; fr. greenish brown, obovate. N. China, Japan. B.M. 4499. F.S. 6:555. R.H. 1878, p. 117.—This is the most graceful species, with long and slender branches, attaining in its native country 50 ft. in height, in cult. usually remaining a shrub.

AA. *Lvs.* 1-2 in. long.

B. *Base of lvs. cuneate; lvs. loosely 2-ranked.*

**Harringtonia**, Koch (*C. pedunculata*, Sieb. & Zucc. *C. drupacea* var. *Harringtonia*, Pilger). With spreading, often somewhat pendulous branches, dark green when young: *lvs.* to 2 in. long, narrowed into a sharp point, shining and dark green above: staminate fls. distinctly peduncled: fr. ovoid, rounded at both ends, rarely globular. Japan, China. G.C. II. 21:113; III. 18:716; 33:228.—In Japan, tree to 25 ft., usually shrub in cult. A remarkable form is var. *fastigiata*, Silva Tarouca (*C. pedunculata* var. *fastigiata*, Carr. *Podocarpus koraiana*, Sieb. & Zucc.), of columnar habit, with upright branches and spirally arranged *lvs.* G.C. II. 21:112; III. 33:229. S.H. 2:450. Gng. 2:341. Var. *sphaeralis*, Rehd. (*C. pedunculata* var. *sphaeralis*, Mast.), has globose fr.: *lvs.* falcate, subacuminate,  $1\frac{1}{2}$ -2 in. long. G.C. II. 21:117.

*drupacea*, Sieb. & Zucc. Branches spreading, stiff, usually light green when young: *lvs.* about 1 in. long, abruptly pointed, narrow and straight, often upturned: staminate fls. very short-stalked: fr. usually obovate, narrowed at the base. Japan. G.C. III. 18:717; 33:227. B.M. 8285.—The dwarfest species. Var. *sinensis*, Rehd. & Wilson. Shrub, to 12 ft.: *lvs.* linear-lanceolate, tapering to sharp point. Cent. and W. China.

BB. *Base of lvs. truncate; lvs. very closely set.*

**Óliveri**, Mast. Shrub or small tree: *lvs.* strictly 2-ranked, rigid, broadly linear, spiny-pointed, about 1 in. long, bright green with 2 broad white bands beneath, the midrib scarcely elevated: fr. ovoid or obovoid, shortly apiculate, about  $\frac{1}{2}$  in. long. Cent. China. H.I. 1933 (as *C. Griffithii*). G.C. III. 33:226.—Differs from the other species in the very closely set rigid *lvs.*

ALFRED REHDER.



875. *Cephalotus follicularis*.

**CEPHALÔTUS** (Greek, *head-shaped*, in reference to the knob-like swelling behind each anther). *Cephalotaceæ*, a monotypic family near *Saxifragaceæ*. The one species *C. follicularis*, Labill. (Fig. 875), is abundant at King George's Sound and Swan River in S. W. Austral. From there it has frequently been intro. into cult., and is now met with in American collections. The short creeping rhizomes form 2 sets

of *lvs.* each season: a set of 4-6 flat spatulate *lvs.*, and later as many dainty pitched *lvs.* that are richly colored green, crimson or purple, and white. The pitchers are  $\frac{1}{2}$ -1 $\frac{1}{2}$  in. long, are covered externally with minute alluring glands, and these with the coloring attract insects. They slip from the smooth-ribbed rim into the cavity, and there are digested by ferment liquids poured out by special glands. The erect scape bears an interrupted spike of small white apetalous fls., each with a 6-parted calyx, 12 stamens, and 6 separate 1-seeded carpels. The plant grows best under a bell-jar, and in a pot amongst fine sandy loam that is covered by sphagnum moss. The lower part of the pot should stand in a vessel with about  $\frac{1}{2}$  in. of water, and the whole should be placed in a cool greenhouse near the light, when the pitchers assume richest colorings. Prop. is easily effected by separation of small pieces of rhizome that bear 1 or 2 *lvs.*, also by seeds that mature not unfrequently under cult. R. B. 23, p. 233. I.H. 27:391. F.S. 3:290. G. 23:340. G. W. 8:390. J.H. III. 35:260.

J. M. MACFARLANE.

**CERÁSTIUM** (Greek for horn, alluding to the shape of the pod). *Caryophyllaceæ*. MOUSE-EAR CHICKWEED.

Decumbent annuals or perennials, used in rockeries or for bedding and borders.

Pubescent or hirsute herbs, rarely glaucous: *lvs.* small, opposite, entire: fls. white, borne in terminal, dichotomous cymes; sepals 5, rarely 4; petals as many, emarginate or 2-cleft; stamens 10, rarely fewer; styles 5, rarely 4 or 3, opposite the sepals: caps. cylindric, often curved, dehiscing at the top by 10, rarely 8, teeth.—About 100 species of world-wide distribution according to the largest delimitation of the genus; by some authorities reduced to 40 or 50 species.

Cerastiums are of easy culture in ordinary garden soil. They are propagated by divisions or by cuttings taken after flowering and planted in a shady place. They are more or less used for edgings and in rockeries.

A. *Lvs. green, merely pubescent.*

**arvense**, Linn. (var. *oblongifolium*, Holl. & Brit.). STARRY GRASSWORT. Fig. 876. Perennial, low, much branched and matted: sts. 8-12 in. long: *lvs.* oblong or lanceolate, pale green, pubescent, obtuse,  $\frac{1}{2}$ -1 $\frac{1}{2}$  in. long,  $\frac{1}{4}$  in. wide: fls. very numerous, appearing in Apr. and May; petals 5, deeply bifid: caps. twice as long as the calyx.—A species of very wide range, growing mostly in dry rocky places from Labrador to Alaska and south to Ga. and Calif.; also in Asia and Eu. Gn. 71, p. 504.—Recommended as a bedding plant, for its mat-like habit, covered with white bloom. Var. **compáctum**, Hort., is hardy in S. E. Canada.

**purpuráscens**, Adams. Perennial, hairy, pubescent, caespitose, about 4 in. high: lower *lvs.* oblong, narrowed into the petiole; upper *lvs.* linear-lanceolate: cymes dichotomous or often simply umbelliform; fls. white; petals twice as long as calyx, ovate-oblong: caps. cylindric, twice as long as calyx. Asia Minor.—Hardy.



876. *Cerastium arvense*.



AA. *Lvs. silvery or grayish.*

B. *Caps. equaling the calyx.*

**grandiflorum**, Waldst. & Kit. (*C. argenteum*, Bieb.). Creeping perennial: lvs. linear, acute, the margins reflexed: infl. dichotomous; fl.-sts. 6-8 in. high; petals oval, 2-parted, transparent white, twice as long as calyx. E. Eu.

BB. *Caps. much longer than the calyx.*

**Bièbersteinii**, DC. Perennial: sts. 6 in., creeping, diffuse, branched: lvs. ovate-lanceolate, tomentose-woolly: peduncles erect, dichotomous; fls. white: caps. ovate-cylindrical. Tauria. B.M. 2782. Gn. 59, p. 470. —Like *C. tomentosum*, but with larger lvs. Fine for edgings.

**Boissieri**, Gren. Perennial, low: lvs. silvery, ovate-lanceolate, acute, entire, sessile: peduncles 4-12 in. high; infl. a dichotomous cyme; fls. large, white. Spain.

**tomentosum**, Linn. SNOW-IN-SUMMER. Perennial, low, creeping, branched: lvs. oblong, spatulate, grayish woolly, upper lvs. lanceolate: peduncles 6 in. high, erect, dichotomous; fls. white: caps. cylindrical. Eu. G. 29:555. Gn. 69, p. 143. —Much used for edgings.

E. Z. B.†

**CÉRASUS** (from *Cerasunt* or *Cerasonte*, a place in Asia Minor on the Black Sea, whence cherries are said to have been brought to Italy before Christ). CHERRY. *Rosaceæ*. Tournefort in 1700 founded the genus *Cerasus*, but by general usage it is now combined with *Prunus* inasmuch as no single important character holds clearly between the two groups. The name is sometimes kept distinct in trade lists, representing the cherries as distinct from the plums. Botanically, the group is distinguished from *Prunus* proper (the plum group) in having conduplicate vernation (young lvs. with the halves folded together) rather than involute vernation, fls. more characteristically in umbels or racemes, fr. mostly lacking bloom and pubescence, and the stone not corrugated or pitted. See *Prunus*.

L. H. B.

**CERATÏOLA** (Greek, *a little horn*, referring to the four-branched, serrate stigma). *Empetraceæ*. A heath-like evergreen, from the sand barrens of South Carolina to Florida and Alabama; rarely cultivated North, but not hardy.

Branches often whorled as are the lvs., which are narrow, strongly revolute and thus almost tubular: fls. dioecious, 2-3-whorled in the axils, sessile; sepals, petals and stamens, each 2.—Only 1 species.

**ericoides**, Michx. Height 2-8 ft.: branches subverticillate, marked with scars of numerous fallen lvs., the younger and upper ones only retaining foliage: lvs. crowded,  $\frac{1}{2}$ - $\frac{3}{4}$  in. long, linear, rigid, shining, pale: fls. inconspicuous reddish, whorled in the axils: drupe round, orange-yellow, berry-like. B.M. 2758.

N. TAYLOR.†

**CERATÓLOBUS** (Greek for *horned pod*). *Palmaceæ*, tribe *Calámææ*. Low or creeping pinnate palms allied to *Calamus*, and not as yet common in the American trade.

Stems and lf.-stalks spiny but not the lf.-blades: sts. frequently 30 ft. or more long and armed with stout spines an inch long: lvs. pinnate, often as much as 7 ft. long, with numerous alternate or opposite lfts., which are crenate-dentate towards the apex: fls. polygamous-monœcious, in a paniculately branched spadix: fr. drupe-like, 1-seeded.—There are only 3 wild species and 2 species known in horticultural literature, the botanical status of which is doubtful. All the wild species come from Java or Sumatra. For cult., see *Calamus* to which *Ceratolobus* is closely related, differing in having rhomboid, not linear lfts. G.C. II. 23:338.

**glaucescens**, Blume. St. up to 30 ft. and about as thick as one's wrist: lvs. 6-7 ft. long, of 14-18 sessile, erect or spreading lfts. which are 8-10 in. long,  $2\frac{1}{2}$ - $3\frac{1}{2}$  in. wide, opposite above, alternate below: spadix from the axils of the upper lvs.: spathes 2-horned, 4-6 in. long. Java.

*C. cœncolor*, Blume. Similar, with 10-14 lfts., relatively broader than in *C. glaucescens*. Sumatra.—*C. Findleyanus*, Hort. Lvs. 2-4 ft. long, clear pale shining green. Hab. (?). A.G. 15:169.—*C. Micholitziana*, Hort. Very elegant palm, the st. and lf.-rachis with scattered spines: lvs. oblong, the lfts. remote, linear-oblong, acute, pale on the under surface.—Horticulturally the most attractive of the group.

N. TAYLOR.

**CERATÏONIA** (Greek for *horn*, in reference to the large pod). *Leguminosæ*. CAROB. A handsome evergreen tree, bearing large pods that are used somewhat for human food but chiefly for forage.

One of the Cassia tribe: calyx-tube disk-bearing, somewhat top-shaped, the segms. 5 and short; petals 0; stamens 5: pod long (4-12 in.), compressed, thick and coriaceous, indehiscent, filled with a pulpy substance, bearing obovate transverse seeds. *C. Siliqua*, Linn. (Figs. 877, 878), the only species, is now widely distributed in warm countries, being grown both for shade and for the edible pods. It reaches a height of 40-50 ft.: lvs. pinnate, shining, the 2-3 pairs of lfts. oval and obtuse: fls. in small lateral red racemes, polygamodioecious, the trees said to be variable in sexuality at different ages. It thrives well in S. Calif. and S. Fla. The dry pods are occasionally seen in the fruit stands in northern markets. There are many varieties, differing in the size and shape of pod.

The *Ceratonia* is known also as *Algaroba*, *Karoub*, *Caroubier*, and *St. John's Bread*. The last name records the notion that the seeds and sweet pulp are respectively the locusts and wild honey which St. John found in the wilderness. The dry valves or pods have been supposed to be the husks that provided the subsistence of the prodigal son. See G.F. 3:318, 323. The seeds are said to have been the original carat weight of goldsmiths.

L. H. B.

The carob is of much importance as a farm crop throughout the Mediterranean basin and other hot and semi-arid regions. According to Alphonse de Candolle, its original home was about the eastern end of the Mediterranean, including the southern coast of Asia Minor and Syria and perhaps Tripoli. Its cultivation began in historic times, and was diffused by the Greeks in Italy and Greece and was carried by the Arabs west as far as Spain and Morocco. In all these countries the large pods, rich in protein and sugar, are a very important forage crop, being eaten with avidity by all kinds of stock, besides furnishing considerable sustenance to the poor in times of scarcity, and are also used for the manufacture of syrups and different fermented drinks. Carob pods were the main sustenance of Wellington's cavalry in the Peninsular campaign and at the present time are the chief food of the British army horses on the island of Malta and the horses of the tramways in the cities of southern Italy. They form one of the principal exports of Palestine, Syria and especially of the island of Cyprus. Thousands of tons are annually imported into England where they are ground for stock-feed. A. Aaronsohn, Chief of the



877. *Ceratonia Siliqua*.

Jewish Experiment Station in Palestine, says that an acre of carob trees on arid soil yields a much greater quantity of food matter than an equal area planted with the best alfalfa. He gives the sugar content at 40 per cent and in some varieties even higher, and the protein content as 7 to 8 per cent. The French and Portuguese writers give somewhat lower percentages, but this seems to be much a matter of climate and varieties. The analysis published by Rivi re and Lecoq points to a high digestive coefficient, and nutritive value a little higher than oats; it is estimated that 147.5 kilos of carobs equals 100 kilos of wheat (a kilo is nearly 2¼ pounds).

The first introduction of the tree into this country on a considerable scale was by the U. S. Patent Office from Alicante, Spain, in 1854 and from Palestine in 1859. About 8,000 plants, grown from seed in Washington, were distributed during the spring of 1860, mostly in the southern states. Some of these plants probably found their way to California, as a number of old trees are growing in various parts of that state from San Diego on the south to Napa and Butte counties on the north. The latest importation was in June, 1911, from Valencia, Spain, by the Office of Foreign Seed and Plant Introduction of the Department of Agriculture. This shipment consisted of cuttings of six of the leading varieties grown in that district which are now being propagated by budding at the Chico (California) Introduction Field Station and will soon be available for distribution.

Centuries of cultivation have given rise to a large number of varieties, differing in quality of pods, vigor and productiveness and adaptability to various soils. The species is either dioecious or monoecious. All trees in California are of course seedlings and, as far as examined by the writer, monoecious, although Aaronsohn states that the best kinds in Palestine are dioecious, and a sufficient number of staminate trees, therefore, must be planted with those varieties to pollinate the female trees. In the province of Algarvia, Portugal, seventeen named varieties are cultivated and about as many in France and Spain. The best of these should be introduced into this country.



878. Pods of *Ceratonia Siliqua*.

The carob tree thrives only in a warm climate, the range being about the same as that of the orange, but with a little protection for two or three winters, the range can be considerably extended. At the Government Field Station at Chico, several varieties have survived temperatures of 18° to 22°, while others when young have been killed to the ground by the same degrees of frost. The old trees scattered about the Pacific Coast States show that a large area is adapted to it.

In France, Spain and Portugal, the carob grows in most kinds of soil, except in stiff clay or wet ground, and even in gravel if fertile and permeable to the roots. The crop is sufficiently valuable to make it worthy of the best soil and treatment.

The carob is usually grown from seed and afterwards budded to the best varieties. It can be raised from cut-

tings, but requires bottom heat and careful treatment. At the Chico Field Station, where thousands of seedlings are grown, the best success is had by planting under glass. Quicker germination is secured by soaking the seed in water for three or four days or until they begin to swell. The tree is difficult to transplant and usually fails unless moved with a ball of earth. The best results are had by growing the plants in pots or in "flats" in tenacious soil, as is the practice with eucalyptus, when the trees are cut apart and lifted with squares of earth attached. At Aleppo, in Syria, the growers make pots of a mixture of clay and cow-dung which, dried in the sun, are strong enough to hold the earth in which the seeds are planted. When ready to put into the orchard the pot is sunk where the tree is to stand. As soon as the pot becomes moist from contact with the earth, it is readily permeable by the roots.

While the carob is a rather slow grower, it lives to a great age and should be planted not less than 35 to 40 feet apart, with interplanting of peaches or other growths for income until the carobs begin to bear. In Algiers and Tunis, it is often planted as a border tree, for which its beauty and utility admirably fit it. When well established, the seedlings are budded with the best varieties. If buds are taken from bearing trees, fruit may be expected in three or four years. In California seedlings bear when six to eight years of age. While it is eminently a dry-climate tree, two or three summer irrigations will greatly aid the development, hasten fruiting and increase the yield. It will respond to the same good treatment that is given to a well-kept fruit orchard.

The crop matures in September and October and, as with most other fruit trees, it is most abundant every second year. When ripe, the pods turn brown and begin to fall. Those that fail to drop are easily knocked down with bamboo or other poles.

Aaronsohn gives the crop in Palestine in good years at an average of 450 pounds to the tree, and states that he has seen wild stocks fifteen to eighteen years after grafting give a yield of 900 to 1,000 pounds of pods. Du Breuil gives the yield in southern France at 220 pounds and mentions single trees at Valencia, Spain, that produce as high as 1,380 kilos, or 3,040 pounds. Rivi re and Lecoq report the yield of trees in Algiers at 100 to 300 kilos, or 220 to 660 pounds. Francis de Mello Lotte gives the crops of mature trees on deep fertile soil in Algarvia, Portugal, at 300 to 750 kilos, or 660 to 1,650 pounds each. As the pods are equal in nutrients to barley and superior to oats for feeding and fattening cattle, sheep, hogs and horses, and the yield is from three to four times the weight per acre of grain, it is evident that few crops will give the farmer an equal value. In the mild climate of the Gulf States, especially the coastal regions of Texas, the southern parts of New Mexico and Arizona and the greater part of California, this beautiful and valuable evergreen tree, when once appreciated, is bound to become a staple addition to farm crops for the nourishment of both man and beast.

G. P. RIXFORD.

**CERATOPÉTALUM** (Greek, *horned petal*). *Cunoniaceæ*; by some, *Cunoniaceæ* is included in *Saxifragaceæ*. Greenhouse trees or shrubs.

Glabrous and resinous trees and shrubs: lvs. opposite, compound, with 1-3 digitate lfts.: fls. small, white, rose or yellow, in terminal branching cymes or panicles; calyx-tube short, 5-lobed; petals 0, or, if present, lacinate; stamens 10, with connectives: fr. a small and hard achene-like body, with persistent calyx-lobes, 1-seeded.—Two or 3 species, in Austral.

**gummiferum**, Smith. Tree, 30-40 ft.: lfts. 3, lanceolate, serrulate, narrowed at base, shining and strongly nerved: petals deeply 3-5-lobed, not exceeding the calyx.—Said to thrive in a peaty soil, and to prop. by cuttings of half-ripened wood under glass. L. H. B.



**CERATÓPTERIS** (Greek, *horned fern*). *Ceratopteridaceæ*. Very succulent tropical ferns, forming also a distinct family. They are the only truly aquatic plants among true ferns and grow floating or rooted under water in the mud or sometimes only occasionally flooded. The lvs. are borne in rosettes, the sterile



879. *Ceratopteris pteridoides*. ( $\times \frac{1}{2}$ )

spreading, often floating, the fertile more erect, 2-4-pinnate, with very slender rolled-up pod-like segms.: sporangia very large, borne separately along the veins and covered by the revolute margins somewhat as in *Pteris*.—Species very few. Best grown by planting in pots, slightly submerged. Reproduced by buds which arise from all parts of the lvs. New plants must be developed each season. Useful in ponds and aquaria.

**pteridoides**, Hook. Fig. 879. Sterile lvs. broadly deltoid, short-stalked, the margins irregularly lobed, floating; the fertile lvs. taller, completely divided into long whip-like segms.: sporangia with a very small annulus, and containing 32 spores. Fla. to S. Amer.

**thalictroides**, Brongn. Sterile lvs. narrowly deltoid, long-stalked, 1-2 pinnatifid into deltoid segms. not floating; fertile lvs. similar but with linear segms.: annulus well developed. Old World tropics.

R. C. BENEDICT.

**CERATOSTÍGMA** (Greek, *horned stigma*). *Plumbaginaceæ*. Diffuse glabrous perennial herbs or subshrubs, one of which is in cultivation as a bedding and border plant.

*Ceratostigma* differs from *Plumbago* in having no glands on the calyx, stamens adnate to the corolla-tube, fls. in dense clusters rather than spicate, and other technical characters: lvs. alternate, lanceolate or obovate, more or less ciliate: fls. mostly in terminal heads, blue or rose; calyx tubular, deeply 5-parted, the lobes narrow; corolla salver-shaped, the tube long and slender, the limb spreading and with 5 obovate obtuse or retuse lobes; stamens 5, attached on the corolla-tube: fr. a 5-valved caps. inclosed in the calyx.—Species 4 or 5, in N. China, Himalayas, Abyssinia.

**plumbaginoides**, Bunge (*Plumbago Lárpentæ*, Lindl. *Valoradia plumbaginoides*, Boiss.). Herb, 6-12 in., the st. red and branchy: lvs. entire, strongly ciliate on the edges: fls. with a deep blue limb, the 5 lobes minutely toothed, collected in dense heads or umbels. China. B.M. 4487. F.S. 4:307.—A hardy bedding plant, producing profusely of its deep blue fls. late in fall; very valuable. Needs covering in winter in the N.

Under the name *C. Póhillii*, a dwarf and creeping shrub, with delicate lavender fls., is mentioned in British journals as coming from high elevations in W. China and giving promise as an outdoor subject.

L. H. B.

**CERATOTHÈCA** (Greek for *horned capsule*). *Pedaliaceæ*. Tropical African glasshouse herbs.

Leaves opposite, ovate: calyx 5-parted; corolla 2-lipped, the lower lip very long in proportion to the upper: fls. in pairs in the axils: caps. 2-horned.—Five species. *C. trifolia*, Mey., is occasionally grown in S.

Fla., and it may be adapted to glasshouses. It is a tall herb (5 ft.), with the habit of foxglove, probably biennial, hairy and rather fleshy: lower lvs. stalked, broadly ovate or almost round, the upper sometimes broadly angular and even 3-lobed, both kinds crenate-dentate: corolla 3 in. long, blue or violet-blue, pubescent, deflexed, the lower lobe prolonged. Handsome. B.M. 6974.—Could be grown in temperate house N. in sandy loam.

N. TAYLOR.†

**CERATOZÀMIA** (Greek, *horned Zamia*; referring to the horned scales of the cones, which distinguish this genus from *Zamia*). *Cycadaceæ*. Handsome Mexican foliage plants, with cycas-like leaves, but less cultivated in American palm-houses than *Cycas*.

Trunk erect in age, crowned by a whorl of pinnate cycas-like lvs. which are petiolate and unarmed: fls. in cones borne from among the lvs., the cones often stalked: seeds rare and little known.—Six species. Best raised from young imported plants, but rarely prop. by seeds, or by offsets from the slow-growing trunk. Burn out the center of the plant with a hot iron, and a number of offsets will spring from the trunk and the crown; these may be used for prop.

**mexicana**, Brongn. Fig. 880. Trunk thick, short, covered with the remains of fallen lf.-stalks: lvs. rich, dark green, pinnate, on prickly petioles 5-6 in. long, which are shaggy when young; lfts. very numerous, 6-12 in. long or more, lanceolate: cones produced annually on separate plants; female cones 9-12 in. long, 4-6 in. thick, the scales 2-horned; male cones narrower, longer, on a hairy stalk, the scales with 2 small teeth. Mex. Gn. 9, pp. 308-9.—An excellent decorative plant, best grown in sandy loam. Give freely of water and heat in spring and summer, but keep cooler and drier in winter. Somewhat tender although grown in Cent. Fla.

*C. Miqueliána*, Wendl. A plant with 20-30 pairs of lfts. and a lf.-stalk 18 in. long; fr. not known certainly. Cult. in botanic gardens and worthy of wider use. Mex. and W. Indies.

N. TAYLOR.†

**CERCIDIPHYLLUM** (*Cercis* and *phyllon*, leaf; the lvs. resemble those of *Cercis*). *Trochodendraceæ*. Tree grown for its handsome foliage and habit.

Leaves deciduous, usually opposite, petioled and palmately nerved: fls. dioecious, inconspicuous, apetalous, solitary; staminate nearly sessile, bearing numerous stamens with slender filaments; pistillate pedicelled,



880. *Ceratozamia mexicana*.—Young plant (fertile).

consisting of 3-5-carpels, ending in long, purplish styles and developing into about  $\frac{3}{4}$  in. long, dehiscent pods, with many seeds.—One species in Japan and W. China. Hardy, ornamental, shrubby tree of pyramidal and, when young, almost fastigiate habit, with handsome,



881. *Cercidiphyllum japonicum*. ( $\times \frac{1}{2}$ )

light green foliage, purplish when unfolding, turning bright yellow or partially scarlet in fall. It prefers rich and moist soil, and grows rapidly when young. Prop. by seeds, sown in spring, and by greenwood-cuttings, taken from forced plants in early spring, or by layers; cuttings from half-ripened wood in summer, under glass, grow also, but not very well.

*japonicum*, Sieb. & Zucc. Fig. 881.

Bushy tree, commonly with several trunks, usually 20-30 ft., but sometimes rising to 100 ft., with slender, glabrous branches: lvs. opposite, occasionally alternate, slender-petioled, cordate, orbicular or broadly ovate, obtuse, crenate-serrate, glabrous, glaucous beneath, 2-3 in. long. Japan. G.F. 7:106, 107, and 6:53. Mn. 3:74. Gag. 5:135. F.E. 32:211 (habit). P.G. 2:105. S.I.F. 1:41. —A very desirable tree, one of the best introductions from Japan. Var. *sinense*, Rehd. & Wilson. Tree, to 120 ft., usually with a single trunk: petioles shorter, about  $\frac{3}{4}$  in. long, somewhat hairy on the veins beneath: caps. gradually narrowed at the apex,  $\frac{1}{2}$  in. long. W. China.—This recently intro. variety is perhaps still more desirable than the type. It is the largest of all broad-ld. trees known from China; the trunk is sometimes free of branches for nearly 50 ft. above the ground and attains to 25 ft. or exceptionally to 55 ft. in girth.

ALFRED REHDER.

**CÉRCIS** (*Kerkis*, ancient Greek name). *Leguminosæ*. **JUDAS TREE. RED-BUD.** Trees or shrubs grown for their pink flowers profusely produced early in spring before the leaves; very interesting, also, in mode of branching, as seen in mature trees.

Leaves deciduous, alternate, petioled, palmately nerved, entire: fls. papilionaceous, pedicelled, pink or red, appearing before or with the lvs., in clusters or racemes from the old wood; calyx 5-toothed, red; petals nearly equal, the uppermost somewhat smaller: pod compressed, narrow-oblong, narrow-winged on the ventral suture, many-seeded.—Seven species in N. Amer., and from S. Eu. to Japan.

These trees and shrubs are very ornamental, with handsome distinct foliage and abundant showy flowers in spring, very effective by their deep pink color. They are well adapted for shrubberies or as single specimens on the lawn, and attain rarely more than 20 or 30 feet in height, forming a broad, irregular head when older. Only *C. canadensis* is hardy North, while *C. chinensis* can still be grown in sheltered positions near Boston, but is occasionally injured in severe winters; the others can not be grown successfully farther north than New York. They grow best in rich sandy and somewhat moist loam, and should be transplanted when young, as older plants can hardly be moved with success. Young plants, four or five years old, produce flowers

freely and may be recommended for forcing, especially *C. chinensis* and *C. racemosa*, which are the most beautiful of all. Propagated by seeds, sown in spring, best with gentle bottom heat; sometimes increased by layers, or by greenwood cuttings from forced plants in early spring; *C. chinensis* grows also from greenwood cuttings in summer under glass.

A. Lvs. abruptly and short-acuminate.

B. Fls. in clusters: lvs. usually pubescent only beneath near the base.

*canadensis*, Linn. Fig. 882. Tree, to 40 ft.: lvs. roundish or broadly ovate, usually cordate, 3-5 in. long: fls. rosy pink,  $\frac{1}{2}$  in. long, 4-8 in clusters: pod  $2\frac{1}{2}$ -3 $\frac{1}{2}$  in. long. From N. J. south, west to Mo. and Texas. S.S. 3:133-4. A.F. 13:1370. Gng. 6:290. F.E. 9:593. Mn. 2, p. 139. M.D.G. 1899:434-5 (habit). Gn. 25, p. 347.—A very desirable ornamental tree for the northern states. Var. *alba*, Rehd. Fls. white. Var. *plena*, Schneid. Fls. double.—Recently *C. canadensis* has been split by Greene into several new species (see Fedde, Rep. Spec. Nov. Veget. 11:110).

*chinensis*, Bunge (*C. japonica*, Sieb.). Fig. 883. Tree, to 50 ft., shrub in cult.: lvs. deeply cordate, roundish, with a white, transparent line at the margin, subcoriaceous, glabrous, shining above, 3-5 in. long: fls. 5-8, purplish pink,  $\frac{3}{4}$  in. long: pod 3-5 in. long, narrow. China, Japan. F.S. 8:849. Mn. 2:139. G.F. 6:476.—A very beautiful species, with the fls. nearly as large as those of *C. Siliquastrum* and more abundant.

BB. Fls. in pendulous racemes.

*racemosa*, Oliv. Tree, to 30 ft.: lvs. broadly ovate, truncate or subcordate at the base, pubescent beneath,



882. *Cercis canadensis*. ( $\times \frac{1}{2}$ )

$2\frac{1}{2}$ -4 in. long: fls. rosy pink, about  $\frac{1}{2}$  in. long on slender pedicels of about equal length, in many-fl. racemes  $1\frac{1}{2}$ -3 in. long: pod  $2\frac{1}{2}$ -4 in. long. Cent. China. H.I. 1894.—The handsomest of all. Young plants have not proved hardy at the Arnold Arboretum, but it is perfectly hardy in S. England.



AA. *Lvs. rounded or emarginate at the apex, usually broader than long.*

*occidentalis*, Torr. (*C. californica*, Torr.). Shrub, to 15 ft.: *lvs.* cordate, roundish, glabrous, about 2 in. wide: *fls.* rose-colored,  $\frac{1}{2}$  in. long: pod 2-2 $\frac{1}{2}$  in. long. Calif. Torrey in U. S. Explor. Exped., 1838-1842, 17, pl. 3.—A closely allied species is *C. reniformis*, Engelm. (*C. texensis*, Sarg.). Small tree: *lvs.* subcoriaceous, 3-5 in. wide, sometimes pubescent beneath: pod 2-4 in. long. Texas, New Mex. S.S. 3:135.

*Siliquastrum*, Linn. Tree, to 40 ft.: *lvs.* roundish, deeply cordate, glabrous, 3-5 in. wide: *fls.* 3-6, purplish rose,  $\frac{3}{4}$  in. long: pod 3-4 in. long. S. Eu., W. Asia. B.M. 1138. Gn. 25, pp. 346, 347, 350; 33, p. 416; 42:342, p. 343; 44, p. 379; 52, p. 5. G.C. III. 52:6 (habit). G. 25:209. R.H. 1899:469 (abnormal form). Var. *alba*, Carr. (var. *albida*, Schneid.) with white *fls.*

**CERCOCÁRPUS** (Greek, *tail* and *fruit*; the fruit with a long, hairy tail). *Rosaceæ*. MOUNTAIN MAHOGANY. Small trees or shrubs but rarely grown for their attractive evergreen or half-evergreen foliage and the peculiar feathery tailed achenes.

Leaves alternate, persistent, rather small: *fls.* inconspicuous, apetalous, whitish or reddish, in the axils of fascicled *lvs.*; calyx-tube cylindric, elongated, abruptly expanded at the apex into a cup-shaped deciduous, 5-lobed limb bearing 15-30 stamens with short filaments; ovary 1-celled, inclosed in the calyx-tube, with a long exerted style: fr. a 1-seeded achene, surmounted by the persistent, long and hairy style.—Small genus of about 10, mostly rather local species, in the Rocky Mts. from Mont. south to Mex. and in Calif.

The cercocarpuses are not particularly ornamental, yet they are attractive with their small evergreen dark foliage and their feathery tailed fruits; they are adapted for planting on dry rocky or gravelly slopes in arid temperate regions, as they thrive under very unfavorable conditions. The very heavy and close-grained wood is manufactured into small articles, and valued as fuel and for making charcoal. *C. ledifolius* and *C. parvifolius* are the hardiest and stand frost to zero, while *C. Traskiae* can be grown only in southern California. They may be cultivated in any well-drained soil in sunny positions, and propagated by seeds or by cuttings of half-ripened wood under glass.

A. *Margin of lvs. toothed: fls. 2-5 in a cluster.*

B. *Lvs. oval to suborbicular, usually rounded at the base.*

*Traskiae*, Eastw. Tree, to 25 ft.: *lvs.* coarsely sinuate-dentate above the middle, lustrous above, tomentose below, 1-2 $\frac{1}{2}$  in. long: achene with the style 2-2 $\frac{1}{2}$  in. long. Santa Catalina Isl., Calif. S.S. 13:635.



383. *Cercis chinensis*.  
(Natural size)

BB. *Lvs. usually cuneate-obovate, smaller.*

*parvifolius*, Nutt. Bushy tree, to 25 ft.: *lvs.* dull green and pubescent above, pubescent or tomentose beneath,  $\frac{1}{2}$ -1 $\frac{1}{2}$  in. long, with 4-5 pairs of veins: style 2-4 in. long. From Neb. and Ore. to Low. Calif. and W. Texas. S.S. 4:166. H.I. 4:323.—D. M. Andrews, of Colo., who handles this shrub, writes of it as follows: "Mountain mahogany, 6 feet. A nearly evergreen rosaceous shrub of peculiar and attractive habit of growth. *Fls.* white, early, followed by the long, plumose achenes, which are 3-5 in. long, strangely curled and twisted, arranged above and on each side of the slender branches, so that at a little distance they have an appearance suggestive of ostrich plumes. Easily transplanted, and thrives anywhere."

*betulæfolius*, Nutt. (*C. parvifolius* var. *glaber*, Wats. *C. parvifolius* var. *betuloides*, Sarg.). Small tree, to 30 ft.: *lvs.* thinner, bright green and glabrous above at maturity, pubescent or glabrescent beneath,  $\frac{1}{2}$ -2 in. long, with 5-6 pairs of veins: style 2-4 in. long. Calif. W.G.Z. 4, pp. 554-5. H.I. 4:322.

AA. *Margin of lvs. entire, revolute: fls. solitary or in pairs.*

*ledifolius*, Nutt. Tree, to 40 ft.: *lvs.* lanceolate, coriaceous, lustrous and glabrous above at maturity, pubescent below, resinous,  $\frac{1}{2}$ -1 in. long, veins obscure: style 2-3 in. long. From Wyo. and Wash. to S. Calif. and New Mex. S.S. 4:165. H.I. 4:324.

ALFRED REHDER.

**CEREALS** (*Ceres*, goddess of agriculture). The agricultural grains, properly those of the grass family: maize or Indian corn, kafir, wheat, emmer, spelt, rice, oats, barley, rye, sorghum (for grain); popularly held to include buckwheat, but not accurately so. Consult Vol. II, Cyclo. Amer. Agric.

**CÈREUS** (from the Latin, but of uncertain application). *Cactaceæ*. Usually arborescent, columnar cacti with the surface covered with spiny ribs.

Flowers large, borne singly along the sides of the st.; fl.-tube slender and, as it decays, cutting off from the ovary; petals numerous; stamens numerous; style single, thick: fr. a large, naked, fleshy berry; seeds small, black. The genus *Cereus*, as it has generally been treated, contained more than 100 species which differed greatly in habit, armament, *fls.* and fr., and was one of the most complex and difficult of the family. As now understood, it contains species of uniform habit, with similar *fls.* and frs., while a number of species of very different habit have been referred elsewhere. Even as here treated, more than half of the species are anomalous. Until the *fls.* and frs. have been studied, it seems best to leave them in *Cereus*. The species are all from S. Amer.

Only a few species of true *Cereus* are grown in this country, and most of these are grown under glass. The flowers do not compare in size and attractiveness with those of the so-called night-blooming *Cereus*, which is described elsewhere under the genus *Selenicereus*. Several of the species have cristate and other abnormal forms which make them desirable to certain growers. *C. lepidotus* is a rather common cultivated species in certain of the West India Islands, where it grows to considerable height, and several of the species are grown in Europe along the Riviera, where they reach great size. With us, however, they do not grow very rapidly. They are easily propagated from seed or by cuttings. See *Succulents*.

The species treated in the first edition of this work that are not here given may be looked for under the following genera: *Acanthocereus*, *Aporocactus*, *Bergocactus*, *Carnegiea*, *Cleistocactus*, *Escontria*, *Harrisia*, *Heliocereus*, *Hylocereus*, *Lemaireocereus*, *Lophocereus*, *Myrtillocactus*, *Oreocereus*, *Pachycereus*, *Rathbunia*, and *Selenicereus*.

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A. *Sts. erect, 2 in. or more diam.*

B. *New growth green, not pruinose or covered with a bloom.*

C. *Ribs of st. 10 or more.*

1. *Pasacana*, Web. A gigantic species, reaching a height of 20–30 ft., and sometimes even 50 ft., and a diam. of 12–16 in.; sparingly branching above; in new growth dark green, becoming gray or bluish: ribs 15–20, or in young plants only 9–10: areoles  $\frac{3}{8}$ – $\frac{3}{4}$  in. apart, large, brown, becoming yellowish and finally gray: radial spines 10–13, about 1 in. long, the under one or lowest pair straight, subulate, the others curved; centrals mostly 4, the under and upper ones the longest, reaching 2 in. length, straight or curved; the young spines are clear brown, often with alternating rings of light and dark tissue, later gray, bulbous at the base: fls. from the lateral areoles about 6 in. long, white. Argentina.—This is the giant cereus of the Argentine desert, as *Carnegiea gigantea* is of the certain N. American deserts. It is not a true *Cereus*.

2. *candicans*, Gillies. *Sts.* upright, low, cylindrical, bright green,  $2\frac{1}{2}$ –3 ft. high by 6–8 in. diam.; freely branching from the base: ribs 10, obtuse-angled: areoles  $\frac{5}{8}$ – $\frac{3}{4}$  in. apart, large, depressed, white, becoming gray: radial spines 11–14, spreading, at first thin, needle-form, later stronger, stiff, straight, about  $\frac{3}{4}$  in. long; central solitary or later 3–4 additional ones appearing above, stronger, reaching a length of  $1\frac{1}{4}$  in., sometimes somewhat curved; all the spines horn-colored, with tips and bases brown, later becoming gray: fls. long, funnell-form, resembling those of *Echinopsis*, 10 in. long by 6 in. diam.: fr. spherical to ellipsoidal, about 3 in. diam., red, somewhat spiny, flesh white. Argentina.—Not a true *Cereus*.

3. *lamprochlorus*, Lem. Related to *C. candicans*, of a taller growth, cylindrical, 3–6½ ft. high by about 3 in. diam., at first simple, but later branching at the base; in new growth bright green, later dirty green: ribs 10–11 or occasionally 15; conspicuously crenate, later blunt and but little crenate: areoles medium size, about  $\frac{1}{2}$  in. apart, yellowish white, becoming gray; above each areole 2 radiating grooves form a letter V: radial spines 11–14, spreading, straight, sharp-pointed, about  $\frac{3}{8}$  in. long, clear to dark amber-color; some are strong and rigid, while others are bristle-form; centrals mostly 4, somewhat longer, stronger and deeper colored, with brown bases, becoming dark gray, about  $\frac{3}{4}$  in. long: fls. from the previous year's growth, about 8–10 in. long by 6 in. diam., white. Argentina.—Not a true *Cereus*.

4. *Spachianus*, Lem. *Sts.* upright, at first simple, later profusely branching at the base, branches ascending parallel with the main st., 2–3 ft. high by 2–2½ in. diam., columnar: ribs 10–15, obtuse, rounded: areoles about  $\frac{1}{2}$  in. apart, large, covered with curly yellow wool, becoming white: radial spines 8–10,  $\frac{1}{4}$ – $\frac{3}{8}$  in. long, spreading, stiff, sharp, amber-yellow to brown; central solitary, stronger and longer; all the spines later becoming gray: fls. about 8 in. long by about 6 in. diam., white. Argentina.—Not a true *Cereus*.

5. *chiloensis*, DC. (*Cactus chiloensis*, Colla). *Sts.* strong, upright, simple (so far as known), about  $2\frac{1}{2}$  ft. high by  $3\frac{1}{2}$ –5 in. diam., cylindrical to somewhat clavate, bright, clear green: ribs 10–12, obtuse: areoles about an inch apart, large: radial spines straight, sharp, rigid, at first 9, but later 4 others appear above these; centrals mostly 4, seldom but a single one, bulbous at the base; the young spines are brown honey-yellow, becoming white, with dark tips, and finally gray: fls. from the upper lateral areoles about 6 in. long, white, resembling those of *Echinopsis*. Chile.—This is not a true *Cereus*.

cc. *Ribs of st. 7–9.*

6. *euphorbioides*, Haw. (*C. Olfersii*, Otto). Columnar, simple, 10–16 ft. high by about  $4\frac{1}{2}$  in. diam., in young growth pale green, changing with age to gray-green: ribs 8–10, separated by sharp grooves, sharp-angled, becoming flattened in older growth: areoles about  $\frac{3}{8}$  in. apart, small, white to gray: radial spines mostly 6, the under one the longest, reaching a length of over an inch, strong, yellowish brown to black, the upper ones shorter and bristle-form; central solitary, in young plants twice as long as the radials; all the spines finally become gray: fls. from near the crown,  $3\frac{1}{2}$ –4 in. long, beautiful flesh-red, remaining open for 24 hours. Brazil. R.H. 1885, p. 279.—This plant is insufficiently understood; it may be a form of some species of *Cephalocereus*.



884. *Cereus peruvianus*. A flower that is just closing; from a plant flowered in Washington, D. C., in 1904. (×  $\frac{3}{8}$ )

7. *Sepium*, DC. (*C. Roezlii*, Haage.) Upright, columnar, about 3 in. diam.: ribs 9, separated by sharp, somewhat serpentine grooves, obtuse, above the areoles, 2 radiating, slightly curved grooves form a letter V: areoles  $\frac{1}{2}$ – $\frac{3}{4}$  in. apart, comparatively large, slightly sunken, yellowish, later gray: radial spines 9–12, radiate, nearly  $\frac{1}{2}$  in. long, straight, subulate, tolerably sharp, slightly thickened at the base, clear brown, with darker stripes; central solitary, reaching  $1\frac{1}{2}$  in. long, straight, porrect, later somewhat deflexed, clear brown; later all the spines become gray. Andes of Ecuador.—Near *Borzacactus*; needs further critical study.

8. *tetracanthus*, Labour. Upright, arborescent or bushy, freely branching, young branches leaf-green, later gray-green: ribs 8–9, low, arched: areoles medium-sized, slightly sunken, about  $\frac{1}{2}$  in. apart, white to gray: radials 5, later 7, radiate, about  $\frac{3}{8}$  in. long, straight, subulate, stout, white, with brown tips and bases, later ashy gray; centrals 1–3, under one largest and porrect, when young yellow and translucent, later gray: fls. resemble those of *C. tortuosus*. Bolivia.—This species should doubtless be referred to *Eriocereus*.



ccc. *Ribs of st. 3-6.*

9. *Hankeanus*, Web. Upright, robust, not branching (so far as known), young growth bright green, later dark green, about 2 in. diam.: ribs 4-5, compressed, about  $1\frac{1}{4}$  in. high, conspicuously crenate, with an S-form line passing from each areole toward the center of the st.: areoles,  $\frac{3}{8}$ -1 in. apart, horizontally elliptical to heart-shaped, brown, becoming gray below and yellow above: radial spines 3, needle-like, stout, sharp-pointed, about  $\frac{3}{8}$  in. long, amber-colored when young, turning to brown; central solitary, straight, porrect,  $\frac{1}{2}$  in. long, stronger than the radials, horn-colored; later all the spines become gray: fls. 4-5 in. long, white. S. Amer.

BB. *New growth blue, white- or gray-pruinose.*

c. *Ribs of st. comparatively broad and low: st. more or less triangular in cross-section.*

10. *macrogonus*, Otto. Arborescent, sparsely branching, reaching a height of 20 ft. (in cult., 6 ft. high by 3-5 in. diam.), branches columnar: ribs mostly 7, seldom 8-9, thick, slightly undulate, obtuse and with convex faces, about 1 in. high. bluish green, frequently having a depressed line near the areole: areoles about  $\frac{1}{2}$  in. apart, large, gray: radial spines 6-9, radiate or spreading, strong, subulate,  $\frac{3}{4}$  in. long, horn-color, later black; central spines 1-3, somewhat stronger and longer than the radials, more or less conspicuously porrect: fls. from the lateral areoles near the end of the branches,  $2\frac{1}{2}$ -3 in. long, tolerably fleshy, white: fr. depressed-globose, 2 in. diam. by little more than 1 in. long. Brazil.

cc. *Ribs of st. strongly compressed laterally.*

11. *peruvianus*, Haw. (*C. monoclonos*, DC.). HEDGE CACTUS. Fig. 884. Tall, 30-50 ft., branching freely toward the base, columnar, 4-8 in. diam., new growth dark green and glaucous, becoming a dull green with age, and, in old sts. becoming corky: ribs 5-8, compressed: areoles  $\frac{1}{2}$ -1 in. apart, in new growth covered with conspicuous, curly brown wool, becoming gray: radial spines about 6-7, about  $\frac{3}{8}$ - $\frac{1}{2}$  in. long; central solitary, reaching a length of  $2\frac{1}{2}$  in.; the number of spines increases with age to as many as 20, all are rigid, brown: fls. abundant, from the lower part of the st., white, nocturnal, 6-7 in. long by 5 in. diam. S. Amer. G.C. III. 24:175 (var. *monstrosus*).

Var. *Alacriportanus*, K. Schum. (*C. Alacriportanus*, Mart.). Of somewhat weaker growth, low, and less conspicuously pruinose in the new growth, which is consequently nearly clear green. S. Brazil.

12. *Jamacaru*, Salm-Dyck (*C. validus*, Haw.). Sts. upright, robust, rigid, 12-16 ft. high by as much as 6 in. diam.; young growth azure-blue, turning dark green with age, glaucous: ribs 4-6, thin, compressed, crenate: radial spines 5-7, stiff, needle-like, clear yellow with brown points, or brown and finally black, about  $\frac{1}{2}$ - $\frac{3}{4}$  in. long; centrals 2-4, somewhat stronger, porrect,  $\frac{3}{4}$ -3 in. long: fls. large, 10 in. long by 8 in. diam., white, nocturnal. Brazil, Venezuela.

13. *chalybæus*, Otto. Sts. upright, branching above, arborescent, azure-blue and pruinose, later dark green,  $1\frac{1}{2}$ -4 in. diam.: ribs 6, in young growth very much compressed, later depressed till the st. is nearly cylindrical: areoles about  $\frac{3}{8}$  in. apart, dark gray-brown: radial spines mostly 7, about  $\frac{1}{2}$  in. long; centrals 3-4, similar but somewhat stronger and a little longer; all the spines are pointed, stiff, when young are black, later brown to gray with black tips, bulbous at the base: fls. very similar to those of *C. cærulescens*. Argentina.

AA. *Sts. erect, less than 2 in. diam.*

B. *Ribs of st. 10 or more.*

14. *isogonus*, K. Schum. St. upright, columnar, about 1- $1\frac{1}{4}$  in. diam., in young growth light green to yellow-green, later darker: ribs 15-16: areoles approximate,

white, turning gray: radial spines as many as 20, spreading, at first clear or dark yellow, becoming white, and finally gray, bristle form, flexible, about  $\frac{3}{8}$  in. long; centrals 6-8; two of these are somewhat stronger and stiffer, about  $\frac{3}{4}$  in. long, one directed upward and one downward, yellowish brown to dark honey-color; later gray, as in the radials. S. Amer.

15. *splendens*, Salm-Dyck. Columnar, slender, short, rigid, more or less branching from the base, reaching a height of about 2 ft. and about 1- $1\frac{1}{2}$  in. diam., light to yellowish green: ribs about 10-12, rounded: areoles prominent, about  $\frac{1}{4}$  in. apart, tawny, becoming white, tomentose: radial spines 8-12, radiating, yellow and light brown, becoming gray; centrals 1-3, scarcely larger than the radial, yellowish to white; all the spines slender, bristle form, about  $\frac{1}{4}$ - $\frac{3}{4}$  in. long. —*C. Cavendishii* has been referred to this species, but with some question.

BB. *Ribs of st. 3-10.*

16. *platygonus*, Otto. At first upright, later somewhat reclining, branching, at the base about 1 in. diam., tapering in the new growth: ribs 8, low, arched: areoles about  $\frac{1}{4}$  in. apart, very small, yellow, becoming gray, subtended by a small 3-angled bract: radial spines 12-15, spreading, bristle form, little more than  $\frac{1}{2}$  in. long; central solitary, slightly longer and stronger; all the spines at first yellow-brown, changing to white or gray with age.

17. *cærulescens*, Salm-Dyck (*C. Lándbeckii*, Phil.). Arborescent or shrubby, 3-5 ft. high: sts. 1- $1\frac{1}{2}$  in. diam.: ribs usually 8, obtuse: areoles approximate, white bud soon becoming black: spines rigid; radials 9-12,  $\frac{1}{4}$ - $\frac{1}{2}$  in. long, black; centrals 4,  $\frac{3}{4}$  in. long, stronger, black or white: fls. from the side of the st., slightly curved, 6-8 in. long by 6 in. diam., tube bronze-green, corolla white or occasionally rose-pink: frs. ellipsoidal, pointed at both ends, about 3 in. long and half that in diam., bright red, with blue glaucous covering. Argentina. B.M. 3922.

18. *Bridgesii*, Salm-Dyck. Upright, tall, columnar, simple or later branching at the base, bright green when young, becoming blue to gray-green,  $1\frac{1}{2}$ -2 in. diam.: ribs 5-7, very broad and low: areoles  $\frac{1}{2}$ - $\frac{3}{4}$  in. apart, yellowish to gray: spines 3-5, radiating, the under one, or seldom the upper one, the longest,  $1\frac{1}{2}$  in. long, stiff, sharp, straight, dark honey-yellow, with brown tips, becoming gray with age. Bolivia.

Var. *lageniformis*, K. Schum. (*C. lageniformis*, Forst.). Spines more numerous, somewhat longer.

19. *azureus*, Parm. (*C. Seidelii*, Lehm.). St. upright, tall, slender, columnar, branching from the base, in the young, fresh bluish green, later dark green with gray, glaucous covering, about 3-4 ft. high and about 1 in. diam.: ribs 5-7, rounded, enlarged at the areole: areoles about  $\frac{3}{4}$ -1 ft. apart, elevated, large, abundantly woolly when young: spines 8-18, nearly alike, about  $\frac{1}{8}$ - $\frac{3}{8}$  in. long, stiff, slender, needle-form to bristle-like, black; the 2-4 central ones somewhat longer: fls. 8-12 in. long, obliquely attached to the st., slightly curved, white. Brazil.

20. *cæsius*, Otto. Upright, columnar, branching at the base, somewhat tapering above; in new growth, beautiful light blue, pruinose; later, light green to slightly bluish, about  $1\frac{1}{2}$  in. diam.: ribs 5-6, separated by sharp grooves, about  $\frac{1}{2}$  in. high, compressed, faintly crenate, becoming depressed in older growth: areoles about  $\frac{3}{8}$  in. apart, small, yellow at first, later becoming white and finally gray: radial spines 8-10, sometimes more appear later; radiate, light amber-color, brown at the base, the lower pair the longest, mostly about  $\frac{1}{2}$  in. long; centrals 4-7, like the radials but usually somewhat stronger, longer and darker; all the spines thin, needle-form, flexible, sharp; later, light, horn-color, finally gray. S. Amer.(?).

AAA. *Sts. weak, clambering over rocks or other plants, and without aerial roots.*

21. *Bónplandii*, Parm. *Sts.* at first upright, later clambering over rocks and bushes, about 1-1½ in. diam., branching and spreading, in new growth commonly of a bluish or purplish green, later gray-green: ribs 4-6, sharp, compressed, crenate, separated by broad, concave faces; later the ribs become much depressed, so that the st. is sometimes nearly cylindrical; the ribs commonly run spirally around the axis of the st.: areoles ½-1½ in. apart, at first considerably depressed, later shallower, white, becoming gray: radial spines 4-6 (later 1-4 more appear), straight, spreading, the largest about ½-1 in., stout, subulate, pointed, the under one needle-form and shorter; central solitary, straight, stronger, 1 in. long, deflexed or porrect; the stronger spines are white, with tips and bases brown, when young beautiful ruby-red, later all are gray, with black tips and bulbous bases: fls. from the lateral areoles about 10 in. long, white, nocturnal: fr. nearly spherical, about 2 in. diam., mammate, dark carmine-red. Paraguay, Brazil, and Argentina.

22. *tortuosus*, Forbes (*C. atropurpureus*, Haage). *Sts.* slender, weak, at first upright, but later reflexed, reaching a length of 3-4 ft., and 1-1½ in. diam.: ribs commonly 7, sometimes but 5, rounded, low, separated by regular serpentine grooves: areoles about 1 in. apart, large: radial spines 5-8, about ⅜-1 in. long; centrals 1-4, about ¾-1½ in. long; all the spines slender, rigid, red-brown when young, becoming ashy with age: fls. from the previous year's growth, about 6 in. long, trumpet-shaped, tube olive-green and spiny, in the axils of the reddish green scales; outer petals pale green, tinted with brown; inner petals clear white: fr. spherical, brilliant red without and white within, mammate, bearing a few spines on the summits of the lower mammas. Argentina.

23. *Mártinii*, Labour (*C. monacanthus*, Hort.). At first upright, later requiring a support; freely branching from the base, branches long, reaching nearly 5 ft., ¾-1 in. diam., slightly tapering, dark green: ribs 5-6, separated by serpentine grooves, contracted between the areoles; sometimes the ribs are not evident, when the st. is cylindrical: areoles about 1-1½ in. apart, white: radial spines 5-7, reddish, short, bristle-form, with bulbous bases or short conical, usually about ⅓ in. long; central solitary, mostly deflexed, ½-1 in. long (in young growth, frequently not longer than the radial), subulate, robust, light brown or white, with bases and tips black: fls. from the older growth sts., 8-9 in. long, clear white, nocturnal: fr. spherical (very

similar to *C. tortuosus*), pointed, dark carmine-red, about 2 in. diam., mammate, a few spines on the mammas, toward the base of the fr. Argentina. R.H. 1860, pp. 658-9.—This species is commonly sold under the name of *C. platygonus*.

24. *Pitajaya*, DC. (*C. pernambucensis* [fernambucensis], Lem. *C. formosus*, Salm-Dyck. *C. variabilis*, Pfeiff.). By recent authorities referred to the genus *Acanthocereus*. *St.* at first simple, later branching, in young growth light green, turning grayish green with age, pointed, ¾-1¼ in. diam.: ribs 3-5, commonly 4: areoles about 1 in. apart, large, bearing a conspicuous amount of curly hair, about ½ in. long, in new growth: radial spines 5-7 and a solitary central one, uniform, about ⅜-⅝ in. long, amber color to brown and finally gray: fls. from the older growth, large, about 8 in. long, slightly curved, white, nocturnal. Uruguay, Brazil, Colombia. B.M. 4084.—*C. grandis*, Haw., according to Weber, is but a larger form of this species.

AAAA. *Sts. more or less climbing by means of aerial roots.*

25. *Martiàus*, Zucc. Of bushy growth, branching, reaching a height of 3 ft. and more: branches slender, provided here and there with aerial roots, cylindrical, about ¾ in. diam.: ribs commonly 8, straight, separated by sharp grooves, very low: areoles ¼-¾ in. apart, small, white: radial spines 6-10, bristle-form, spreading, clear honey-yellow, at base brownish, later whitish and becoming gray, about ¼ in. long; centrals 3-4, similar, only somewhat stouter and darker: fls. usually abundant, straight or slightly S-shaped, 4-5 in. long, scarlet-red: fr. spherical, reddish green, covered with bristles. S. Mex. B.M. 3768.

*C. ventimiglia*, Vaupel (*Borziacactus ventimiglia*, Riccob.). *St.* slender, 8- or 9-ribbed: spines in clusters of 8-10, spreading; perianth-tube elongated, opening into a large throat; petals red-violet: fr. small, globular, bearing few bracts. This species apparently does not belong to the true *Cereus*, and is probably much nearer *Cleistocactus*, as suggested in the Kew Bulletin. It was described from plants flowering in the Botanical Garden at Palermo, Italy, and which are said to have come from Ecuador. *Borziacactus* is a recently described genus, not yet intro. into American collections.

*C. alamosensis*=*Rathbunia alamosensis*.—*C. Baummannii*=*Cleistocactus Baummannii*.—*C. Berlandieri*=*Echinocereus*.—*C. caryophyllus*=*Echinocereus*.—*C. candelabrum*=*Lemaireocereus Weberi*.—*C. Chiotilla*=*Escontria Chiotilla*.—*C. chloranthus*=*Echinocereus*.—*C. coccineus*=*Echinocereus*.—*C. Cochal*=*Myrtillocactus Cochal*.—*C. conoides*=*Echinocereus*.—*C. ctenoides*=*Echinocereus*.—*C. cylindricus*=*Opuntia*.—*C. dasyacanthus*=*Echinocereus*.—*C. Donkeléri*=*Selenicereus Donkelérii*.—*C. dubius*=*Echinocereus*.—*C. Dumortieri*=*Lemaireocereus Dumortieri*.—*C. eburneus*=*Lemaireocereus griseus*.—*C. Emoryi*=*Bergerocactus Emoryi*.—*C. Engelmannii*=*Echinocereus*.—*C. enneacanthus*=*Echinocereus*.—*C. eruca*=*Lemaireocereus eruca*.—*C. extensus*=*Hylocereus extensus*.—*C. Fendleri*=*Echinocereus*.—*C. flagelliformis*=*Aporocactus flagelliformis*.—*C. geometrizans*=*Myrtillocactus geometrizans*.—*C. giganteus*=*Carnegiea gigantea*.—*C. gonacanthus*=*Echinocereus*.—*C. grandiflorus*=*Selenicereus grandiflorus*.—*C. Greggii*=*Peniocereus Greggii*.—*C. gummosus*=*Lemaireocereus gummosus*.—*C. hamatus*=*Selenicereus hamatus*.—*C. inermis*=*Selenicereus inermis*.—*C. longisetus*=*Echinocereus*.—*C. Malisonii* is a hybrid.—*C. MacDonaldii*=*Selenicereus MacDonaldii*.—*C. marginatus*=*Pachycereus marginatus*.—*C. Maynardii*=*Selenicereus*.—*C. mexicanus* is probably a hybrid.—*C. mojavensis*=*Echinocereus*.—*C. napoleonis*=*Hylocereus napoleonis*.—*C. Nickelsii*=*Cephalocereus*.—*C. nycticalus*=*Selenicereus nycticalus*.—*C. paucispinus*=*Echinocereus*.—*C. pectinatus*=*Echinocereus*.—*C. phaniceus*=*Echinocereus*.—*C. princeps*=*Acanthocereus pentagonus*.—*C. procumbens*=*Echinocereus*.—*C. queretarensis*=*Pachycereus queretarensis*.—*C. Régeli*=*Selenicereus hybrid*.—*C. repandus*=*Harrisia gracilis*.—*C. Ratterii*=*Echinocereus*.—*C. Scheeri*=*Echinocereus*.—*C. senilis*=*Cephalocereus*.—*C. serpentinus*=*Nyctocereus serpentinus*.—*C. speciosus*=*Helicocereus speciosus*.—*C. spinulosus*=*Selenicereus spinulosus*.—*C. stellatus*=*Lemaireocereus stellatus*.—*C. stramineus*=*Echinocereus*.—*C. Thurberi*=*Lemaireocereus Thurberi*.—*C. triangularis*=*Hylocereus tricostratus*.—*C. tuberosus*=*Wilcoxia*.—*C. viridiflorus*=*Echinocereus*.

J. N. ROSE.†



885 *Cerinthe retorte*. (×¼)

**CERINTHE** (Greek, *keros*, wax; *anthos*, flower: the ancients thought that the bees visited the flowers for wax). *Boraginaceæ*. Annual or perennial herbs from Europe and Asia Minor, with alternate glaucous leaves and showy purple bracts.

Calyx deeply divided, the tubular corolla with 5 very small reflexed lobes, usually differently colored from





XXV. Celery.—The cultivation under field conditions, at the hilling-up or banking stage.





the tube.—About 6 species. The best species is *C. retorta*, which has a unique appearance in the garden, and is strongly recommended for more general cult. It is a hardy annual of easy cult.

**retorta**, Sibth. & Smith. HONEYWORT. Fig. 885. Height 1½–2 ft.: lvs. glaucous, often spotted white or red; lower lvs. obovate-spatulate; upper lvs. amplexicaul, with 2 round ears, on the flowering branches gradually becoming smaller and closer together until they pass into purple bracts, which form the chief attractive feature of the plant: fls. when full-blown protruded beyond the bracts; corolla tubular-club-shaped, yellow, tipped purple, with 5 small, spreading teeth: frs. smooth but not shining. Greece. B.M. 5264. Gn. 41:212. For a garden review of the other honeyworts, see Gn. 41, p. 212.

*C. major*, Linn. A showy annual 6–15 in. high: lvs. clasping the st., very rough and ciliate: fls. with showy bracts; the corolla yellow below, purplish at the top: fr. smooth, shining and brown-spotted. Medit. region. B.M. 333.

WILHELM MILLER.  
N. TAYLOR.†

**CEROPEGIA** (Greek, *wax* and *fountain*, the flowers having a waxy look). *Asclepiadaceæ*. Greenhouse vines of Africa and Asia.

Stems fleshy, erect and twining among the other plants in nature, or pendulous: lvs. opposite, sometimes in the S. African species wanting: fls. medium-sized, the corolla more or less inflated at the base, straight or curved; corona something as in our common milkweeds, double.—A genus of 100 species, a dozen of which are known in Old World collections but only the following in Amer. Many of them have tuberous roots, and need a season of rest and dryness. May be grown in a compost of loam, leaf-mold or peat, and sand. Temperate house is the best for the two following. Prop. by cuttings in spring over bottom heat. Odd and handsome.

**Woodii**, Schlecht. With many slender prostrate or trailing sts.: lvs. fleshy, about 1½ in. long, almost rotund: fls. in pairs, axillary on stalks, 3–7 in. long; corolla slightly curved, about ¾ in. long, pink or with dark lines below, the upper part sometimes purplish. Natal. G.C. III. 22:357; 37:244 (desc.). B.M. 7704.

**Sándersonii**, Decne. St. twining, fleshy and thick: lvs. about 1¾ in. long, ovate-lanceolate: fls. cymose, 3–4 at a node, the greenish white corolla about 1½–2 in. long, curved and with an obvious inflation at the base. Natal. B.M. 5792. G.C. III. 40:383. R.H. 1901, p. 111.

*C. barbertonensis*, N. E. Br. Lvs. somewhat variegated with pale green along the veins: fls. similar to *C. Woodii*. Transvaal.—*C. Brönnii*, Ledger. Corolla-tube pale green with dark blotches; lobes greenish with a zone of white and dark purple in the middle. Uganda.—*C. discreta*, N. E. Br. Tuberous: tube whitish, dark-veined; lobes pale yellow at base, purple-green at apex. Madras.—*C. fusca*, C. Bolle. Many succulent sts.: corolla dull reddish brown; corona light yellow. Canary Is. B.M. 8066.—*C. gemmifera*, K. Schum. A tall climbing species: fls. solitary. W. Trop. Afr.—*C. Lugardæ*, N. E. Br. Lvs. thin, 1–2 in. long; tube 1 in. long, abruptly curved immediately above inflated base, dilated at apex into funnel-shaped mouth. Bechuanaland. G.C. III. 30:302 (desc.).—*C. Rëndallii*, N. E. Br. A small species with fl. having an umbrella-like canopy surmounting the corolla: twining. Transvaal.—*C. similis*, N. E. Br. In cult. as *C. Thwaitesii*. Corolla-lobes white or pale green at base, ciliate. G.C. III. 40:384. *C. Thornecroftii*, N. Br. Sts. twining: cymes axillary, many-fld.; corolla white, with purple blotches. Transvaal. B.M. 8458.

N. TAYLOR.

**CEROPTERIS** (Greek, *wax fern*). *Polypodiaceæ*. Hot-house ferns of rather small size, interesting for the powdery covering on the leaves.

A rather small group somewhat related to *Pteris*, characterized most conspicuously by having the under surface of the lvs. covered with a colored powder, often silver, white or bright yellow (so-called silver and gold ferns). The sporangia are borne in indefinite lines and are unprotected by any indusium. The species of *Ceropteris* have in the past been classified under the generic name *Gymnogramma*, but fern students

are now generally agreed in separating it as a distinct genus.

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A. Powder commonly yellow: lvs. about as broad as long.

1. **triangularis**, Underw. (*Gymnogramma triangularis*, Kaulf.). Fig. 886. Lf.-blades 2–5 in. wide and long, on stalks 6–12 in. long, dark green above, below deep golden yellow, or occasionally white; lower pinnae much larger than the others, deltoid; the upper lanceolate. Calif. to Brit. Col. Gn. 48, p. 444.—A white-powdered variety with a viscous upper surface and coarser cuttings (var. **viscosa**, D. C. Eaton) is found in S. Calif.



886. *Ceropteris triangularis*.  
(×½)

AA. Powder yellow: lvs. lanceolate, several times as long as broad.

B. Lvs. scarcely more than bipinnate.

2. **chrysophylla**, Link (*Gymnogramma chrysophylla*, Kaulf.). Lvs. 12–18 in. long, with blackish stalks and rachises, the segms. slightly pinnatifid at the base: powder golden yellow. W. Indies to Brazil. R.H. 1856:201. G.C. III. 23:373.—Often considered a var. of *C. calomelanos*. Var. **Laucheana** (*Gymnogramma Laucheana*, Hort.), has triangular lvs. except in its sub-variety *gigantea*. Gn. 48, p. 437.

BB. Lvs. tripinnatifid to quadripinnate.

3. **sulphurea**, Fée (*Gymnogramma sulphurea*, Desv.). Lf.-blades 6–12 in. long on chestnut-brown stalks, the pinnae long, tapering, less than 1½ in. wide at base, the pinnules compact, with 3–7 divisions: powder sulfur-yellow. W. Indies.

4. **argentea**, Kuhn (*Gymnogramma aurea*, Desv.). Lvs. 6–12 in. long, 7–10 in. wide, deltoid; pinnae deltoid, 2–3 in. wide at base, the ultimate divisions cuneate. Madagascar.—By some this is referred to *Gymnogramma argentea*, Mett., a similar fern with white powder.

5. **decomposita**, Baker (known only under the name *Gymnogramma decomposita*, belongs in *Ceropteris*). Lvs. 1½ ft. long, 1 ft. broad, deltoid, quadripinnate or even 5-pinnate; pinnae close, lanceolate, with the ultimate divisions linear and 1-nerved: powder rather scanty. Andes. F.R. 2:25. G.C. III. 11:365. F. 1874, p. 148.

AAA. Powder white: lvs. lanceolate.

B. Segms. acute.

6. **calomelanos**, Underw. (*Gymnogramma calomelanos*, Kaulf.). Fig. 887. Stalks and rachises nearly black: lvs. 1–3 ft. long, with lanceolate pinnae; segms. often with a large lobe-like auricle at the upper side of the base. W. Indies to Brazil. A.G. 14:303.—The most variable species of the genus. *C. magnifica*, Hort., is probably one of the many garden varieties. Var. **chrysophylla**, is here considered a distinct species. (See No. 2.)

BB. Segms. obtuse, rounded.

7. **peruviana**, Link (*Gymnogramma peruviana*, Desv.). Lvs. 6–12 in. long, 3–5 in. wide, with dark

chestnut-brown stalks; pinnæ somewhat regularly pinnatifid on both sides below. Mex. to Peru. By some considered a var. of *G. calomelanos*. Var. *argyrophylla* (*G. argyrophylla*, Hort.) is silvery on both sides.



887. *Ceropteris calomelanos*. ( $\times \frac{3}{10}$ )

in. long, 4 in. wide, the lower pinnæ much the largest; pinnules imbricated; texture rather thin. Venezuela. Var. *Wettenhalliana*, Moore (*G. Wettenhalliana*, Hort.), is a garden variety, with pale sulfur-yellow powder.

L. M. UNDERWOOD.

R. C. BENEDICT.†

**CERÓXYLON** (Greek, *wax and wood*, i.e., wax-tree). *Palmaceæ*. WAX-PALM. Tall palms with ringed stems and pinnate leaves.

Spineless, the trunk covered with wax: lvs. clustered at the top, 15-20 ft. long when full grown, equally pinnate; pinnæ long, rigid, sword-shaped, bases recurved and tips pointed, dark green above and glaucous beneath, the petiole very short and sheathed; fls. mostly unisexual, on spikes nearly or quite covered by the simple spathe; fl.-parts 3; stamens 9-15: seed as large as a hazel-nut, round, bony, inclosed in a soft or crumbling integument.—Perhaps 4 or 5 species in the Andes of Colombia and Ecuador.

*andicolum*, HBK. (*Iriartea andicola*, Spreng. *I. Klopstockia*, Hort. *Klopstockia cerifera*, Karst. *Beethovénia cerifera*, Engl.). The celebrated wax-palm of the Andes, and a good greenhouse subject: said to reach nearly 200 ft.: trunk slender, swollen at the middle: lvs. 6-8 in., the crown, the under sides silvery-scurfy.—The waxy covering of the trunk gives it a marble-like and columnar appearance. The wax, used as an ingredient in the making of candles, is an article of commerce. It is said that *Diplothemium caudescens* (*Ceroxylon niveum*, Hort.) is sometimes sold for the wax-palm by plant dealers. *C. ferrugineum*, Regel, is probably referable to *Iriartea*. It appears not to be in the trade. *C. andicolum* is a free grower under cult., and is a very ornamental subject. It thrives in a warm moist house, and the seeds also germinate well under similar conditions.

L. H. B.

**CESPEDESIA** (named in honor of Juan Maria Cespedes, priest of Bogota). *Ochnaceæ*. Tall handsome glabrous trees, sometimes grown in the juvenile state in hothouses.

Leaves alternate, large, coriaceous, mostly obovate to lanceolate and narrowed at base, entire, or crenate: fls. yellow, showy, in large terminal bractless panicles; sepals 5, small and deciduous; petals 5; stamens 10 to

many: fr. a 5-valved caps.; seeds very small.—Species probably 6-10, in S. Amer. and Panama.

*discolor*, Buil. Lvs. large, lanceolate, drooping, handsomely colored on young growths in bright brown or tan tinted with rose and veined with yellow. Gn. W. 20:618.—A comparatively recent intro. to cult. in England.

L. H. B.

**CÉSTRUM** (old Greek name). Incl. *Habrothamnus*. *Solanaceæ*. Greenhouse shrubs (or low trees) some of them with a climbing habit, and grown in the open in southern California and elsewhere South.

Leaves alternate and entire, usually rather narrow: fls. tubular, in axillary or terminal cymes, red, yellow, greenish or white, often very fragrant; corolla salver-shaped or somewhat trumpet-shaped, the long tube often enlarged at the throat, 5-lobed, exceeding the bell-shaped or tubular 5-toothed calyx; stamens mostly 5, all perfect, attached in the tube: fr. a scarcely succulent mostly reddish or blackish berry, derived from a 2-celled stipitate ovary and seeds few or reduced to 1.—Probably 150 species, in Trop. and Subtrop. Amer. They are much grown in warm countries, where they bloom continuously. For a monograph of the West Indian species (about 20) see O. E. Schulz, in *Urban, Symbolæ, Antillanæ*, vi, p. 249-279 (1909-1910).

Cestrum are among the most useful of bright-flowering shrubby greenhouse plants, and they may be grown either as pot-plants, or planted against the back wall or supports of a greenhouse, where, if given a light position, they will produce an abundance of flowers from January to April. The Mexican species will do well in a winter temperature of 45° to 50°, but the species from Central America require stove temperature. They are propagated by cuttings taken in February or early in March and inserted in sand in a warm temperature, keeping them somewhat close until rooted, when they should be potted in a light soil, after which they may be grown in pots, shifting on as often as required, or planted out in the open ground toward the end of May in a sunny position, where, if kept pinched back to induce a bushy growth and attention is paid to watering, they will make fine plants by the first of September. They should then be lifted and potted in a light rich soil and kept close and shaded for a few days, and then transferred to their winter quarters. After flowering, the plants should be given a rest for a month or six weeks, gradually reducing the supply of water to induce the leaves and wood to ripen, after which they should be cut well back, the old soil shaken



888. *Cestrum elegans*. ( $\times \frac{1}{2}$ )

off, and the roots trimmed back, and then either potted again or planted out for the summer. While in the greenhouse, cestrum are very subject to the attacks of insects, especially the mealy-bug. (E. J. Canning.)

A. Fls. red.

*élegans*, Schlecht. (*Habrothamnus elegans*, Brongn.). Fig. 888. Tall and slender, half-climbing, the branches pubescent; lvs. ovate, lanceolate, long-acuminate, of medium size, pubescent beneath; fls. red-purple, swollen



near the top of the tube, in loose clusters which nod at the ends of the branches, the lobes ciliate. Mex. F.S. 2:82.—One of the old-fashioned greenhouse shrubs, blooming almost continuously. There is a form with variegated lvs. Var. *Smithii* (*C. Smithii*, Hort. Bull.) has beautiful blush-rose fls., profusely produced through summer and autumn. Gn. 62, p. 242, desc.

*fasciculatum*, Miers. Spring bloomer, with larger fls. than those of *C. elegans*, and more compact, nearly globular fl.-clusters, the cluster subtended by small lvs. as if an involucre: lvs. ovate. Mex. B.M. 4183 (and probably the *C. elegans*, B.M. 5659.).

*Néwelli*, Nichols. (*H. Néwelli*, Veitch). Fls. bright crimson, larger and more brilliant than those of *C. elegans* and *C. fasciculatum*. Gn. 34:106.—A free-growing plant, originating from seed by Mr. Newell, Downham Market, England. Evidently an offshoot of one of the preceding species.

AA. Fls. orange or yellow.

*aurantiacum*, Lindl. Of half-climbing habit: lvs. oval to ovate, more or less undulate: fls. sessile in a panicle, orange-yellow. Guatemala. R.H. 1858, p. 238.

*Pseudo-Quina*, Mart. Glabrous: lvs. membranaceous, ovate, obtusish or acute, narrowed at base: peduncles articulated at apex, axillary or in congested 4-8-fld. terminal racemes; corolla slender with acute lobes, much longer than the toothed calyx. Brazil.—Said to have marked medicinal qualities. Differs from *C. Parqui* in having glabrous filaments and pedicellate fls.

AAA. Fls. white, greenish, or cream-yellow.

*Parqui*, L'Her. Shrub, half-hardy, nearly glabrous: lvs. lanceolate to oblong, petioled, short, acuminate: fls. sessile, long, tubular, with a wide-spreading limb, in an open panicle, greenish yellow, very fragrant at night. Chile. B.M. 1770. Adventive in Fla.

*diurnum*, Linn. Quick-growing evergreen shrub, minutely pubescent or glabrous: lvs. oblong and short-acute, thickish and glabrous, shining above: fls. white, very sweet-scented by day, in axillary long-peduncled spikes; corolla-lobes roundish and reflexed: berry nearly globular; filaments erect and not denticulate. W. Indies.

*nocturnum*, Linn. NIGHT-BLOOMING JESSAMINE. Shrub, 4-12 ft.: branches brownish, very slender or flexuose, glabrous or nearly so: lvs. thinner, ovate or elliptic, prominently acuminate: fls. creamy-yellow, very fragrant by night; corolla-lobes ovate and blunt: berry ovoid-oblong; filaments denticulate. W. Indies.

*pūbens*, Griseb. Sts. and lvs. woolly-pubescent: fls. greenish, much like those of *C. nocturnum* and also fragrant at night. Argentina.

*laurifolium*, L'Her. Glabrous shrub: lvs. ovate to oblong, glossy, thick: fls. greenish yellow and changing color (sometimes described under cult as pure white), in erect heads, slightly fragrant; corolla-tube club-shaped, tapering gradually; corolla-lobes ovate-roundish and blunt; filaments toothed: berry ovoid. W. Indies, S. Amer.—Much planted in S. Calif. L. H. B.

**CHÆNÁCTIS** (Greek, *gaping ray*: the marginal corollas often ray-like). *Compositæ*. West American low herbs or undershrubs sometimes planted in the open for ornament.

Leaves alternate and mostly dissected: fls. yellow, white or flesh-colored on solitary peduncles or in loose cymes; florets of one kind, but the marginal ones with a more or less enlarged limb; involucre campanulate; receptacle flat and generally naked: pappus of toothed or entire scales (wanting in one species).—About 20 species, of which 3 have been intro. as border plants; but they are little known to gardeners. Of easy cult. Prop. by seeds or division.

A. *Pappus of entire or nearly entire persistent scales.*

*tenuifolia*, Nutt. Small, tufted annual, white-pubescent when young but becoming nearly or quite glabrous: 1 ft.: lvs. once or twice pinnately parted, the lobes linear or filiform: heads  $\frac{1}{2}$  in. high, lemon-yellow. S. Calif.

*Doùglasii*, Hook. & Arn. Perennial, 3-15 in. high, usually white-woolly when young: lvs. broad, bipinnately parted into short and crowded, obtuse lobes: heads  $\frac{1}{2}$ - $\frac{3}{4}$  in. high, white or whitish, usually in crowded, cymose clusters. Mont. south and west.—Variable. Var. *achilleæfolia*, A. Nelson, is often sold for the type. It has more finely divided lvs.

AA. *Pappus of fimbriate and deciduous scales, or even wanting.*

*artemisifolia*, Gray. Tufted annual, 1-2 ft., rusty pubescent and somewhat sticky on the under side of the lvs., glandular hairy above: lvs. twice or thrice pinnately parted into short-linear or oblong lobes: heads  $\frac{1}{2}$  in. high, the involucre viscid, the florets white or cream-color. S. Calif. N. TAYLOR.†

**CHÆNOMÈLES** (Greek *chainein*, to gape, to split, and *melea*, apple: the fruit was supposed by Thunberg to split into five valves). *Rosaceæ*, subfamily *Pomeæ*. Woody plants, grown chiefly for their handsome brightly colored flowers appearing early in spring; formerly commonly included in *Cydonia*.

Shrubs or small trees, sometimes spiny: lvs. subpersistent or deciduous, alternate, short-petioled, serrate: fls. solitary or fascicled, before or after the lvs., sometimes partly staminate; calyx-lobes entire or serrate; petals 5; stamens numerous; styles 5, connate at the base: fr. 5-celled, each cell with many seeds.—Four species in China and Japan. See page 3567.

These are ornamental plants, nearly hardy North except *C. sinensis*, which can be grown only South. *C. japonica* and *C. Maulei*, with handsome glossy foliage and abundant flowers in early spring, varying in all shades from pure white to deep scarlet, are highly decorative, and especially adapted for borders of shrubberies and for low ornamental hedges. The fruit of all species can be made into conserves. They thrive in almost any soil, but require sunny position to bloom abundantly. Propagated by seeds, usually stratified and sown in spring; also readily increased by root-cuttings made in fall or early spring, and rarer kinds or less vigorous-growing varieties are grafted in the greenhouse in early spring, on stock of the Japanese or common quince; they grow also from cuttings of half-ripened or nearly mature wood, under glass, and from layers.

A. *Fls. solitary, with reflexed serrate calyx-lobes, with or after the lvs.: stipules small. (Pseudocydonia.)*

*sinensis*, Koehne (*Pyrus sinensis*, Poir. *Cydonia sinensis*, Thoun. *Pseudocydonia sinensis*, Schneid.). Shrub or small tree: lvs. elliptic-ovate or elliptic-oblong, acute at both ends, sharply and finely serrate, villous beneath when young, 2-3 in. long: fls. light pink, about  $1\frac{1}{2}$  in. across: fr. dark yellow, oblong, 4-6 in. long. May. China. B.R. 11:905. R.H. 1889:228. A.G. 12:16. B.M. 7988.—The lvs. assume a scarlet fall coloring. Not hardy North of Philadelphia, except in favored localities. See also *Quince*.

AA. *Fls. in leafless clusters, nearly sessile, before or with the lvs.; calyx-lobes erect, entire: stipules large. (Chænomeles proper.)*

B. *Lvs. lanceolate or narrow-lanceolate, pubescent beneath while young.*

*cathayensis*, Schneid. (*Pyrus cathayensis*, Hemsl. *Cydonia cathayensis*, Hemsl.). Shrub, to 10 ft.: lvs. lanceolate or oblong-lanceolate, acute, finely and sharply serrate,  $2\frac{1}{2}$ - $4\frac{1}{2}$  in. long and  $\frac{1}{2}$ - $1\frac{1}{2}$  in. broad;

petioles about  $\frac{1}{2}$  in. long: fls. in clusters, red,  $1\frac{1}{2}$  in. across; styles pubescent at the base; petals distinctly clawed: fr. oblong-ovoid, 6–7 in. long, with a cavity at each end. Cent. China. H.I. 27:2657, 2658.—Closely related to the following species, but lvs. much narrower; less hardy.

BB. Lvs. elliptic-oblong to obovate, glabrous.

**japonica**, Lindl. (*Pyrus japonica*, Thunb. *Cydonia japonica*, Pers. *Chænomeles lagenaria*, Koidzumi). JAPAN QUINCE. JAPONICA. Fig. 889. Shrub, 3–6 ft., with spreading, spiny branches: lvs. ovate or oblong, acute, sharply serrate, glabrous, glossy above,  $1\frac{1}{2}$ –3 in. long: fls. in 2–6 fld. clusters, scarlet-red in the type,  $1\frac{1}{2}$ –2 in. across: fr. globular or ovoid,  $1\frac{1}{2}$ –2 in. high, yellowish green. March, April. China, Japan. R.B. 1:260. L.B.C. 16:1594. Gn. 33, p. 491; 40:126; 50, p. 106 (frs.); 71, p. 262 (habit). G.C. III. 34:434. B.H. 1:260 (frs.). R.H. 1876:330 (fr.). G.M. 35, suppl. Nov. 12. V. 4:38.—Many garden forms in all shades from white to deep scarlet, and also with double fls. Some of the best are the following: Var. **alba**, Lodd. Fls. white, blushed. L.B.C. 6:541. Var. **álbo-cincta**,



889. *Chænomeles japonica*, the Japan or flowering quince. ( $\times\frac{1}{2}$ )

Van Houtte. Fls. white with pink margin. F.S. 14:1403. Var. **álbo-rôsea**, Spaeth. Fls. white, partly pink. G.W. 7:113. Var. **atrosanguinea plèna**, Hort. Fls. deep scarlet, semi-double. Var. **Báltzii**, Spaeth. Fls. beautiful rosy pink, very floriferous. G.W. 7:113. Var. **cándida**, Hort. Fls. pure white. Var. **cardinalis**, Carr. Fls. large, deep scarlet. R.H. 1872:330, f. 1. Var. **ebúrnea**, Carr. Fls. pure white, rather small. R.H. 1872:330, f. 4. Var. **Gaujárdii**, Lem. Fls. salmon-orange. I.H. 7:260. Var. **grandiflora**, Rehd. (*C. álba grandiflora*, Carr.). Fls. nearly white, large. R. H. 1876:410. Gn. 13:144. Var. **Mállardii**, Carr. Fls. rose, bordered white. R.H. 1872:330, p. 2. I.H. 4:135. G.Z. 1:208. Var. **Moerlòdsei**, Versch. Fls. white, striped pink. I.H. 3:107. F.S. 5:510. Var. **Papeleùii**, Lem. Fls. yellow, bordered pink. I.H. 7:260. Var. **péndula**, Temple & Beard, with slender, pendulous branches. Var. **rôsea plèna**, Hort. Fls. rose, semi-double. Var. **rùbra grandiflora**, Hort. Fls. large, deep crimson. Var. **sanguinea plèna**, Hort. Fls. scarlet, double. Var. **seròtina**, André. Fls. in stalked leafy clusters in autumn. R.H. 1894, pp. 424, 425; 1903, p. 20. Var. **Simoniù**, André. Fls. dark crimson, semi-double: low and upright. G.W. 7:113. Var. **sulphùrea**, Hort. (var. *sulphùrea perfècta*, Van Houtte). Fls. yellowish. Var. **umbilicàta**, Sieb. & De Vries. With rose-red fls., and large frs. umbilicate at the apex. F.S. 5:510.

**Maùlei**, Schneid. (*Pyrus Maùlei*, Mast. *Cydonia Maùlei*, Moore. *C. alpina*, Koehne). Low shrub, 1–3 ft.: branches spiny, with short, rough tomentum when young: lvs. roundish oval to obovate, obtuse or acute, coarsely crenate-serrate, glabrous, 1–2 in. long: fls. bright orange-scarlet,  $1\frac{1}{2}$  in. across: fr. yellow, nearly globular, about  $1\frac{1}{2}$  in. across. March, April. Japan. B.M. 6780. G.C. II. 1:757 and 2:741; III. 34:435. Gn. 13:390; 33, p. 490; 50, p. 106; 55, p. 354. F. 1875:49. R.H. 1875:195. F.M. 1875:161. H.B. 26:241.—A very desirable hardy shrub, with abundant fls. of a peculiar shade of red. Var. **alpina**, Schneid. (*C. japonica* var. *alpina*, Maxim. *Cydonia Sárgentii*, Lemoine). Dwarf spiny shrub, with procumbent sts. and ascending branches: lvs. roundish oval,  $\frac{1}{2}$ –1 in. long: flowering and fruiting profusely. R.H. 1911:204. Var. **superba**, Hort. Fls. deeper red. Var. **tricolor** Hort. Dwarf shrub, with pink and white variegated lvs.—By some botanists this species is considered to be the typical *C. japonica*, and the preceding species is called *C. lagenaria*. ALFRED REHDER.

**CHÆNÓSTOMA** (*gaping mouth*, in allusion to the shape of the corolla). *Scrophulariaceæ*. African herbs or sub-shrubs sometimes planted in greenhouses, or in the open in mild climates.

Leaves simple, mostly opposite: fls. axillary or terminal-racemose, showy; stamens attached to the throat of the corolla, more or less exserted; style filiform and club-shaped, and obtuse at the apex; corolla tubular, swollen in the throat, with a 5-lobed spreading limb: fr. a caps. with numerous seeds.—Recent authorities combine this genus with *Sutera*, which, in the enlarged sense, comprises more than 190 species in Afr. and the Canary Isls. *Chænostoma*, as separately limited, has 25–30 S. African plants with white, yellow or reddish fls. axillary or in terminal racemes, lvs. usually opposite, mostly dentate, 4 didynamous stamens which are exserted rather than included as in typical *Sutera* and the top of the style club-shaped and stigma obtuse rather than 2-lobed.

**hispidum**, Benth. (*Sutera brachiàta*, Roth). Small perennial, sometimes an under-shrub, with opposite, oval or oblong, toothed lvs., and bluish-white or rosy white star-like fls.  $\frac{1}{2}$  in. across, in dense clusters. S. Afr. J. H. III. 33:636.—An old and deserving greenhouse or pot-plant, but rarely seen at present. It blooms almost continuously, the fls. sometimes hiding the foliage. Prop. by seeds or cuttings, either in fall or spring. Begins to bloom when 4–6 in. high. To be recommended for windows, and for summer vases. It has been listed as *Schænostoma hispidum*. In S. Calif., it is a half-hardy dwarf shrub (12 to 20 in. high and withstanding 4–6 degrees of frost), recommended for edgings. N. TAYLOR.†

**CHÆROPHÝLLUM** (Greek-made name, referring to the agreeably scented foliage). *Umbellifereæ*. Scented herbs, annual, biennial or perennial, glabrous or hirsute, often tuberous-rooted, of 30–40 species in the northern hemisphere, one of which is cult. Lvs. pinnately or ternately decompound, the segms. also toothed or cut: fls. small, white, in a compound many-rayed umbel; calyx-teeth 0: carpels with 5 more or less apparent ribs, the beak 0 or much shorter than the body. *C. bulbòsum*, Linn., of Cent. Eu. and the Caucasus, biennial, is the turnip-rooted chervil. (See *Chervil*.) St. hairy, at least below, 3–5 ft. tall, branching, swollen below the joints, the root tuberous (and edible): lvs. much compound, the ultimate divisions very narrow. L. H. B.

**CHÆTOSPÉRMUM** (from Greek, *hair* and *seed*). *Limonia* § *Chætospermum*, Roemer. *Rutaceæ*, tribe *Citreeæ*. A small spiny tree, proposed as a stock for citrus fruits.



*Chætospermum* bears hard-shelled frs.: lvs. persistent, trifoliate: fls. pentamerous with 10 free stamens; ovary 8–10-celled, with numerous ovules in each cell; cells filled with spongy vesicular tissue; seeds hairy, the cotyledons aerial in germination: first foliage lvs. opposite.—Only one species is known.

*glutinosa*, Swingle (*Limnoria glutinosa*, Blanco. *Egle decandra*, Naves. *Egle glutinosa*, Merrill). TABOG. Fig. 890. Petioles margined; lateral lfts. small, sessile, scarcely one-third as long as the terminal one; spines slender, straight, sharp, axillary usually in pairs in the axils of the lvs.: fls. rather large, occurring singly, or in few-fl'd. clusters on long slender pedicels in the axils of the lvs.: fr. oblong, 2–3 x 1½ in. with a thick leathery rind longitudinally ribbed, 8–10-celled; it contains numerous flattened hairy seeds, ⅜ to ⅔ in. immersed in a watery tissue. Native to the Isl. of Luzon, Philippine Archipelago. Ill. Blanco., Fl. Filip. ed. III, pl. 124. Vidal y Soler, Sinop. de fam. Fil. pl. 25. Bull. Soc. Bot. Fr. 58, Mem. 8d. pl. 5.—The tabog is a rapid-growing tree when young, and in a warm greenhouse shows a vigorous root-growth. This species is being tested as a stock for use in commercial citriculture. Experiments have shown that oranges, lemons, grapefruits and kumquats grow well when budded or grafted on young tabog plants.

WALTER T. SWINGLE.

**CHÁLCAS** (from Greek for *copper*, as the wood has a copper-colored grain). *Murræa* of Koenig. *Rutaceæ*. Small spineless trees or shrubs, suggested as a stock for citrus fruits.

Leaves pinnate, alternate: fls. large, 4–5-merous, solitary or in terminal or axillary cymes; ovary 1–5-celled, with 1 to several ovules: seeds white, woolly or glabrous, cotyledons aerial in germination: first foliage lvs. opposite.

*exótica*, Millsp. (*Murræa exótica*, Linn.). ORANGE JESSAMINE. A small tree with pale bark, twigs and petioles usually puberulous: lvs. pinnate; lfts. usually 5–9, ovate, obtuse or obtusely acuminate, often emarginate, dark green above, paler below: fls. fragrant, campanulate, 5-parted; petals white; stamens 10, free; ovary 2-celled, style deciduous: fr. subglobose, ⅔–½ in. long, pointed, red. Ill. Beddome, Outlines Bot., pl. vii., Wight, Ic., pl. Ind. I, pl. 96.—The orange jessamine is commonly grown in greenhouses on account of its abundant and very fragrant fls. These are often to be seen along with the mature red fr., which makes a striking contrast with the panicles of white fls. and delicate foliage. The root-growth of this species is remarkably vigorous under greenhouse conditions. Lemons can be budded on it and make a rapid growth. It is being tested as a stock for the common citrus fruits in situations in which a vigorous root-system is desired.

WALTER T. SWINGLE.

**CHAMÆBÀTIA** (Greek, *dwarf*, and *bramble*, alluding to its bramble-like flowers). *Rosaceæ*. A woody plant, grown for its handsome white flowers and for the finely divided aromatic foliage.

Low shrub, clothed with glandular pubescence: lvs. alternate, stipulate, tripinnatifid, persistent: fls. in terminal corymbs, white; calyx-tube broadly campanulate; petals 5; stamens numerous; pistil solitary, with short style and decurrent stigma: fr. a small achene inclosed by the persistent calyx.—One species in Calif. Ornamental shrub of agreeable aromatic odor, with graceful foliage and showy white fls. in June and July. It can be grown only in warmer temperate regions, and thrives best in sandy well-drained soil and sunny position. Prop. by seeds sown in spring and by greenwood cuttings under glass.

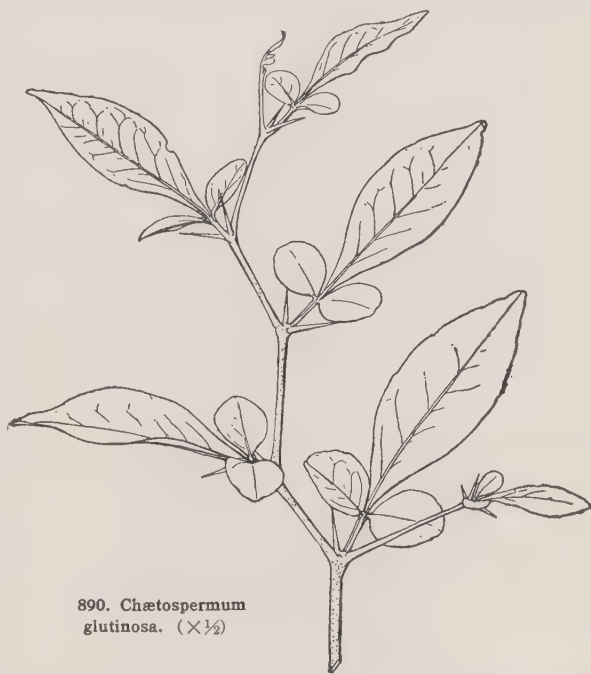
*foliolosa*, Benth. Two to 3 ft.: lvs. nearly sessile, oval or ovate-oblong, closely tripinnately dissected, 1½–2½ in. long: fls. white, ¾ in. wide, in 4–8-fl'd.

corymbs. B.M. 5171. G. 29:29. B.H. 10, p. 295. H.F. 1861:9. Gn. 3, p. 27.

ALFRED REHDER.

**CHAMÆBATIÀRIA** (in allusion to the similarity of this plant to *Chamæbatia*). *Rosaceæ*. Shrub grown for its handsome white flowers and the finely divided foliage; allied to the spireas.

Deciduous, with glandular aromatic pubescence: lvs. alternate, bipinnate, with numerous minute segms.; stipules lanceolate, entire: fls. in terminal panicles; calyx turbinate, with 5 erect lobes; petals 5, suborbicular; stamens about 60: carpels 5, connate along the ventral suture, at maturity dehiscent into 2 valves: seeds few, terete, with a simple testa.—One species in W. N. Amer. Very similar in general appearance to *Chamæbatia*, but easily distinguished by the bipinnate lvs. and the large dense panicles, and very different in its floral structure. An upright aromatic shrub with finely cut foliage and white fls. in large terminal



panicles; one of the first shrubs to burst into leaf. It is hardy as far north as Mass., but, like other plants from the same region, it dislikes an excess of moisture, particularly during the winter, and is likely to be killed by it. It prefers a sunny position and a well-drained soil, and likes limestone, but grows nearly as well without; it is not a plant for dense shrubberies. Propagated by cuttings of half-ripened wood taken with a heel in August with slight bottom heat; usually by seeds sown in spring, and treated like those of spirea.

*Millefólium*, Maxim. (*Spiræa Millefólium*, Torr. *Sorbària Millefólium*, Focke). Shrub, to 3 ft., glandular-pubescent: lvs. bipinnate, short-stalked, ovate-oblong to linear-oblong in outline, 2–3 in. long, primary segms. linear, deeply pinnatifid, with closely set obtuse lobes about a line long: fls. white, ½–⅔ in. across, short-pedicelled, in terminal panicles 3–6 in. long: carpels hairy. Calif. to Wyo. and Ariz. B.M. 7810. G.C. III. 22:237; 40:183. Gn. 75, p. 459. G.F. 2:509. R.H. 1900, p. 515. M.D. 1905:198. M.D.G. 1908:208.

ALFRED REHDER.

**CHAMÆCÉRASUS:** *Lonicera*.

**CHAMÆCYPARIS** (*chamai*, dwarf, and *kuparissos*, cypress; referring to its affinity). *Pinaceæ*. Trees or shrubs grown for their handsome evergreen foliage; also valuable timber trees; *RETINOSPORAS*, in part.

Evergreen, with opposite scale-like lvs. in 4 rows, densely clothing the compressed branchlets: fls. monœcious, small; pistillate inconspicuous, globose; staminate yellow or red, oblong, often conspicuous by their abundance: cones small, globular, with 6-11 bracts, each bearing 2, or rarely 5, winged seeds, ripening the first season. Closely allied to *Cupressus*, which differs in its larger cones maturing the second year, the bracts containing 4 or more seeds, and in its quadrangular branches and minutely denticulate lvs.—Six species in N. Amer. and E. Asia, all very valuable timber trees in their native countries. Highly ornamental evergreen trees of pyramidal habit, of which only *C. thyoides* is fully hardy N., while the Japanese species



891. *Chamæcyparis pisifera*.

are hardy in sheltered positions north to New England, and *C. Lawsoniana* only from Mass. south; the horticultural varieties are often shrubby.

They grow best in somewhat moist but well-drained, sandy loam and in a partly shaded position, sheltered against dry winds. *C. Lawsoniana* and *C. obtusa* like more dry, the others more moist situations, and *C. thyoides* grows well even in swamps. Propagated by seeds sown in spring; increased also by cuttings from mature wood in fall, inserted in a sandy soil and kept in a coolframe or greenhouse during the winter; if in early spring gentle bottom heat can be given, it will hasten the development of roots considerably. All the so-called *retinosporas* and the dwarf forms, and most of the varieties of *C. Lawsoniana*, are readily increased in this way, while the other forms of *C. nootkatensis*, *C. obtusa* and *C. thyoides* do not grow well from cuttings; therefore for most varieties veneer-grafting on seedling stock during the winter in green-

house is preferred, but dwarf forms always should be grown from cuttings, as they often lose their dwarf habit if grafted. The so-called *retinosporas* of the gardens, with linear, spreading leaves, are juvenile forms, which have retained the foliage of the seedling state. There are similar forms in *Thuja*. For their distinguishing characters, see *Retinospora*. For the numerous gardens forms, see Beissner, *Handb. der Nadelholzk.*, 2d ed., pp. 528-574, quoted below as Beissner.

A. Lvs. green on both sides or paler beneath.

**thyoides**, Brit. (*C. sphæroidea*, Spach. *Cuprèssus thyoides*, Linn.). WHITE CEDAR. Tree, to 70 or 80 ft., with erect-spreading branches: branchlets irregularly arranged, spreading, not pendulous, very thin and slender, flattened: lvs. closely imbricate, glaucous or light green, with a conspicuous gland on the back, fragrant: cones small,  $\frac{1}{4}$  in. diam., bluish purple, with glaucous bloom. From Maine to Fla., west to Miss. S.S. 10:529. M.D.G. 1896:301 (habit). Beissner 529 (habit). Var. **ericoides**, Sudworth (*C. ericoides*, Carr. *Retinospora ericoides*, Hort.). Compact shrub, of erect, dense habit: lvs. linear-lanceolate, spreading, with 2 glaucous lines beneath, coloring in winter usually reddish brown. Beissner 532; see also *Retinospora*. Var. **andelyensis**, Silva-Tarouca (*C. sphæroidea andelyensis*, Carr. *C. leptoclada*, Hochst. *Retinospora leptoclada*, Hort., not Zucc.). Intermediate form between the former and the type; bluish green, and of erect growth, with loosely appressed, lanceolate lvs.; often some branchlets with lvs. of the type and some with lvs. of the var. *ericoides*. R.H. 1869, p. 32, and 1880, p. 36. M.D.G. 1890:329. R.B. 2:155. Beissner 532; see also *Retinospora*. Var. **glaûca**, Sudworth (*C. sphæroidea glaûca*, Endl. Var. *kewensis*, Hort.). Of compact habit, very glaucous, with silvery hue. Var. **variegata**, Sudworth (*Cuprèssus thyoides variegata*, Loud.). Branchlets partially colored golden yellow.

**nootkatensis**, Sudworth (*Cuprèssus nootkatensis*, Lambert. *C. nutkaensis*, Spach. *Thuyopsis borealis*, Hort.). YELLOW CEDAR. Tree, to 120 ft., with ascending branches, pendulous at the extremities: branchlets distichously arranged, slightly flattened or nearly quadrangular, pendulous: lvs. densely imbricate, usually dark green, acute, mostly without glands: cones subglobose, nearly  $\frac{1}{2}$  in. diam., dark red-brown, with glaucous bloom. From Sitka to Ore. S.S. 10:530. R.H. 1869, p. 48. G. 19:345. F.E. 25:543. Gt. 53, p. 542. G.W. 8, p. 484; 10, pp. 41, 227. Beissner 555. Gn. 5:395. G.C. III. 40:167. Var. **glaûca**, Regel (*Thuyopsis borealis* var. *glaûca*, Jaeger). With very glaucous foliage. Var. **péndula**, Beissn. Distinctly pendulous. Gt. 53, p. 542. G.W. 1, p. 300. G.C. III. 40:166. Beissner 539. Var. **lutea**, Beissn. The young growth colored light yellow. J.H.S. 1902:427, fig. 113. Gn. 50, p. 68. Gn.W. 11:313.—There are other forms with variegated lvs. *C. nootkatensis* is about as hardy as the Japanese species.

AA. Lvs. with glaucous or whitish marks beneath: branches with horizontally spreading ramifications.

**Lawsoniana**, Parlatores (*Cuprèssus Lawsoniana*, Murr. *C. Boursieri*, Decne.). LAWSON'S CYPRESS. Tree, to 200 ft., with horizontally spreading and usually pendulous branches: branchlets frond-like arranged, flattened: lvs. closely appressed, obtuse or somewhat acute, usually bright green, with a gland on the back: staminate catkins bright red (yellow in all other species): cone globose, about  $\frac{1}{2}$  in. across, red-brown and often glaucous. From Ore. to Calif. S.S. 10:531. Gng. 2:327. S.M. 2, p. 49. F.E. 23:309; 33:559. G.W. 10, p. 42. Beissner 541. G. 1:121; 7:129.—This is one of the most beautiful conifers and very variable, about 80 garden forms being cult. in European nurseries and collections. The following are some of the best: Var. **álbo-spica**, Beissn. Tips of branchlets creamy white, of



slender habit. Var. *Álumii*, Beissn. Of columnar habit, foliage very glaucous, with a bluish metallic hue. The best blue columnar form. Var. *argentea*, Beissn. (*Cupressus Lawsoniana argentea*, Gord.). Of slender habit, with very glaucous, almost silvery foliage. Var. *erecta viridis*, Beissn. Dense, columnar habit and

bright green foliage. One of the most beautiful varieties, but somewhat tender. G.W. 14, p. 601. M.D.G. 1909:45. G.M. 51: 511. F. 1871, p. 92. Var. *erecta glauca*, Beissn. Similar in habit, but with glaucous foliage. Var. *filiformis*, Beissn. Branches elongated, somewhat pendulous, with few lateral branchlets, of low, globular habit. Var. *glauca*, Beissn. Foliage of metallic glaucous tint. One of the hardier forms. G.M. 53:832. Var. *gracilis*, Beissn. (var. *gracilis pendula*, Hort.). Elegant light green form, with graceful, pendulous branchlets. Var. *inter-*

*texta*, Beissn. Glaucous form, of vigorous growth, with remote, pendulous branches and distant, thickish branchlets. Beissner 550. Var. *lutea*, Beissn. Of compact habit, young growth clear yellow. G.C. III. 20:721. J.H.S. 1902, p. 426, fig. 110. Var. *nana*, Beissn. (*C. Boursieri nana*, Carr.). Dwarf, globose habit (Beissner 553), with some variegated and glaucous forms. Var. *pendula*, Beissn. With pendulous branches. Mn. 1:43. F.E. 27:187. Gt. 1890, p. 449. Var. *pyramidalis*, P. Smith. Of columnar habit. Var. *pyramidalis alba*, Beissn. Of columnar habit with the young growth colored white. R.B. 4:281. Var. *Weisseana*, Hansen. Low dense form of umbrella-like habit with almost horizontally spreading branches and nodding tips. M.D.G. 1890:245. S.M. 1, p. 214. Var. *Youngii*, Beissn. Upright form of vigorous growth with thickish dark green branchlets. G.C. III. 1:176, 177.

*obtusa*, Sieb. & Zucc. (*Cupressus obtusa*, Koch. *Retinóspora obtusa*, Sieb. & Zucc.). HINOKI CYPRESS. Tree, to 120 ft., with horizontal branches: branchlets frond-like arranged, flattened, pendulous: lvs. bright green and shining above, with whitish lines beneath, thickish, obtuse, and very closely appressed, with a gland on the back: cones globose, nearly  $\frac{1}{2}$  in. diam., brown. Japan. S.Z. 121. G.C. II. 5:236. R.H. 1869, p. 97. Gn. W. 20, suppl. April 25. Var. *álbo-spicata*, Beissn. Tips of branchlets whitish. Var. *aurea*, Beissn. (*Retinóspora obtusa aurea*, Gord.) Golden yellow. Gt. 25:19. Var. *breviramea*, Beissn. (*C. breviramea*, Maxim. *Thuja obtusa* var. *breviramea*, Mast.). Tree, of narrow pyramidal habit, with short branches: branchlets crowded, glossy green on both sides. Var. *compacta*, Beissn. Of dwarf and dense subglobose habit. Gn. M. 7:76. Var. *ericoides*, Boehmer (*Retinóspora Sánderi*, Sander. *Juniperus Sánderi*, Hort.). Of low subglobose habit with bluish gray linear spreading blunt lvs., marked with a green line above. G.C. III. 33:266;

36, suppl. April 25. M.D.G. 1900:589; 1903:291, R.H. 1903, p. 399. Beissner, 556. Var. *filicoides*. Beissn. Of slow growth with short and densely frond-like arranged branchlets. G.C. II. 5:235. Var. *filiformis*, Beissn. (*C. pendula*, Maxim. *Thuja obtusa pendula*, Mast., not *C. obtusa pendula*, Beissn.). Branches elongated, thick and thread-like, pendulous, with few distant branchlets. Var. *gracilis aurea*, Beissn. Graceful form, foliage bright yellow when young, changing later to greenish yellow. Var. *lycopodioides*, Carr. Low form, of somewhat irregular habit, with spreading, rigid branches and thick, nearly quadrangular, dark green branchlets. Var. *nana*, Carr. Low form, of slow growth, with short, deep green branchlets. R.H. 1882:102. Var. *pygmaea*, Carr. (*C. obtusa breviramea*, Hort., not Beissn.). Very dwarf form, with horizontal, almost creeping branches, densely frond-like branched. Exceedingly interesting form for rockeries. R.H. 1889, p. 376. Var. *formosana*, Hayata. Differs in its smaller and finer foliage, and much smaller cones. Formosa. J.C.T. 25, 19, p. 209.

*pisifera*, Sieb. & Zucc. (*Cupressus pisifera*, Koch. *Retinóspora pisifera*, Sieb. & Zucc.). SAWARA CYPRESS. Fig. 891. Tree, to 100 ft., with horizontal branches: branchlets flattened, distichously arranged and somewhat pendulous: lvs. ovate-lanceolate, pointed, shining above, with whitish lines beneath: cones globose,  $\frac{1}{4}$ – $\frac{1}{2}$  in. diam., brown. S.Z. 122. G.C. II. 5:237. C.L.A. 11:311.—This is, next to *C. thyoides* the hardiest species, and some varieties are much cult., while the type is less planted. Var. *aurea*, Carr. Yellow foliage. G.W. 1, p. 303. Var. *filifera*, Beissn. (*Retinóspora filifera*, Standish. *C. obtusa filifera*, Hort.). Branches elongated and slender, threadlike, gracefully pendulous, with distant branchlets and lvs. Very decorative form. G.C. II. 5:237. G.W. 1, p. 301;



892. *Chamæcyparis pisifera* var. *plumosa*.



893. *Chamæcyparis pisifera* var. *squarrosa*.

5, p. 17. Beissner 571, 572. Var. *plumosa*, Beissn. (*Retinóspora plumosa*, Veitch). Fig. 892. Of dense, conical habit: branches almost erect, with slender branchlets of feathery appearance: lvs. subulate, pointed and slightly spreading, bright green. Intermediate between the type and var. *squarrosa*. G.C. II. 5:236. Gn. M. 2:27. Beissner 569. Var. *plumosa*

*argentea*, Beissn. Tips of branchlets whitish. Var. *plumbosa aurea*, Beissn. (*Retinospora plumbosa aurea*, Standish). Young growth of golden yellow color. A very showy form. Var. *squarrosa*, Beissn. & Hochst. (*Retinospora squarrosa*, Sieb. & Zucc. *R. leptoclada*, Zucc.). Fig. 893. Densely branched, bushy tree or shrub, with spreading, feathery branchlets: lvs. linear, spreading, glaucous above, silvery below. A very distinct and beautiful variety. S.Z. 123. R.H. 1869, p. 95, and 1880, p. 37. Beissner 567. M.D.G. 1909:44. R.B. 2:189.

*C. formosensis*, Matsum. (*Cupressus formosensis*, Henry). Allied to *C. pisifera*. Tree, to nearly 200 ft. and 20 ft. diam.: branchlets dull green on both surfaces or slightly bloomy below: lvs. acute, ovate: cones ovoid,  $\frac{1}{2}$  in. across, with 10 or 11 scales. Formosa. G.C. III. 51:132, 133. — Recently intro. into England, but probably tender.

ALFRED REHDER.

**CHAMÆDAPHNE** (*chamai*, dwarf, and *daphne*, the laurel in ancient Greek, alluding to its dwarf habit and evergreen leaves). Syn., *Cassandra*. *Ericaceæ*. LEATHER-LEAF. Small plant, rarely cultivated for its early white flowers and evergreen foliage.

Low shrub, with evergreen alternate small lvs.: fls. nodding in terminal leafy racemes; calyx small, 5-lobed; corolla urceolate-oblong, 5-lobed, with 5 included stamens; anthers 2-pointed: fr. a depressed-globose, 5-lobed caps. with numerous seeds. — One species in the colder regions of the northern hemisphere. Low, hardy, ornamental shrub, valuable for the earliness of its pretty white fls. It thrives best in a peaty and sandy, moist soil. Prop. by seeds sown in sandy peat, only slightly or not covered, and kept moist and shady; also by layers and suckers and by cuttings from mature wood in late summer under glass.

*caliculata*, Moench (*Cassandra caliculata*, Don. *Lyonia caliculata*, Reichb. *Andrōmeda caliculata*, Linn.). Fig. 894. Bush with spreading or horizontal branches, 1–3 ft.: lvs. short-petioled, oblong, obtuse, slightly serrulate and revolute at the margins, dull green above and rusty-lepidote beneath: fls. short-peduncled, nodding; corolla white, oblong, about  $\frac{1}{4}$  in. long. B.M. 1286. L.B.C. 6:530; 15:1464; 16:1582. Mn. N. 1:125. Em. 423. Var. *angustifolia*, Rehd. (*Andrōmeda caliculata* var. *angustifolia*, Ait. *A. crisp*, Poir.). Lvs. linear-lanceolate, undulate and crisped at the margin.

Var. *nana*, Rehd. (*Andrōmeda caliculata* var. *nana*, Lodd. *A. vaccinioides*, Hort.). One foot or less high, with horizontal branches. L.B.C. 9:862. — Handsome little shrub, well suited for borders of evergreen shrubberies and for rockeries.

ALFRED REHDER.



894. *Chamædaphne caliculata*.  
( $\times \frac{1}{2}$ )

**CHAMÆDOREA** (Greek, *dwarf* and *gift*). *Palmaceæ*. Spineless, erect, procumbent or rarely climbing usually pinnatisect or pinnate palms.

Trunks solitary or cespitose, slender or reed-like: lvs. simple, bifid at the apex or variously equally-pinnatisect; lobes broad or narrow, straight or oblique, acuminate, plicate-nerved, usually callous at the base, the basal margins folded back or recurved; petiole usually cylindrical; sheath tubular, oblique at the throat: spadices among or below the lvs., simple or paniculately branched; spathes 3 or many, often appearing much below the lvs., alternate, sheathing, elongated, split at the apex, membranous or coriaceous, usually per-

sistent; pistillate fls. very small, solitary, in small pits in the spadix: fr. small, of 1–3 globose or oblong-obtuse carpels, coriaceous or fleshy. — Species about 60. Mex. to Panama. G.C. II. 23:410, and Dammer's articles in G.C. III. 38:42–44 (1905), and 36:202, 245 (1904).

Peat or leaf-mold, loam and sand in equal parts, with a little charcoal added, form the best soil. The species common in cultivation are quick-growing. They are well suited for planting out in greenhouse borders. The sexes are on different plants; therefore several should be planted in a group if the handsomely colored fruit is desired. All of the kinds require warm temperature in winter. Increased from seeds. Of the many species, only a few appear in the American trade. (G. W. Oliver.)



895. *Chamædorea glaucifolia*.

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#### A. Lvs. simple.

1. *Ernesti-Augusti*, Wendl. St. 3–4 ft., reedy, erect, radicate at base: blade obovate, cuneate at the base, deeply bifid, coarsely serrate along the margins; petiole shorter than blade; sheath amplexicaul: sterile spadix 8–9 in., the simple branches 6–8 in., attenuate, slender; fertile spadix simple; fls. red. Mex. B.M. 4837. F.S. 13:1357.

#### AA. Lvs. pinnate.

##### B. Plant becoming of climbing habit.

2. *desmoncoides*, Wendl. Lvs. 2–3 ft. long, with drooping, narrow lfts. a foot long, and glaucous petiole: plant tending to climb after it becomes a few feet high. Mex.

##### BB. Plant not climbing.

##### C. St. or trunk evident.

##### D. Lfts. 40–50, glaucous on both sides.

3. *glaucifolia*, Wendl. Fig. 895. St. 20 ft.: lvs. long, pinnate; lfts. 40–50, narrowed, long and slender, dark green, glaucous: fls. on a tall spadix which often exceeds the lvs. and comes out from between them. Guatemala. G.F. 8:507 (adapted in Fig. 895). — Horticulturally one of the best of all *chamædoreas*.

##### DD. Lfts. less than 40, bright green, at least above.

##### E. Spadix appearing among or with the lvs., not conspicuously cauline.

4. *Sartorii*, Liebm. St. 8–14 ft., ringed, clothed above with lf.-sheaths: lvs. 3–3½ ft. long; petiole terete, sulcate, dilated at the base; sheath, petiole and rachis white on the back; lfts. 12 in. long, 1½–2 in. wide, alternate, falcate, acuminate, narrowed at the base, sometimes almost confluent: spadix among or just below the lvs. Mex.

5. *élegans*, Mart. St. strict, 6 ft. high, scarcely more than 1–1½ in. thick, closely ringed, often sending out



roots from above the base: lvs. 6-8 in a cluster, broadly lanceolate; lfts. about 14, the upper pair sometimes confluent, acuminate, straight; fls. reddish orange: fr. globose. Mex. B.M. 4845.

EE. *Spadix appearing much below the lvs., conspicuously cauline.*

6. *Tepejilôte*, Liebm. St. 10 ft. high, closely ringed, about 1½ in. thick: lvs. 4 ft.; lfts. 20-30, 7-nerved, close alternate, falcate, acute, narrowly lanceolate, 13-15 in. long, 1½ in. wide; rachis convex on the back, canaliculate above: fls. yellow. Mex. B.M. 6030.

7. *elàtor*, Mart. (*C. Karwinskiàna*, Wendl.). St. 20-30 ft., bamboo-like: lvs. 6 ft. long, the sheath 18 in. long; lfts. 15 or 16, the lower very narrow, opposite or nearly so, the upper lanceolate, acuminate at each end; petioles 1½-3 ft. long; spadix simply branched, appearing at least 6 ft. below the lvs.; fls. reddish orange: fr. globose, ovoid. Mex.—Intro. by Franchesi in 1898.

8. *Arenbergiàna*, Wendl. (*C. latifolia*, Hort.). St. slender, 5-6 ft., green: lvs. usually only 5 or 6, erect-spreading; lfts. 10-15 pairs, alternate and drooping, very long-pointed, plicate and many-ribbed: fls. yellowish white. Guatemala. B.M. 6838.

cc. *St. or trunk none.*

9. *Pringlei*, Wats. Acaulescent or nearly so: lvs. usually rather stiff, erect, pinnate, 3 ft.; lfts. 12-15 on each side, linear-lanceolate, acuminate, 6-8 in. long, ¼-½ in. wide; rachis triangular: spadix simple, 8 in. long. San Louis Potosi, Mex.

*C. atrovirens*, Mart. St. bamboo-like, stiff and simple, about 9 ft. high: lvs. bright green, spreading, about 2½ ft. long. Mex. Not common in the trade but grown in fanciers' collections.—*C. bambusoides*, Hort.. Sts. tufted, thin, reed-like, with feathery light green lvs. Honduras.—*C. formosa*, Hort. A showy pinnate-lv. palm of unknown botanical status. G.C. II. 5:724.—*C. geomorphaformis*, Wendl. St. 4 ft.: lvs. simple, deeply cut, about 9 in. long; spadix from among the lvs. long-pendulous. Guatemala. Gn. 24, p. 244; 30, p. 593.—There are said to be a number of unidentified species scattered about Calif.

JARED G. SMITH.  
N. TAYLOR.†

**CHAMÆLIRIUM** (*dwarf or ground lily*, a Greek combination). *Liliacæ*. Sometimes spelled *Chamælrion*. Rhizomatous whitish flowered hardy plant, sometimes planted in the herbary.

Erect, tall unbranched herb 2-4 ft. high (or perhaps 2 species), inhabiting low grounds from Mass. to Fla. and W.: rootstock tuberous: dioecious, the sterile plant less leafy than the other: lvs. radical and cauline, the lowermost spatulate, the upper lanceolate, narrowed at the base: fls. small (¼ in. across), in a slender terminal raceme; segms. of perianth 6, white, narrow, 1-nerved, withering and persistent; sterile fls. with 6 stamens, and fertile fls. with rudiments of stamens; ovary 3-celled and 3-styled: fr. a 3-valved caps.

*luteum* Gray (*C. carolinianum*, Willd. *Chamælrion carolinia*, Hort.). BLAZING-STAR. DEVIL'S-BIT. Variable as to height (6 in. to 3 ft. or more), with most of the lvs. at the base: raceme spike-like, 4-12 in. long; fls. yellowish white, in effect, fruiting pedicels ½ in. or less long.—A good perennial, blooming May-July, thriving in moist shady places.—*C. obovate*, Small, by some considered not to be distinct, has larger fls. and fruiting pedicels ½ in. or more long. L. H. B.

**CHAMÆMELUM** (*small apple*, suggested by the odor of the fls.). *Compósitæ*. Under this name one plant is offered. The genus is by many included in *Anthemis*, however, the sub-group being distinguished by very short or absent pappus, sometimes making a 1-sided border, ray-fls. fertile, and other minor characters. *C. caucasicum*, Boiss. (*Pyræthrum caucasicum*, Bieb.), is listed, with white daisy-like fls. about the size of a marguerite, of trailing habit, very free-flowering,

recommended for the rockery: perennial, 1-1½ ft., smooth, not strong-scented: st. ascending from a rhizome or procumbent or sub-erect: lvs. oblong, pinnatisect, the segms., cut into linear-subulate parts: fl.-heads large, terminal; involucre-scales oblong-obtuse, margined. High mts. in the Caucasus; variable.

**CHAMÆPEÛCE**: *Carduus*.

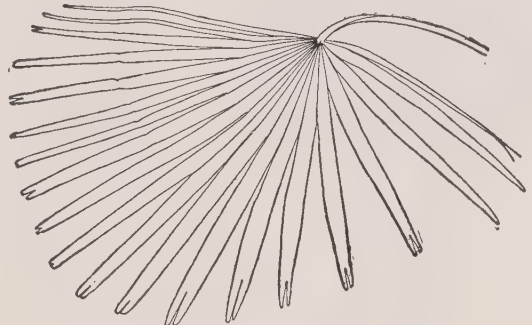
L. H. B.

**CHAMÆRÁNTHENUM** (*dwarf and flower*, from the Greek). *Acanthacæ*. Three or 4 Brazilian small herbs, allied to *Eranthemum*, but readily distinguished by the 4 (instead of 2) stamens. Lvs. large and membranaceous, entire, variously marked: fls. showy, white or yellow, in bracteate clusters.—Grown chiefly for the beautiful foliage; greenhouse subjects. *C. igneum*, Regel (*Eranthemum igneum*, Lind.), is in the American trade. It is a low spreading warmhouse plant (cult. of *Eranthemum* and *Justicia*), with dark green lvs., with the veins and sometimes the margins richly banded with orange or yellow: fls. small. F.S. 17:1722.

N. TAYLOR.†

**CHAMÆROPS** (Greek for *dwarf bush*). *Palmacæ*, tribe *Sabalæ*. Low fan-leaved palms.

Caudices caespitose, branched from the base and clothed with the bases of the lf.-sheaths: lvs. terminal, rigid, semi-orbicular or cuneate-fanbellate, deeply



896. *Chamærops humilis*.

lacinate, the lobes narrow, bifid, plicate; no rachis; ligule very short; petiole slender, bi-convex, the margins smooth or rough; sheath split, reticulate, fibrous: spadices short, erect compressed; branches short, densely fld.: spathes 2-4, broad, thickly coriaceous, the lower ones split, the upper entire; bracts small, subulate; bractlets none: primary spadix branches bracted: fls. small, yellow: fr. globose or ovoid, 3-sided toward the base, brown or yellow.—Species 1 or perhaps 2. Medit. region. From *Rhapidophyllum*, an American relative, it may be distinguished by its bracted spadix. The common *C. humilis* is widely cult., and very variable. Many of specific-made names represent forms of this species. Of such cases are evidently the garden names *C. arborescens*, *C. argentea*, *C. canariensis*, *C. elata*, *C. elegans*, *C. farinosa*, *C. gracilis*, *C. littoralis*, *C. nivea*. G.C. II. 23:410.

The best soil for these palms is fibrous loam two parts, leaf-mold and sand one part, with good drainage. Propagated by suckers and by seeds. These are among the hardest of all palms, and are well suited to greenhouses where a high temperature is not kept up. (G. W. Oliver.)

*humilis*, Linn. Fig. 896. This is the only palm native to Eu. St. 1-1½ ft. high: lvs. ragged, fibrous; margins of the petioles armed with stout, straight or hooked spines; blade suborbicular, truncate or cuneate at the base, rigid, palmately multifid; segms. acuminate, bifid. Medit. B.M. 2152. R.H. 1892:84 (showing habit and a colored plate of the fr.).—Reaches 20 ft. in a rather arborescent variety. Var. *dactylocarpa*,

Becc., is interesting for its elongated frs. shaped like a date. Offered by Montarioso Nursery in 1912.

*C. Btroo*, Sieb.—*Livistona rotundifolia*.—*C. Bjrrho*, Hort.—*Livistona rotundifolia*.—*C. excelsa*, Thunb.—*Trachycarpus excelsus*.—*C. farinosa*, Hort.—*C. humilis*, Ling.—*C. Fortunei*, Hook.—*Trachycarpus*.—*C. h'milis x h'strix*, Hort. Said to be a "choice garden hybrid of Florida origin."—*C. h'strix*, Fraser.—*Rhapido-phyllum hystrix*.—*C. stauracantha*, Hort.—*Acanthorhiza aculeata*.

JARED G. SMITH.  
N. TAYLOR.†

CHAMOMILE: *Anthemis*.

**CHAPTÀLIA** (J. A. C. Chaptal, 1756–1831, agricultural chemist). *Compósitæ*. Low perennial herbs, with white or purplish fls. on naked scapes, blooming in spring and summer: heads radiate, the ray-fls. pistillate, and the disk-fls. perfect, but some or all of them sterile; involucre campanulate or turbinate, of appressed and imbricated bracts; pappus of soft capillary bristles: achenes oblong or fusiform, narrowed above, 5-nerved.—Twenty-five American species. The only species in the American trade is *C. tomentosa*, Vent. (*Thyránthema semiflosculare*, Kuntze), of N. C. and south. Of this the scape is 1 ft. or less high, and the heads are

purple-rayed: lvs. oblong or oblanceolate, more or less remotely denticulate, rather thick, white-tomentose beneath. Intro. as a border plant. B. M. 2257. N. TAYLOR.†



897. Chard, or sea-kale beet.

**CHARD** (*ch* pronounced as in *charge*). SWISS CHARD. SEA-KALE BEET. A form of the plant (*Beta vulgaris*) which has produced the common beet; known as *Beta Cicla* (p. 496). See *Beet* and *Beta*.

The beet plant has given rise to two general types of varieties: those varieties with thickened roots (the beet of America, the beet-root of European literature); and those with large and pulpy or thickened leaves (but whose roots are small and woody). The latter type is known under the general name

of leaf-beets. These leaf-beets may be arranged into two sub-groups: (1) Common or normal leaf-beets, or spinach beets, in which the leaf-blade is large and pulpy, and is used as spinach; chard, in which the petiole and midrib are very broad and thick, is a form of this, although the name is sometimes used as synonymous with the general edible leaf-beet group. (Fig. 897); (2) ornamental beets, of which the foliage is variously colored.

Chard is of the easiest culture. Seed is sown in spring, as for common beets. The broad petioles, or chards, may be gathered from midsummer until frost. These broad white stalks or ribs are used as a pot-herb; and, if desired, the leaf-blades may be cooked with them. The dish is usually more attractive, however, if only the chards are cooked. If cutting of the leaves is carefully performed, a succession may be had till cold weather. Chard is an attractive vegetable when well grown, but is little used in this country.

L. H. B.

**CHÁRIEIS** (Greek, *elegant*, from the pleasing flowers). *Compósitæ*. Attractive hardy flower-garden annual.

A small, branchy plant, 6–12 in. high, with blue or red aster-like fls., on long sts.: plant pubescent or hispid: lvs. oblong-spatulate or oblong-lanceolate, entire or remotely denticulate: heads many-fld., radiate, the ray-fls. pistillate, the disk-fls. perfect: achene obovate and compressed, those of the disk with plumose pappus: involucre scales in 2 rows.—One species, in the W. Cape region. Known as *Kaulfussia* in gardens. The genus *Kaulfussia* was founded by Nees in 1820; in 1817, however, the plant was described by Cassini as *Charieis heterophylla*.



898. *Charieis heterophylla*. (×1)

**heterophýlla**, Cass. (*C. Neesii*, Hort. *Kaulfussia amelloides*, Nees). Figs. 898, 899. Rays blue, disk yellow or blue. An excellent subject of easy cult. in any garden soil. Var. *atroviolacea*, Hort., has dark violet fls. Var. *kermesina*, Hort., has violet-red fls. Sow seeds where the plants are to grow; or they may be started indoors and the plants transplanted to the open. L. H. B.

**CHARLOCK**: *Brassica*; also *Raphanus*.

**CHARLWOODIA**: *Cordylone*.

**CHASTE TREE**: *Vitex*.

**CHAVICA**, kept distinct in part by recent authors, is accounted for under *Piper*.

**CHEAT**, or **CHESS**: *Bromus*.

**CHECKERBERRY**: *Gaultheria*.

**CHEESES**: Vernacular for *Malva rotundifolia*.

**CHEILÁNTHE** (Greek, *lip-flower*, alluding to the indusium). *Polypodiaceæ*. Semi-hardy or hothouse ferns of small size.

Plants often hairy or woolly, with the sori terminal on the veins and covered with a roundish indusium.—Some 60 or 70 species are known, nearly a third of which are natives of the W. and S. W. United States, one species as far east as Conn. They are of easy cult., enjoying a position near the glass, and disliking strong, close heat and syringing or watering overhead. Most of the



899. *Charieis heterophylla*.

species grow naturally in dry rocky situations. They are among the few ferns to be found in dry regions. Commercially valuable only from the fern collector's standpoint.

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A. Lvs. pentagonal-deltoid, the indusium confined to a single veinlet.

1. *californica*, Mett. (*Hypolepis californica*, Hook.). Lvs. densely cespitose from a short creeping rootstock, 2-4 in. each way, on stalks 4-8 in. long, quadripinnatifid; ultimate segms. lanceolate, incised or serrate. Calif.

2. *meifolia*, D. C. Eaton (*Hypolepis meifolia*, Baker). Lvs. cespitose, with slender brown stalks 5-7 in. long, the lamina 2-3 in. each way, 3-4-pinnatifid, with finely cut segms.  $\frac{1}{16}$  in. wide. Mex.

AA. Lvs. lanceolate or ovate-lanceolate.

B. Segms. flat: indusia extending over the apices of several veinlets, but not continuous.

c. Surface of lvs. smooth.

3. *microphylla*, Swartz. Lvs. 4-10 in. long, on stalks nearly as long, from a short, creeping rootstock, bi-tripinnate: sts. glossy, rusty-pubescent on the upper side. Fla. and New Mex. southward.

cc. Surface of lvs. viscid-glandular.

4. *viscida*, Davenport. Lvs. 3-5 in. long, on stalks of the same length, tripinnatifid; segms. toothed, everywhere glandular. Calif.

ccc. Surface of lvs. hairy, not woolly.

5. *hirta*, Swartz. Lvs. densely cespitose, with short, scaly stalks which are brownish, like the rachides; pinnae numerous, rather distant bipinnatifid, the segms. with much incurved margins. The lvs. are usually 6-15 in. long. Cape of Good Hope. Var. *Ellisiana*, is more commonly cult.

6. *lanosa*, Wats. (*C. vestita*, Swartz). Fig. 900. Lvs. cespitose, with stalks 2-4 in. long, slightly hairy, as are the segms., tripinnatifid, 4-10 in. long, 1-2½ in. wide, the pinnae lanceolate-deltoid: indusia formed of the ends of roundish or oblong lobes. Conn. to Kans. and Ala.—Hardy.

7. *Codperæ*, D. C. Eaton. Lvs. 3-8 in. long, bipinnate, the stalks covered with nearly white hairs, each tipped with a gland; pinnules roundish ovate, crenate and incised. Calif. to Mex.

BB. Segms. bead-like, minute: indusia usually continuous.

c. Lvs. hairy or woolly beneath, but not scaly.

D. Upper surface of segms. smooth.

8. *gracillima*, D. C. Eaton. LACE FERN. Lvs. cespitose, 1-4 in. long, borne on the nearly equal dark brown stalks, bipinnate; pinnae with about 9 pinnules, finally smooth above. Idaho to Calif.—Hardy

9. *Clélandii*, D. C. Eaton. Lvs. 4-8 in. long, tripinnate, dark brown beneath, with closely imbricate, ciliate scales, which grow on both the segms. and the rachides; segms. nearly round, the terminal larger. Calif.

DD. Upper surface of segms. pubescent.

10. *tomentosa*, Link. Lvs. 8-15 in. long, on stalks 4-6 in. long, everywhere covered with brownish white hairs, tripinnate; terminal segms. twice as large as the lateral. Va. to Ariz.

cc. Lvs. covered beneath with scales, but not woolly.

11. *Féndleri*, Hook. Lvs. 3-6 in. long, borne on the chaffy stalks, rising from tangled, creeping rootstocks, tripinnate; rachis with broadly-ovate white-edged scales, which overlap the subglobose segms. Texas, and Colo. to Calif.

ccc. Lvs. covered beneath with both scales and wool.

12. *myriophylla*, Desv. (*C. elegans*, Desv.). Lvs. densely cespitose from short, erect, scaly rootstocks, 3-9 in. long, borne on the chestnut-colored scaly stalks, triquadripinnatifid; ultimate segms. minute, innumerable. Texas, Ariz. and Trop. Amer.

A native species worthy of cult. is *C. leucopoda*, Link, from Texas, with broadly deltoid-ovate lvs.—*C. undulata*, Hope & Wright. Dark green fronds, softly pubescent. China. G.C. III. 34: 397 (desc.)

L. M. UNDERWOOD.

R. C. BENEDICT.†

**CHEIRÁNTHUS** (derivation in dispute, but probably from Greek for *hand and flower*). *Cruciferae*. Flower-garden perennials, with large purple, brown, orange or yellow fragrant bloom.

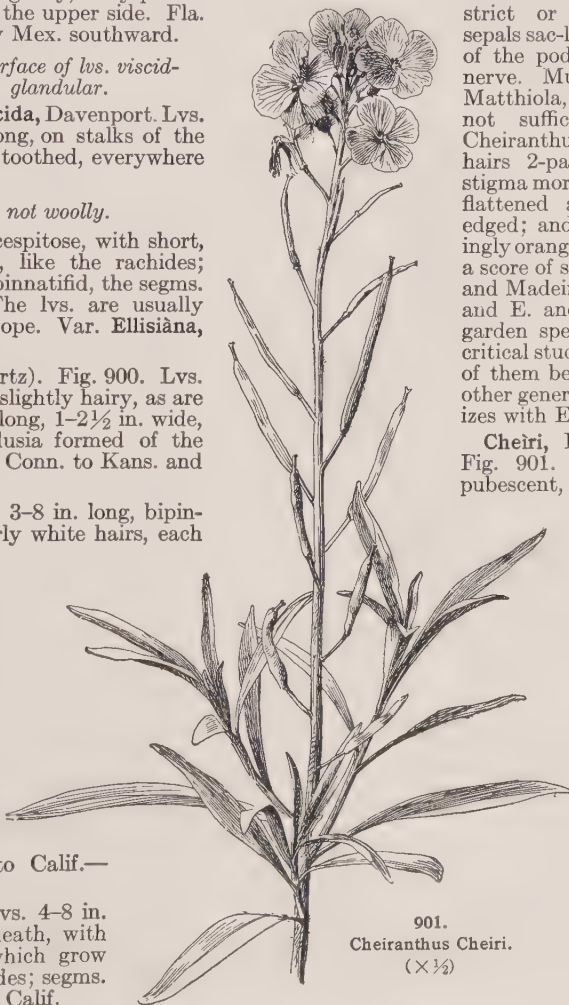
Leaves alternate, entire, on a strict or upright st.: lateral sepals sac-like at the base: valves of the pod with a strong mid-nerve. Much confounded with *Matthiola*, and the genera are not sufficiently distinct. In *Cheiranthus*, the lvs. are acute, hairs 2-parted and appressed, stigma more spreading, pod more flattened and seeds not thinned; and the fls. are prevailingly orange or yellow—Probably a score of species, in the Canary and Madeira Isls., Medit. region and E. and in N. Amer. The garden species are confused; a critical study may find that some of them belong to *Erysimum* or other genera. The genus hybridizes with *Erysimum*.

**Cheiri**, Linn. WALLFLOWER.

Fig. 901. Perennial, slightly pubescent, 1-2½ ft.: lvs. lanceolate and entire, acute: fls. large, mostly in shades of yellow, in long, terminal racemes, sweet-scented. S. Eu.—An old garden favorite, blooming in spring. Although a woody perennial, it is best to renew the plants from seed, for they begin to fail after having bloomed one or two years. Seedlings should bloom the second year; in England, Christmas bloom is secured from seeds sown in Feb. There are dwarf and double-fl. varieties,



900. *Cheilanthes lanosa*.  
(× ½)



901.  
*Cheiranthus Cheiri*.  
(× ½)

and innumerable forms in various shades of yellow, brownish, and even purple. Not prized so much in Amer. as in Eu. A common plant on walls in England.

**alpinus**, Linn. St. strict and simple, 1 ft.: lvs. lanceolate, somewhat dentate, stellate-pubescent: pods spreading on short pedicels: fls. lemon-yellow, spring. Norway, Lapland.

**mutabilis**, L'Her. More or less woody, 2-3 ft.: lvs. linear-lanceolate and pointed, obscurely serrate: fls. white, cream-colored or yellowish, becoming darker and striped. Madeira. B.M. 195.—It is doubtful whether the plant known in cult. as *C. mutabilis* is this species.

**Marshallii**, Hort. Perhaps a hybrid, 1-1½ ft.: lvs. spatulate and crowded below, more scattered and narrower above: fls. orange.

**Alliönii**, Hort. Said to be a hybrid: 12 in. or less: fls. brilliant orange, profusely produced in spring and summer and sometimes so freely that the plant exhausts itself and becomes practically biennial.

**kewensis**, Hort., is valuable as a winter-blooming greenhouse plant, prized for its fragrance and its dark-colored fls. In 1897 at Kew a cross was made between *C. mutabilis* of the Canary Isls. and a yellow wallflower, the cross being known as *C. hybridus*; and this in turn was crossed with a red wallflower, producing the plant known as *C. kewensis*. It has the bushy character of *C. mutabilis*; racemes upright; fls. about 1 in. across, brown in bud, or expanding brownish orange inside and reddish brown outside, all turning pale purple with age. Prop. by cuttings. G.C. III. 35:123. Gn. 65, p. 89.

*C. annuus*, Hort.=Matthiola, but early-blooming forms of *C. Cheiri* seem to pass under this name.—*C. Méziésii*, Benth & Hook.=Parrya.

L. H. B.



902. *Chelone glabra*. (×¼)

**CHELIDONIUM** (Greek for the swallow: the fls. appear when the swallow comes). *Papaveraceæ*. **Celandine Poppy**. One or two loose-growing herbs, sometimes seen in old gardens. Plant with fl.-buds nodding, and small yellow fls. in small umbel-like clusters; sepals 2; petals 4; stamens 16-24; style very short, the

stigma 2-lobed: pod slender, 2-valved, opening first at the bottom. *C. majus*, Linn., is a European plant, now run wild in waste places, and often seen in old gardens. It is biennial or perennial, with brittle hairy sts. and pinately-parted lvs., the lobes rounded and toothed (or, in var. *laciniatum* again dissected). The plant has bright orange juice which has been used for removing warts. Herb an old-time remedy, used for its cathartic and diuretic properties, for promoting perspiration, and as an expectorant. Lvs. light glaucous underneath.

L. H. B.

**CHELONE** (Greek for *tortoise* or *turtle*: the corolla fancied to resemble a reptile's head). *Scrophulariaceæ*. **TURTLE-HEAD**. Several North American perennial herbs, with showy flowers in short spikes or in panicles, some of which are now sold by dealers in native plants. Allied to *Pentstemon*.

Upright smooth branching plants: corolla more or less 2-lipped or gaping, white or red, the upper lip arched and conspicuous and notched; anthers 4, woolly, and a rudiment of a fifth stamen: seeds winged: lvs. opposite, serrate.—Four species, in N. Amer.

Half-shaded places are preferable for these easily cultivated plants. Very dry grounds should be avoided, from the fact that they are best in swampy places. In the ordinary border they should have a very liberal mulch of old manure in their growing season: 4-5 in. thick is none too much: the surface roots will feed in this compost, and the plants are not so liable to suffer from drought when thus protected. (J. B. Keller.)

A. Fls. in terminal and axillary close spikes.

B. Lvs. elliptic to broad-ovate, long-petioled.

**Lyonii**, Pursh. Plant, 2-3 ft. high: lvs. broad to nearly cordate at base, thin, evenly serrate: fl.-bracts minutely ciliate: fls. rose-purple. Mts., Va. and S.

BB. Lvs. lanceolate or oblong, short-petioled.

**obliqua**, Linn. Two ft. or less: lvs. 2-8 in. long, broad-lanceolate or oblong, very veiny, sharp- or deep-serrate or cut: fl.-bracts ciliate: fls. deep rose. Damp grounds, Ill., Va., S.

**glabra**, Linn. (*C. obliqua* var. *alba*, Hort.). Fig. 902. One to 2 or more ft. high, more strict: lvs. mostly narrower, acuminate, appressed-serrate, nearly sessile, not very veiny: fl.-bracts not ciliate: fls. white or rose-tinged. Wet grounds: common.

AA. Fls. in a loose thyrse or panicle.

**memorosa**, Douglas (*Pentstemon memorosus*, Trautv.). Two ft. or less high, of unpleasant odor: lvs. ovate and acute, sharp-dentate, sessile or nearly so: fl.-bracts none; corolla 1 in. long, violet-purple. Calif. and N. B.R. 1211.

*C. barbata* of gardens is *Pentstemon barbatus*.

L. H. B.

**CHENILLE PLANT**. A proposed name for *Acalypha hispida*, better known as *A. Sanderi*.

**CHENOPODIUM** (*goosefoot*, alluding to the shape of the leaves). *Chenopodiaceæ*. **GOOSEFOOT**. Widely dispersed weedy herbs, with very inconspicuous greenish flowers, some of which occur in gardens as oddities or for ornament, and others are pot-herbs of very minor importance. Spinach, beet, and orach are allied plants.

Plants of various habit, mostly erect: fls. perfect, bractless, sessile in small masses and these clusters arranged in spikes or panicles; calyx 4-5-parted, petals wanting; stamens usually 5; styles 2 or 3: seed lenticular: lvs. alternate. The calyx sometimes enlarges and becomes succulent and colored, inclosing the fr., and the glomerules may then look like berries.—Perhaps 60 species in all parts of the globe, annuals and perennials, sometimes woody. Many of them are field and garden weeds. They are mostly mealy or



glandular herbs, often with strong odor. Some of them are used as pot-herbs or "greens."

A. *Fls. in dense heads or glomerules which become berry-like and bright red in fr.*

**capitatum**, Aschers. (*Blitum capitatum*, Linn.). **STRAW-BERRY BLITE**. Annual, erect and becoming diffuse or spreading, branching, glabrous or nearly so: lvs. soft, hastate-ovate, toothed, stalked: fr.-clusters large and becoming fleshy, in an interrupted spike, the upper part leafless. Eu.—A frequent but not pernicious weed, and sometimes offered as a pot-herb.

AA. *Fls. not in dense separate heads, and the clusters not becoming prominently fleshy or colored.*

B. *Plant shrubby, spinescent.*

**nitrariaceum**, F. Muell. Rigid, much-branched, often prostrate shrub or undershrub, mealy-white: lvs. linear-oblong or linear-spatulate, obtuse, entire, 1 in. or less long, often clustered: fls. clustered in dense or more or less interrupted spikes and panicles, greenish. Austral.—Offered in Eu.

BB. *Plant herbaceous.*

c. *Species perennial: a pot-herb.*

**Bònus-Henricus**, Linn. (*Blitum Bònus-Henricus*, Reichb.). **GOOD KING HENRY**. **MERCURY** (by corruption, Markery). Stout and erect from a thick rootstock, to 2½ ft., glabrous: lvs. broad, triangular-hastate or ovate, with very long wide-spreading basal points, entire or undulate: fls. in panicle spikes. Eu.—Escaped now and then; and sometimes cult. for "greens."

cc. *Species annual.*

**purpurascens**, Jacq. (*C. Atriplicis*, Linn. f.). Vigorous, erect, 3 ft., the young parts and lvs. covered attractively with a rose-violet or violet-purple crystalline pulverulence: lvs. spatulate or rhomboid or oval, obtuse, long-petioled, the lower ones sinuate-dentate and the upper lanceolate and entire: fls. small and numerous, in dense pyramidal leafy reddish clusters. China.—An old garden plant, seldom seen in this country; grown for its colored character in summer. There are different forms, one with variegated foliage.

**amaranticolor**, Coste & Reyn. Very large, 8 ft., much like the preceding and perhaps derived from it: st. glabrous, striped white and red: lvs. triangular to rhomboid, 4 in. or less long, red-pulverulent: fls. in a long red panicle. S. France.—Differs from *C. purpurascens* in its greater size and its black shining somewhat sharp-edged seeds. The brilliant colors disappear as the plant matures.

**Quindà**, Willd. **QUINOA**. Erect, stout, st. furrowed, 4-5 ft.: lvs. triangular-ovate, sinuate, long-petioled, angulate-pinnatifid, glaucous: fls. small and green, in dense axillary and terminal farinose clusters arranged in panicles: seeds very large. W. slope of the Andes. B.M. 3641.—A very important plant in W. S. Amer., the seeds being used as food. There are white- and red-fruited forms. Sometimes cult. in this country as a curiosity. Allied to *C. album*, the common pigweed.

**Bòtrys**, Linn. **FEATHER GERANIUM**. **JERUSALEM OAK**. Erect, glandular-pubescent and viscid, aromatic, 1-3 ft. high, with pinnatifid long-petioled lvs. and long, feather-like, enduring spikes, for which it is used in vases and baskets; pretty. Eu., and widely naturalized although not usually becoming abundant.

Many weedy chenopods invade cult. grounds. *C. album*, Linn., the common pigweed or lamb's quarters, is a favorite for "greens." This species runs into many forms. *C. rìride*, of Eu. and Asia, has seeds that are said to be edible. *C. Vulgaris*, Linn., sparingly intro. from Eu., has the smell of stale fish. *C. ambrosioides*, Linn., Mexican tea, and var. *anthelminticum*, Gray, wormseed, are frequent; they contain strong essential oils. The weedy species are variable, and puzzling to the systematist.

L. H. B.

**CHERIMOYA, CHERIMOYER** (Quichua language of Peru, *chirimuya*, signifying cold seeds). (*Annona Cherimòla*, Mill.). Figs. 903-905. An important table fruit of warm countries. See p. 293, Vol. I, for botanical description.

The cherimoya is considered by many to be the finest of the subtropical fruits, and that not only by the natives of the countries in which it grows, but also by Europeans. It is somewhat like the pomme-cannelle, or sweet-sop, but differs from it in having a peculiar acidulous flavor most agreeable and grateful to the taste. For centuries the cherimoya has been cultivated



903. Cherimoya—smooth form. (×¼)

and several distinct varieties have resulted. One of these has smooth fruit devoid of protuberances, which has been confused with the inferior fruits of both *Annona glabra* and *A. reticulata*. The last two species, however, are easily distinguished by their leaves and flowers; *Annona glabra*, commonly known as the alligator apple or mangrove annona, having glossy laurel-like leaves and globose flowers with 6 ovate petals, and *A. reticulata* having long narrow glabrate leaves devoid of the velvety lining which characterizes those of the cherimoya. Both of these species, moreover, are essentially tropical, while the cherimoya is subtropical, growing in tropical countries only at considerable elevations, where the climate is cool and the soil well drained.

The origin of the cherimoya has been much discussed. De Candolle, however, is in all probability correct in attributing it to the mountains of Ecuador and Peru. The common name which it bears, even in Mexico, is of Quichua origin, as explained above; and terracotta vases modeled from cherimoya fruits have been dug up repeatedly from prehistoric graves in Peru. It was introduced at a very early date into Central America and Mexico and into Jamaica in 1786 by Hinton East. It is now of spontaneous growth in limited areas both in Central America and the mountains of Jamaica. In Madeira, the cherimoya has taken the place of the grape-vine on many of the estates on the warm southern slopes of the island. Here the cultivation is systematic. The two-year-old seedlings are budded or grafted. The trees are frequently trained on walls or on trellises, so that the fruit may hang in the shade while ripening, and manure is regularly supplied (see *Annona*). The result of careful selection is that there are varieties of fine flavor, comparatively few seeds, and great size, weighing from twelve to sixteen pounds. According to W. Fawcett, ordinary fruits weighing from three to eight pounds, have been sold in the London market at \$1.50; large ones at \$2.50 and even \$3. The cherimoya has been

successfully introduced into southern California where it finds the most favorable conditions in the foot-hills near the coast.

The cherimoya grows in the form of a small tree, usually about 15 or 20 feet high. The flowers are remarkably uniform, but vary somewhat in size. They are often solitary or in two's or three's, while those of the bullock's heart (*Annona reticulata*) and the sugar-apple (*A. squamosa*) are usually clustered. The leaves are always velvety on the lower surface. The following varieties, based upon the form of the fruit, are recognized:

(1) Finger-printed cherimoya (forma *impressa*), known in Costa Rica as "anona de dedos pintados." This form was the first to be figured (Feuillée, Pl. med. Journ. Obs. 3: append. 24, pl. 17, 1725). The fruit, conoid or subglobose in shape, has a smooth surface covered with concave U-shaped areoles resembling finger-prints in soft wax or putty. It is one of the best varieties, with sweet juicy pulp of good flavor, and with relatively few seeds.

(2) Smooth cherimoya (forma *laevis*), called in South America "chirimoya lisa" and in the market of Mexico City, "anon." Fig. 903. It is this form which is so often mistaken for *Annona glabra* and *A. reticulata* on account of the general appearance of the fruit and the common name "anon," which is also applied to the fruit of the last-named species. This is one of the finest of all the cherimoyas.

(3) Tuberculate cherimoya (forma *tuberculata*). Fig. 904. One of the commonest forms, in which the fruit is heart-shaped and bears small wart-like tubercles near the rounded apex of each areole. To this group belongs the "golden russet" cherimoya grown in the orchard of C. P. Taft at Orange, California. It is the form most frequently found in the Peruvian markets and is represented in prehistoric pottery from the graves of that country.

(4) Mammillate cherimoya (forma *mamillata*), called in South America, "chirimoya de tetillas."

This is the form successfully established on the ranch of Charles F. O'Brien, in the mountains of Santa Monica, southern California. It is also the common form of the Nilgiri Hills of India, and is one of the best forms grown on the Island of Madeira.

(5) Umbonate cherimoya (forma *umbonata*), called "chirimoya de puas" and "anona picuda" in Latin America. In this form the skin of the fruit is comparatively thick, the pulp more acid than in other forms, and the seeds more numerous. It has the flavor of pineapple and is one of the best for producing cooling drinks and sher-

bets. The fruit is oblong-conical in shape, with the base more or less umbilicate and the surface studded with protuberances, each of which corresponds to a component carpel. To this form should be referred the "Horton" cherimoya, grown in the vicinity of Pasadena, California.

Very recently there has been received from Florida an interesting fruit borne by a hybrid, the result of pollinating the stigmas of a cherimoya with the pollen of *Annona squamosa*. The leaves of this plant are very broad, resembling those of *A. Cherimola* in shape, but glabrous like those of *A. squamosa*. The fruit resembles that of *A. Cherimola* in form, but with the protuberances very distinct and covered with a glaucous bloom like that of *A. squamosa*. The seeds are distinct from both species, larger than those of *A. squamosa*, and much darker colored than those of *A. Cherimola*; and the pulp is very juicy, with the fine slightly acidulous flavor of the cherimoya.

For the propagation and culture of cherimoyas, see *Annona*.

W. E. SAFFORD.

#### CHERLÈRIA: *Arenaria*.

**CHERRY.** Several kinds or types of small stone-fruits ripening in late spring and in summer, widespread and popular in domestic and commercial use. Figs. 906-910. Plate XXI.

Sweet and sour cherries have been domesticated from two Old World species: cultivated sweet cherries having come from *Prunus avium* and the sour cherries from *Prunus Cerasus*. Varieties of these two species, and hybrids between them, now encircle the globe in the north temperate zone and are being rapidly disseminated throughout the temperate parts of the southern hemisphere. For centuries, probably from the beginnings of agriculture, cherries have been valuable fruit-producing trees in Europe and Asia,—inhabitants of nearly every orchard and garden as well as common roadside trees in temperate climates of both continents.

Coming from the Old World to the New, the cherry has played an important part in the orcharding in temperate regions of the western hemisphere. In North America, varieties of one or the other of the two cultivated species are grown from Newfoundland to Vancouver Island on the north, southward to the Gulf of California, Texas and Florida, probably yielding crops in a greater diversity of soils and climates on this continent than any other tree fruit.

Sour cherries are suited to many environments, thriving in various soils and withstanding rather better than most orchard fruits heat, cold and atmospheric dryness, and though they respond to good care, yet they thrive under neglect better than most other tree fruits. Sour cherries also have fewer insect and fungous troubles than other tree fruits, being practically immune to the dreaded San José scale. Sweet cherries, however, are much less easily grown. Sweet varieties are all somewhat fastidious as to soils, are lacking in hardiness to both heat and cold, are prey to more insects than sour cherries and subject to nearly all of the fungous ills to which stone-fruits are heir, suffering in America in particular from brown-rot and leaf-spot.



905. Flower of Cherimoya with two outer petals removed to show minute inner petals and essential parts; also an outer petal. ( $\times 1\frac{1}{2}$ )



904. Cherimoya, tuberculate form. ( $\times \frac{1}{2}$ )



Sweet cherries can be grown with commercial success in but few and comparatively limited regions, although the localities adapted to sweet varieties are rather widely distributed.

The cherry is probably the most popular of temperate climate fruits for the home yard, being planted more commonly than any other tree-fruit, in the many regions in which it is grown, in the dooryard, garden and along the roadside. The characters, other than those already named, that commend it for home plantations, are, early bearing after planting, early ripening in the season, regularity in bearing, great fruitfulness and ease of culture. It is more than a home fruit, however, and is largely grown for the markets, for canning and for preserving.

In America, the consumption of cherries is being greatly increased by the fashion of adding them preserved to many ices and drinks. The demand for canned cherries has also increased enormously in this country during the last few years. In Europe, wine is made from cherries, "kirschwasser," a spirit, is distilled from the fermented fruit pulp, and in the Austrian province of Dalmatia a cordial called maraschino is made by a secret process of fermentation and distillation. This liquor is imported to America in considerable quantities to flavor preserved cherries which become the well-known "maraschino cherries" of confection and delicatessen shops.

#### Other species.

Several species of cherries other than the two named have more or less horticultural value. *Prunus Padus* and *Prunus Mahaleb* of the Old World furnish fruits sometimes used for culinary purposes but much more cultivated, in their various forms, as ornamentals; the latter furnishes a stock upon which orchard varieties are now most commonly budded. *Prunus Besseyi*, *Prunus pumila* and *Prunus pennsylvanica* are species from North America, the first two having varieties cultivated for their fruits and all three being used as ornamentals and for stocks. *Prunus Pseudo-Cerasus* and *Prunus tomentosa* from Asia are much grown in China and Japan as ornamentals, for their fruits and as stocks, and should find favor in Europe and America for these purposes. In recent years many new species of cherries have been discovered in Asia. E. Koehne, one of the best authorities on the genus *Prunus*, places 120 species, nearly all from Asia, in the sub-genus *Cerasus* to which belong the orchard cherries (Mitt. Deut. Dendrol. Gesell., 1912:168-183). A few of these have already been introduced in America by the United States Department of Agriculture, and from them one is sure to find valuable horticultural species to be

used for their fruits, as ornamentals, as stocks, and for hybridization with species already domesticated.

#### Propagation.

Both orchard and ornamental cherries are commonly propagated in Europe and America by budding on Mazzard or Mahaleb stocks and in Japan, where cherries are much grown, on *Prunus Pseudo-Cerasus*. When exceptional hardiness is required, seedlings of the Russian sour cherries may be used or those of *Prunus Besseyi* or *Prunus pennsylvanica*. Undoubtedly the Mazzard is the best stock for regions in which cherries can be grown commercially. Upon the Mazzard, varieties of either sweet or sour cherries make larger, thriftier, longer-lived and more productive trees.

The Mahaleb, on the other hand, is the best stock from the nurseryman's point of view. It is more easily budded, hardier, freer from insects and fungi as it stands in the nursery before budding, and the buds more quickly develop into salable trees. But the advantages of the Mazzard are so much greater for the fruit-grower that he should accept only trees on this stock unless hardiness be a prime requisite. Cherries are set in the orchard at two years from the bud.

#### The cultivation and handling.

Sweet cherries are most profitably grown on high, comparatively light, sandy, gravelly or even stony loams, while sour cherries do best on somewhat heavier soils. The former are set 22 to 24 feet apart; the latter 16 to 20 feet. Both respond to care in cultivation which, in brief is: early spring plowing, frequent cultivation until the first of August with a cover-crop sown just before the last cultivation. Cover-crops are various—a favorite one in New York and Michigan is a half bushel of oats or barley, and twelve pounds of clover or twenty pounds of winter vetch. In Delaware and New Jersey the cowpea is much liked as a cover-crop.

Cherry trees are usually headed 2 or 3 feet from the ground with a tendency to head them lower—half the



907. Low-headed and spreading growth of sour cherry.



908. Old sweet cherry tree, on the Chesapeake peninsula.

above distances; in the lower-headed orchards there seems to be no inconvenience in tilling with modern implements. Nearly all commercial growers form the head with five to seven main branches about a central trunk, but some prefer to remove the central stem, especially in sweet varieties, leaving a vase-formed head. After the head is formed, the subsequent pruning is exceedingly simple, consisting of cutting out an occasional injured or crossed branch and now and then heading-in a long whip-like growth.

In soils well adapted to cherry-growing, commer-

cial fertilizers are little needed. Good cultivation, the yearly cover-crop and an occasional dressing of stable-manure furnish an abundance of food. If, with this treatment, the trees fail to make sufficient growth, and if the drainage be good, the grower should experiment with fertilizers containing potash, phosphoric acid or nitrogen to see which, if any, his trees may need.

Cherries are picked with stems on, the sweet a few days before fully ripe, the sour when practically



909. Napoleon cherry.—Sweet.  
( $\times \frac{1}{2}$ )

mature. Some growers guard against breaking the fruit-spurs for the next year by using picking scissors. Cherries are variously packed in boxes and baskets but the container is usually a small one and much art may be displayed in placing in layers, facing, and in making the package in all ways attractive. Fruit for canning must be carefully picked but is sent to the cannery in trays holding one or two pecks.

The chief commercial plantations in eastern America are found in New York, New Jersey, Delaware, northern Ohio and western Michigan. Sweet-cherry growing is precarious because of natural obstacles, and sour cherries are so easily grown that through very abundance their sale is often difficult. Yet with both success has been attained by many, the profits ranging as high as \$300 to the acre.

#### Special difficulties.

The cherry is attacked by a dozen or more fungi. Of these, three are serious pests. The brown-rot, *Sclerotinia fructigena*, attacks the flowers, leaves, twigs and most disastrously the fruits at ripening time. Leaf-blight, *Cylindrosporium Padi*, produces diseased spots on the leaves, which for the most part drop out, giving a shot-hole effect and eventually causing the foliage to drop prematurely. A common and striking disease of the cherry is black-knot, *Plowrightia morbosa*, characterized by wart-like excrescences on shoots and branches which at maturity are black; affected parts sooner or later die.

The text-books give no less than forty insect enemies of cherries, of which the plum-curculio, *Conotrachelus nenuphor*, the peach-borer, *Sanninoidea exitiosa*, and the San José scale, *Aspidiotus perniciosus*, on sweet

cherries, must be combated. All of the pests named, both fungi and insects, are more destructive to plums and peaches, and the reader is referred to these fruits for treatment which is much the same as for the cherry.

Sweet cherries suffer severely in the South and the Mississippi Valley, and somewhat in the North, from sun-scald, either directly from the sun's rays or from alternate freezing and thawing in winter or spring. The injury is manifested by the bursting of the bark and the exudation of gum on the south and west sides of the tree. Some immunity from such injuries may be obtained by protecting the trunks with boards or other screens. "Gummosis," or a flow of gum from the wood, often follows injuries of various kinds and the work of insects and fungi in both sweet and sour cherries.

#### Types and varieties.

There are now about 600 varieties of cherries grown in America and Europe, and the names of as many more that have passed from cultivation remain. These are variously grouped, but the following simple classification takes in the common orchard sorts:

##### A. *Prunus avium*

(1) *The Hearts*.—Large, heart-shaped, soft-fleshed, sweet cherries, light-colored as represented by Governor Wood and dark as in Black Tartarian.

(2) *The Bigarreaus*.—Large, sweet, heart-shaped and colored as in the previous group but with firm, crisp and crackling flesh. Well represented by Napoleon (Fig. 909) and Yellow Spanish as light-colored members of the group, and by Schmidt and Bing as dark sorts.

(3) *The Dukes*.—Somewhat smaller cherries than the Hearts and Bigarreaus, softer in flesh, light-colored and usually sour or nearly so. This group is placed under *Prunus avium*, but there can be no doubt but that the widely varying Dukes are hybrids between *Prunus avium* and *Prunus Cerasus*. May Duke and Reine Hortense serve as illustrations of the group.

##### AA. *Prunus Cerasus*.

(1) *The Amarells*.—Rather small, light-colored, sour cherries with colorless or nearly colorless juice, produced on upright trees, represented by Early Richmond and Montmorency (Fig. 910).

(2) *The Morellos*.—Also comparatively small and very sour but dark in color and with dark-colored juice and trees with a drooping habit, represented by English Morello and Louis Philippe.

In spite of the great number of varieties, the cherry, of all stone-fruits, seems most fixed in its characters. Thus, the difference between tree and fruit in the cherries of the several groups is comparatively slight and many of the varieties come nearly true to seed. So, too, cherries, although probably domesticated as long ago as any other of the tree-fruits, are now most of all like their wild progenitors. Notwithstanding this stability, there are probably rich rewards to be secured in breeding cherries by those who will put in practice the discoveries of recent years in plant-breeding, and will hybridize especially the various groups of the two species now cultivated and introduce wholly new blood from wild species. So little effort has been directed toward improving cherries, and the material seems so promising, that it would seem that with proper endeavor the coming generation may have a new and greatly improved cultivated cherry flora.

U. P. HEDRICK.

#### The cherry in California.

In commercial importance, the cherry is least of the fruits of the temperate zone grown in California on a commercial scale—not considering the quince and







XXVI. Sweet cherry in flower and fruit.



nectarine, of which the product is almost insignificant. This is not because the finest cherries cannot be grown, but because the avenues for the disposition of the product are not so wide as for other leading fruits. Recently there are indications that these avenues will be widened, for, in the year 1912, 244 carloads were profitably shipped in a fresh state to eastern markets, and in 1911 a product equivalent to 243,010 cases (each containing two dozen 2½-pound cans) of canned cherries were disposed of to advantage. In 1910, there was large shipment of barreled cherries in sulfur water to eastern bottlers who put up maraschino cherries in competition with importations, but this business seems to have transgressed the pure food laws and declined. Until it is demonstrated that such distant demands will increase, present plantations will not be largely extended. Cherries are costly in picking and packing, and the chance of low price in a local market, over-supplied whenever the trees do their full duty, the grower does not enjoy. Cherry-drying has never seemed warranted on a large scale, because of the large amount of labor required to the pound of product; and the grower has had no recourse when the canner and local consumer would pay only the cost of picking and boxing. A good shipping demand seems, therefore, the measure of the extension of California's cherry interest, and the early ripening of the fruit, which permits its sale during the blooming season of eastern cherry trees, is the leading surety of such demand. On several occasions early varieties have been shipped from the Vacaville district overland, on March 31, but the usual opening date is about two weeks later, and thence onward later varieties, and from later regions, may be shipped until July, if found profitable.

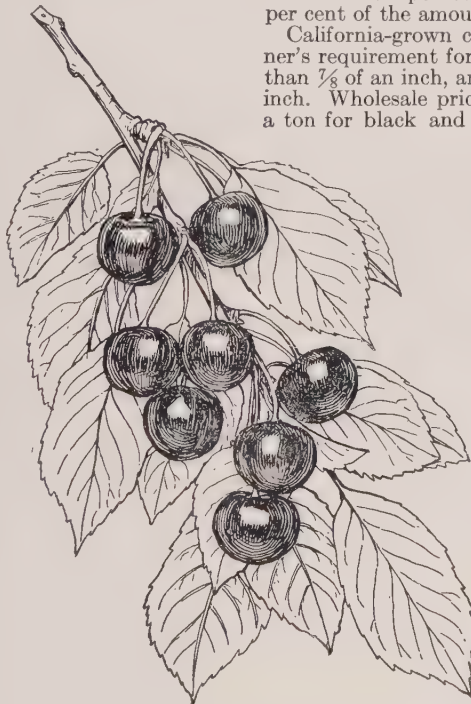
But, although there is plenty of good land upon which to multiply the present total of three-quarters of a million trees, the cherry regions of California are restricted. It is one of the most exacting of all trees, and is profitable only when its requirements are respected. About one-half of the present acreage lies in valleys opening upon the bay of San Francisco, where deep and moist, but well-drained alluvial soil fosters strong and sound root-growth, and modified atmospheric aridity favors leaf and fruiting. On similar deep and moist soils, however, the sweet cherry enters the hot interior valleys to certain limits, chiefly along the river bottoms. It abhors dry plains. In dry air it usually refuses to fruit, although, if the soil be moist, it may make stalwart tree-growth. In foot-hill valleys it sometimes does admirably, both in growth and fruiting, and in mountain valleys, above an elevation of 2,000 feet, on good soil, and in the greater rainfall, and even with the snow flurries, which are experienced every year at proper elevations, the tree becomes very thrifty and profitable to the limits of local markets. The tree seems to have no geographical limitations in California; wherever suitable soil and weather conditions occur, it accepts the situation—the Dukes and Morellos succeeding under conditions too trying for the Hearts and Bigarreus, but the latter, only, are of commercial account.

Cherry trees are grown by budding upon Mazzard and Mahaleb seedlings—both being largely imported. It is customary to plant out in orchards at the end of the first year's growth from the bud, though two-year-old cherry trees can be more successfully handled than other two-year-olds. The trees are headed at 1 or 2 feet from the ground, cut back to promote low branching for two years, and then allowed to make long branches, and not usually shortened-in, so long as thrifty and healthy. The tree, in a good environment, is, however, a very hardy tree, and will endure pruning to almost any degree. There are many trees which have made a very broad but not usually high growth, bearing 1,000 pounds of fruit to the tree, and a few others which have even doubled that figure, while others have been dwarfed and trained *en espalier*. The commercial orchards are, however, uniformly of low trees, approximately of vase form in exterior outline, and with branches curving outward without shortening.

The cherry is very readily grafted over by the usual top-grafting methods, and large orchards have been thus transformed into varieties more acceptable for canning or shipping. Comparatively few varieties are grown. Early Purple Guigne, Chapman and Knights Early Black are grown in early-ripening localities. Black Tartarian, Lewelling and Bing are the mainstay for black cherries. The Napoleon Bigarreau (locally known as Royal Ann) is the ideal for a white cherry, and almost excludes all others, although the Rockport Bigarreau has some standing. Of all the varieties grown, the Black Tartarian and Napoleon (Fig. 909) constitute 70 per cent of the crop, and probably 90 per cent of the amount marketed.

California-grown cherries attain large size; the canner's requirement for fancy fruit is a diameter not less than ⅞ of an inch, and for No. 1 not less than ¾ of an inch. Wholesale prices usually range from \$40 to \$60 a ton for black and \$80 to \$120 for white, but occasionally canners have paid as high as \$160 a ton for white cherries. The higher rates can be expected only in years of short crops.

EDWARD J. WICKSON



910. Montmorency cherry.—Sour. (×½)

**CHERVIL.** A term applied to two umbelliferous plants that produce edible parts, neither of which is well known in America. The name is sometimes applied, also, to the sweet cicely.

Salad chervil or leaf chervil is *Anthriscus Cerefolium*, Hoffm., a native of Caucasus, southern Russia and western Asia. It is annual, reaching 1½ to 2 feet high. The neat and aromatic leaves are used like parsley, which they much resemble. The leaves are decompose, with oval cut leaflets; and there are varieties with much cut and curled foliage. The cultivation of salad chervil presents no difficulties. Leaves are ready to use in six to ten weeks from seed-sowing, and any good garden soil is congenial. It thrives best in the cooler and moister part of the year. In hot weather, seeds would better be sown in a shaded place.

Tuberous or turnip-rooted chervil is *Cherophyllum bulbosum*, Linn., of southern Europe. (See *Cherophyllum*.) It is biennial or plur-annual, like the radish and carrot. The roots are like small carrots in shape (4 to 5 inches long), but are gray or blackish, and the

flesh is yellowish white and of different flavor. The roots are eaten as carrots are, either boiled or in stews. The one difficulty in the growing of tuberous chervil is the fact that the seeds germinate very tardily, or even not at all, if kept dry over winter. It is customary, therefore, to sow them in the fall, although they do not germinate until spring. If they are to be reserved for spring-growing, they should be stratified (see *Seedage*) or kept in sand. In four or five months after germination, the roots are fit to use, although they improve in quality by being left in the ground. The roots keep well in winter.

L. H. B.

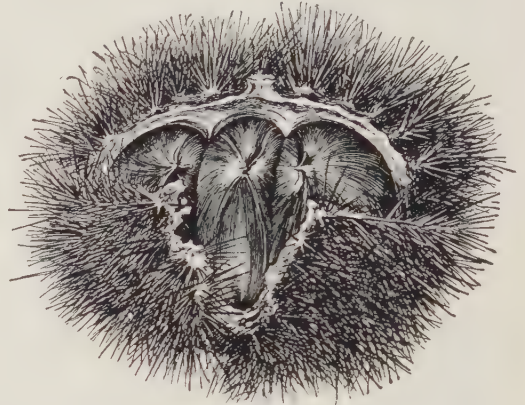
**CHESS, or CHEAT:** *Bromus*.

**CHESTNUT.** Three species of tree or true chestnuts are cultivated in this country for their nuts,—the European *Castanea sativa*, the American *Castanea dentata*, the Japanese *Castanea crenata*. See *Castanea*. The horticultural characters that distinguish these three types are as follows:

*European chestnuts*.—Tree large, with a spreading but compact head, stocky, smooth-barked twigs and large glossy buds of a yellowish brown color; leaves oblong-lanceolate, abruptly pointed, with coarse sometimes incurved serrations, thick and leathery, generally pubescent beneath when young, but green on both sides when mature. Burs very large, with long branching spines, and a thick velvety lining. Nut larger than American chestnut, sometimes very large, shell dark mahogany-brown, pubescent at tip, thick, tough and leathery; kernel inclosed in a thin tough and astringent skin: quality variable from insipid, astringent to moderately sweet. The leaves remain on the trees until late in autumn, but are more susceptible to the attacks of fungi than the American and Japanese species. At least one variegated and one cut-leaved variety are grown as ornamentals. This species is variously known as European, French, Spanish and Italian chestnut (*Castanea sativa*), and sweet chestnut of English writers. It is an inhabitant of mountain forests in the temperate regions of western Asia, Europe and north Africa, and is esteemed for its nuts in Spain, France and Italy, where they have constituted an important article of food since an early day. Introduced to the United States by Irénée Dupont, at Wilmington, Delaware, in 1803, although recorded by Jefferson, under the designation "French chestnut," as grafted by him on native chestnut near Charlottesville (Monticello), Virginia, in 1773.

*American chestnut* (*Castanea dentata*).—Fig. 911. A tall straight columnar tree, in forests reaching a height of 100 feet and a diameter of 3 to 4 feet; when grown in the open, forming a low round-topped head of slightly pendulous branches. Leaves thinner than in *C. sativa*, oblong-lanceolate, acute, long-pointed at the apex, coarsely serrate except toward the wedge-shaped

base, green and glabrous on both surfaces, changing to bright clear yellow later in autumn. The staminate flowers open in June or July after leaves have attained full size, and exhale a sweet, heavy odor, disagreeable to many persons, and sometimes causing symptoms of hay-fever. The



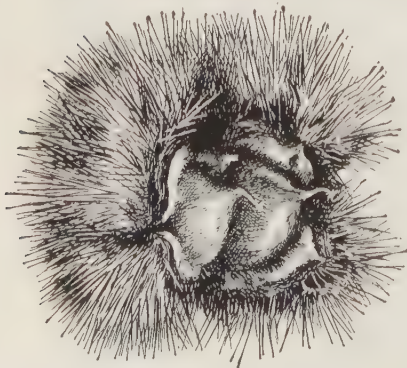
912. Japanese chestnuts. ( $\times \frac{1}{2}$ )

They are of a bright brown color, covered at the apex with thick pale tomentum, which sometimes extends nearly to the base of the nut. The nuts are sweet and agreeable in flavor, the best among chestnuts, and are marketed in large quantities from the forests of the Appalachian region. Occurs in eastern North America, Maine to Georgia, westward to Michigan, Mississippi and Louisiana. Gradually receding from its southern areas from causes not yet understood. A few selected forms have been propagated by grafting.

*Japanese chestnut* (*C. crenata*).—Fig. 912. A dwarfish close-headed tree of slender growth, said to attain a height of 50 feet in Japan, with small buds: leaves smaller than other chestnuts, lanceolate-oblong, usually pointed, with a truncate or cordate base, finely serrated, with shallow sharp-pointed indentations, whitish tomentose beneath, pale green above, less subject to injury by fungi than other species. Burs small, with a thin papery lining and short widely branching spines. Nuts large to very large, glossy, usually three, sometimes five or seven in a bur, usually inferior to the other chestnuts in quality, although good when cooked, and in a few varieties excellent in the fresh state. Many cultural varieties are recognized. Introduced to the United States in 1876 by S. B. Parsons, Flushing, New York.

Aside from these three types, there are certain dwarf and small-fruited castaneas known as chinquapins. The two native chinquapins may be contrasted as follows (page 682):

*Common or tree chinquapin* (*C. pumila*).—Fig. 913. A shrub 4 or 5 feet tall, rarely a tree, attaining a height of 50 feet, with slender branchlets marked with numerous minute lenticels, and coated with a pale tomentum, which disappears during the first winter. Leaves oblong, acute and coarsely serrate at apex, bright yellowish green, changing to dull yellow before falling in autumn. Flowers strong-smelling, the catkins of staminate ones appearing with the unfolding leaves in May or June, the spicate androgynous aments later, with pistillate flowers in spiny involucre, producing solitary cylindrical nuts  $\frac{3}{4}$  to 1 inch in length and  $\frac{1}{8}$  inch in diameter, with sweet seeds. This species occurs in dry lands from southern Pennsylvania to Florida and Texas, and its nuts, which ripen earlier than the American chestnut, are esteemed for



911. Native wild chestnuts. ( $\times \frac{1}{4}$ )



food and marketed in considerable quantities. The species is sparingly introduced to cultivation and in its native region is being somewhat grafted upon in place with the choicer varieties of chestnuts. It has some promise as a dwarfing stock but is subject to the troublesome fault of suckering rather abundantly. Two named varieties, the Fuller and the Rush, have been published and somewhat propagated. (Upper part of Fig. 913 illustrates common chinquapin bur, and nut in natural size.) Apparent intermediates between this species and the American chestnut, probably of hybrid origin, are found in various localities from Pennsylvania southward and westward to southern Arkansas and eastern Texas, in some localities attaining truly arborescent proportions. (Lower figure in Fig. 913 illustrates bur of hybrid chinquapin.)

*Bush chinquapin* (*C. alnifolia*).—A shrub, rarely more than 3 feet in height, forming small thickets, by means of stolons, in sandy barrens. South Atlantic states, westward to Louisiana and Arkansas. Distinguished from *C. pumila* by larger, oval-lanceolate, mostly obtuse leaves, which are but slightly tomentose beneath, and by its larger nuts, which ripen earlier.

The cultural range of *Castanea* in America is not well defined, but extends from Florida and Texas to Massachusetts and Wisconsin, and on the Pacific slope. The three species cultivated in America thrive best on dry, rocky or gravelly ridges or silicious uplands, failing on heavy clays and on limestone soils unless deep, dry and rich.

#### Propagation of chestnuts.

Propagation of species is by seeds. Certain types reproduce their striking characteristics in their seedlings, but varieties are perpetuated by grafting, occasionally by budding. Seeds for planting should be free from insect larvæ, and should not be allowed to dry out before planting. They may be planted in drills in fall on deep and well-drained loam, or, to avoid damage by rodents, may be stratified in damp sand until spring. Nuts held in cold storage at 15° F. from October to April have germinated well at Washington, D. C. Young trees destined for removal to orchard should be transplanted in nursery at one year old, to promote symmetrical development of root system. Grafting may be done on any of the species of *Castanea*, and on some of the oaks, notably the chestnut oak, *Quercus Prinos*, though the durability of grafts on the oak is questionable. Where the chestnut is indigenous, bearing orchards of improved varieties are quickly secured by cutting down and removing the timber, and grafting the young sprouts which spring up in abundance about the chestnut stumps (Fig. 914). Recently the chinquapin has been similarly used with good success where chestnut does not occur. Grafting may be by splice method on one-year-old seedling roots; by splice or cleft at crown on two- or three-year trees in place; or by veneer, splice or cleft methods on one- to three-year-old sprouts or branches. Top-working of old trees is uncertain and practised only in special cases. Cions should be dormant, and work may be done at any time after freezing ceases, but in trunk- and branch-grafting best results are secured by most grafters if work is done after leaves begin to unfold. Two- or three-bud scions are preferred. The fitting of cion to cleft or splice and the waxing should be carefully done. If strips of waxed muslin are wrapped about the stubs, the danger of loss by summer cracking of wax is lessened. In cleft-grafting young sprouts or seedlings, the stub should be cut 2 or 3 inches above the departure of a branch, to prevent too deep splitting of cleft. Two or three weeks after growth begins the waxing should be inspected and repaired if cracked. If grafts make rank and brittle growth they should be checked by pinching, and if in exposed situations, tied to stakes to prevent breaking out of cions. Budding is sometimes

practised, usually by use of dormant buds inserted in shoots of previous year, when the bark "slips" after growth has begun in spring. There is a growing conviction in the minds of close observers that certain of the popular varieties, especially Paragon, under certain conditions do not find the American chestnut a congenial stock. In several orchards, Paragon, when grafted on native sprouts, although apparently making a good union at the start, has within eight to ten years developed weakness at the point of union, followed by loss of vigor and death of the top without other apparent cause than lack of congeniality of cion to stock. For this variety, at least, the grafting upon seedling stocks grown from nuts of the variety appears advisable.

The chestnut is admirably adapted to ornamental planting, either singly or in groups on suitable soils.



913. Chinquapin. (Nut and bur natural size.)

The native species is successfully used as a roadside tree in many sections outside of its natural range. It requires a space of at least 40 feet for development when thus used, the European species 30 feet, and the Japanese 20 feet. If in orchard, the last-mentioned may be planted as close as 20 feet, and thinned when the trees begin to crowd, thus securing several crops of nuts from land otherwise unoccupied.

#### Care of chestnut orchards.

Planted orchards are yet few in America, most of the extensive commercial efforts having consisted in the grafting of sprouts on rough lands where the American chestnut is indigenous. On such lands no cultivation is attempted, the brambles and undesired sprouts being held in check by occasional cutting in summer, or by pasturing with sheep. Much care is necessary

to protect against damage of the sprouts by fire on such land. Clean cultivation, at least during the first few years, is probably best in planted orchards, although heavy mulching may be found a satisfactory substitute. The Japanese and some of the American varieties of the European species require thinning of the burs on young trees to avoid over-bearing, with its consequent injury to the vitality of the tree.

#### *Special difficulties.*

Leaf diseases are apparently subject to control by bordeaux mixture, but for the weevils, which damage the nuts previous to maturity, no satisfactory remedy has yet been discovered except the yarding of poultry in sufficient numbers to destroy the adult insects and their larvæ when they reach the ground.

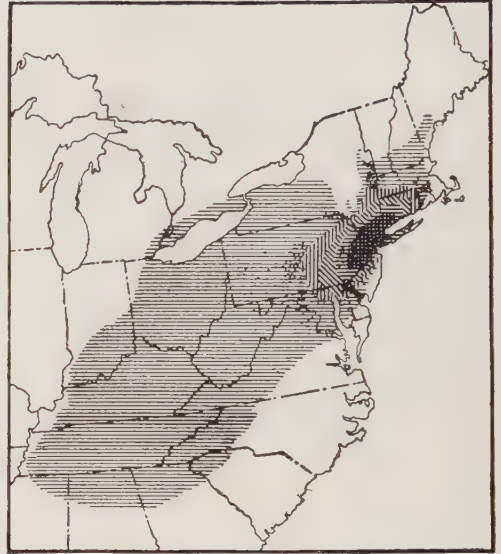
The most serious difficulty confronting the present or prospective chestnut-grower in North America is the chestnut-bark disease which, during the last decade, has worked havoc in the native chestnut forests throughout a region of country extending from central Connecticut through southeastern New York, New Jersey, and eastern Pennsylvania into northern Delaware, northeastern Maryland and northern Virginia. As this region contains most of the commercial plantings of improved chestnuts they have also suffered severely, especially since about 1908. The distribution of the native chestnut, together with the known distribution of the disease February 1, 1912, is shown on the accompanying map (Fig. 915), which was prepared by Metcalf to accompany a special report on the disease in response to a resolution of the United States Senate.

This disease, caused by a parasitic fungus (*Diaporthe* or *Endothia parasitica*), attacks trees of all ages and kills by girdling at various points. It is known to attack all species of chestnut and chinquapin grown in this country, although some, at least, of the Japanese varieties, are practically resistant, so far as observed. A few cases of the disease have also been found on living trees of the chestnut oak in Pennsylvania, though with less evidence of destructive effect than on chestnut.



914. Chestnut sprouts two years grafted. The cion was inserted where branching begins.

The disease is spread by the spores of the fungus, which are sticky, and are carried by rain, insects, and man, and probably by birds and small mammals. It is known to have been carried on nursery stock for long distances and is easily transported on newly cut



915. Distribution of the chestnut blight.

timber and cordwood from which the bark has not been removed. Infection frequently occurs through wounds made by bark-borers.

Although first attracting attention in New York City in 1904, it appears certain that it had secured a firm foothold in southeastern New York, including Long Island and adjacent portions of Connecticut and New Jersey, prior to that time, there being some indication that it was introduced from Japan, although satisfactory evidence of this is still lacking. The presence of the disease in chestnut forests in China was discovered by Meyer in 1913, where, upon an unidentified species of chestnut, it is reported to be less virulent than in American chestnut forests.

For several years after publication of the cause of the disease by Murrill, in 1906, little effort was made in a systematic way to accomplish its control until 1911, when the legislature of Pennsylvania appropriated \$275,000 for this purpose and inaugurated a state-wide, two-year campaign of eradication. The work is being done in cooperation with the Federal Department of Agriculture which, since 1907, has been investigating the disease with a view to developing effective methods of controlling it. Several other chestnut-producing states are also giving more or less attention to the problem. Up to the present time, systematic cutting out of infected trees coupled with destruction of their bark by fire has proved the only practicable control method. This is being vigorously applied in Pennsylvania and those portions of Maryland, West Virginia, and Virginia in which the disease has appeared.

In forests, the disease is exceedingly difficult to eradicate after it has once gained a foothold, owing to the minute examination of the entire tree which is required to locate infections in their early stages. In any district in which there is a general infection of the forests, the only practicable course is to clear off the timber while it is sufficiently sound to be merchantable.

The relative disease-resistance of the Japanese chestnuts, coupled with their precocity and productiveness, renders them now the most promising sorts for the American chestnut-grower. Planted in sections



outside of the native range of the American chestnut, they may reasonably be expected to remain practically free from the disease, especially if care is exercised to prevent its introduction from infested regions on nursery stock or cions. The poor flavor and eating quality of most of these varieties is their worst fault, but in view of their wide range of variation in this respect, the problem of producing resistant varieties of good quality appears relatively simple. The few trees of Korean and Chinese chestnuts thus far grown in the eastern United States are apparently quite resistant to the disease and therefore of much interest to the tree breeder as parents of possible resistant forms. Systematic work on the breeding of resistant varieties is being prosecuted in the Bureau of Plant Industry.

#### *Varieties of chestnuts.*

The varieties of the three species, although possessing many points in common, differ sufficiently in important characteristics to justify separate grouping for cultural discussion. As chestnut-culture is new in this country, it seems best to append descriptions of all the varieties which are in the American trade. For fuller discussion of cultivated chestnuts, see *Nut Culture in the United States* (Bull. Div. of Pomology, U. S. Dept. of Agric.), from which Fig. 913 is adapted; *Nut Culturist*, A. S. Fuller, 1896; *European and Japanese Chestnuts in Eastern United States*, G. Harold Powell (Bull. Del. Exp. Station), 1898; *Nut Culture for Profit*, Jno. R. Parry, 1897.

**AMERICAN GROUP.**—Although the wild nuts exhibit wide variations in size, form, quality, productiveness, and season of ripening, but few varieties have been dignified by names and propagated. Solitary trees are frequently sterile, although producing both staminate and pistillate flowers, apparently requiring cross-fertilization to insure fruitfulness. This is especially true of planted trees of this species on the Pacific slope, where productive trees are reported to be rare. The susceptibility of the species to injury by leaf diseases, as pointed out by Powell, and the injury to nuts by larvae of weevils, are drawbacks to its extensive culture.

The following varieties are propagated to some extent:

*Dulaney.*—Bowling Green, Ky. Large, and of fine quality. Original tree productive, though isolated.

*Griffin.*—Griffin, Ga. A large, very downy nut, of good quality.

*Hathaway.*—Little Prairie Ronde, Mich. A large, light-colored, sweet nut, annually productive, frequently having five to seven nuts to the bur.

*Keckham.*—Mountainville, N. Y. Above medium in size, oblong, tomentose, sweet. Tree productive and vigorous in heavy sod at fifty years of age.

*Murrell.*—Coleman's Falls, Va. A large, high-flavored nut, bearing three nuts to the bur.

*Otto.*—Otto, Tenn. Large, oblong, very downy at tip, very sweet, and rich.

*Rochester.*—Rochester, N. Y. First fruited at Alton, Ill. Nuts medium to large; somewhat rounded, usually three in a bur; of dull brown color, downy at tip; quality excellent. Tree a very rapid grower and a heavy bearer; ripens late.

*Watson.*—Fay, Pa. Medium to large, slightly downy, compressed, very good.

**EUROPEAN GROUP.**—It is a significant fact that, during the century that has elapsed since the introduction of this species, the imported named varieties of Europe have not found favor in eastern America. Seedling trees have been found productive and profitable at many points in New Jersey, Pennsylvania, Delaware, and Mary-

land, however, and these form the basis of the culture of the species east of the continental divide. West of the Rocky Mountains, several of the choice French "Marrons" are reported to succeed in California and Oregon. Among the more important varieties of the European group in America, are the following:

*Anderson.*—Flushing, N. J. Bur medium to small; nuts of medium size, bright reddish brown, pubescent at the tip and over half of the nut. Tree a strong grower, with medium to small leathery leaves. Very productive.

*Bartram.*—Milltown, Pa. Bur medium to small; nut medium, thickly pubescent at tip, dark reddish mahogany color; three in a bur; unusually free from insect attack; quality good. Tree vigorous, spreading, with large leaves; productive.

*Combale* (Marron Combale).—France. A large and handsome, bright brown striped nut, with but little tomentum at tip; usually two, sometimes but one in a bur. Somewhat grown in California, where it was introduced from France about 1870.

*Chalon* (syn., Marron Chalon Early).—France. Sparingly grown in California. Nut of medium size, early, productive, precocious.

*Corson.*—Plymouth Meeting, Pa. Bur large, with thin husk; nuts large, usually three in a bur; dark brown, ridged, heavily pubescent at tip; quality very good. Tree vigorous, spreading, very productive.

*Dager.*—Camden, Del. Bur medium; nut medium to large, dark brown, thickly tomentose, usually three in a bur; quality good. Tree vigorous, spreading, productive; a seedling of Ridgely.

*Darlington.*—Wilmington, Del. Bur medium to small; nut medium to large, usually three in a bur; dark, distinctly striped, thickly tomentose at tip; sweet, good. Tree vigorous. One of the earliest to ripen of this group.

*Lyon* (Marron de Lyon).—France. A large, round nut of fair quality, grown in a small way in California, but less productive than Combale, which it resembles.

*Marron.*—This term is used by the French to designate the larger cultivated chestnuts, most of which have relatively few nuts, often only one in a bur.

*Moncur.*—Dover, Del. A seedling of Ridgely. Bur medium; nuts medium, of light color, heavily tomentose. Tree vigorous, spreading, very productive.

*Nouzeillard.*—France. A large, handsome variety from central France, and there considered very productive and valuable. Has been tested in New Jersey, Pennsylvania and California without marked success in any locality.

*Numbo.*—Morrisville, Pa. Bur medium conical; nut large, from two to three in a bur; bright brown striped, thinly tomentose, of good quality. Tree compact and drooping, rather uncertain in bearing.

*Paragon* (syn., Great American; Sobers Paragon).—Germantown, Philadelphia, Pa. Bur very large; nut large, usually three in a bur, broad, plump, thickly tomentose at the tip, and thinly over two-thirds of surface, color dull brown, quality very good. Tree hardy, spreading, vigorous, with narrow, coarsely serrate leaves having a narrow base; subject to leaf-blight, but very productive. The most widely planted and most uniformly successful variety of chestnut yet cultivated in the United States. Possibly a hybrid with *C. dentata*.

*Quercy* (syn., Marron Quercy).—France. A beautiful, medium-sized nut, commended in portions of California for precocity, earliness, productiveness and quality.

*Ridgely* (syn., Du Pont).—Dover, Del. Bur medium; nut medium to large, moderately tomentose, dark, of very good quality. Tree vigorous, with narrow leaves free from blight, spreading, very productive, hardy.

*Scott.*—Burlington, N. J. Bur medium; nut medium, slightly pointed, usually three in a bur; glossy, dark brown, slightly tomentose at the tip. Tree open, spreading, very productive; said to be comparatively free from attacks of weevil.

*Styer.*—Concordville, Pa. Bur medium; nut medium pointed, dark brown, striped, tomentose at tip, 1 to 3 in a bur. Tree very vigorous, upright, with large, dark green leaves; free from disease.

**JAPANESE GROUP.**—Though most of the imported Japanese chestnuts have been found of poor quality for eating in the fresh state, the product of many imported seedling trees, and of a number of American-grown seedlings of this type, is equal to the European nut in this respect. The Japanese varieties in general have the advantage, also, of greater precocity and productiveness, larger size and earlier maturity of nut, greater freedom from injury



916. Successive stages in the ravages of the chestnut blight. 1909, 1910, 1911.



by leaf diseases and nut-eating insect larvæ. As productiveness and earliness are the most important points in chestnut-culture at the present time, this type is the most important to commercial nut-growers. Because of the ease with which chestnuts hybridize, the disease-resistance of varieties that have originated from seed produced within the habitat of the American chestnut must be regarded as doubtful until thoroughly tested. Information as to the place of production of the seed from which the several varieties

originated is therefore of importance in selecting varieties for planting. The more important named varieties are as follows:

*Alpha*.—New Jersey. Bur medium; nuts medium to large, generally three in a bur, dark, of fair quality, ripening very early. Tree upright, very vigorous and productive. Originated in New Jersey from seed of Parry.

*Beta*.—New Jersey. Bur small; nut medium, light brown, smooth, slightly tomentose at tip, good; ripening just after *Alpha*. Seedling of Parry.

*Biddle*.—New Jersey. First fruited in Maryland. Bur

medium; nut large, bright brown, broad, rather thickly tomentose, two to five in a bur; of medium season and fair quality. Tree regular, round-headed, vigorous. Grown from imported seed.

*Black* (syn., Dr. Black).—New Jersey. First fruited in Maryland. Bur large; nut medium to large; three to seven in a bur, consequently irregular in shape; dark brown, slightly tomentose, very early and of good quality. Tree round, close-headed, vigorous, productive. Grown from imported seed.

*Boone*.—Villa Ridge, Ill. Fig. 917. A hybrid between Giant and a native chestnut. Bur of medium size; nuts large, usually three in a bur; of light brown color, rather heavily tomentose; quality very good. Tree vigorous, precocious and productive, nuts ripening early. Considered difficult to propagate.

*Coe*.—California. A large, very sweet variety, but recently disseminated. Tree upright, somewhat spreading. Grown from imported seed.

*Felton*.—New Jersey. First fruited in Delaware. Bur small; nut medium, dark brown, slightly tomentose, rather early and of excellent quality. Tree round-headed and fairly productive. Grown from seed of an imported tree.

*Giant*.—Japan. A trade name, under which a number of varieties have been imported from Japan. See Parry.

*Hale* (syn., Eighteen Months).—California. A newly introduced variety, having a large, dark brown nut of excellent quality. Very precocious. Grown from imported seed.

*Kent* (syn., Extra Early).—New Jersey. First fruited in Delaware. Bur small, nut medium to large, dark, usually three in a bur; very early, of good quality. Tree round-headed, precocious, productive. Grown from seed of an imported tree.

*Kerr*.—New Jersey. First fruited in Maryland. Bur small; nut medium to large, dark brown, broad, three in a bur, early, and of excellent quality. Tree vigorous, symmetrical, round-headed, very productive. Grown from imported seed.

*Killen*.—New Jersey. First fruited in Delaware. Bur very large; nut very large, broad, light brown, slightly ridged, of excellent quality, midseason. Tree upright, open, spreading, moderately vigorous, productive. The largest chestnut yet brought to notice. Grown from seed of an imported tree.

*Mammoth*.—A trade name for the imported Japanese nuts and trees, not restricted to any particular variety.

*Martin* (syn., Col. Martin).—New Jersey. First fruited in Maryland. Bur large; nut large to very large, broad, bright reddish brown, slightly tomentose, three to five nuts in a bur. Midseason; of good quality for cooking. Tree vigorous, open, spreading, productive. Grown from imported seed.

*McFarland*.—California. Bur very large; nut large, and of fine quality; early. Tree spreading, very productive. A newly disseminated variety of great promise. Grown from imported seed.

*Parry*.—Japan. Bur very large; nut very large, one to three in a bur, broad, with apex sometimes depressed; dark brown, ridged, of fair quality. Tree moderately vigorous, open, spreading, with large leaves. One of the largest and most beautiful of this group. Selected for propagation as the best of 1,000 imported grafted Japanese chestnuts.

*Prolific*.—Japan. Bur small; nut medium, rather long, striped, three in a bur; early. Tree vigorous, compact, with small narrow leaves.

*Reliance*.—New Jersey. Bur medium; nut medium to large, rather long, light brown, ridged; midseason, and of fair quality. Tree dwarfish, spreading, drooping, very precocious and productive; inclined to overbear, and needs thinning. Seedling of Parry.

*Success*.—New Jersey. Bur very large; nut very large, usually

three in a bur; midseason; of rather poor quality until cooked. Seedling of Parry. Tree upright, productive.

*Superb*.—New Jersey. Bur large; nut large, broad, brown, usually three in a bur, early, and of fair quality. Tree vigorous and very productive. Seedling of Parry.

Wm. A. TAYLOR.

**CHEVALIÈRE, CHEVALIÈRIA, CHEVALLIÈRE, CHEVALLIÈRIA.** The species in the American trade are *Æchmeas*.

**CHICK-PEA:** *Cicer*.

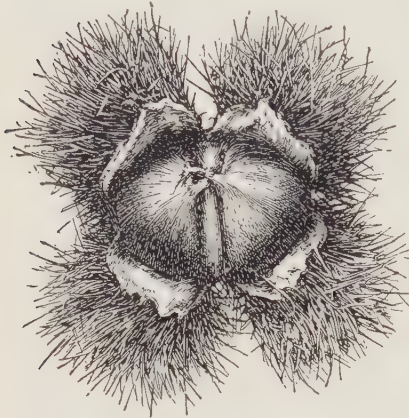
**CHICKWEED:** *Cerastium* and *Stellaria*.

**CHICORY, or SUCCORY** (*Cichorium Intybus*, Linn.). *Compositæ* Fig. 918. A native of Europe, naturalized in America and familiar to many as a weed, is a pot-herb, a salad, and the leading adulterant of coffee. It came prominently before the public in the late nineties and the early years of this century as an American farm crop. Prior to that year, its cultivation as an adulterant and substitute for coffee was largely prevented by the prejudice of the principal consumers, our foreign-born population, who insisted that American was inferior to European root, and also by the low tariff, which allowed the root to enter duty free, or with a very small impost. During 1898 and 1899 advantage was taken of a protective duty, and several factories were erected, for which farmers grew the roots. For a few years our home market was supplied from American fields in part. But even the substitution of horse-power for manual labor, improved plows and cultivating implements for crude ones, machine-digging of the roots for hand-digging, efficient slicing machines, and improved evaporating kilns did not make the business satisfactory. There was not enough money in it either to growers or to manufacturers, so it has been abandoned.

Chicory will probably succeed wherever the sugar beet is grown in this country, the climatic requirements being similar. In general, it may be said to thrive upon all stone-free soils that will produce paying staple crops, except clays, lightest sands and mucks. The first are too hard, the second too dry, the third too rich in nitrogen and too sour. The surface layer of soil should be deep, the subsoil open and well drained. If the water-supply be sufficient, high land is as good as low land of the same texture, though if too dry for profitable grain-growing, the former may yet be made to produce chicory; but if too wet for cereals, the latter will generally be found unsuitable for this root. The fertilizing of the land should be the same as for other root-crops, nitrogen being used sparingly, potash and phosphoric acid rather freely—one and one-fourth to one and one-half times as much of the former and two and one-half times the latter as has been removed by the preceding crop. It is best to apply these fertilizers to preceding crops that do not make heavy demands upon them. In rotation, chicory is classed with root-crops, and should be preceded by a small grain, since this is harvested in time for fall plowing. Clover should not immediately precede, since it leaves too much nitrogen in the soil. The ground being warm, fairly moist, thoroughly



918. Improved chicory root. ( $\times \frac{1}{2}$ )



917. Boone chestnut.



prepared by deep plowing, harrowing and scarifying with a weeder, the seed, which must be fresh and clean, is sown rather thickly but covered thinly, in drills 18 inches apart.

There are but few well-defined varieties of this plant used for field culture, and even the garden sorts are not so stable as could be desired. Of the former group, Magdeburg, Brunswick and Schlesische are the principal; of the latter, Witloof (so-called), Red Italian, Broad-leaved, Improved Variegated and Curled-leaved are best known. Witloof and Barbe de Capucin can be produced from any variety, the difference being brought about by the method of growing.

Chicory has no specific enemies in this country, and is troubled by only a few of the general-feeding insects, such as cut-worms and wire-worms.

From six to ten tons is the general acre yield, although with good management fifteen tons may be produced. The cost of growing and the returns are about as follows: Rent, wear of tools, etc., \$5; preparation of land, \$4.50; seed, 75 cents; cultivating and tending, \$15; harvesting and delivering, \$12; total, \$37.25. Average price the ton, \$7.

From a purely horticultural standpoint, chicory is of interest as a root, a pot-herb, and a salad plant. The young tender roots are occasionally boiled and served with butter, pepper and salt, like young carrots, but they have never become widely popular in this form. As a pot-herb, the young leaves are equal to those of dandelion. They are cut when 6 to 8 inches long, boiled in two waters to remove the bitter flavor, and served like spinach. As a salad, chicory is famous in three forms: Common Blanched, Barbe de Capucin and Witloof. Barbe de Capucin is comprised of small blanched leaves. Witloof is a more solid head. The pink, red and curled varieties make a very pretty appearance, and, if well grown and served fresh, are delicious, there being only a slightly bitter flavor. The method of growing for salads is the same as for endive.

For Barbe and Witloof, well-grown roots are dug in October, trimmed of unnecessary roots and of all but an inch of top. For Barbe, the roots are laid horizontally in tiers in moist earth, the whole forming a sloping heap, the crowns of the roots protruding an inch or so. Since darkness is essential, a warm vegetable cellar is the usual place selected to grow this vegetable, which requires three or four weeks to produce its fine white leaves. These are cut when about 6 inches long, eaten as a salad, boiled like kale or cut up like slaw. If undisturbed, the roots will continue to produce for several weeks. The most rapid way to produce Witloof is to plunge the roots (shortened to 5 inches) in spent tanbark, or such material, and cover with 2 feet or more of manure, the space under a greenhouse bench being used. In about two weeks, heads resembling cos lettuce may be dug up, boiled like brussels sprouts, or served as salad. If the roots be left in place, protected from the light, but uncovered, a crop of leaves resembling Barbe may be gathered. Sowing and other cultural management is the same as for other garden roots, as beets and carrots. It is a pity that these vegetables are so little known in this country. Witloof is a popular winter vegetable in the larger cities of the East. Much of it is imported from Europe.

Chicory has run wild along roadsides and in dry fields in many parts of the country, and is considered to be a bad weed. However, the handsome sky-blue flowers (Fig. 962), which open only in sunshine, are very attractive.

M. G. KAINS.

**CHILDSIA WERCKLEI:** *Hidalgoa*.

**CHILIANTHUS** (*a thousand flowers*). *Loganiaceæ*. Four or 5 S. African trees or shrubs, very closely allied to *Buddleia*, from which it differs in having stamens

exserted from the short tube: lvs. opposite, entire or dentate, nearly always tomentose or scaly: fls. very numerous, in dense terminal cymes or panicles; calyx and corolla deeply 4-parted, the latter usually yellowish. Unknown to the American trade. The plants known as *Buddleia salicifolia*, Jacq., and *B. saligna*, Willd., are *Chilianthus arboreus*, Benth. (which is probably identical with *C. oleaceus*, Burch.).

**CHILÓPSIS** (Greek, *lip-like*). *Bignoniaceæ*. One deciduous shrub or low tree, often planted in southern California and other parts.

Allied to *Catalpa*: differs in having 4 anther-bearing stamens and 1 rudiment, a more trumpet-shaped corolla and with jagged lobes, and lvs. linear and often not opposite.

*linearis*, DC (*C. saligna*, Don). Slender-branched, 10-20 ft.: fls. handsome, bignonia-like, in a short terminal raceme; corolla 1-2 in. long, 5-lobed and crimped, the tube and throat lilac, and 2 yellow stripes inside. Dry districts from S. Texas to Calif., and in Mex.—From its narrow-lanceolate or linear lvs., it is known as desert willow; also called flowering willow and mimbrres. There is a white-fl'd. form.

L. H. B.

**CHIMÁPHILA** (Greek, *winter-loving*; green in winter). *Eri-caceæ*. PIPSSISSEWA. Perennial small plants, interesting for the white or pinkish flowers and the evergreen foliage, but little cultivated.

Half shrubby or herbaceous, with creeping st.: lvs. evergreen, serrate, in irregular whorls: fls. nodding, forming a terminal, few-fl'd. umbel, on a long naked peduncle; petals 5, spreading; stamens 10, the anthers opening with 2 pores at the apex, the filaments short, dilated; style short, with a peltate stigma: fr. a dehiscent, deeply furrowed, 5-celled caps. with numerous minute seeds.—Four species in N. Amer., Eu., and N. Asia to Japan; formerly united with *Pyrola*. Low evergreen plants, with pretty white or reddish fls. in summer. They grow best in a light, sandy soil, mixed with peat or leaf-mold, and prefer a half-shady position. Prop. by division of the creeping rootstock. Useful in wild borders.

A. Lvs. broadest above the middle.

**umbellata**, Nutt. (*C. corymbosa*, Pursh). Five to 12 in.: lvs. 3-6 in a whorl, short-petioled, cuneate-lanceolate to oblong-obovate, sharply serrate, dark green and shining above, 1-2 in. long: fls. 4-7, white or reddish,  $\frac{1}{2}$ - $\frac{3}{4}$  in. wide. N. Amer., from Canada to Mex., Eu., Japan. B.M. 778. L.B.C. 5:463. Mn. 7:161.—Lvs. said to be employed in rheumatic and kidney affections.

AA. Lvs. broadest below the middle.

**maculata**, Pursh. Fig. 919. Lower and less branched than the foregoing: lvs. usually in 3's, ovate or oblong-



919.  
*Chimaphila maculata*.  
( $\times \frac{3}{8}$ )

lanceolate, sparsely and sharply serrate, variegated with white along the nerves, 1-2 in. long; fls. 2-5, white,  $\frac{3}{4}$  in. wide. From Canada to Ga. and Miss. B.M. 897. Mn. 9:1. G.C. III. 32:318.

**Ménziesii**, Spreng. Slender plant, 3-8 in. high: lvs. alternate or in 3's, ovate to oblong-lanceolate, acute at both ends,  $\frac{3}{4}$ -1 $\frac{3}{4}$  in. long, sharply serrate, sometimes variegated: fls. 1-3, white,  $\frac{1}{2}$  in. across; filaments with a round dilated portion in the middle. Brit. Col. to Calif.

ALFRED REHDER.

**CHIMONÁNTHUS:** *Meratía*.

**CHINA ASTER:** *Aster*.

**CHINA-TREE:** *Melia*.

**CHINA WOOD-OIL:** *Aleurites Fordii*.

**CHINESE LANTERN PLANT:** *Physalis*.

**CHINESE LAUREL:** *Antidesma*.

**CHINESE SACRED LILY:** *Narcissus*.

**CHINKAPIN, CHINQUAPIN:** *Chestnut* and *Castanea*.

**CHIOCÓCCA.** *Rubiaceae*. SNOWBERRY (which the name means in Greek). Shrubs, mostly climbing or trailing, of Trop. Amer. (a half-dozen or so species), and 3 in extreme S. Fla. Fls. in axillary panicles, the corolla funnelliform and 5-parted; stamens 5, inserted on the base of the corolla, the filaments cohering at base; style filiform, the stigma club-shaped; ovary 2-3-loculed, becoming a small globular 2-seeded drupe. **C. racemosa**, Linn., of the Fla. Keys and S., is sometimes cult. in hothouses for its panicles of yellowish white fls. and the white frs.: lvs. ovate to lanceolate, thick and shining, entire: drupes  $\frac{1}{4}$  in. diam.: twining, glabrous. **C. anguifuga**, Mart. (*C. brachiata*, Ruiz & Pav.), of S. Amer., the root affording a native snake-bite remedy, has appeared in cult. (under the name var. *acutifolia*): woody, with erect branches: lvs. ovate, 3 in. or less long, sharp-acuminate: fls.  $\frac{1}{4}$  in. long with recurved lobes, in axillary panicles shorter than the lvs.—In S. Fla. or on the Keys, 2 other species occur, but they apparently are not in cult.: *C. alba*, Hitchcock. Large, erect or reclining: lvs. elliptic to ovate: fls. white, often becoming yellow. *C. pinetorum*, Brit. Small, trailing: lvs. mostly elliptic to oblong: corolla always white.

L. H. B.

**CHIÓGENES** (Greek, *snow*, *offspring*; referring to the snow-white berries). *Ericaceae*. SNOWBERRY. Creeping plant, rarely grown in rockeries for the carpeting effect of the evergreen foliage and for the attractive white berries; with small alternate 2-ranked lvs. and inconspicuous axillary fls.; corolla short-campanulate, 4-cleft; stamens 8, included, with short filaments, anthers opening by a slit: berry white, many-seeded.—Two species in the colder regions of N. Amer. and Japan. Slender trailing evergreens, in appearance much like the cranberry; rarely cult. Thriving best in moist and peaty soil, in a shaded position, creeping amongst growing moss. Prop. by seeds, by division or by cuttings in Aug. under glass. The American species, **C. hispídula**, Torr. & Gray (*C. serpyllifolia*, Salisb.), has hirsute branches and ovate or oval,  $\frac{1}{4}$ - $\frac{1}{2}$  in.-long ciliate lvs., greenish white fls. and white berries,  $\frac{1}{4}$  in. across, usually hirsute.

ALFRED REHDER.

**CHIONÁNTHUS** (Greek for *snow* and *flower*; alluding to the abundance of snow-white fls.). *Oleaceae*. FRINGE TREE. Woody plants grown for their profusely produced white flowers.

Shrubs or low trees, with deciduous, opposite and entire lvs.: fls. in loose panicles from lateral buds at the end of last year's branches, white, dioecious or only functionally dioecious; calyx 4-cleft; corolla divided nearly to the base in 4 narrow petals; stamens 2, short;

ovary superior, 2-celled; style very short with a 2-lobed stigma: fr. a 1-seeded oval drupe.—Two species in E. N. Amer. and China. Ornamental shrubs, with large, dark green foliage, and very showy white fls. in early summer. The American species is almost hardy N., but requires a somewhat sheltered position; the Chinese may be more tender, but has proved hardy at the Arnold Arboretum. They thrive best in a somewhat moist and sandy loam, and in a sunny position. Prop. by seeds sown in fall or stratified; increased also by layers and by grafting under glass or budding in the open air on ash seedlings (in Europe, *Fraxinus Ornus* is preferred); sometimes by cuttings from forced plants in early spring.

**virginica**, Linn. Fig. 920. Large shrub or slender tree, to 30 ft.: lvs. oval or oblong, acuminate, pubescent beneath when young, mostly glabrous at length, 4-8 in. long; panicles 4-6 in. long, pendulous; fls. functionally dioecious; petals 1 in. long: fr. dark blue, ovoid,  $\frac{3}{4}$  in. long. May, June. From Pa. to Fla. and Texas. L.B. C. 13:1264. Gt. 16:564. Mn. 2:154. G. F. 7:325. A.G. 22:362. F.E. 29:733. Gng. 16:306. G.M. 31:527. V. 10:227. G.W. 8, p. 293. M.D.G. 1899:412, 413; 1900:413; 1907:73, 337.—Variable in shape and pubescence of the lvs., and several varieties have been distinguished, but none of them sufficiently distinct for horticultural purposes. The staminate plants are showier in flower on account of their larger panicles and broader petals, but lack the attractive pendulous blue frs. in autumn. Root-bark tonic, febrifuge, laxative; reputed narcotic.



920. *Chionanthus virginica*.

( $\times 12$ )

**retusa**, Lindl. (*C. chinensis*, Maxim.). Shrub, with spreading branches, or small tree, to 20 ft.: lvs. obovate or oval to oval-oblong, acute or obtuse, sometimes emarginate, pubescent on the veins beneath, at least when young, and reticulate; petioles densely pubescent: fls. dioecious, fragrant, in panicles 2-4 in. long; petals about  $\frac{1}{2}$  in. long; narrow oblong: drupe ovoid, dark blue,  $\frac{1}{2}$  in. long. China. P.F.G. 3, p. 85. G.C. II. 23:821; III. 47:328, 329. Gt. 35, p. 667. A.G. 13:374; 20:107; 22:363. Mn. 2:157. G.F. 7:327. G. 29:347; 33:521. Gn. W. 8:453.—Young plants have the lvs. serrulate.

ALFRED REHDER.

**CHIONODÓXA** (Greek, *snow* and *glory*). *Liliaceae*. GLORY-OF-THE-SNOW. Very early-blooming hardy bulbs, flowers and leaves appearing together.

Closely allied to *Scilla*, but differs, among other characters, in having a short tube to the corolla: fls. blue (running into white and red forms), with recurved-spreading acute segms., dilated filaments, and small or capitate stigma.—Four species, Crete to Asia Minor.

These are among the best of early-flowering plants, blooming in February, March and April, according to the locality, with the early snowdrops and scillas. Since their introduction to cultivation by Maw in 1877, they have been widely cultivated under the popular name of "glory-of-the-snow," in allusion to their early-blooming habit. *C. Luciliae* is the most widely cultivated species. This varies much in color, the type having flowers whose petals are more or less deeply tipped with blue, shading to white at their bases. *C. Luciliae* also occurs with pure white flowers, and in reddish and pink forms. *C. sardensis* has smaller flowers of a deeper tone of blue and without the white markings of the petals. There are two varieties of this, one with white



and the other with black stamens. *C. grandiflora* is the largest-flowered of the group, the type being slaty blue with dark lines down the center of the segments; however, like others of the genus, there are pink and white forms sometimes found in collected bulbs, although somewhat rare. *C. Tmolusii*, one of the kinds sent out by Whittall of Smyrna some years ago, is very like *C. Luciliae* in form but of a deeper blue and a distinctly later flowering habit. Chionodoxas hybridize with Scilla, and the hybrids are sometimes known as chionoscillas.—Chionodoxas thrive in any fertile soil, well drained and not too heavy, and in any exposure, the main requisite for growth being that they have light and an adequate supply of moisture while growing and until the foliage is ripened. The bulbs should be planted about 3 inches deep, and closely, say an inch or less apart. Lift and replant about the third year. They need no winter covering. They flower well in pots in winter in a coolhouse temperature. Must be forced only gently, and given abundance of air, light and moisture. They are increased by offsets and seeds, which they produce freely. Under favorable conditions they increase rapidly by self-sown seeds. Preferably, seeds should be sown in a frame, and may be expected to germinate the following winter. Under ordinary conditions, self-sown seeds germinate early in the year, or late winter. (J. N. Gerard.)

*Luciliae*, Boiss. Fig. 921. Bulb ovoid, brown-coated: lvs. long and narrow, 2 or 3 with each st.: scape 3-6 in. high, bearing a dozen or less bright blue, more or less hanging, white-centered fls. Asia Minor and Crete. B.M. 6433. Gn. 28, p. 179.—Runs into many forms, one of which has white fls. *C. gigantæa*, Hort., is a larger form of it, distinct in habit. *C. grandiflora*, Hort., is a large garden form, with fls. violet-blue and white in the throat. Var. *Förbesii*, Hort., somewhat taller and bearing more fls. *C. amabilis Leichtlinii*, Hort., is a very handsome form, 2 weeks later than the others: fls.  $1\frac{3}{4}$  in. across, with broad full segms. of soft creamy white shaded rose-purple. *C. Tmolusii*, Hort., is a late-blooming form, bright blue and white, apparently a variant of *C. Luciliae*.

*sardensis*, Drude. Fls. 2-6, smaller, much darker blue with no white in the eye, the perianth-limb twice longer than the tube: lvs. channeled. Sardis. Gn. 28:178.—Probably a form of *C. Luciliae*.

*crética*, Boiss. & Held. Slender: fls. smaller and fewer (1-2 on a scape) than *C. Luciliae*, white or very pale blue. Crete.—Of little horticultural value.

*Allenii*, Hort. (*Chionoscilla Allenii*, Hort.). Perianth segms. cut to

the base: habit of *C. Luciliae*, but the white eye is indistinct. Supposed natural hybrid of *Scilla bifolia* and *Chionodoxa Luciliae*. G.C. III. 21:191. There is said to be another *C. Allenii* that is a direct selection probably from *C. Luciliae*, very like var. *grandiflora*. *Chionoscilla Penryi* is another Chionodoxa × Scilla hybrid, the exact parentage not being stated.

L. H. B.

**CHIONOSCILLA:**  
Hybrids of Chionodoxa and Scilla; consult these genera.

**CHIRANTHODENDRON** (Greek, signifying *hand-flower-tree*). *Sterculiaceæ*. Odd-flowered ornamental tree of Mexico and to be expected in West Indies and elsewhere in cultivation.

A monotypic genus, which together with the Californian *Fremontodendron* forms the remarkable group *Fremontieæ*. The fls. are devoid of a corolla, but in its place have a large deeply 5-parted cup-shaped calyx, concave at the base, in which there are 5 glands which secrete an abundance of honey; stamens united together for about one-third their length, above which they separate into 5 rays bearing linear anthers which dehisce by a longitudinal groove; style issuing from the center of the stamens and terminating in a pointed stigma: fr. a woody caps. with 5 valvate dehiscent lobes: foliage linden-like and densely clothed with stellate hairs.

*platanoides*, Baill. (*Cheirostemon platanoides*, Humb. & Bonpl.). The celebrated MACPALXOCHIQUAHUITL, or HANDFLOWER TREE of the Mexicans; also called MANO DE MICO, MONKEY'S HAND, and DEVIL'S HAND. Fig. 922. The remarkable feature of the fl. is the form of the bright red stamens, which resemble the fingers of a human hand and are tipped with appendages like claws; from the base of the fingers issues the style which is more or less like a thumb. A single tree growing near the city of Toluca was known to the ancient Mexicans, who regarded it with superstitious veneration. It was of great age and was supposed to be the only tree of its kind in the world. But an entire grove of the trees was discovered in Guatemala on the slope of the Volcano de Agua, near the town of Antigua, whence in pre-Columbian times the specimen had been brought. This established itself on the slope of the volcano of Toluca, where the conditions of soil and climate were similar to those of its original habitat.

W. E. SAFFORD.

**CHIRITA** (Hindustani name). *Gesneriaceæ*. Plants much like gloxinias and streptocarpuses. A genus of 100 species, none of which is in the American trade. They are natives of E. Asia and are herbs or low undershrubs with opposite, often unequal lvs.: fls. in shades of purple and blue, tubular, in clusters on the tops of short scapes. For cult., see *Gloxinia*.

*C. barbata*, Sprague. Perennial: fls. pedicellate; corolla funnel-shaped, bluish lilac, with yellow band in front. India. B.M. 8200.—*C. rupestris*, Ridl. Bushy, compact annual. Malay Peninsula. B.M. 8333.—*C. sinensis*, Lindl., is the best known



922. *Chiranthodendron platanoides*.  
The hand-flower. ( $\times \frac{1}{2}$ )



921. *Chionodoxa Luciliae*. ( $\times \frac{1}{2}$ )

species and is well worth cult. It has bright green lvs. and scapose cymes of blue and white fls., the yellow anthers of which add attractiveness. B.R. 30:59.—A variegated form is known.

N. TAYLOR.†

**CHIRÒNIA** (classical mythological name). *Geniandaceae*. A dozen or so soft perennial herbs or shrubs of Afr., rarely seen in collections of greenhouse material. Fls. in shades of red and purple, terminal, with a salver-form corolla and short tube: lvs. opposite, sessile, on single or branching sts. Most of them are from the Cape region.

**CHIVE, or CHIVES** (written also Cive). *Allium Schenóprasum*, Linn., a perennial plant native to Europe and the northern borders of the United States and northward. See *Allium*. The leaves of chive are used green as seasoning in soups, salads and stews. Chive grows 6 to 8 inches high, making dense mats of narrow hollow leaves, and blooming freely in violet-colored heads, which scarcely overtop the foliage; bulbs small, oval. The plant makes an excellent permanent edging, and is worth growing for this purpose alone. It is easily propagated by dividing the clumps; but, like other tufted plants, it profits by having the stools broken up and replanted every few years. It rarely seeds. It thrives in any garden soil. The leaves may be cut freely, for they quickly grow again.

L. H. B.

**CHLIDÁNTHUS** (*delicate flower*, from the Greek). *Amaryllidaceae*. Tropical American summer-flowering bulbs. Allied to *Zephyranthes*.

Flowers erect, yellow, fragrant, in a small 2-bracted umbel, terminating a solid scape, long-tubed, with wide-spreading segms.; stamens 6, inserted at the throat, the filaments unequal and dilated at base: fr. a 3-valved caps.: lvs. long and strap-shaped; bulb tunicate.—Three or four species. Mex., and S. Amer.

Chlidanthuses are increased by offsets or by seeds. The bulbs should be kept dry and cool during winter and in spring started in a moderately warm house. After flowering, care must be taken to have the bulbs make their annual growth. They may either be grown in pots plunged in ashes, or planted out where they can be watered occasionally during dry weather. Like other similar plants, they will benefit by a mulching of spent hops or rotted manure. (G. W. Oliver.)

**frāgrans**, Herb. (*C. luteus*, Voss). Bulb large and ovoid: lvs. about 6, appearing in spring or early summer with the fls., narrow, glaucous, obtuse: fls. 4 or less in each umbel, 3 in. or less long, nearly sessile, erect, on a 2-edged scape or peduncle 10 in. or less high. Andes. B.R. 640. F.S. 4:326.—A good summer-blooming plant.

**Ēhrenbergii**, Kunth. Somewhat taller: fls. yellow, nearly horizontal, distinctly stalked, the 3 outer segms.

wider than the inner. Mex.—Perhaps a form of the above.

L. H. B.

**CHLORÁNTHUS** (*green flower*). *Chloranthaceae*. Tropical herbs, shrubs or trees, one of which is sometimes grown under glass in the North.

Perennial aromatic herbs or evergreen shrubs, with jointed sts. opposite simple lvs., and small, inconspicuous fls., in slender terminal spikes: perianth represented by a single scale, in the axil of which is the 1-loculed ovary and mostly 3 united stamens (the side stamens sometimes obsolete).—Some 10 species in the eastern tropics. Two other genera (*Ascarina* and *Hedyosmum*) comprise the family *Chloranthaceae*, of the pepper-like series of plants.

**brachystachys**, Blume. Shrub used for pot-growing, reaching a height of 1-2 ft., bearing glossy foliage and small yellow berries: stamen single in each fl.: lvs. long-lanceolate, acuminate, serrate.—Tropics and subtropics, Ceylon eastward. There is a variegated-leaved form.

L. H. B.

**CHLÒRIS** (the goddess of flowers). *Gramineae*. FINGER-GRASS. Annual or usually perennial grasses, some-

times grown for decoration.

Plants with flat blades, compressed sheaths and digitate unilateral spikes: spikelets with 1 perfect fl. and 1 or more rudimentary sterile lemmas on the prolonged rachilla.—Species about 40, in the warmer regions of the world. A few are cult. for ornament on account of the attractive infl. Of simple treatment.

**élegans**, HBK. Fig. 923. Annual, 1-3 ft.: uppermost sheaths usually inflated around the base of the infl.; spikes 6-12, pale or dark, 1-3 in. long; lemma fusiform, 1 line long, short-pilose at base and along the lower half of the keel, long-pilose on the margins near the apex, the awn about 5 lines long; rudiment cuneate, twice as long as broad, the single awn somewhat shorter than the awn of the perfect floret. Mex. Dept. Agric., Div. Agrost., 7:192; 20:102.

**polydactyla**, Swartz (*C. barbata*, Nash). Fig. 924. Perennial, 1-3 ft.: spikes several; awns 2-3 lines; rudiment triangular-truncate, the 2 awns about as long as the awn of the perfect floret. Tropics of both hemispheres.

**verticillata**, Nutt. WINDMILL-GRASS. Perennial, 4-15 in.: spikes several, slender, in 1-3 whorls, 2-4 in. long; awns 2-3 lines; lemma 1 line long, nearly glabrous; rudiment oblong-truncate, 1-awned. Dept. Agric., Div. Agrost. 7:191. Kan. to Texas.

**radiata**, Swartz. Perennial, 2-3 ft.: spikes several, about 3 in. long; spikelets slender; lemma slightly ciliate on callus and near apex, the awn 6 lines long; rudiment narrow, acute, the single awn about half as long as the awn of the perfect floret. W. Indies.

**gayana**, Kunth. RHODES-GRASS. Robust perennial, with abundant foliage and terminal umbels of 6-15 spikes.—An African species at present under experimentation in U. S. in dry regions. Cult. in Austral. (See Agr. Gaz. New S. Wales 19:19, 118, 389 [1908]).



923. *Chloris elegans*. ( $\times \frac{1}{2}$ )

924. *Chloris polydactyla*. ( $\times \frac{1}{2}$ )



*truncata*, R. Br. (*C. barbata vera*, Host., not *C. barbata*, Swartz or Nash). STAR-GRASS. A stoloniferous perennial, with erect culms 1-3 ft.: spikes 6-10, 3-6 in., becoming horizontal or reflexed; spikelets  $1\frac{1}{2}$  lines, dark at maturity, the awns 3-6 lines long. Austral. Turner, Austr. Grasses 1:17.—Cult. for ornament.

*C. gracilis*, Dur.=*Leptochloa virgata*, Beauv. This has been recommended as an ornamental.—*C. petraea*, Swartz, and *C. glauca*, Vasey, both handsome species from Fla., have been recommended for cult. as ornamentals.

A. S. HITCHCOCK.

**CHLORÓCODON** (Greek for green and bell, alluding to the flowers). *Asclepiadaceæ*. Twiners, one of which is planted far South.

Large plants with opposite cordate entire heavy lvs., notched stipules and purplish or greenish fls. in axillary panicles: calyx 5-parted; corolla deeply 5-lobed; corona of 5 lobes coming from the base of the filaments, the lobes obcordate or broader, sometimes with an erect or incurved projection or horn on the back; pollen granular.—Two species in Trop. and S. Afr. *C. ecornutus*, N. E. Br., is apparently not in cult.

**Whiteii**, Hook. f. Strong woody twiner, with large opposite cordate-ovate thick lvs. and axillary clusters of odd fls.  $\frac{3}{4}$ -1 in. diam.; corolla rotate-bell-shaped, thick; segms. ovate and acute, purple and with margins and central stripe green, and bearing long-notched lobes; corona-lobes horned; anthers connivent over the capitate stigma. Guinea to Natal. B.M. 5898. G.C. III. 18:243.—It is now cult. in S. Fla. and S. Calif. The roots are used medicinally in Natal, under the name of mundi. The plant is an interesting greenhouse climber, but not handsome. L. H. B.

**CHLORÓGALUM** (green and milk, from the Greek, referring to the juice of the plant). *Liliacæ*. Hardy West American bulbs, allied to *Camassia*.

Tall plants with a tunicated bulb: lvs. at base of st. long-linear, wavy-margined, those on the st. very small: fls. white or pink, in a panicle terminating a nearly leafless st., on jointed pedicels; segms. of perianth 6, 3-nerved, at length twisting over the ovary; stamens 6, not exceeding segms.; style long and deciduous. Plants of easy cult., to be treated like *camassias* or *ornithogalum*s. Three species, in Calif.

A. *Pedicels nearly as long as the fls.: segms spreading from near the base.*

**pomeridiānum**, Kunth (*Anthericum californicum*, Hort.). SOAP-PLANT. AMOLE. St. reaching 5 ft., many-branched, from a very large bulb: fls. small (1 in. or less long) and star-like, numerous, white with purple veins, on spreading pedicels, opening in the afternoon (hence the specific name: *pomeridianus*, *post-meridian*).—Bulb used by Indians and Mexicans for soap-making. Has been catalogued as *Anthericum californicum*. Bulb 4 in. long and half as thick, covered with coarse brown fibers.

AA. *Pedicels very short: segms. spreading from above the base.*

**parviflorum**, Wats. Bulb small (1 in. diam.): st. 1-3 ft., slender-branched; lvs. narrow and grass-like: fls. pinkish,  $\frac{1}{4}$  in. long; ovary broad and acute.

**angustifolium**, Kellogg. Low, about  $1\frac{1}{2}$  ft. Resembles the last, but fls. white and green-lined and somewhat larger, the ovary acute above; perianth funnel-form campanulate, the segms. narrow-oblong.

*C. Leichtlinii*, Baker=*Camassia Leichtlinii*.

L. H. B.

**CHLORÓPHORA** (Greek, referring to the fact that the fustic-tree bears a green dye). *Moracæ*. Two milky-juiced alternate-leaved trees, one in Trop. Afr. and one in Trop. Amer. Lvs. entire or toothed: dioecious; male fls. in cylindrical spikes, the females in nearly globular or oblong heads, these clusters solitary in the axils; perianth of male fls. 4-parted, the segms.

broad and obtuse; stamens 4; ovary a minute rudiment in the males; perianth of female fls. 4-parted or -divided, the segms. concave-thickened at the apex; style lateral on the oblique-ovoid ovary; achene equaling the perianth or somewhat exserted, covering the receptacle. *C. tinctoria*, Gaud. (*Maciara tinctoria*, Don) is the fustic of the W. Indies. It reaches a height of 50 ft., and a diam. of trunk of 2 ft.: usually not thorny: lvs. nearly entire, oblong, acuminate. Variable. The handsome yellow wood yields a yellow dye, which is used also in the making of browns and greens; it is also a strong and resistant timber.

L. H. B.

**CHLORÓPHYTUM** (name means, in Greek, green plant). *Liliacæ*. Rhizomatous herbaceous plants, one of which is familiar in greenhouses.

Very like *Anthericum*, but differing in the thickened filaments of the stamens and the 3-angled or 3-winged caps.: infl. often denser: lvs. broader, often oblanceolate and petiolate: seed disk-like.—Some 60 or more species, in warm parts of Asia, Afr., and Amer. *Consult Anthericum and Paradisea.*

**elatum**, R. Br. (*Anthericum variegatum*, A. *vittatum*, A. *picturatum*, A. *Williamsii*, Hort.). Root fleshy and white: lvs. freely produced from the crown, often 1 in. wide, flattish and bright green, or in the garden varieties with white lines along the margins, and often (*var. picturatum*) also with a yellow band down the center: scape terete and glabrous, 2-3 ft. high, branched; fls. white,  $\frac{1}{2}$  in. long, with revolute oblanceolate segms., which are obscurely 3-nerved on the back. S. Afr. F.S. 21:2240-1.—A valuable and common plant for vases and pots, and sometimes used in summer borders.

Three species that recently have been mentioned in horticultural literature are: *C. amanienae*, Engler, from German E. Afr.; 10 in.: lvs. lanceolate-acuminate, 16 in. long and  $3\frac{1}{2}$  in. or less broad, somewhat fleshy, bronze, with white margin: fls. greenish white, in cluster 6 in. long.—*C. comosum*, Wood (Natal Plants, fig. 279), from Lake Albert. Cent. Afr.; profliferous: lvs. radical, linear, deep green, 2 ft. long: fls. small, white, soon fading, usually in 4's, in a branched cluster 3 ft. long.—*C. Huygheii*, De Wild, Congo; lvs. in a basal tuft, lanceolate, petioled, about 18-20 in. long, 2-2½ in. broad: fls. greenish white, about  $\frac{1}{4}$  in. long, in a bracted raceme 2-3 ft. long.

L. H. B.

**CHLORÓPSIS BLANCHARDIANA**: *Trichloris*.

**CHLORÓXYLON** (green wood: Greek). *Rutacæ*. One species of moderate-sized tree of India, slightly intro. in this country, *C. Swietenia*, DC. (*Swietenia Chloroxylon*, Roxbg.). Young parts gray-puberulent: lvs. abruptly pinnate, the lfts. 20-40, oblique and obtuse and entire: fls. small, 5-merous in terminal and axillary pubescent panicles; calyx deeply lobed; petals clawed, spreading; stamens 10; disk a 10-lobed pubescent body, in which the stamens are inserted: fr. a coriaceous 3-celled caps. Heartwood fragrant, with a beautiful satiny luster, whence the name "Indian Satin-wood." An interesting tree for trial on the southern borders of the U. S.

L. H. B.

**CHOCOLATE**: *Theobroma*.

**CHOÍSYA** (J. D. Choisy, Swiss botanist, 1799-1859). *Rutacæ*. One Mexican shrub, *C. ternata*, HBK., grown in S. Calif. and S. Fla., and sometimes under glass. It grows 4-8 ft. high, making a compact free-blooming bush, with opposite ternate lvs., the lfts. lance-obovate or oblong, thick and entire, with pellucid dots: fls. in a terminal, forking cluster, white, fragrant, orange-like (whence the vernacular name "Mexican orange"), 1 in. across, with pellucid dots. R.H. 1869:330. Gn. 50, p. 203. J.H. III. 34:253.—A handsome shrub, worthy of greater popularity. It will endure several degrees of frost, and should succeed in the open in many of the southern states. Blossoms in S. Calif. at different seasons; it can be made to bloom, it is said, every two months by withholding water and then watering liberally, as is done with roses in S. France. Hardy against a wall in parts of S. England.

L. H. B.

**CHOKE-CHERRY:** *Prunus demissa* (West) and *P. virginiana* (East).

**CHONDROBOLLEA** (compounded from *Chondrorhyncha* and *Bollea*). A genus established to contain hybrids between these genera. See also *Bolleo-Chondrorhyncha*.

**CHONDROPÉTALUM:** hybrids of *Chondrorhyncha* and *Zygopetalum*; see those genera.

**CHONDRORHYNCHA** (*cartilage* and *beak*). *Orchidaceæ*. Three species of S. American epiphytal orchids, practically unknown in the American trade. Cult. as for *Odontoglossum crispum*. They are short-stemmed herbs without pseudobulbs, and oblong, plicate, petioled lvs., the simple scape bearing a single large, odd, yellowish fl. *C. Chéstertonii*, Reichb. f. (O.R. 11:305; 16:57), *C. fimbriata*, Reichb. f., and *C. rosea*, Lindl., are the species. Keep cool and moist. A garden hybrid is reported between *C. Chéstertonii* and *Zygopetalum Mackayi* under the name of *Chondropetalum Fletcheri*. O.R. 1908, 56, f. 8.

GEORGE V. NASH.

**CHORÍSIA** (Ludwig Choris, born 1795, artist of Kotzebue's expedition). *Bombacææ*. Spiny trees of S. Amer. (3 species), one of which is somewhat cult. Lvs. alternate, digitate, of 5-7 entire or serrate lfts.: fls. large, with 5 linear or oblong petals, the peduncles axillary or racemose; staminal tube double, the outer one short and with sterile anthers; ovary 5-loculed and many-ovuled: fr. a pear-shaped caps. with many silky seeds. *C. speciosa*, St. Hil., of Brazil, the "floss silk tree," is cult. in S. Calif., and is adapted to warm glasshouses. It is a medium-sized tree, allied to *Ceiba* and *Bombax*. Lfts. lanceolate, acuminate, dentate; calyx irregular, shining outside, but silky inside; petals obtuse, yellowish and brown-striped at the base, pubescent on the back. The soft silk or cotton of the seed-pods is used for pillows and cushions. L. H. B.

**CHORÍZEMA** (fanciful Greek name). Sometimes spelled *Chorozema*. *Leguminosæ*. Evergreen coolhouse small shrubs grown for the showy pea-like yellow orange and red, usually racemose flowers; spring- and summer-blooming.

Woody plants of diffuse or half-climbing habit, with thick and shining simple often spiny-toothed lvs. and pea-like red or yellow fls.: calyx-lobes 5, the 2 upper ones mostly broader; petals clawed, the standard very broad, keel short; stamens not united: pod short, not constricted.—About 15 species, in Austral., 3 of which



925. *Chorizema ilicifolium*. (× 1/3)

appear to be chiefly concerned in the garden forms. Handsome plants for the cool greenhouse, less popular in this country than abroad. When not grown too soft, they will stand slight frost at times. Grown in the open in S. Calif. and S. Fla. They are grown in a rather peaty soil, after the manner of azaleas, and usually rested in the open in summer. They are excellent for training on pillars and rafters.

Chorizemas are among the most attractive spring-flowering plants, and they are not difficult to grow. Cuttings should be secured in March from medium-ripened wood and may be either potted singly in small pots, or several placed together in larger pots. The

former method has the advantage, because when cuttings are well rooted in the small pots, they may be shifted along without so much disturbance to the roots. The cuttings root readily in a mixture of two parts sharp sand and one of peat, sifted through a fine sieve. They should be placed in a tight case or covered with a bell-glass in a temperature of 58° to 60° by night. A rise of 10° in the day will be sufficient. The inclosure that protects them from drafts should be opened a few minutes now and then to change the air. For potting chorizemas in the early stages, equal parts of good peat and sharp sand is about right. When a 5- or 6-inch pot is reached, much less sand should be used,—just enough to give the earth a gritty feeling and the peat may be in a rather rough state, just small enough to be conveniently used in potting. The potting should be firm, as loose potting is bad for all kinds of hardwood plants. Keep the plants shaded from the sun during the hot months, and use the syringe freely. Also pinching must be attended to from their early stages to insure a good bushy plant. It is best not to stop the plants after August, as they will begin then to set buds. A plant in a 5- or 6-inch pot may be grown the first year if properly attended to. The plants should be wintered in a night temperature of 40° with a rise of 10° or 15° during the day. The second summer, and from that on as long as the plants are kept, they do better if plunged in a bed of clean coal-ashes out-of-doors, provided there is no danger from frost; by so doing, a much shorter-jointed growth will be the result. Plants well established in their pots may be fed with liquid manure until they set buds. A 3-inch potful of cow- or horse-urine to two and one half or three gallons of water, will be sufficient, and for a change a handful of soft-coal soot to the same amount of water; but always water twice with clean water between applications. Brown scale sometimes gets a foothold on chorizemas and it may be eradicated by fumigation with cyanide of potassium. Red-spider may be kept down with the syringe. (George F. Stewart.)

**varium**, Benth. (*C. elegans*, Hort.). The common cult. species, in several forms: erect, 4-6 ft., pubescent on under side of lvs. and on branches: lvs. cordate-ovate, undulate and prickly-toothed, 2 in. or less long: fls. in many pubescent racemes; standard light orange, wings and keel handsome purple-red. B.R. 25:49.—Garden forms are *C. Chandleri*, with yellow-red standard, and blood-red wings, the fls. large and numerous; and such names as *grandiflorum*, *macrophyllum*, *latifolium*, *floribundum*, *multiflorum*. *C. Löwii*, Hort., is a form of this species, with larger and brighter-colored fls.

**cordatum**, Lindl. (*C. superbum*, Lem.). Tall slender glabrous shrub (7-10 ft.), with weak branches: lvs. cordate-ovate to ovate-lanceolate, 2 in. or less long, small-toothed and more or less prickly: fls. many; standard scarlet-red, wings and keel purple-red. B.R. 24:10. I.H.:29. Var. *rotundifolium*, Hort., has roundish lvs. Var. *splendens*, Hort., is offered.

**ilicifolium**, Labill. Fig. 925. Low and diffuse, weak, glabrous, the branches slender and erect or drooping: lvs. ovate to lanceolate, 1 in. long, often cordate at base, thick, coarsely veined, strongly undulate and with prickly teeth or lobes: fls. in few-fld. loose racemes, orange-red in spring and summer. B.M. 1032 (as *C. nanum*). B.R. 1513 (as *C. triangulare*). L. H. B.

**CHRISTMAS FLOWER:** *Euphorbia pulcherrima*.

**CHROSPÉRMA:** *Zygadenus*.

**CHROZÓPHORA** (Greek, *color-bearing*, on account of their use). *Euphorbiææ*. Dye-yielding herbs. Lvs. alternate, stellate hairy: fls. monœcious; staminate calyx 5-parted, valvate; petals free; styles biparted;



ovary 3-celled, 3-ovuled.—Nine, species chiefly of Old World deserts. *C. tinctoria*, Juss. (*Crōton tinctorius*, Linn.), TURNSOLE, a Medit. annual, formerly used for its blue dye, is listed in some European catalogues.

**CHRYSALIDOCÁRPUS** (Greek for *golden fruit*). *Palmaceæ*, tribe *Arécæ*. Spineless stoloniferous feather palms, with medium fasciculate ringed stems.

Leaves pinnatisect, long-acuminate; segms. about 100, bifid at the apex, the lateral nerves remote from the midrib; fr. usually violet or almost black.—Species 1, which is a popular florist's plant. Madagascar. Treated



926. *Chrysalidocarpus lutescens*.

as a part of *Hyophorbe* by Engler and Prantl, but here kept distinct, as it is commonly known as *Chrysalidocarpus* by cultivators.

*lutescens*, Wendl. (*Hyophorbe indica*, Gaertn. *H. Commersoniana*, Mart. *Aréca lutescens*, Bory). Fig. 926. St. 30 ft. high, 4-6 in. diam., cylindrical, smooth, thickened at the base; lvs. very long; segms. almost opposite, lanceolate, 2 ft. long, 2½ in. wide, acute, with 3 prominent primary nerves, which are convex below and acutely 2-faced above. Bourbon. A.G. 13: 141. A.F. 4:566.—In growing *Chrysalidocarpus* (or *Aréca*) *lutescens* in quantity, it will be found a good plan to sow the seeds either on a bench, in boxes or seed-pans, so prepared that the seedlings will remain in the soil in which they germinate until they have made 2 or more lvs. The first lf. made above the soil is small, and if plants are potted off at this stage they must be very carefully watered in order not to sour the soil. In the preparation of the receptacles for the seed, a little gravel in the bottom will be found good, as the roots work very freely through it, and when the time comes to separate the plants previous to potting, it is an easy matter to disentangle the roots without bruising them. Probably the plan which works best is to wash the soil and gravel entirely from among the roots. Pot in soil not too dry, and for the next few days keep the house extra warm and humid, and the plants shaded from the sun without any moisture applied to the soil.

JARED G. SMITH and G. W. OLIVER.

**CHRYSANTHEMUM** (Greek, *golden flower*). Including *Pyrethrum*. *Compósitæ*. Plate XXX. A diverse group of herbaceous and sub-shrubby plants, mostly hardy, and typically with white or yellow single flowers, but the more important kinds greatly modified in form and color, grown in the open or flowered under glass in fall.

Annual or perennial herbs, sometimes partly woody, glabrous or loosely pubescent or rarely viscid, usually heavy-scented: lvs. alternate, various, from nearly or quite entire to much dissected: heads many-fl., terminating long peduncles or disposed in corymbose clusters, radiate (rays sometimes wanting); disk-fls. perfect and mostly fertile; ray-fls. pistillate, mostly fertile, the ray white, yellow, rose-colored, toothed or entire; receptacle naked, flat or convex; involucre-scales imbricated and appressed, mostly in several series, the margins usually scarious: achene of disk- and ray-fls. similar, striate or angled or terete or more or less ribbed, those of the ray-fls. often 3-angled; pappus 0, or a scale-like cup or raised border.—Probably nearly 150 recognizable species, in temperate and boreal regions in many parts of the globe, but mostly in the Old World.

The genus *Chrysanthemum*, as now accepted by botanists, includes many diverse species so far as general appearance is concerned, but nevertheless well agreeing within themselves in systematic marks and by these same marks being separated from related groups. The marks are in large part set forth in the preceding paragraph. Bentham and Hooker make twenty-two sub-groups (of which about six include the garden forms), based chiefly on the way in which the seeds are ribbed, cornered, or winged, and the form of the pappus. The garden pyrethrums cannot be kept distinct from chrysanthemums by garden characters. The garden conception of *Pyrethrum* is a group of hardy herbaceous plants with mostly single flowers, as opposed to the florists' or autumn chrysanthemums, which reach perfection only under glass, and the familiar annual kinds which are commonly called summer chrysanthemums. When the gardener speaks of pyrethrums, he usually means *P. roseum*. Many of the species described below have been called pyrethrums at various times, but they all have the same specific name under the genus *Chrysanthemum*, except the most important of all garden pyrethrums, viz., *P. roseum*, which is *C. coccineum*. The feverfew and golden feather are still sold as pyrethrums, and there are other garden species of less importance. The botanical conception of *Pyrethrum* is variously defined; the presence of a rather marked pappus-border on the achene is one of the distinctions; the pyrethrums are mostly plants with large and broad heads either solitary or in loose corymbose clusters, the rays usually conspicuous and commonly not yellow, and the fruits five- to ten-ribbed. Hoffmann, in Engler & Prantl "Natürlichen Pflanzenfamilien," adopts eight sections, one of them being *Tanacetum* (tansy) which most botanists prefer to keep distinct.

Although the genus is large and widespread, the number of plants of interest to the cultivator is relatively few. Of course the common garden chrysanthemum, derived apparently from two species, is the most useful. The insect powder known as "pyrethrum," is produced from the dried flowers of *C. cinerariæfolium* and *C. coccineum*. The former species grows wild in Dalmatia, a long narrow mountainous tract of the Austrian empire. "Dalmatian insect powder" is one of the commonest insecticides, especially for household pests. *C. cinerariæfolium* is largely cultivated in France. *C. coccineum* is cultivated in California, and the product is known as buhach.

There are over one hundred books about the garden chrysanthemum, and its magazine literature is probably exceeded in bulk only by that of the rose. It is the flower of the East, as the rose is the flower of the West.

Aside from oriental literature, there were eighty-three books mentioned by C. Harman Payne, in the Catalogue of the National Chrysanthemum Society for 1896. Most of these are cheap cultural guides, circulated by the dealers. The botany of the two common species has been monographed by W. B. Hemsley in the *Gardeners' Chronicle*, series III, vol. 6, pp. 521, 555, 585, 652, and in the *Journal of the Royal Horticultural Society*, vol. 12, part I. The great repositories of information regarding the history of the chrysanthemum, from the garden point of view, are the scattered writings of C. Harman Payne, his "Short History of the Chrysanthemum," London, 1885, and the older books of F. W. Burbidge and John Salter. For information about varieties, see the Catalogues of the National Chrysanthemum Society (England) and the *Liste Descriptive*, and supplements thereto, by O. Meulenaere, Ghent, Belgium.



927. *Chrysanthemum carinatum*, the form sold as *C. Burridgeanum*. ( $\times \frac{1}{2}$ )

There are a number of rather expensive art works, among which one of the most delightful is the "Golden Flower: Chrysanthemum," edited by F. Schuyler Mathews, Prang, Boston, 1890. "Chrysanthemum Culture for America," by James Morton, Clarksville, Tenn., published in New York in 1891, was the first authentic American work. Within the past few years have appeared "The Chrysanthemum," by Arthur Herrington, "Smith's Chrysanthemum Manual," by Elmer D. Smith, and recently "Chrysanthemums and How to Grow Them," by I. L. Powell.

Aside from the florist's chrysanthemum (*C. hortorum*), no particular skill is required in the growing of these plants, although great perfection is attained by some gardeners in the handling of individual plants of the marguerites (*C. frutescens*). The hardy border perennial chrysanthemums may be either small-flowered rugged forms of *C. hortorum*, as the "hardy pompons" and also the "artemisias" of old gardens, or they may be other species. Some of these other species are the "pyrethrums" of gardens, and some (as the *C. maximum* and *C. uliginosum* class) are the "moon daisies" and "moonpenny daisies" of the hardy perennial plantation. Some of the very dwarf tufted kinds (as *C. Tchihatchewii*) make excellent edging plants. The moon daisies deserve to be better known for mass planting and bold lines when a great display of heavy white bloom is wanted. Most of them bloom the first season from early-sown seed. The Shasta daisy and its derivatives are of the moon daisy group. They all profit by a covering of coarse mulch in the fall. See *Pyrethrum* and *Marguerite*.

The annual chrysanthemums are easily grown flower-garden subjects, suitable for a bold late display in places where delicate and soft effects are not desired.

*C. carinatum*, *C. coronarium* and *C. segetum* are the common sources of these annuals. They are hardy and rugged; and they need much room.

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#### A. Plant annual (at least so treated in cult.): the "summer chrysanthemums."

##### B. Rays typically white.

1. *carinatum*, Schousb. (*C. tricolor*, Andr. *C. matricaroides*, Hort.). Fig. 927. Glabrous annual, 2-3 ft. high; st. much branched; lvs. rather fleshy, pinnatifid: fls. in solitary heads which are nearly 2 in. across, with typically white rays and a yellow ring at the base; involucre bracts carinate (keeled). Summer. The two colors, together with the dark purple disk, gave rise to the name "tricolor." The typical form, intro. into England from Morocco in 1798, was pictured in B.M. 508 (1799). By 1856 signs of doubling appeared (F.S. 11:1099). In 1858 shades of red in the rays appeared in a strain intro. by F. K. Burridge, of Colchester, England, and known as *C. Burridgeanum*, Hort. (see B.M. 5095, which shows a ring of red on the rays, adding a fourth color to this remarkably brilliant and varied fl., and F.S. 13:1313, which also shows *C. venustum*, Hort., in which the rays are entirely red, except the original yellow circle at the base). G. 2:307. Gn.W. 24:675. *C. annulatum*, Hort., is a name for the kinds with circular bands of red, maroon, or purple. R.H. 1869:450. *C. Dunnettii*, Hort., is another seed-grower's strain. There are full double forms in yellow margined red, and white margined red, the fls. 3 in. across (see R.H. 1874:410), under many names. See, also, Gn. 26, p. 440; 10, p. 213; 21:22. R.H. 1874, p. 412. S.H. 2:477. G.W. 14, p. 99.—The commonest and gaudiest of annual chrysanthemums, distinguished by the keeled or ridged scales of involucre and the dark purple disk.

##### BB. Rays typically tight yellow.

2. *coronarium*, Linn. (*Anthemis coronaria*, Hort.), Annual, 3-4 ft.: lvs. bipinnately parted, somewhat clasping or eared at the base, glabrous, the segms. closer together than in *C. carinatum*: involucre scales broad, scarious; rays lemon-colored or nearly white. July-Sept. Medit. Gn. 26:440. G.C. II. 19:541.—The full double forms, with rays reflexed and imbricated, are more popular than the single forms. This and *C. carinatum* are the common "summer chrysanthemums." This is common in old gardens, and is also somewhat used for bedding and for pot culture.

##### BBB. Rays typically golden yellow.

3. *segetum*, Linn. CORN MARIGOLD. Annual, 1-1½ ft.: lvs. sparse, clasping, oblong to oblanceolate, variable, the lower petioled and the upper clasping incisions coarse or fine, deep or shallow, but usually only coarsely serrate, with few and distant teeth, the lower ones less cut; bracts of involucre broad, obtuse; rays obovate and emarginate, golden yellow. June-Aug. Eu., N. Afr., W. Asia. Escaped in waste places. Gn. 18, p. 195. R.H. 1895, pp. 448, 449. Var. *grandiflorum*, Hort., is a larger-fl. form of this weed, which is com-



mon in the English grain fields. Forms of the plant are cult.; the var. *Cloth of Gold*, J.H. III. 12:445, is one of the best. Var. *pumilum*, Hort., very compact, 8 in. high. This species is much less popular than *P. carinatum* and *P. coronarium*. It is forced to a slight extent for winter bloom.

4. *multicaule*, Desf. Glabrous and glaucous annual, 6-12 in. high: sts. numerous, simple or branched, stout, terete: lvs. fleshy, variable, usually linear-spatulate, 1-3 in. long and  $\frac{1}{2}$ - $\frac{3}{4}$  in. broad, very coarsely toothed or lobed, sometimes shorter, with few narrow-linear, acute, entire segms. about 1 line broad: rays much shorter and rounder than in *C. segetum*, golden yellow. Algeria. B.M. 6930.—Rarer in cult. than the last. Said to be useless as a cut-fl.

AA. Plant perennial.

B. The florist's chrysanthemum, and wild progenitors or near relatives, grown as pot or bench subjects because the seasons are not long enough, in the N., for full maturity in the open: heads often double: lvs. usually lobed or strongly notched.

5. *morifolium*, Ram. (*C. sinense*, Sabine). Fig. 928. Perennial, one of the sources (with *C. indicum*) of the large florist's chrysanthemums: wild plant shrubby, erect and rigid, 2-3 ft., branching, few-lvd.: lvs. thick and stiff, 2 in. long, densely white-tomentose beneath, variable in shape from ovate to lanceolate, cuneate at base, margin entire or coarsely toothed: outer bracts of involucre thick, linear, acute, white-tomentose; fl.-heads small, with yellow disk and white rays somewhat exceeding the disk. China. G.C. III. 31:302 (adapted in Fig. 928). Var. *gracile*, Hemsl. Lvs. thin or only moderately thick, palmately lobed or pinnately lobed, dentate, the teeth often mucronate: outer involucre bracts herbaceous, linear and acute, varying in pubescence; rays white, pink or lilac, equaling or exceeding the disk. China, Mongolia, Japan.

6. *indicum*, Linn. Fig. 929. Much like the last, but lvs. thin and flaccid, pinnately parted, with acute or



929. Wild form of *Chrysanthemum indicum*, as grown in England.

mucronate teeth: outer involucre bracts broad and scarious except the herbaceous midnerve; rays yellow, shorter than diam. of the disk. China and Japan. B.M. 7874. G.C. III. 8:565; 28:342; 31:303 (adapted in Fig. 929).—This species is not native to India, and therefore Linnaeus' name is inappropriate. Abroad, *C. indicum* is often used in a wide sense, to include *C. morifolium*. In recent years, both *C. morifolium* and *C. indicum* have been grown in England from wild stock, and from such studies of them the present descriptions and figures are drawn. From these plants it is supposed, by endless variation and by hybridization, the highly developed glasshouse or florist's chrysanthemums have come, a group that may be distinguished as *C. hortorum*, Figs. 938-50.

7. *ornatum*, Hemsl. (*C. marginatum*, Hort.). Allied to the above two species, and perhaps a form of *C. morifolium*: bushy plant, 3-4 ft.: lvs. palmately lobed, ovate in outline, white-tomentose beneath and on the margin,  $1\frac{1}{2}$ -2 in. long: fl.-heads loosely corymbose, 2 in. or less across, the disk yellow and rays white and broad; bracts of involucre in about 3 series, all similar, white in center, purple-brown on margin: achenes small, oblique, glabrous. B.M. 7965. G.C. III. 35:51. Gn. 71, p. 53; 73, p. 90.—A recent introduction; grows well in the open in England, but does not bloom unless taken indoors.

BB. The garden pyrethrums and others; heads usually not highly doubled and modified.

c. Lvs. cut to the midrib or nearly so.

D. Heads borne in corymbs, i.e., flat-topped, dense clusters.

EE. Rays yellow.

8. *achilleæfolium*, DC. (*Achillea aurea*, Lam.). Perennial, 2 ft.: st. usually unbranched, except along the creeping and rooting base: sts. and lvs. covered with fine soft grayish white hairs, oblong in outline, about 1 in. long,  $\frac{1}{4}$  in. wide, finely cut: rays 7-8, short, a little longer than the involucre. Siberia, Caucasus.—Rare in cult. Less popular than the achilleas, with larger fl.-clusters.

EE. Rays white.

9. *corymbosum*, Linn. (*Pyræthrum corymbosum*, Willd.). Robust perennial, 1-4 ft.: st. branched at the apex: lvs. sometimes 6 in. long, 3 in. wide, widest at middle and tapering both ways, cut to the very midrib, the segms. alternating along the midrib. Eu., N. Afr., Caucasus. G.C. II. 20:201.—Rare in cult. Segms. may be coarsely or finely cut, and lvs. glabrous or vilous beneath.



928. Wild form of *Chrysanthemum morifolium*, as grown in England.

10. *Parthénium*, Pers. (*Pyrèthrum Parthénium*, Smith. *Parthénium Matricària*, Guedl.). **FEVERFEW**. Fig. 930. Glabrous strong-scented perennial, 1-3 ft., much branched in the taller forms; lvs. ovate or oblong-ovate in outline, pinnatisect or bi-pinnatisect, smooth or lightly pubescent; segms. oblong or elliptic-oblong, pinnatifid or cut, the uppermost more or less confluent.; fl.-heads small, many, stalked, corymbose; disk yellow; rays white, oblong, equaling or exceeding the disk. Eu. to the Caucasus.—Some authors regard this as one widely variable species; others make at least two species, one of them (*C. præaltum*, Vent.) being the Caucasian form, distinguished by more deeply cut lvs., longer-peduncled heads, and rays longer than the disk rather than equaling it (as in *C. Parthenium* type).—There are double-fl. and also discoid forms. Var. *aureum*, Hort. (*P. aureum*, Hort.), is the **GOLDEN**



930. *Chrysanthemum Parthenium*. Feverfew.  
( $\times \frac{1}{2}$ )

**FEATHER** commonly used for carpet-bedding. It has yellow foliage, which becomes green later in the season, especially if fls. are allowed to form. It is used for edgings and cover. Var. *aureum crispum*, Hort., is dwarf, compact, with foliage curled like parsley. Var. *selaginoides*, and var. *laciniatum*, Hort., are distinct horticultural forms. Var. *glaucum*, Hort., has dusty white foliage, and does not bloom until the second year. Intro. by Danman & Co., 1895. All these varieties are prop. by seeds. The feverfew is common about old yards, and is much employed in home gardens as edging. In its undeveloped and prevailing forms, it is one of the "old-fashioned" plants.

DD. Heads borne singly on the branches or sts. (or at least not definitely clustered).

E. Height less than 1 ft.

11. *Tchihatchewii*, Hort. (*C. Tchihatcheffii*, Hort.). **TURFING DAISY**. Densely tufted perennial for carpet-

ing dry, waste places; height 2-9 in.: sts. very numerous, rooting at the base: foliage handsome dark green, finely cut, the segms. linear, persisting into winter: fl.-heads solitary on axillary peduncles, borne profusely for several weeks; rays white, disk yellow. Asia Minor. R.H. 1869, p. 380, desc., and 1897, p. 470. Gn. 26, p. 443.—Prop. by division of roots or simply by cutting the rooted sts., but chiefly by seeds. Highly recommended abroad for spring and early summer bloom in edgings and low formal plantings. Said to thrive in dry places and under trees.

EE. Height more than 1 ft.

F. Group of greenhouse plants (at the N.), shrubby at the base: sts. branched at the top: rays white or lemon.

G. Foliage not glaucous.

12. *frutescens*, Linn. **MARGUERITE**. **PARIS DAISY**. Figs. 931, 932. Usually glabrous, 3 ft. high, perennial: lvs. fleshy, green: heads numerous, always single; rays typically white, with a lemon-colored (never pure yellow or golden) form. Canaries. G.C. II. 13:561; III. 35:216. Gn. 12, p. 255; 17, p. 5; 26, p. 445; 70, p. 310.—Intro. into England. 1699. This is the popular florists' Marguerite, which can



931. *Chrysanthemum frutescens*.  
The Marguerite or Paris daisy.  
( $\times \frac{1}{2}$ )

be had in flower the year round, but is especially grown for winter bloom. Var. *grandiflorum*, Hort., is the large-fl. prevailing form. The lemon-colored form seems to have originated about 1880. Under this name an entirely distinct species has also been passing, yet it has never been advertised separately in the American trade. See No. 13.

GG. Foliage glaucous.

13. *anethifolium*, Brouss. (*C. feniculaceum*, Steud. *P. feniculaceum* var. *bipinnatifidum*, DC.). **GLAUCOUS MARGUERITE**. Fig. 932. Perennial: rarer in cult. than *C. frutescens* (which see), but distinguished by its glaucous hue, and by the way in which the lvs. are cut. The segms. are narrower, more deeply cut, and more distant than in No. 12. The lvs. are shorter petioled. Canaries.—This species is doubtless cult. in American greenhouses as *C. frutescens*. A lemon-fl. form is shown in R.H. 1845:61 but called *C. frutescens*.



FF. Group of hardy outdoor herbs: sts. usually unbranched: rays white or red, never yellow.

G. Foliage not glaucous: fls. sometimes double.

14. *coccineum*, Willd. (*Pyrèthrum roseum*, Bieb., not Web. & Mohr. *P. hybridum*, Hort.). Fig. 933. Glabrous perennial, 1-2 ft. high: st. usually unbranched,



932. Leaves of *Chrysanthemum frutescens* (left) and *C. anethifolium* (right). ( $\times 1$ )

rarely branched at the top: lvs. thin, dark green, or in dried specimens dark brown: involucre scales with a brown margin; rays white or red in such shades as pink, carmine, rose, lilac, and crimson, and sometimes tipped yellow, but never wholly yellow. Caucasus, Persia. F.S. 9:917. Gn. 26, pp. 440, 443. Gng. 2:7; 5:309. R.H. 1897, p. 521. Not B.M. 1080, which is *C. coronopifolium*. The first picture of a full double form is R. H. 1864:71.—This species is the most important and variable of all the hardy herbaceous kinds. There have been perhaps 700 named horticultural varieties. There is an anemone-fl'd. form with a high disk. The species is also cult. in Calif. and France for insect powder. *C. atrosanguineum*, Hort., is said to be a good horticultural variety with dark crimson fls. The *C. roseum* of Weber & Mohr being a tenable name, Hoffmann proposes Ascherson's name, *C. Marshallii*, for the *P. roseum* of Bieberstein; but Willdenow's *C. coccineum* is here retained.

gg. Foliage glaucous: fls. never double.

15. *cinerariæfolium*, Vis. Glaucous perennial, slender, 12-15 in. high: sts. unbranched, with a few short, scattered hairs below the fl.: lvs. long-petioled, silky beneath, with distant segms.: involucre scales scarious and whitish at the apex. Dalmatia. B.M. 6781.—Said to be chief source of Dalmatian insect powder. Rarely cult. as border plant. Common in botanic gardens.

cc. Lvs. not cut to the midrib, pinnatifid or coarsely toothed (except perhaps in No. 22).

d. Heads borne in clusters, mostly flat-topped

16. *Balsámíta*, Linn. (*Tanacetum Balsámíta*, Linn. *Pyrèthrum Balsámíta*, Willd. *Balsámíta vulgaris*, Willd.). COSTMARY. MINT GERANIUM. Sometimes erroneously called "lavender," from its sweet agreeable odor. Tall and stout perennial: lvs. sweet-scented, oval or oblong, obtuse, margined with blunt or sharp teeth, lower ones petioled, upper ones almost sessile, the largest lvs. 5-11 in. long,  $1\frac{1}{2}$ -2 in. wide: pappus a short crown. W. Asia.—Typically with short white rays, but when they are absent the plant is var. *tanacetoides*, Boiss. Fig. 934. Rayless. This has escaped in a few places from old gardens: it seems to be the prevailing garden form.

DD. Heads borne singly on the branches or sts., or at least not in definite clusters; rays large, white.

17. *lacústre*, Brot. (*C. latifolium*, DC.). Fig. 935. Perennial; endlessly confused with *C. maximum* in gardens, and the two species are very variable and difficult to distinguish; the fls. can hardly be told apart. *C. lacustre* is a taller and more vigorous plant, and sometimes it is branched at the top, bearing 3 heads, while *C. maximum* is always 1-headed, and the lvs. in that species are much narrower. Height 3-6 ft.: st. sparsely branched: lvs. partly clasping, ovate-lanceolate, with coarse, hard teeth: rays about 1 in. long; pappus of the ray 2-3-eared. Portugal, along rivers, swamps and lakes. R.H. 1857, p. 456.

18. *máximum*, Ramond. Fig. 936. This perennial species has narrower lvs. than *C. lacustre*, and they are narrowed at the base: height 1 ft.: st. more angled than the above, simple or branched at the very base, always 1-headed and leafless for 3-4 in. below the head: lower lvs. petioled, wedge-shaped at the base, or long-ob lanceolate; the upper lvs. becoming few, lanceolate but usually not very prominently pointed, the teeth not very large or striking: pappus none: involucre scales narrower and longer, whitish-transparent at the margin, while those of *C. lacustre* are broader, more rounded at the apex, and with a light brown scarious margin. Pyrenees. J.H. III. 5:251. Gn. 26, p. 437; 73, p. 567. G. 5:445. G.M. 46:676. Var. *Róbinsonii*, Hort., has finely cut or fringed rays, giving the bloom the appearance of a Japanese chrysanthemum.

R. H. 1904:515. Var. *Dávidsii*, Hort., has sts. of great length, suitable for cutting. Var. *filifórmis*, Hort., has deeply serrate long and drooping rays. There are many other forms, differing in time of bloom as well as in habit and in form of fl. The *Shasta daisy* (said to be a



933. *Chrysanthemum coccineum*. The *Pyrèthrum roseum* of gardens. ( $\times \frac{1}{2}$ )

934. *Chrysanthemum Balsámíta* var. *tanacetoides*. Costmary or mint geranium. ( $\times \frac{1}{2}$ )

hybrid) is an early-flowering very floriferous race, with several strains of fls., mostly large and pure white, although in one form the buds are reported as lemon-yellow but opening white; various sub-varieties are now offered. It is a good summer and autumn bloomer, and usually hardy in the northeastern states.



935. *Chrysanthemum lacustre*. A short-rayed form. ( $\times \frac{1}{2}$ )

19. *uliginosum*, Pers. (*Pyrethrum uliginosum*, Waldst.). GIANT DAISY. Stout, erect bushy leafy-stemmed perennial, 4-7 ft. high, with light green foliage: st. nearly glabrous, striate, branching above, roughish: lvs. long-lanceolate, prominently pointed, with large coarse sharp teeth: heads often several together and not long-stalked, 2-3 in. across, white, late. Hungary. B.M. 2706. A.F. 4:523; 8:813. Gng. 2:375; 5:183. A.G. 19:403. R.H. 1894, p. 82. Gt. 46, p. 103. G.C.H. 10:493. Gn. 26, p. 442; 38, p. 523; 62, p. 180. G.W. 15, p. 316. G.M. 51:453. Gn. W. 23:415.

—It blooms the first year from seed or division, and has been forced for Easter somewhat as *Hydrangea paniculata* can be

treated. Excellent for cut-fls. The blossoms should be cut soon after opening, as the disks darken with age. The plant needs a rich moist soil; it deserves a greater popularity.

20. *Leucanthemum*, Linn. (*Leucanthemum vulgare*, Lam.). WHITEWEED. OX-EYE DAISY. Fig. 937. Glabrous perennial erect weed, 1-2 ft. high: root-lvs. long-petioled, with a large, oval blade and coarse, rounded notches; st.-lvs. lanceolate, becoming narrower toward the top, serrate, with few distant and sharper teeth. (Var. *pinnatifidum*, Lec. & Lam., has more divided lvs.): heads terminal, showy white. June, July. Eu., N. Asia. Gn. 70, p. 176. —One of the commonest weeds in the eastern states, being characteristic of worn-out meadows. The daisies are not cult., but they are often gathered for decoration, and make excellent cut-fls. The plant is very variable, and forms adapted to fl.-garden uses will probably be developed. Rayless plants are sometimes found.

21. *nipponicum*, Hort. (*Leucanthemum nipponicum*, Franch.). Differs from others of this set in being shrubby at base and lvs. broadest above the middle: to 2 ft., the sts. strong, simple, few-fl.: lvs. thick, oblong-spatulate to oblanceolate, sessile, irregularly denticulate but entire at base, 3-4 in. long, pale beneath: fl.-heads 2-3½ in. across, with a hemispherical involucre of oval

obtuse bracts; rays bright white, linear, minutely 5-toothed; disk pale greenish yellow. Japan. B.M. 7660. R.H. 1905, p. 47. F. E. 20:434.—Hardy in the N., in the root, but the sts. killed down by frost; has the general appearance of *C. lacustre*. A beautiful large-fl. species, producing its large blooms in late autumn.

22. *arcticum*, Linn. Low perennial, 3-15 in., glabrous or nearly so: lvs. cuneate, long-tapering at base, toothed or cut at the apex, sometimes 3-5-lobed, the uppermost ones small and very narrow and nearly entire: involucre-bracts broad and brown-margined; rays clear white, about 1 in. long: pappus wanting. Arctic Eu., Asia and Amer. —An attractive very hardy species, making a clump of dark green foliage and producing in autumn many large white fls., sometimes tinged lilac or rose.

*C. coronopifolium*, Willd. = *C. roseum*. — *C. grande*, Hook. f. (*Plagius grandiflorus*, L'Her.). Stout erect perennial of Algeria, 2-3 ft.: lvs. oblong to linear-oblong, often lyrate, coarsely toothed: fl.-heads large, solitary, rayless, golden yellow, to 2 in. across. B.M. 7886. — *C. grandiflorum*, Willd. Shrubby, smooth, from the Canaries, with cuneate lobed lvs., the parts lanceolate or linear and toothed or entire: fl.-heads solitary, the rays white and disk yellow: allied to *C. frutescens*; variable. — *C. inodorum*, Linn. = *Matricaria inodora*. — *C. macrophyllum*, Waldst. & Kit. Perennial herb, 3 ft.: lvs. very large, nearly sessile, pinnatisect, the lobes lanceolate and coarsely toothed: heads very many, corymbed; rays white with yellowish tinge, the disk yellow. June, July; an outdoor plant. Hungary. G.W. 12, p. 410. — *C. Mawii*, Hook. f. Herbaceous, with woody rootstock, 1½ ft.: lvs. about 1 in. long, triangular to oblong, pinnatifid: fl.-heads 1½ in. diam., long-stalked; rays 3-toothed, white with reddish backs. Mts. Morocco; summer in the open. B.M. 5997. — *C. multiflorum*, Hort. Fls. greenish white: said to be a cross between a single-fl. chrysanthemum and *C. Pallasianum* (*Pyrethrum Pallasianum*, Maxim., of N. Asia, apparently not a garden species). — *C. ochroleucum*, Masf. Glabrous undershrub of the Canaries: lvs. obovate-cuneate, coarsely toothed: rays pale yellow. — *C. parthenioides*, Willd., a form of *C. Parthenium*. — *C. parthenioides*, Voss. One of the feverfew forms; probably *C. præaltum*. — *C. roseum*, Web. & Mohr. (*C. coronopifolium*, Willd., not Vill.), not Bieb. Perennial herb, 2½ ft.: lvs. once-pinnate: fl.-heads solitary; rays rose-red or flesh-color. Caucasus. — *C. tomentosum*, Loisel. An alpine Corsican species: tufted, 2 in. high when in bloom: lvs. pinnatifid, densely tomentose: fl.-heads ¾ in. across, white-rayed, on sts. 1 in. long. — *C. viscosum*, Desf. Annual: disk orange-yellow, rays sulfur-yellow. Medit. — *C. vulgare*, Bernh. = *Tanacetum vulgare*. — *C. Zawadskii*, Herbach, of Galicia, is a tufted plant with rose-tinted fls. all summer.

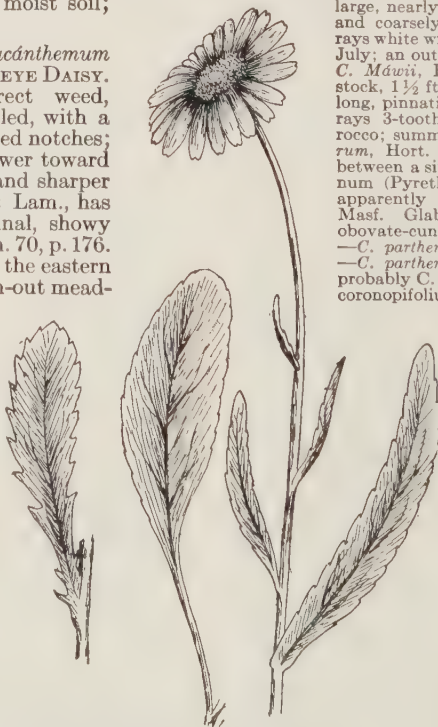
WILHELM MILLER.  
L. H. B.†

#### Types of the common chrysanthemum.

The common chrysanthemums of the florists (*C. hortorum*) are often called "large-flowering," and "autumn chrysanthemums," to distinguish them from the hardy outdoor kinds, although



937. *Chrysanthemum leucanthemum*. Ox-eye daisy, or whiteweed. ( $\times \frac{1}{2}$ )



936. *Chrysanthemum maximum*. ( $\times \frac{1}{2}$ )



neither of these popular names is entirely accurate or distinctive. They are the blended product of *C. indicum* and *C. morifolium*, two species of plants that grow wild in China and Japan. The outdoor or hardy chrysanthemums are derived from the same species, being less developed forms. The florist's chrysanthemum is not necessarily a glasshouse subject; but it is bloomed under glass for protection and to secure a longer season. Ten to fifteen dominant types of chrysanthemums have been recognized by the National Chrysanthemum Society of England. The words "types," "races," and "sections," have always been used by horticulturists to express much the same thing, but types can always be defined clearly, while sections cannot, and the word race should be restricted to cultivated varieties that reproduce their character by seed, which is not the case with the large-flowering chrysanthemums. The following explanation and scheme, it is hoped, will clearly set forth the main types, and explain some of the many terms that confuse the beginner. The horticultural sections are wholly arbitrary, being chiefly for the convenience of competitors at exhibitions, and therefore changing with the fashions. The present classification is based on the form of the flower, as each type can be had in any color found in the whole genus.

**A. Single forms: rays in 1 series, or few series: disk low and flat.**

**1. The Small Single Type.**—Fig. 950. Fls. about 2 in. across, star-like, i. e., with the rays arranged in one series around the yellow disk. "Single," however, is a relative term, and in Fig. 950 there is more than one series of rays, but this does not destroy the "singleness" of effect. All fls. are either single, semi-double, or double, but all the intermediate forms tend to disappear, as they are not desired.

**2. The Large Single Type.**—Like the preceding, but the fls. 4 in. or more across, and fewer. The large and small single types are practically never grown outdoors and are best suited for pot culture, each specimen bearing 20–80 fls. They are also grown by florists in considerable quantity for cutting.

939. Japanese anemone chrysanthemum when fully expanded.



938. The small and regular anemone type.

**AA. Anemone-fl'd. forms: rays as in A: disk high and rounded.**

**B. Fls. (florets) small, numerous, regular.**

**3. The Small Anemone Type.**

—Commonly called "Pompon Anemone." Fig. 938. Fls. 2–3 in. across, and usually more numerous than in the large anemone type. All the anemone forms are essentially single, but the raised disk, with its elongated tubular fls., usually yellow but often of other colors, gives them a distinct artistic effect, and they are, therefore, treated as intermediates in character between the single and double forms. Like the single forms, they are less popular than the double kinds, and the varieties are, therefore, less numerous and more subject to the caprices of fashion.

**BB. Fls. large, fewer, regular.**

**4. The Large Anemone Type.**—Fls. 4 in or more across and fewer. Heads must have large size, high neatly formed centers, and regularly arranged florets, the disk being composed of long tubes or quills and the rays flat and horizontally arranged.

**BBB. Fls. large, few, irregular.**

**5. The Japanese Anemone Type.**—Fig. 939. Fls. 4 in. or more across, and irregular in outline; fantastic and extreme anemone forms.

**AAA. Double-fl'd. forms: rays in many series: disk absent or nearly so.**

**B. Fls. small; rays short.**

**6. The Pompon Type.**—Figs. 940, 949. Fls. 1–2 in. across. The outdoor kinds are likely to be small, flat and buttonlike, while those cult. indoors are usually larger and nearly globular. Fig. 940 shows the former condition. It is from one of the old hardy kinds long cult. in the gardens as "Chinese" or "small-flowered" chrysanthemums, and commonly supposed to be the product of *C. indicum*, as opposed to the "Japanese" or "large-flowered" kinds intro. in 1862, which marked a new era by being less formal and more fanciful than any of the preceding kinds. Pompoms are little cult. under glass in Amer., being regarded mostly as outdoor subjects.

**BB. Fls. large.**

**c. Blossoms hairy.**

**7. The Hairy Type.**—Fig. 941. Also called "Ostrich Plume" and "Japanese Hairy." The famous prototype is the variety Mrs. Alpheus Hardy, pictured in Gn. 35, p. 307, which was sold for \$1,500 in 1888, and started the American chrysanthemum craze. White fls. with long hairs are very delicate and pretty, but the hairs are often minute, and on many of the colored fls. they are



940. Type of pompon chrysanthemum. Grown outdoors, with no special care.



considered more curious and interesting than beautiful. So far, nearly all hairy chrysanthemums are of the Japanese Incurved type. Since the hairs are on the backs of the florets, they show best in incurved types.

cc. Blossoms not hairy.

d. Rays reflexed.

8. *The Reflexed Type.*—

Also called "Recurved." Fig. 942. The reflexed forms can be easily broken up into 3 types. (a) the small and regular, (b) the large and regular, and (c) the large and irregular types. The latest standard requires that reflexed flowers have hemispherical heads, with no trace of thinness in the center, and broad overlapping florets.

dd. Rays incurved.

e. Form absolutely regular.

9. *The Incurved Type.*—

Fig. 943 shows the general idea, but such a fl. would hardly win a prize at an English show, where anything short of absolute regularity is relegated to the "Japanese Incurved" section (No. 10). This form is by far the most clear-cut ideal of any of these types, and for many years this ideal of the florists so completely dominated the English chrysanthemum shows that the incurved section came to be known there as the "exhibition" or "show type." In America the Japanese types, which are less formal and fanciful, early prevailed, but in England this has been the most important section of all.

ee. Form more or less irregular.

10. *The Japanese Incurved Type.*—This section and the next have been the most important in America. There are many variations of this type. It often happens that the outer 4 or 5 series of rays gradually become reflexed, but if most of the rays are incurved, the variety may be exhibited in this section. Fig. 943.

ddd. Rays of various shapes: forms diverse.

11. *The Japanese Types.*—The word "Japanese" was originally used to designate the large-fl. fantastic kinds, intro. by Robert Fortune from Japan in 1862. It has never been restricted to varieties imported directly from Japan, but has always included seedlings raised in the western world. Before 1862, all florists' fls. in England were relatively formal and small. The informal, loose, grotesque, Japanese chrysanthemums, intro. by Fortune broke up the conventional era, and the demand for large specimen blooms that resulted in fl.-shows all over the world reached Amer. in 1889. The "Japanese section" now means little more than "Miscellaneous." The 10 types previously mentioned can be rather accurately defined, but the Japanese section is purposely left undefined to include everything else. All the tubular and quilled sorts are now included in it, although formerly kept distinct.



942. Reflexed type.



941. Hairy type.

*Relative importance and uses of the foregoing types.*—

In general, the large-flowered forms are more popular than the small-flowered forms, especially at exhibitions, where great size is often the greatest factor in prize-winning. Types 9, 10 and 11 are the most important in America, especially the Japanese section. The flowers of types 9 and 10 are likely to be more compact and globular, and hence better for long shipments than the looser and more fanciful types. Types 9, 10 and 11 are those to which most care is given, especially in disbudding and training. They are the ones most commonly grown by the florists for cut-flowers, and whenever one large flower on a long stem is desired. The anemone-flowered forms are all usually considered as curiosities, especially the Japanese anemones, which are often exhibited as freaks and oddities. The single and anemone-flowered forms are used chiefly for specimens in pots with many small flowers, but all the other types are used for the same purpose. For outdoor culture, the hardy pompons, with their numerous small flowers, are usually better than the large-flowering or Japanese kinds.

As an indication of the constant change in standards of appreciation, may be cited the present popularity



943. Type of Japanese incurved chrysanthemum.

of short-stemmed chrysanthemums (Fig. 944) as distinguished from the greatly elongated stem that was exclusively desired some years ago; and also the demand for bushy many-flowered plants, producing small bloom as compared with the former excessively large detached flowers.

*The current English classification.*

The Floral Committee of the National Chrysanthemum Society (of England) in 1912 published the following "new classification of Chrysanthemums" (published also in *American Florist*, Sept. 21, 1912, by Elmer D. Smith):

SECTION I. INCURVED (Fig. 945).

The distinguishing characteristics of this section are the globular form and regular outline of the blooms. The flower should be as nearly a globe as possible, as depth is an important point in estimating its value. The florets ought to be smooth, rounded, or somewhat pointed at the tip, of sufficient length to form a graceful curve, and be regularly arranged. A hollow center or prominent eye are serious defects, as also are a roughness in the blooms, unevenness of outline and a want of freshness in the outer florets.

The section is now subdivided into:

Sub-section (a).—Large-flowered varieties.

Sub-section (b).—Medium- and small-flowered varieties.



## SECTION II. JAPANESE (Fig. 946).

Japanese varieties include a wide range of form, size and color. Their florets may be either flat, fluted, quilled or tubulated, of varying length, from short, straight, spreading florets, to long, drooping, twisted or irregularly incurved. In breadth the florets may vary greatly, ranging from those an inch in width to others scarcely broader than a stout thread. Some also either have the tips of the florets cupped, hollowed, curved or reflexed.

### Sub-section I. Japanese.

- (a) Large-flowered varieties.
- (b) Medium-flowered varieties.
- (c) Small-flowered varieties.

### Sub-section II. Incurved Japanese.

- (a) Large-flowered varieties.
- (b) Medium- and small-flowered.

### Sub-section III. Hairy Japanese.

Reflexed section to be deleted as these varieties are now referred to other sections.



944. New type with short stem, which is becoming very popular with commercial growers.

## SECTION III. ANEMONES (Figs. 947 and 948; also Figs. 938, 939).

The distinctive characteristics of anemone varieties are their high, neatly formed centers and regularly arranged ray-florets. There are two distinct sets of florets, one quilled and forming the center or disk, and the other flat and more or less horizontally arranged, forming the border or ray. The flowers may have the ray or guard florets broad or twisted, or narrow, and forming a fringe, but should be so regularly arranged as to form a circle round the center, the latter should be a hemispherical disk, with no trace of hollowness and every floret in its place.

- (a) Large-flowered, i. e., with a diameter of 3 inches and upwards.
- (b) Small-flowered, i. e., with a diameter of less than 3 inches.

## SECTION IV. POMPONS (Fig. 949; also Fig. 940).

Pompon varieties have blooms that may be somewhat flat or nearly globular, very neat and compact, formed of short, flat, fluted or quilled florets, regularly spreading or erect, the florets of each bloom being of one character.

- (a) Large-flowered, i. e., with a diameter of 2 inches and upwards.
- (b) Small-flowered, i. e., with a diameter of less than 2 inches.

## SECTION V. SINGLES (Fig. 950).

Single varieties may be of any size and form; but the florets, whether short and rigid or long and drooping, should be arranged sufficiently close together to form a regular fringe.

### Sub-section I. Varieties with one or two rows of ray florets.

- (a) Large-flowered, i. e., with a diameter of 3 inches and upwards.
- (b) Medium and small-flowered, i. e., with a diameter of less than 3 inches.

### Sub-section II. Varieties with three to five rows of ray florets.

- (a) Large-flowered, i. e., with a diameter of 3 inches and upwards.
- (b) Medium and small-flowered, i. e., with a diameter of less than 3 inches.

### Sub-section III. Anemone-centered varieties.

## SECTION VI. SPIDERY, PLUMED AND FEATHERY.

Varieties in this section have small or medium-sized flowers of

eccentric shape, but most frequently of a light and graceful character; some have threadlike florets, but they may be either erect, horizontal or drooping and of various shapes and colors.

Market, Decorative and Early-flowering varieties will be deleted as such, but lists will be drawn up under each heading for general guidance.

WILHELM MILLER.

## Culture of the florist's chrysanthemum (*C. hortorum*)

The first step towards success in chrysanthemum-culture is good healthy cuttings, and as they become established plants they should receive generous culture throughout their entire growing season. This requires close attention to watering, airing, repotting, and a liberal supply of nutriment.

Chrysanthemums are propagated in four ways,—by cuttings, division, seeds, and grafting. By far the most important is the first, because it is the most rapid. It is the method of the florists. In localities in which the plants can remain outdoors over winter without injury, they may be increased by division. This system is practised more by amateurs than florists, being the easiest method for the home garden but not rapid enough for the florist. Propagation by seeds is employed only to produce new varieties, and is discussed at length elsewhere (page 764). Grafting is seldom practised. Skilful gardeners sometimes graft a dozen or more varieties on a large plant, and the sight of many different colored fls. on the same plant is always interesting at exhibitions.

### Section I.—Culture of chrysanthemums for cut-flowers.

This account is intended to describe the method chiefly employed by florists, the plants being grown in benches under glass.

1. *Propagation by cuttings.*—Plants of the preceding year afford stock from which to propagate the following season. They produce quantities of stools or suckers, which form excellent material

for the cuttings. These are usually taken from 1½ to 3 inches in length, the lower leaves removed, also the tips of the broad leaves, then placed in propagating-beds close together, where they are kept continually wet until rooted. To insure a large percentage, the condition of the cuttings should be moderately soft. If the stock plants are allowed to become excessively dry, the cuttings are likely to harden, and thus be very slow in producing roots. Single-eye cuttings may be used of new and scarce varieties when necessary. These are fastened to a tooth-pick with fine stemming wire, allowing half of the tooth-pick to extend below the end of the



947. Japanese anemone type.



945. Incurved type.



946. Japanese type.



948. Pompon anemone type.

cutting, and when inserted in the cutting-bed the end of the cutting should rest upon the sand. It requires more time to produce good plants by this system than when fair-sized cuttings can be taken, but it is often of service when stock is limited. The propagating-

house should be well aired, and it is advisable to change the sand after the second or third batch of cuttings has been removed, to avoid what is termed cutting-bench fungus. The cuttings should never be allowed to wilt, and this is avoided by giving abundance of air, and when the temperature reaches over 70° from sun heat, by shading with some material, either cloth or paper. Fig. 951 shows a good form of chrysanthemum cutting.

2. *Planting.*—Cuttings should not be allowed to remain in the cutting-bench after the roots are  $\frac{1}{2}$  inch in length, or they will become hardened, which will check the growth. As soon as rooted, they should be potted into 2- or 2½-inch pots, using good mellow

soil, with a slight admixture of decomposed manure. Most of the large flowers are produced under glass, and the bench system is generally employed, which consists of 4 or 5 inches of soil placed upon benches. In these benches the small plants are planted 8 to 12 inches apart each way, from the latter part of May to the middle of July. Those planted at the first date usually give the best results. The soil should be pounded rather firm either before planting or after the plants have become established.

3. *Soil.*—There are many ideas as to what soil is best suited for the chrysanthemum, but good blooms may be grown on clay or light sandy loam, provided the cultivator is a close observer and considers the condition of the soil in which they are growing. Clay soil, being more retentive of moisture, will require less water and feeding than soil of a more porous nature. The chrysanthemum is a gross feeder, and, therefore, the fertility of the soil is very important in the production of fine blooms. Each expert has a way of his own in preparing the soil, but as equally good results have been secured under varied conditions, it is safe to conclude that the method of preparing the soil has little to do with the results, provided there is sufficient food within their reach. All concede that fresh-cut sod, piled late the preceding fall or in early spring, with one-fourth to one-fifth its bulk of half-decomposed manure, forms an excellent compost. Many use 1 or 2 inches of manure as a mulch after the plants have become established. Others place an inch of half-decomposed manure in the bottom of the bench. This the roots find as soon as they require it. Good blooms have been grown by planting on decomposed sod and relying on liquid applications of chemicals.

4. *Feeding.*—No definite rule can be given for this work, as so much depends on the amount of food

incorporated in the soil. If the soil be very rich, the liquid applications should be only occasional and very dilute. There is more danger of overfeeding by the use of liquids than by using excessively rich soil. Each grower must depend on his own judgment as to the requirements, being guided by the appearance of the plants. When the leaves become dark-colored and very brittle, it is safe to consider that the limit in feeding has been reached. Some varieties refuse to bud when overfed, making a mass of leaves instead. Others show very contorted petals, giving a rough unfinished bloom. Still others, particularly the red varieties, are likely to be ruined by decomposition of the petals, called "burning," especially if the atmosphere is allowed to become hot and stuffy. The same result will follow in dark weather, or when the nights become cool, if the moisture of the house is allowed to fall upon the blooms. Under such conditions, the ventilation should remain on during the night, or heat be turned in according to the outside temperature.

5. *Watering and shading.*—Let the foliage be the index to watering. If it appears yellow and sickly, use less water, and see that the drainage is perfect. There is little danger of over-watering as long as the foliage is bright green. A little shading at planting time is not objectionable, but it should be removed as soon as the plants are established. It is often necessary to shade the pink and red flowers, if the weather continues bright for some time, to prevent their fading.

6. *Training.*—When the plants are 8 inches high, they should be tied either to stakes or to jute twine. In the former system, use one horizontal wire over each row, tying the stake to this after the bottom has been inserted into the ground. Two wires will be necessary when twine is used, one above the plants and the other a few inches above the soil to which the twine is fastened. From the first of August until the flowers are in color, all lateral growths should be removed as soon as they appear, allowing only the shoots intended for flowers to remain. The above remarks refer to the training of benched chrysanthemums as grown by florists for cut-flowers. Other kinds of training are described under Section II, pages 763-4.

7. *Disbudding.*—No special date can be given for this work, as much depends on the season and the earliness or lateness of the variety to be treated. Buds usually begin to form on the early sorts about August 15, or soon after, and some of the late varieties are not in condition before October 10. Golden Glow and Smith Advance among the large-flowering, and several of the early-flowering of the hardy varieties, are exceptions to the foregoing, as they will set buds in June and July that will develop very good blooms during the month of August and later. The advent of these kinds has advanced the flowering season four to six weeks. The object of removing the weak and small buds and retaining the best is to con-



949. A pompon chrysanthemum. ( $\times \frac{1}{2}$ )



950. Single type.



951.  
One kind of chrysanthemum cutting.



concentrate the whole energy of the plant and thereby increase the size of the flower.

There are two forms of buds, crowns and terminals. A crown bud (Fig. 952) is formed first, never coming with other flower-buds, and is provided with lateral growths which, if allowed to remain, will continue their growth and produce terminal buds later. Terminal buds come later, always in clusters (Fig. 954), are never associated with lateral growths, and terminate the plant's growth for that season. If the crown bud is to be saved, remove the lateral growths as shown by Figs. 952, 953, and the operation is complete. If the terminal bud is desired, remove the crown and allow one, two or three (according to the vigor of the plant) of the growths to remain. In a few weeks these will show a cluster of buds, and, when well advanced, it will be noticed that the largest is at the apex of the growth (the one saved, if perfect, as it usually is), and one at each of the leaf axils (see Fig. 955). The rejected buds are easiest and safest removed with the thumb and forefinger. Fig. 956. Should the bud appear to be one-sided or otherwise imperfect, remove it and retain the next best. In removing the buds, begin at the top and work down. By so doing there are buds in reserve, in case the best one should accidentally be broken, while if the reverse course were taken, and the best bud broken at the completion of the work, all the labor would be lost. A few hours' disbudding will teach the operator how far the buds should be advanced to disbud easily. Early and late in the day, when the growths are brittle, are the best times for the work. Some growers speak of first, second and third buds. The first is a crown, and usually appears on early-propagated plants from July 15 to August 15. If removed, the lateral growths push forward, forming another bud. In many cases in which the crowns are removed early, the next bud is not a terminal, but a second crown, which is termed the second bud. Remove this, and the third bud will be the terminal. Plants propagated in May and June usually give the second and third bud, not forming the typical crown. Those struck in July and planted late give the terminal only. Most of the best blooms are from second crown and terminal. Pink, bronze and red flowers from first crowns are much lighter in color than those from later buds. They are large, but very often abnormal to such an extent as to be decidedly inferior. This is doubtless due to the large amount of food utilized in their construction, owing to the long time consumed in development. The hot weather of September and October must have a detrimental effect upon the color.

**Enemies.**—Green aphid (*Aphis rufomaculata*) and the black aphid (*Macrosiphum sanboni*) are sometimes very troublesome. They may be controlled by spraying with "Black Leaf 40" tobacco extract, one part to 800 parts water with soap added. Fumigation with hydrocyanic acid gas is also widely practised by commercial growers. In moderately tight greenhouses, use one ounce potassium cyanide for each 3,500 cubic feet of space for all-night fumigation. For details, see *Fumigation*. Red Spider (*Tetranychus bimaculatus*) becomes injurious if neglected. It may be easily controlled by spraying with water, using much force and little water to avoid drenching the beds. The use of sulfur has also a beneficial effect.

**Thrips.** (See *Carnation*).

Leaf-tyer (*Phlyctenia ferrugalis*) is frequently very abundant in some parts of the country. It is essentially a greenhouse pest although it can live out-of-doors. The greenish whitish striped caterpillars,  $\frac{3}{4}$  inch in length when full grown, feed on the under side of the leaves which they roll or tie together. The moth is pale brownish with an expanse of about  $\frac{3}{4}$  inch. The leaf-tyer is most destructive during the summer months when the temperature is highest. It can be controlled by spraying with arsenate of lead. It is advisable to

begin the work early in the season when the insects are less numerous and the plants are small. Care should be taken to hit the under surface of the leaves.

The tarnished plant-bug (*Lygus pratensis*) often injures the blossom buds by its feeding punctures. This causes wilting and blind growths. The bugs may be excluded from greenhouses with screens. Out-of-doors no satisfactory means of control has been devised. But it has been noticed that plants growing in partial shade are less subject to injury.

Grasshoppers are sometimes injurious. They may be controlled by the use of arsenate of lead or by hand-picking.

**Diseases.**—Damping-off in the cutting-benches is not uncommon. See *Damping-off*, page 961. Rust (*Puccinia chrysanthemi*) is the only serious fungous disease of the chrysanthemum. It is characterized by the reddish brown pulverulent masses on the foliage consisting of the spores of the fungus. The disease is usually not destructive but may make the foliage unsightly. Any leaves appearing diseased should be removed promptly. In watering care should be taken not to wet the foliage, as moisture on the leaves allows new infections. Leaf-blight (*Cylindrosporium*) and leaf-spot (*Septoria*) occur on mature or languishing foliage and usually do little damage.

#### Section II.—Culture of chrysanthemums in pots.

The same principles are employed in pot culture as when planted upon the bench, with the exception that the plants are generally allowed to produce more blooms. The most popular type of pot-plant for home growing, or for sale by florists and intended for home use, is a compact, bushy plant,  $1\frac{1}{2}$  to 2 feet high, branched at the base, and bearing four to twenty flowers averaging 3 to 4 inches across.

They are here called "market plants." "Single-stem plants" are also popular. Great quantities of large flowers (say twenty to one hundred) are rarely grown on a potted plant, except for exhibitions. Such plants are commonly called "specimens," and the three leading forms are the bush, the standard and the pyramid, the first mentioned being the most popular.

1. *Market plants.*—Dwarf plants of symmetrical form, with foliage down to the pots, are the most salable, and when thus grown require constant attention as to watering and stopping, allowing each plant plenty of room to keep the lower leaves in a healthy condition. Cuttings taken June 1 and grown in pots, or



952. The crown bud



953. Crown bud after it has been selected or taken.

planted on old carnation benches or in spent hotbeds (light soil preferable), and lifted by August 15, will make very good plants 1 to 1½ feet high. The reason for lifting early is to have them well established in their flowering pots before the buds are formed.

2. *Single-stem plants*.—Same culture as market plants, except that they are restricted to one stem and flower. Those from 1 to 2 feet in height are more effective and useful than tall ones. For this reason, many prefer plunging the pots out-of-doors where they have the full benefit of the sun and air, making them more dwarf than when grown under glass.



954. The terminal bud.

3. *Pot-plants for cut-flowers*.—Culture same as for specimen plants, except that the nipping should be discontinued July 1 to give sufficient length to the stems. If large flowers are desired, restrict the plants to eight or ten growths. Such plants can be accommodated in less space than specimens,

when the chief object is symmetry.

4. *Bush plants*.—For large bush plants, the cuttings should be struck early in February, and grown along in a cool airy house, giving attention to repotting as often as necessary. The final potting into 10- or 12-inch pots generally takes place in June. They are potted moderately firm, and watered sparingly until well rooted. As soon as the plants are 5 or 6 inches high the tips should be pinched out, to induce several growths to start. As the season advances and the plants make rapid growth, pinching must be attended to every day up to the latter part of July, to give as many breaks as possible and keep them in symmetrical form. By the middle of August (if not previously attended to), staking and getting the plants in shape will be a very important detail. If stakes are used, they must be continually tied-out, as the stems soon begin to harden, and this work can be best accomplished by looking them over daily. Light stakes of any material may be used. Many other methods are in use, such as wire hoops and wire framework, to which the growths are securely tied.

5. *Standards* differ from bush plants in having one stout self-supporting stem, instead of many stems. They require the same culture as bush plants, with the exception that they are not stopped, but allowed to make one continuous growth until 3, 4 or 5 feet high, and are then treated the same as bush plants. They require the same attention as to stopping and tying to secure symmetrical heads.

6. *Pyramids* are only another form of bush plants, and it is optional with the grower which form he prefers.

### Section III.—Culture of chrysanthemums for the production of new varieties.

The object of seed-saving is the improvement of existing varieties. It is not conclusive, however, that all seedlings will be improvements; in fact, it is far from this, as the greater proportion are inferior to their antecedents. Only those who give the most careful consideration to cross-fertilization are certain of marked success. Hand-hybridized seeds possess value over those haphazardly pollinated by wind and insects only according to the degree of intelligence employed in the selection of parents. What the result will be when a white flower is fertilized with a yellow one, the operator cannot determine at the outset. It may be either white, yellow, intermediate, or partake of some antecedent, and thus be distinct from either. Improvements in color can be secured only by the union of colors,

bearing in mind the laws of nature in uniting two to make the third. Red upon yellow, or vice-versa, may intensify the red or yellow—give orange or bronze, as nature may see fit. The operator is more certain of improving along other lines, such as sturdiness or dwarfness of growth, earliness or lateness of bloom, or doubleness of flowers. The selection of those most perfect in these particulars is very sure to give similar or improved results. Always keep a record of this work showing the parents of a seedling. The satisfaction of knowing how a meritorious variety was produced more than pays for the trouble, and may lead to further improvements along certain lines.—The operation begins when the flower is half open, cutting the petals off close to their base with a pair of scissors, until the style is exposed. Should the flower show signs of having disk or staminate florets, remove these with the points of the scissors and thus avoid self-fertilization. When the styles are fully grown and developed, the upper surface or stigma is in condition to receive the pollen. By pushing aside (with the thumb) the ray-florets of the flower desired for pollen, the disk-florets which produce the pollen will become visible. The pollen may be collected on a camel's-hair pencil or toothpick and applied to the stigma of the flower previously prepared. If a toothpick be used, never use it for more than one kind of pollen. By allowing the camel's-hair pencil to stand in an open-mouthed vial of alcohol a few moments after using, it may be again used, when dry, upon another variety without fear of the pollen of the former operation affecting the present.—Cuttings struck in June and July and grown to single bloom in 4-inch pots are the most convenient for seeding. Such flowers, if not given too much food are more natural and furnish an abundance of pollen, as well as being easier to trim than the massive blooms produced for the exhibition-table. The pollinating should be done on bright, sunny days, and as early in the day as possible. As soon as the seed plants are trimmed, they should be placed by themselves to avoid fertilization by insects, and should there remain until the seeds are ripe. Keep the plants rather on the dry side, and give abundance of air. Seeds, which ripen in five to six weeks, should be saved without delay, and carefully labelled. In sowing seeds,



955. Terminal buds of chrysanthemum at an early stage. None too early for disbudding.

they should be covered very lightly and kept in a temperature of 60°. When the seedlings are large enough to handle easily, remove to small pots, or transplant farther apart in shallow boxes. Chrysanthemums flower the first season from seed.

### Section IV.—Varieties.

Of the long list of new varieties sent out each year, but few are retained after the second year's trial. This is probably due to the fact that most American growers are more interested in the commercial value of the flower than the curious forms or striking colors they present. Exhibitions have not reached the people here



as in England and France. There are a few varieties that have stood the test for several years; such as Ivory, 1889; Geo. W. Childs, 1892; Golden Wedding, 1893; Major Bonnaillon, 1894; Yanoma, 1896; W. H. Chadwick, 1898; John K. Shaw and Nagoya, 1899; Monrovia, Col. D. Appleton and White Bonnaillon, 1900. There are many other varieties that have stood the test for four or five years.

It is not the purpose of this article to recommend varieties of chrysanthemums, but the following list includes the best varieties known in North America at the present time. The list will be valuable as showing a serviceable classification, and also for reference when other varieties have come into existence:

*Selection of varieties based on main types.*—(1) *Incurved*: *Æsthetic*, Emberta, Major Bonnaillon, Pink Gem, Mary Donellan, Naomah, Smith's Sensation, William Turner. (2) *Japanese*: Pacific Supreme, Crocus, Ramapo, December Gem, F. S. Vallis, Glen Cove, Golden Robin, Reginald Vallis. (3) *Japanese Incurved*: Chrysolara, Col. D. Appleton, W. H. Chadwick, Mlle. Jeanne Nonin, Artistic Queen, Christy Mathewson, Elberon, Nakota. (4) *Hairy*: Arvede Barine, Beauty of Truro, Frison d'Or, Leocadie Gentils, Louis Boehmer, L'Enfant des Deux Mondes, R. M. Grey, White Swan. (5) *Reflexed*: Smith's Advance, Dick Witterstaetter, Harvard, Yanoma, Mrs. J. Wells, Rose Pockett, Thanksgiving Queen, Madison. (6) *Large Anemone*: Satisfaction, Surprise, Ernest Cooper, Geo. Hawkins, Gladys Spaulding, John Bunyan. (7) *Japanese Anemone*: Eleanor, Mrs. F. Gordon Dexter, Zoraida. (8) *Pompons*: Alma, Baby, Clorinda, Fairy Queen, Helen Newberry, Minta, Julie Lagraverre, Quinola. (9) *Pompon Anemone*: Diantha, Ada Sweet, Gertrude Wilson, Lida Thomas, Vayenne, Bessie Flight. (10) *Large-flowering Singles*: Arlee, Catherine Livingstone, Felicity, Itaska, Lady Lu, Red Light. (11) *Small-flowering Singles*: Ladysmith, Anna, Blazing Star, Little Barber.

*Selection of varieties based on color.*—*White*: Smith's Advance, Chadwick Improved, Christy Mathewson, Mrs. Gilbert Drabble, Naomah, William Turner. *Yellow*: Chrysolara, Comoleta, Golden Glow, Golden Eagle, Ramapo, Lenox. *Pink*: Pacific Supreme, Unaka, Patty, Glen Cove, Morristown, Smith's Sensation. *Crimson*: Dick Witterstaetter, Harvard, Intensity, J. W. Molyneux, Pockett's Crimson, Mrs. Harry Turner. *Bronze and buff*: Glenview, Mrs. J. A. Miller, Mrs. H. Stevens, Ongawa, Rose Pockett, William Kleinheinz. *Crimson, golden reverse*: Harry E. Converse, Howard Gould, Mrs. O. H. Kahn, W. Woodmason. *Amaranth or purplish crimson*: George J. Bruzard, Mrs. G. C. Kelly, Reginald Vallis, T. Carrington, Leslie Morrison.

*Selection based on special uses.*—*Bush plants*: Golden Age, Brutus, Dick Witterstaetter, Dr. Enguehard, Garza. *Single stemmed pot-plant*: Naomah, Chrysolara, *Æsthetic*, President Roosevelt, Ben Wells, Glen Cove, Mrs. George Hunt, Mrs. O. H. Kahn, Pockett's Crimson. *Exhibition blooms*: Artistic Queen, Christy Mathewson, Chrysanthemiste Montigny, F. S. Vallis, George J. Bruzard, Glen Cove, Glenview, Harry E. Converse, Lady Hopetoun, Lenox, Elberon, Morristown, M. Loiseau-Rousseau, Mrs. Gilbert Drabble, Mrs. H. Stevens, Mrs. Harry Turner, Naomah, Pockett's Crimson, Rose Pockett, William Turner, W. Woodmason, Ben Wells, Merza, Reginald Vallis. *Commercial blooms*.—*Extra-early-flowering, July to October*: Golden Glow, Smith's Advance. *Second-early-flowering, last of September into October*: Early Snow, Glory of Pacific, Monrovia, October Frost, Roserie. *Early-midseason-flowering, middle of October*: Chrysolara, Comoleta, Gloria, Ivory, Pacific Supreme, Unaka, Virginia Poehlmann. *Midseason-flowering, last of October to November 10*: Col. D. Appleton, Crocus, Dick Witterstaetter, Pink Gem, Ramapo, Mrs. W. E. Kelley. *Late-midseason-flowering, November 10 to Thanksgiving*: Dr. Enguehard, Emberta, Golden Eagle, Golden Wedding, Major Bonnaillon, Patty, President Roosevelt, Timothy Eaton, W. H. Chadwick, Mrs. Jerome Jones, White Bonnaillon. *Late-flowering, Thanksgiving and later*: December Gem, Harvard, Helen Frick, Intensity, John Burton, Mlle. Jeanne Nonin, Thanksgiving Queen, Yanoma.

#### Section V.—Culture of chrysanthemums for exhibition.

This branch in which the highest standard must be attained if the slightest hope of success at the exhibitions is entertained, requires a thorough knowledge of the most suitable kinds for the purpose and the ability to bring them to the highest state of perfection. The methods are not very different from those employed in the production of high-grade commercial blooms. The most successful growers usually propagate earlier, and if grown on benches they are also planted earlier to secure all the vigor possible. The finest blooms are those produced on the private estates, where one man has charge of a few hundred plants, giving them his undivided attention, so that every need is provided at the proper time. During the past few years, the majority of such expert growers have adopted a system of growing in pots, each plant restricted to one bloom, which is practically the same method as the one used

throughout England for many years. Here they are kept under glass the entire season, while in England the climate permits them to be grown out-of-doors during the summer months. By this method, the roots are more closely confined, which has a tendency to produce short-jointed plants with stronger stems, and gives the grower perfect control, so that each variety may be treated according to its needs, especially when liquid fertilizers are necessary to promote the maximum in size and finish. The other factors necessary to the successful exhibitor are full consideration of the requirements of the schedules, so as to select the best varieties for the various classes, and a complete knowledge of packing and staging the blooms. During the past decade, those originating new varieties have scrutinized more closely in making a decision, and, as the commercial and exhibition varieties are considered from



956. Terminal bud after the disbudding operation.

an entirely different standpoint, these two sections are drifting farther and farther apart. Size is the foremost quality from the exhibition point of view.

At the present time (1912), the varieties generally shown in prize-winning exhibits are: *White*.—Beatrice May, Lady Carmichael, Merza, Mrs. David Syme, Naomah, Wm. Turner. *Yellow*.—F. S. Vallis, Lenox, Mrs. Geo. Hunt, Mrs. J. C. Neill, Yellow Miller. *Pink*.—Lady Hopetoun, M. Loiseau-Rousseau, Mrs. C. H. Totty, O. H. Broomhead, Wm. Duckham, Wells' Late Pink. *Bronze*.—Glenview, Harry E. Converse, Mrs. O. H. Kahn, Mrs. H. Stevens. *Red*.—J. W. Molyneux, Pockett's Crimson, W. Woodmason.

A few of the commercial section are suitable for this purpose, especially when the schedule calls for twelve or more blooms of a kind for one vase and at exhibitions at which artificial supports are prohibited. The best are as follows: *White*.—Lynnwood Hall, Timothy Eaton, Chadwick Improved, Mrs. Jerome Jones. *Yellow*.—Col. D. Appleton, Golden Eagle, Golden Wedding, Yellow Eaton, Golden Chadwick, Major Bonnaillon. *Pink*.—Dr. Enguehard, Mayor Weaver, Maud Dean. *Red*.—Dick Witterstaetter, Geo. W. Childs.

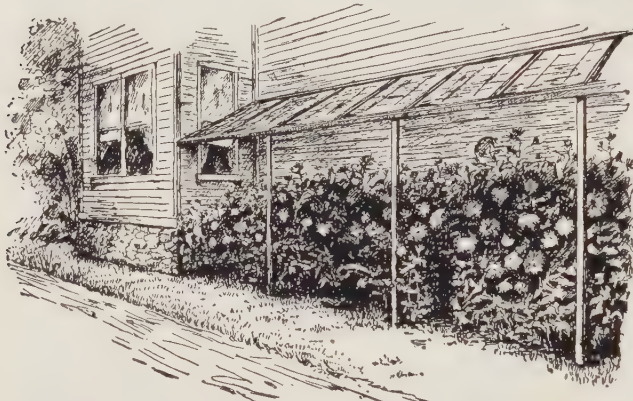
#### Section VI.—Culture of chrysanthemums out-of-doors.

The kinds most suitable for out-of-door culture are those making abundance of rhizomes or underground stems, which withstand the winter and furnish the new growths for the successive years. The Pompons are more hardy than the large-flowering sorts, and, as hardiness is of vital importance to those interested in this subject, especially north of the Ohio River, it should be fully considered in selecting for this purpose. It is more practicable to choose varieties which perfect their flowers early, during August, September and October when grown in the northern states, as the buds are less likely to be injured while in a soft growing state by frost. In the South many of the later varieties will live over and be satisfactory, owing to the continuance of mild weather. In the past few years, some improvements in this section have been attained, many of which are the results of crosses between the Pompons and the large-flowering Japanese, in which the progeny have combined the hardiness and dwarf habit of the former with the larger and more irregular-formed flowers of the latter, producing aster-like flowers rather than the symmetrical form of the pompons. All of the types may be successfully grown out-of-doors if provision is made to protect the bud, blooms and roots from severe frost. A temporary covering of cloth or sash in early autumn will protect the blooms, but the roots will require artificial heat or should be removed to the greenhouse or frame where the temperature can be maintained a few degrees above freezing. In growing exhibition blooms out-of-doors, all the important details, such as watering, airing, disbudding, feeding

staking and tying, must be complied with, if the grower expects to be rewarded for his efforts.

The oldest of the outdoor types are the Pompons, which produce from forty to one hundred buttons an inch or two across, with short and regular rays. Such plants can be left outdoors all winter.

Since the large-flowering or Japanese types have come in, numberless attempts have been made to grow them outdoors, but with poor results. The greenhouse varieties are not so hardy. In the North they are likely to be killed by the winter. Their flowers usually lack in size, depth and symmetry, largely because there are more of them on a plant than a florist allows for his best blooms, but chiefly because they do not have so much care in general as is given to plants under glass, where space is precious. For the very best results, chrysanthemums must be flowered under glass, and they need the greatest care and forethought practi-



957. Suggestion for protecting chrysanthemums that are to bloom outdoors.

cally all the year round. Half-way measures are unsatisfactory. Thus it happens that the Japanese varieties are usually unsatisfactory out-of-doors, and the Pompons are chosen by those who can give very little care to plants and would rather have many small flowers than a few large ones. This also partly explains why no two dealers recommend anything like the same list of Japanese varieties for outdoor culture. Nevertheless, it is possible to grow excellent flowers 4 and 5 or even 6 inches across outdoors, but it requires staking, disbudding, and some kind of temporary protection, as of a tent or glass, during frosty weather. Fig. 957 shows a cheap and simple structure of coldframe sashes resting on a temporary framework. In severe weather a canvas curtain can be dropped in front, and the window of a warm cellar in the rear opened to temper the air. For general outdoor culture, however, when no special care is given to the plants, the Japanese kinds are usually less satisfactory than the Pompons. These Pompons are a much-neglected class since the rise of the large-flowered Japanese kinds, but they are unlike anything else in our garden flora. Their vivid and sometimes too artificial colors harmonize with nothing else at Thanksgiving time, and they are so strong and commanding that they should have a place by themselves. It is not uncommon for the flowers to be in good condition even after several light falls of snow, and they may be considered the most resistant to frost of any garden herbs. In fact, their peculiar merit is blooming after the landscape is completely desolated by successive frosts. The flowers are not ruined until their petals are wet and then frozen stiff. They are essentially for mass effects of color, and great size is not to be expected. Masses of brown and masses of yellow, side by side, make rich combinations. The whole tribe of crimsons, amaranths, pinks, and the

like, should be kept by themselves, because their colors are variable and because they make a violent contrast with yellow, which few persons can find agreeable.

WILHELM MILLER.  
ELMER SMITH.†

**CHRYSOBACTRON** (*golden wand*, from the Greek). *Liliaceæ*. Two New Zealand rhizomatous herbs, usually classed with "bulbs" by gardeners, bearing many small yellow fls. in a long raceme on the top of an elongated scape: plant often dioecious or polygamous: perianth 6-parted, the segms. nearly equal; stamens 6: caps. 3-celled and 3-valved. The genus is now commonly united with the S. African *Bulbinella*, the combined species becoming 13 or 14. **C. Hoökeri**, Colenso (*Bulbinella Hoökeri*, Benth & Hook., now the accepted name. *Anthericum Hoökeri*, Colenso) is in cult. in this country. It is a hardy plant 2-3 ft. high, with sword-like foliage: fls.  $\frac{1}{2}$  in. diam., bright yellow, perfect, on slender pedicels, the segms. linear-oblong, and obtuse and spreading. B.M. 4602.—Cult. in the ordinary border, and treated like the asphodel, they do well. But they are improved in rich, deep and rather moist soil; strong clumps, 4-6 years old, are then at their best and are very excellent plants. After that they should be divided. Prop. by division or seed. Blooms in June and July.

J. B. KELLER and L. H. B.

**CHRYSOBALANUS** (*golden acorn*, from the Greek, referring to the fruit). *Rosaceæ*. Bushes or trees, planted far south for ornament; fruit often edible.

Leaves thick and coriaceous, entire, glabrous: fls. white, rather small, in axillary or terminal short cymes; calyx 5-parted; petals 5, clawed; stamens 15 to many, some of them perhaps sterile: fr. a dryish-pulpy drupe, with stone pointed at base and ridged.—Two species in tropics of Amer. and Afr., reaching Fla., and another one in S. U. S.

**ICACO**, Linn. **COCOA-PLUM**. **ICACO**. On coasts and along streams in S. Fla., to S. Amer., and also in Afr., and is sometimes planted in the extreme S. (and in the tropics) as an ornamental shrub and for its sweetish but insipid and dry plum-shaped frs. which are sometimes used for preserves. It is a mere bush on the northern limits of its distribution, and on elevations, but in extreme S. Fla. it reaches a height of 25-30 ft. Lvs. glossy, thick, obovate (sometimes obovate): fls. small and white, in axillary erect racemes or cymes; calyx 5-cleft, pubescent; petals 5; stamens about 20: fr. 1-seeded, 1-1½ in. long, varying from nearly white to almost black, globular or nearly so. Wood close-grained and heavy, hard, brown or reddish. It is best prop. by seeds, but may also be had from cuttings of half-ripened wood. *C. pellocarpus*, Meyer, the small-fruited cocoa-plum, is a smaller plant, with smaller lvs., petals spatulate, drupe obovoid or oblong, about half the size of that of *C. Icaco*; it grows in extreme S. Fla. and farther south; probably not planted. *C. oblongifolius*, Michx., occurs from Ga. to Fla. and Miss. It is a low shrub, spreading widely by means of underground sts.: lf.-blades longer than broad, sharp-tipped: fr. ovoid or obovoid, about 1-1½ in. long; not in cult.

L. H. B.

**CHRYSOCOMA**: *Linosyris*.

**CHRYSODIUM**: *Elaphoglossum*.

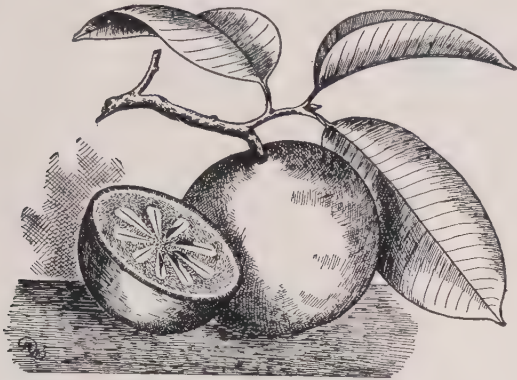
**CHRYSOGONUM** (Greek-made name, *golden knee* or *joint*). *Compositæ*. A few composites, of which *C. virginicum*, Linn., is a perennial yellow-fl. plant of S. Pa. and south; sometimes cult. as a border plant. It blooms in spring or early summer on sts. which become 1 ft. high, the heads being solitary and pedun-



cled in the axils or some of them terminal: lvs. opposite and basal, ovate and mostly obtuse, crenate. Prop. by creeping rootstocks and runners. Of little merit horticulturally.

**CHRYSOPHYLLUM** (Greek, *golden leaf*, in reference to the color of the under surface of the leaves). *Sapotaceæ*. Handsome trees, grown far south for fruit and for ornament.

Juice milky: lvs. alternate, thick and stiff, usually shining and copper-colored or golden beneath with



958. *Chrysophyllum Cainito*. ( $\times \frac{1}{2}$ )

silky pubescence, with many parallel cross-veins: fls. small, sessile or stalked, clustered at the nodes or in the axils; calyx mostly 5-parted; corolla tubular-campanulate or somewhat rotate, mostly 5-lobed, without appendages; stamens as many as the corolla-lobes, and staminodia 0; ovary 5-10-celled: fr. fleshy and usually edible, 1- to several-seeded.—About 60 species in tropics, the larger part American.

The various species of *Chrysophyllum* have beautiful broad green leaves, with under surfaces of a silky texture, varying in color from a silvery white through golden to a russet-brown, and are well worth a place in the conservatory as ornamental trees. By giving them sufficient room, they will bear fruit in the course of a few years, under glass, which in the case of *C. Cainito*, the star-apple of tropical America, is edible, and well liked even by people of a temperate clime. All species are strictly tropical, and cannot be grown where frosts occur unless properly protected. Propagation is ordinarily effected by seed, which readily germinate if planted when fresh, and it is stated that all species may be grown from cuttings of well-ripened shoots placed in strong, moist heat. The soil most suited for their growth is of a sandy character, and if not of a good quality should be well manured, using a considerable proportion of potash in the fertilizer for fruiting specimens. They seem to do well on a great variety of soils, however, that are sufficiently well drained, wet land not agreeing with them. (E. N. Reasoner.)

**Cainito**, Linn. **STAR-APPLE**. **CAIMITO**. Fig. 958. Thick-headed evergreen, to 50 ft.: lvs. oval or oblong, silky-golden beneath: corolla-tube twice as long as the calyx; stigma 8-10-crenate or -lobed; fls. purplish white. W. Indies, Panama, Cent. Amer. I.H. 32:567. A.G. 11:405.—The fr. is the size of an apple, symmetrically globular and smooth, hard; a cross-section shows the star-shaped core, whence the common name; it varies from white to purple in color of skin and also of flesh. The pulp is delicious (used uncooked) if the fr. is allowed to remain on the tree until ripe. It has large, pumpkin-like dark seeds. It is very impatient of frost.

**olivifforme**, Lam. (*C. monopyrenum*, Swartz). **SATIN-LEAF**. To 35 ft.: lvs. like those of *C. Cainito*: fls. white; stigma 5-crenate: fr. ovoid-oblong or oval, 1-seeded by abortion of ovules, blackish,  $1\frac{1}{2}$  in. long,

said to be insipid. S. Fla. and S. B.M. 3303.—Sparingly transferred to grounds as an ornamental tree.

**imperiale**, Benth. (*Theophrasta imperialis*, Lind.). Plant strict and simple, to 20 ft. or more, unarmed: lvs. obovate-oblong to oblong-oblancoelate, 3 ft. long, on large plants very sharply serrate: fls. yellowish green, small, in clusters along the trunk, the cluster sessile but the fls. pedicellate; corolla rotate, 5-lobed, thick: fr. 5-angled, nearly globular, size of a small apple, with a hard thick flesh; seeds 1 in. long and  $\frac{3}{4}$  in. wide, compressed. Brazil. B.M. 6823. I.H. 21:184. Gt. 1864:453.—This species was grown 30 years before its genus was determined, but upon flowering in European gardens it was found to be a *Chrysophyllum* (by some referred to *Martiusella*, which see). L. H. B.

**CHRYSTOPOGON**: *Sorghastrum*.

**CHRYSOPSIS** (*golden appearance*, from the heads). *Compositæ*. Mostly low and hairy perennials, sometimes planted in borders: heads of medium size and many-fl., usually with numerous yellow rays; involucre bell-shaped or hemispherical, of imbricated narrow bracts: achenes compressed, bearing a pappus of numerous hair-like bristles. About 20 species of *Chrysopsis* are known. Mex. and N. **C. villosa**, Nutt. (*C. Bolanderi*, Gray), is one of the species in the trade. It is widely distributed from Ill., west, north, and south: 1-2 ft., grayish pubescent: lvs. oblong to lanceolate, entire or few-toothed: heads usually at the ends of leafy branches, aster-like in shape. Extremely variable, and has several named forms. Mn. 7:101. Var. **Rütteri**, Rothr., is larger and later. Of value as a border plant. Cult. the same as aster. Perennials, but bloom the first year from seed, if sown early.

**C. mariâna**, Nutt. Differs from *C. villosa* in having corymbose-paniculate fl.-clusters. E. N. Amer. Aug.-Sept. Offered by dealers in native plants. It has showy yellow fls. and prefers dry sandy places.

N. TAYLOR.†

**CHRYSOPLËNIUM** (name from *golden* and *spleen*, referring to some old medicinal tradition). *Saxifragaceæ*. **GOLDEN SAXIFRAGE**. Low semi-aquatics, sometimes used in bog-planting.

**C. americanum**, Schw., is a native plant creeping in mud. Sts. forking, bearing roundish or cordate small mostly opposite lvs., with very small, nearly sessile, greenish, inconspicuous fls. Scarcely known in cult. and, except for wet places where a cover or carpet is wanted, of no value horticulturally.

**CHRYSURUS**  
**CYNOSUROIDES**:  
*Lamarckia*.

**CHUFA**. The edible subterranean tubers of *Cyperus esculentus*, Linn.; (which see) much prized in the South. Fig.



959. *Chufa*—*Cyperus esculentus*. ( $\times \frac{1}{2}$ )

959. Chufas are eaten raw or baked, or used for the making of coffee. The plant is sometimes cultivated in the North, but it will not withstand the winter. The tubers are oblong,  $\frac{1}{2}$  to  $\frac{3}{4}$  inches long, cylindrical, hard. The plant is grass-like, and in the North does not flower. Tubers are planted in the spring, and the new crop is ready for digging in the fall. It thrives easily in loose and warm soils. The nutty flavor of the hard tubers is very agreeable.

**CHUSQUËA:** *Bamboo*, p. 449, Vol. I.

**CHYSIS** (Greek for *melting*, in allusion to the pollen-masses). *Orchidaceæ*. Orchids, pendulous from trees; grown in hothouses.

Stems fusiform, leafy, thickening after the lvs. drop: fls. fleshy, in short racemes, which are produced freely in the axils of the young growths; dorsal sepal and petals similar in shape, the lateral sepals with the foot of the column forming a long foot; lip jointed to the column foot, lamellate longitudinally, the lateral lobes upright, loosely surrounding the column; pollinia 8.—About 6 species in Trop. Amer. Cult. as for Vanda, in baskets, pans or pots. They require tropical temperature when growing, then cooler.

A. Ground-color of fls. yellow.

**auræa**, Lindl. Fls. 5–8, about 2 in. across; sepals and petals yellow, oblong-oval; lateral lobes of lip yellow, the middle lobe white, downy, spotted with red and yellow. S. Amer. B.R. 1937. B.M. 3617.

**lævis**, Lindl. Fls. 8–12, about  $2\frac{1}{2}$  in. across; sepals and petals yellow, tinted above with lines of purple-carmine; sepals oblong, the dorsal one inflexed, the lateral falcate; lip yellow, marked with red. Mex.

**Chelsonii**, Hort. Fls. 5–7, about  $2\frac{1}{2}$  in. across; sepals and petals yellow, with a large blotch of reddish fawn at the apex; lip yellow spotted with red. Hybrid: *C. bractescens*  $\times$  *C. lævis*. F.M. 1878:297.

AA. Ground-color of fls. white.

**bractescens**, Lindl. Fig. 960. Fls. 3–5, about 3 in. across; sepals and petals ivory-white; lip with the lateral lobes white outside, the inner surface yellow, streaked red, the middle lobe yellow, streaked and stained with red. Mex. B.M. 5186. R.H. 1859, pp. 294, 295. I.H. 27:398. O.R. 9:371; 13:236; 19:201. J.H. III. 28:263. C.O. 1. A.F. 28:747.

**Limminghei**, Lindl. & Reichb. Fls. 4–7,  $1\frac{1}{2}$ –2 in. across; sepals and petals white, with an apical blotch of purple; lip with lateral lobes yellow, marked with reddish purple on the inside, the middle lobe white, streaked with bright purple. Mex. B.M. 5265. I.H. 7:240. C.O. 3.

**Sedenii**, Hort. Fls. 3–6; sepals white; petals white with an apical rose-purple blotch; lip with the side

lobes sulfur-yellow, purple-streaked within, the middle lobe white, streaked with amethyst. Hybrid: *C. Limminghei*  $\times$  *C. bractescens*. GEORGE V. NASH.†

**CIBOTIUM** (Greek, *a little seed-vessel*). *Cyatheaceæ*. A small group of tree-ferns from Mexico and Polynesia,

with bivalved coriaceous indusia, differing from *Dicksonia* in having the outer valve entirely distinct from the leaf. For culture, see *Dicksonia*.

*C. Barometz* is the plant that gave rise to the wonder stories of the Barometz or Scythian lamb (Fig. 961), which, according to Bauhin, 1650, had wool, flesh and blood, and a root attached to the navel. The plant was said to resemble a lamb in every respect, but grew on a stalk about a yard high, and turning about and bending to the herbage consumed the foliage within reach, and then pined away with the failure of the food until it died. In 1725 Breyne, of Dantzic, declared that the Barometz was only the root of a large fern, covered with its natural yellow

down and accompanied by stems, which had been placed in museums in an inverted position, the better to represent the appearance of the legs and horns of a quadruped.

Young plants of *C. Schiedei* and *C. regale* are frequently offered by florists at a stage before the trunk has developed and when the leaves are about four or five feet long. They require greenhouse conditions for successful culture.

A. Outer valve of the indusium larger, or the valves subequal.

**gladucum**, Hook. & Arn. Lvs. ovate-lanceolate, tripinnate; pinnules about 6 in. long, taper-pointed; segms. close: outer valve of indusium larger, broader than the inner: veins once- or twice-forked. Hawaiian Isls.

**Barometz**, J. Smith. **SCYTHIAN LAMB**. Trunkless: lvs. scented, tripinnate, the lower pinnae ovate-lanceolate; pinnules short-stalked, 4–6 in. long, with falcate segms.: valves of the indusium nearly equal: veins prominent, rarely forked. China.



961. The Scythian Lamb; reproduced from an old book. See *Cibotium Barometz*.

AA. Outer valve of the indusium smaller than the inner.

**Schiedei**, Hook. Trunk 10–15 ft. high: lvs. oblong-deltoid, tripinnate, with pinnae 1–2 ft. long; segms. falcate, sharp-pointed: sori sparse: veins forked, on the lowest pinnate. Mex.

**regale**, Lind. Trunk 10–12 ft. high: lvs. oblong-deltoid, tripinnate, with pinnae 18–24 in. long; pinnules sessile, with close, falcate, deeply incised segms.; veins pinnate in the lobes. Mex.

L. M. UNDERWOOD.  
R. C. BENEDICT.†





CICCA: *Phyllanthus*.

**CICER**, (old Latin name for the vetch). *Leguminosæ*. Pea-like annual or perennial herbs, with 5-parted calyx, the lobes being nearly equal or the 2 upper ones somewhat shorter and connivent, oblong turgid 2-valved pod, mostly 1-flid. peduncles, odd-pinnate lvs. and toothed lfts.: standard ovate or nearly orbicular, wings obovate and free, keel rather broad and incurved: fls. white, blue or violet: terminal lft. often represented by a tendril or spine.—A dozen or more species, with a Mediterranean-Asian range. **C. arietinum**, Linn., the CHICK-PEA or GARBANZO, is sometimes cult. in vegetable-gardens for the edible ripe seeds. It is an annual and is cult. the same as bush beans. It withstands dry weather well. It grows 2 ft. high, making a bushy, hairy plant; seeds are planted as soon as warm weather comes, usually in drills, the plants standing 8-12 in. apart. Lvs. with small, roundish lfts.: fls. white or reddish, small, axillary. Seed roundish, but flattened on the sides, with a projection on one side, shaped like a miniature ram's head (hence the name *arietinum*, in vars. of red, black and white. Much cult. in S. Eu. and Asia; and widely known in Calif. and in Mex., and other Spanish-American regions. The peas are eaten boiled, or roasted like peanuts, often used for soup or as a substitute for coffee; and some kinds are used for horse-feed. It is a promising crop for some purposes; yield sometimes 500 to 1,000 lbs. to the acre.

L. H. B.

**CICHORIUM** (from an old Arabic name). *Compósitæ*. Seven or eight herbs, one of which is chicory and one endive.

Perennial, biennial or annual, branching and diffuse when in bloom, mostly with deep hard roots, milky juice and alternate lvs., and sessile axillary and terminal fl.-heads: fls. several to many in the head, all ligulate and perfect, blue, purple or white; involucre double; pappus of bristle-like scales.—Mostly in the Mediterranean region and to Abyssinia.

**Intybus**, Linn. **CHICORY**. **SUCCORY**. Fig. 962. Stout deep-rooted tall perennial (3-6 ft.): lvs. broadly oblong, oblanceolate or lanceolate, hairy, rapidly becoming very small toward top of plant so that the branches appear nearly naked and wand-like, more or less clasping and the lower ones runcinate: fls. bright azure-blue,  $1\frac{1}{2}$  in. or more across, closing about noon; pappus about 8 times shorter than fr. July-Oct.—Now a widespread weed of hard roadsides and fields but producing one of the clearest of light blues and worthy a place in the fl.-garden. Recent experiments promise attractive color forms. For cult. for the root and for the salad lvs. see *Chicory*.

**Endivia**, Linn. **ENDIVE**. Annual or biennial: lvs. many at the base, oblong, lobed and cut, smooth: st. 2-4 ft., branching, grooved: fls. pale blue; pappus about 4 times shorter than fr. India; but by some thought to be a derivative of *C. Intybus*, or of *C. divaricatum* of the Medit. region. For cult. as a salad plant. see *Endive*.

L. H. B.

CLENKOWSKIA: *Kaempferia*.



962. Flowers of chicory.—Cichorium Intybus. ( $\times \frac{1}{2}$ ). A familiar weed along roadsides in the eastern part of the country.

**CIMICIFUGA**, Linn. (*cimex*, a bug; *fugere*, to drive away). *Ranunculaceæ*. **BUGBANE**. Tall hardy herbaceous perennials, ornamental, but bad-smelling, suited for the back of plantings or for partially shaded places in the wild garden. The leaves and tall plants are admired in the hardy border.

Leaves large, decomposed: fls. white, in racemes; sepals 2-5, petaloid, deciduous; petals 1-8, small, clawed, 2-lobed or none: follicles 1-8, many-seeded, sessile or stalked; stigma broad or minute. Allied to *Actæa*.—About 10 species, natives of the north temperate zone, practically all of which have been used in gardens.

*Cimicifugas* thrive in half shady or open places in any good garden soil, but are much taller and more showy if the soil is very black and rich. Propagated by seeds and division of roots in fall or early spring. Seeds should be sown in cool moist soil soon after ripening.

**americana**, Michx. (*Actæa podocarpa*, DC.). Slender, 2-4 ft. high: lvs. pale beneath: fls. in elongated raceme; petals 2-horned; pedicels nearly as long as the fl.: follicles 3 or 5, stalked; seeds in 1 row, chaffy; stamens and pistils usually in same fl. Aug.-Sept. Moist woods N. Y. and S.

**foetida**, Linn. Lvs. bipinnate, terminal lft. 3-lobed: petals of the white fls. often tipped with anthers; no staminodia: follicles 3-5; seeds very chaffy. Summer. Siberia.—Following forms are more commonly cult.

**racemosa**, Nutt. (*C. serpentaria*, Pursh). Fig. 963. St. 3-8 ft. high: lvs. 2-3 times 3-4-parted; lfts. mostly ovate, firm texture: racemes few, rigidly erect, often becoming 2 ft. long: follicles rather shorter than the pedicel, nearly  $\frac{1}{4}$  in. long, short style abruptly recurved. July, Aug. Ga. to Canada and westward. Intro. 1891. Gt. 13:443. Gn. 46, p. 269. G.C. II. 10:557; III. 48:218.—Very pretty in fr., with its 2 rows of oval follicles always extending upward from the lateral branches. The commonest in gardens. Rhizome and roots valued in medicine.

Var. **dissecta**, Gray (*C. spicata*, Hort.). Lvs. more compound than the type: small white fls. closely packed on lateral and terminal branches. Lasting until Sept. Conn. to S. Pa. J.H. III. 33:381.

Var. **simplex**, Regel (*C. simplex*, Wormsk.). Tall and handsome: fls. short-pedicelled, forming a fine, dense raceme, and at first pubescent: follicle short-stalked. Kamtschatka. Gn. 67, p. 8. Gn.W. 21:115; 23:899.

*C. cordifolia*, Pursh. Lvs. very broadly ovate or orbicular. U. S. B.M. 2069.—*C. dahurica*, Hutt. Higher and more branched than former. Cent. Asia.—*C. elata*, Nutt. (*C. foetida*, Pursh. *Actæa Cimicifuga*, Linn.). Used in medicine. Ore., Wash.—*C. japonica*, Spreng. 3 ft. high: lvs. very large. F.S. 22:2363 (as *Pithyosperma acerinum*).—*C. palmata*, Michx.—*Trautvetteria carolinensis*, Vail.

K. C. DAVIS.

**CINCHONA** (from the Countess Cinchon, wife of a Spanish Viceroy of Peru, who was cured of fever in 1638 by the use of Peruvian bark). *Rubiaceæ*. Plants widely known as yielding a remedy, in the bark, for malaria.

Some of the species are lofty trees, others are mere shrubs. They grow isolated in various districts of the Andes, at elevations ranging from 2,300–9,000 ft., and between 22° south and 10° north latitude. Lvs. opposite, with deciduous stipules; fls. much frequented by humming-birds, fragrant, white and pink in color, growing in terminal panicles; calyx small, 5-toothed,



963. *Cimicifuga racemosa*.  
(Lfts.  $\times \frac{2}{3}$ )

and persistent; corolla has a long tube with 5 short spreading valvate lobes, hairy at the margins; stamens 5, included in the corolla; ovary 2-celled, with very numerous ovules inserted on linear axile placenta: caps. opening septicidally from the base upwards; seeds small, numerous, flat and surrounded with a wing.—There are 30–40 confused species. Specimens are sometimes seen in collections of economic plants, but they are not horticultural subjects.

From the pharmacopœial point of view there are two distinct kinds of cinchona bark: (1) *Cinchona*, also called yellow cinchona and calisaya bark, which is probably the bark obtained from *Cinchona Ledgeriana*, Moens, and hybrids of this with other species of *Cinchona*. The bark secured from these sources is said to contain 6 to 7 per cent of alkaloids, of which one-half to two-thirds is quinine. (2) *Cinchona rubra*, or red cinchona, which is obtained from *Cinchona succirubra*, Pavon, or its hybrids. In this bark the alkaloid cinchonidine exists in greater proportion.

The cinchona trees are considered to yield the maximum of alkaloids at six to nine years of age. The bark of the trunk and roots is removed; the latter is used mostly in the manufacture of quinine. Effort has been made to adopt the spelling Chinchona, although Linnaeus, in founding the genus, used only one h: see

Clements R. Markham "A Memoir of the Lady Ana de Osorio, Countess of Chinchon and Vice-Queen of Peru (A.D. 1629–39), with a Plea for the Correct Spelling of the Chinchona Genus," London, 1874.

The febrifuge reached Spain as early as 1639. Knowledge of it was spread by the Countess of Chinchon, hence it was called Countess' powder and Peruvian bark, and also Jesuits' bark, from the knowledge of it spread by Jesuits. The word quinine is derived from the name by which it was known in Peru, *quinaquina*, or "bark of barks." In 1849, trees were sent by the Jesuits to Algeria, but the experiment was not successful. In 1852–4, Hasskarl successfully introduced living plants into Java. In 1859, Clements R. Markham was entrusted by the government of India with the task of collecting plants and seeds on the Andes, and establishing them in India. In his fascinating book "Peruvian Bark: a popular account of the introduction of *Cinchona* cultivation into British India" (1880), Markham recounts the difficulties in South America and his final success. *Cinchona* is now grown commercially in India and also in Jamaica, but most of the commercial product is secured from trees grown in Java; it is also cultivated in New Zealand and Australia. *C. Ledgeriana*, Moens (*C. Calisaya*, Wedd., var. *Ledgeriana*, How.), is a small tree with small thick elliptical lvs., reddish beneath, and with yellowish not fragrant fls., and a short caps. *C. succirubra*, Pav., has large and thin broad-elliptic lvs., purple-red calyx and rose-colored petals, and an elongated caps. *C. officinalis*, Hook. f., has oval-lanceolate acute shining lvs., and rose-colored silky fls. It is sometimes seen (in some of its forms) in collections. Var. *Condaminea* (*C. Condaminea*, Humb. & Bonpl.) is one of these forms and has been intro. in S. Calif. and said to be easily grown there. L. H. B.

#### Cultivation of cinchona. (By Wm. Fawcett.)

The seedlings may be raised either in boxes or in beds. The boxes should not be more than 3 or 4 inches deep. Three-quarter-inch drainage-holes should be made in the bottom, about 6 inches apart. Whitewash the boxes or dust them inside with lime. Put pieces of broken flower-pots over the drainage holes, and cover the bottom with gravel to a depth of 1 inch. The soil should be made up of one-third leaf-mold, one-third good soil and one-third fine river gravel. These should be thoroughly mixed and passed through a  $\frac{1}{4}$ -inch sieve. Fill the boxes to within  $\frac{1}{4}$  inch of the top, and slightly water. Sow the seed evenly, and sprinkle over it some of the sifted soil, only just covering it. The boxes should be under shade, sheltered from rain, and watered every day with a very fine spray from a watering-can. The seedlings will appear in three or four weeks. If the seeds are sown in beds, they require the protection of a roof sloping south, and supported by posts 4 feet 6 inches high on the north, and 3 feet 3 inches on the south side. The sides may also have to be covered in. The breadth of the beds is 3 feet. The roof projects beyond the south posts sufficiently to keep off direct sunlight, and in the summertime, at any rate, a narrow north roof must be added at right angles. If the sheds are built under the shade of tall trees, the roof is needed only for shelter from rain.

When the seedlings are  $1\frac{1}{2}$  to 2 inches high, they should be transplanted into nursery beds, made up in the same way as for seeds. In transplanting, use a wooden peg 4 or 5 inches long,  $\frac{3}{4}$  inch thick at one end and tapering to a dull point. A seedling is picked up with the left hand from a bundle brought from the seed-beds, a hole is made with the peg in the right hand, big enough to receive the roots without bending or crushing them. The soil is then pressed closely over the rootlets with the peg. Two inches between each plant is enough room. At first the plants should be shaded, but



when they are twice or thrice as high as when transplanted the shading may be gradually removed to harden them for putting out in their permanent positions.

The soil and subsoil should be free and open to insure good drainage; newly cleared forest land on a hillside is the best for Cinchona trees. In Jamaica, *Cinchona officinalis* flourishes best at an elevation of about 5,500 feet, with a mean annual temperature of about 60° F., ranging from a minimum of 46° to a maximum of 75° and with a total annual rainfall of 120 to 150 inches.

The distance when planted out in their permanent positions is 3 by 3 feet, and as soon as they begin to interfere with each other's growth they should be thinned out just sufficiently at first to prevent this. The bark of those cut down may be worth stripping if the price of bark is high.

Several methods have been used in taking the bark from the trees. In South America, the tree is uprooted, and the whole of the bark may be taken from both root and stem. A second plan is used if shoots spring from the root; the trunk is cut through above the ground, the bark stripped, and the stump left to coppice, one or two of the shoots being allowed to grow. The third method is to make the same tree yield bark in successive seasons; for this purpose longitudinal layers of the bark are removed from the trunk, and the exposed surface is sometimes covered with moss; the bark renews itself, and the "renewed bark" is as rich (or richer) in alkaloids as the original. In this way, by taking successive strips of bark in different years, the tree yields a continuous supply of bark. L. H. B.†

**CINERARIA** (ash-colored, from the Latin, referring to the gray foliage). *Compósitæ*. Herbs or undershrubs, closely allied to *Senecio*, from which they are separated chiefly by technical characters of the achene. The genus is variously understood by different authors. As limited by Bentham & Hooker, and also by Engler & Prantl, it comprises about 25 South African species, and the common garden Cineraria becomes a *Senecio* (*S. cruentus*, DC.). The genus Cineraria differs from *Senecio* in having a cone-like rather than branched style, and a usually flattened or many-angled rather than terete achene; the species are herbs or subshrubs with yellow fl.-heads.

The cineraria of the florists (Fig. 964) is now much modified by cultivation. There are two views of its origin, one holding that it is a direct development of *C. cruenta*, Mass. (*Pericallis cruenta*, Webb. & Berth.), B.M. 406; the other that it is a hybrid, into which *C. cruenta*, *C. Heritieri*, *C. populifolia*, and perhaps others, have probably blended. These are all natives of the Canary Islands. For important literature respecting the origin of the garden cineraria, see Nature, 51:461, 605; 52:3, 29, 54, 78, 103, 128; 55:341. G.C. III. 3:654, 657; 17:588, 655, 742; 18:89, 186; 29:297

The florists' cinerarias run in white, and in shades of blue, pink and purple-red. There is promise of yellow-flowered strains by hybridizing with yellow *senecios* or related plants.

See *Senecio* for *Cineraria acanthifolia*, *C. candidissima*, and *C. maritima*. To the garden or florists' cineraria (*C. cruenta*) belong the horticultural names *C. grandiflora*, *C. kewensis*, *C. nana*, *C. stellata*, and others. There are full-double forms (see R.H. 1874, p. 47; 1886, p. 41. F.S. 22:2347-8. I.H. 32:556).—*C. flavescens*, Hort., is a garden hybrid between Cineraria "Feltham Beauty" and *Senecio auriculatissimus*. G.C. III. 45, 322. Gn. 73:252. It is a compact grower, originating with James Veitch & Sons, giving promise of a new strain of winter-blooming plants: fls. creamy yellow, the younger blooms almost canary yellow; lf. peculiarly constricted at the middle and much enlarged at the top.—*C. hybrida*, Hort., is a hybrid between *Senecio cruentus* and *S. tussilaginis*, with white fls. having pale blue tips on the rays and purplish centers. G.M. 55:337.—*C. stellata*, Hort., now a popular race of florists' cineraria, has open spready panicles of star-like single fls. Fig. 965. Most excellent.

The true yellow-fl. South African cinerarias seem not to be in cultivation, although *C. pentactina*, Hook. f., has been recorded in horticultural literature within recent years: slender and climbing, with lax paniculate inflorescence, pale red flower-stems and five golden yellows rays in each head. B.M. 7799. Elegant greenhouse climber.

L. H. B.

#### Culture of the florists' cineraria.

The single hybrid cinerarias are among the most useful and beautiful of all greenhouse flowering plants.

The ease with which they can be raised, the little heat required, together with their free-blooming qualities, brilliant and various-colored flowers, which last for a considerable time in blossom, make them popular with most people possessing even only a small greenhouse. Though they are herbaceous in character and may be propagated by cuttings or division of the roots, the single varieties are best treated as annuals, raising them from seed each year and throwing away the plants after flowering. Although one may save one's own seed, the cinerarias, like most hybrids, will deteriorate both in size and quality of the flower after one

or two generations unless they are crossed; therefore, unless one cares to cross one's own plants, it is best to purchase fresh seed from some reliable firm that secures its stock from hybridists. For florists' use, or when a succession of



964. Small plant of the florists' cineraria.—  
Botanically *Senecio cruentus*.



these flowers is required, two sowings of seed should be made—the first about the middle of August, and the second a month later. The seed should be sown in pans or shallow boxes 1 foot square; these should be well drained, and the soil should consist of one part fine loam, one part leaf-mold, and one part clean sharp silver sand. The surface should be made very fine and pressed down evenly. The seed should then be sown evenly and rather thinly, and covered with sand about the eighth part of an inch. This will in a great measure prevent the seedlings from what gardeners term “damping off,” which they are very apt to do if the atmospheric conditions become at all stagnant. The seed-pans or boxes should be carefully watered with a fine rose and then placed in some cool shaded

place, such as a frame placed on sifted coal-ashes on the north side of a wall or building, where they will germinate in about a week or ten days. As soon as large enough to handle conveniently, the seedlings should be potted into thumb-pots and grown on as rapidly as possible, shifting on into larger size pots as often as required, never allowing them to become the least pot-bound, or suffer in any way during the season of growth. The soil should consist of half leaf-mold and half fine fibrous loam, with a good sprinkling of silver sand, until the final shift into their flowering pots, when the soil should be three parts fibrous loam and one part well-decayed cow-manure or pulverized sheep-manure. About the first of October the plants should all be removed to the greenhouse, where the atmosphere should be kept cool and moist, but not stagnant. If a rainy spell should set in, a little artificial heat should be given to cause a circulation of the atmosphere, and as autumn advances the temperature should be kept about 45° at night, with a rise of 10° by day. Liquid stimulants should not be given until the flower-buds begin to appear, when they are greatly benefited by an occasional watering of clear liquid cow- or sheep-manure. The plants should be well in bloom after the holidays.

If bloom is wanted in late fall or early winter, seed may be sown in May; keep the plants growing all summer, but do not let them bloom till they are established in 5- or 6-inch pots.

The Star cineraria (Fig. 965), now popular, is an open grower, 2 feet, not having the large solid masses of flower-heads of the older larger-flowered kinds. The blooms are single and mostly smaller, and the rays are separated as in a wild aster. These plants go under the

name of *C. stellata*. They are very free flowering, and as pot plants are more decorative than the large-flowered types; they meet the present demand for simplicity. In color they have the same range as the ordinary florists' cinerarias; and there are cactus-flowered strains, with narrow rolled petals. The star cinerarias require the same handling and treatment as the others.

Double-flowered varieties of cineraria are not commonly grown, neither are they so beautiful as the single varieties. They may be propagated by seed or by cuttings, the latter being the best method, as a large percentage of seedlings are sure to turn out single, which will be inferior in size of flower as compared with the best single varieties. Double-flowering varieties must be propagated each year to secure the best results. As

soon as the plants have finished blossoming, the flower stalks should be cut away to induce the plants to make fresh growth, which, as soon as large enough for cuttings, should be taken off and inserted in an ordinary propagating bed, where they will soon root, after which they should be potted and shifted on as often as required, growing them during the hottest months in as cool and shaded a position as can be provided.

Cinerarias are very subject to the attacks of greenfly. To keep these in check, the house in which they are grown should be fumigated with tobacco about once in ten days, or tobacco stems placed among the plants if fumigating is objectionable; or the cyanide treatment used. See *Diseases and Insects*.

Of the different species of Cineraria from southern Europe (properly Senecios), *C. maritima* is perhaps the best. It is of



965. *Stellata*, a popular form of cineraria. ( $\times \frac{1}{2}$ )

dwarf habit, with tomentose, silvery, pinnatifid leaves, and is a most useful subject for edging flower-beds. It is not hardy in the North, consequently must be treated as an annual, sowing the seeds early in March in the greenhouse, afterward treating it as an ordinary summer bedding plant. The other species from south and eastern Europe do not prove hardy North, and if grown should be treated as tender annuals, planting them in the herbaceous borders for the summer. The species from the Cape of Good Hope require greenhouse treatment, the culture being the same as for the common cineraria, although, from an ornamental point of view, most of them would hardly pay for the room they would occupy.

EDWARD J. CANNING.

**CINNA** (old Greek name for a kind of grass). *Gramineæ*. Tall perennials with flat leaf-blades. Spikelets 1-fl., numerous, in nodding panicles, the







XXVII. Coconut in flower and fruit, Southern Florida.



rachilla prolonged; lemma short-awned below the apex. There are two species, *C. arundinacea*, Linn., with contracted panicle, the spikelets  $2\frac{1}{2}$  lines long, (Dept. Agric., Div. Agrost. 7:140; 20:79) and *C. latifolia*, Griseb. (*C. péndula*, Trin.), with open panicle, the spikelets 2 lines long. Both species are native in cooler parts of N. Amer.

A. S. HITCHCOCK.

**CINNAMOMUM** (the ancient Greek name). *Laurææ*. Evergreen trees and shrubs of Asia and Australia, with aromatic leaves and wood, of which a few are cultivated in the extreme southern United States.

Leaves usually thick, mostly opposite, strongly 3-nerved or pinnate-nerved; buds not scaly (exception in *C. Camphora*): fls. usually perfect, with 9 (or less) perfect stamens in 3 unlike rows and a row of imperfect ones; perianth short-tubed, segms. 6 and nearly equal: fr. a small 1-seeded berry, in the cup-like perianth.—Upward of 50 species, among which are plants yielding cinnamon (*C. zeylanicum*), camphor (*C. Camphora*), cassia-bark (*C. Cassia*), and other aromatic and medicinal products. Various species may be expected in collections of economic plants, but most of them are not strictly horticultural subjects. It is not known whether some of the species in cult. in this country are passing under the proper names; possibly *C. Tamala*, Fr. Nees, widely distributed in the Far East, may be confused in our cultures.

The genus *Cinnamomum* embraces tropical and semi-tropical shrubs and trees, which are mostly of economic value, and in one or more cases are valuable shade trees for lawn and street planting. The leaves are evergreen, usually of a rich shining green, and in *C. Camphora* have a silvery blue color on the under surfaces. *C. Camphora*, the camphor tree, is hardy in the lower Gulf states, and is now being extensively planted, both for shade and extraction of gum. *C. Cassia* is not quite so hardy, but withstands a temperature of 20° F. without injury, and has been planted in Florida for manufacture of its various products,—oil, gum, buds and cinnamon bark. *C. zeylanicum*, is likely to be extensively grown in Mexico and the West Indies.—The various species are usually propagated by seeds, which are sown as soon as ripe in a shaded bed, the seedlings being transplanted when very small into pots and kept thus growing until permanent planting out. The species, without exception, are very difficult to transplant from the open ground, and hence pot-grown plants are almost a necessity. Cuttings of half-ripened wood of some species may be rooted in the spring in moderate heat, following the usual method of preparation, and planting in coarse sand. The soil best suited to cinnamomums in general, and *C. Camphora* in particular, is sandy loam, although a heavy loam, when well prepared, answers fairly well. The sandy soil of Florida, when moderately manured, suits all species so far tried admirably. (E. N. Reasoner.)

**Camphora**, Nees & Eberm. (*Camphora officinarum*, Nees. *Laurus Camphora*, Linn.). CAMPHOR TREE. Stout tree with enlarged base, to 40 ft.: lvs. alternate, ovate-elliptic, acuminate, not large or very thick, pinkish on the young growths, with a pair or more of strong side veins: buds scaly: fls. small, yellow, in axillary panicles; perianth membranaceous: fr. a drupe the size of a large pea. China, Japan. B.M. 2658.—A handsome dense-topped tree when young, becoming bare below with age; withstands some frost. The young growth is very attractive. It is hardy in central peninsular Fla., where it thrives well if attention is given to fertilizing and cultivating; it does not thrive in wet soils. Camphor is a common roadside planting in S. Calif. Commercial camphor is extracted from the wood.

**zeylanicum**, Nees. CINNAMON TREE. Small tree (20–30 ft.): lvs. very stiff, 4–7 in. long, ovate to lance-ovate, glossy, 3–5-nerved, obtuse or somewhat acute, reticulate on under side: fls. small ( $\frac{1}{4}$  in. long), yellow-

white, in loose somewhat silky clusters, which often exceed the lvs.: fr.  $\frac{3}{4}$  in. long, dry, pointed. India, Malaya, and widely dispersed in tropical countries as a cult. plant. B.M. 2028. L.B.C. 1:91.—Variable; and many forms have been described.

**Cássia**, Blume. CASSIA-BARK TREE. Handsome tree: lvs. stiff, 3–6 in. long, oblong to nearly lanceolate, long-acuminate, glossy, 3-ribbed; petiole slender: fls. very small, in terminal or axillary silky-tomentose panicles 3–6 in. long: fr. size of a pea. China.—Young branches somewhat 4-angled. Hardy and successful in central peninsular Fla. (Nehrling), thriving best in moist and rich land, and making specially fine specimens near residences where now and then it receives applications of fertilizer and water.

**pedunculatum**, Presl. Glabrous tree: lvs. thick, oblong-lanceolate, acuminate, 3-nerved, glossy above; petiole to  $\frac{3}{4}$  in. long; blade 2–5 in. long and somewhat glaucous or areolate beneath: fls. very small ( $\frac{1}{2}$  in. or less long), in axillary corymbs that about equal the lvs.; perianth glabrous outside and whitish-puberulent inside, the lobes oval-obtuse: berry globose-ovoid,  $\frac{1}{4}$  in. long. Japan.—This species is said to have been intro. at Los Angeles some 35 years ago, where a handsome tree still exists, seedlings of which are to be found in other parts of S. Calif. In central peninsular Fla., this species and *C. Lourerii* are hardy and attractive, thriving particularly well in rich and rather moist land.

**Lourerii**, Nees. CASSIA-FLOWER TREE. Middle-sized tree, glabrous: lvs. opposite or alternate, rigid, elliptic or oblong, attenuate-acuminate; petiole to  $\frac{1}{2}$  in. long, the blades 3–5 in. long: fls. very small (there is a variegated-lvd. form). China, Japan.—Perhaps a form of the last, with nerves on upper side of lf. less prominent or sunken, and other minor differences.

L. H. B.

CINNAMON FERN: *Osmunda*.

CINNAMON VINE: *Dioscorea*.

CINQUEFOIL: *Potentilla*.

**CIPURA** (origin of name unexplained). *Iridææ*. Four Trop. American bulbous plants, rarely grown under glass. Allied to *Nemastylis*: fls. with 6 parts or petals, the inner 3 being much smaller, white or light blue, borne in terminal heads, short-tubed. The only species likely to be in cult. is *C. paludosa*, Aubl., with white fls. and radical linear-lanceolate lvs.; bulb conical-globose. B.M. 646 (as *Marica*). Prop. by seeds and offsets; to be kept on the dry side through winter.

**CIRCÆA** (Circe, the enchantress). *Onagrææ*. ENCHANTER'S NIGHTSHADE. Six or seven herbs of low or moist woods in North America and other temperate and cold regions of the northern hemisphere, two of which have been offered for growing in shady places and about garden bogs.

Perennials, small and soft: lvs. opposite and stalked: fls. perfect, small, and white, in terminal and lateral racemes; calyx-tube hairy, prolonged beyond the ovary, 2-lobed; petals 2, notched: fr. a small, bristly bur. They are interesting little plants, but not showy. Of easy cult. in shady, damp spots.

**Lutetiàna**, Linn. Erect and branching, 1–3 ft., the st. swollen at the nodes: lvs. ovate-acuminate, more or less rounded at the base, somewhat toothed: pedicels slender, reflexed in fr.: fr. 2-celled, bristly. Woods, E.

**pacifica**, Aschers & Mag. From 6–12 in., from a little tuber; smaller than the above, lvs. less acuminate, fls. smaller, fr. 1-celled and less bristly. Wyo., west.

L. H. B.

**CIRRHÆA** (from *Cirrhos*, a tendril). *Orchidææ*. About a half-dozen Brazilian orchids, of no special importance, one of which, *C. viridipurpurea*, Lindl., is sparingly offered abroad, and two or three others of

which are mentioned in horticultural literature. Allied to Gongora; cultured as for Cymbidium; warmhouse. Fls. mostly greenish and red (or purple), on long pendulous racemes that arise from base of the pseudobulbs.

**CIRRHOPE TALUM** (*tendrill petal*, alluding to the narrow lateral sepals). *Orchidaceæ*. Epiphytes, grown in baskets or on blocks in a warmhouse.

Pseudobulbs from a creeping st.: dorsal sepal free; lateral sepals much longer than the dorsal, cohering excepting at the base; petals much shorter, often ciliate; lip entire, usually recurved; column short, 2-winged at the apex; pollinia 4.—About 90 species in Trop. Asia, Mascarene Isls., and Australia.

Being of rambling habit, with creeping rhizomes, cirrhopetalums should be grown in baskets sufficiently large to afford plenty of growing surface, and suspended from the roof where they will get abundant light and free access of air to the roots, which is equally essential. Liberal allowance must be made for drainage, which should consist of either broken potsherds or charcoal, the latter being preferable, as it is light, durable and contains nothing detrimental. Two-thirds osmundine, or other clean fiber, and one-third chopped live sphagnum moss, well mixed together, afford a good compost; and after this has been carefully tucked in about the roots and interstices, the plant should be held firm with brass or copper wire until reestablished. The compost should be used rather sparingly to prevent over-watering. Many of the smaller-growing species do very well on orchid blocks, firmly attached, with a small quantity of compost beneath them. During the winter months, little or no shade is required. The temperature may range from 58° to 65° F. by night, with about 10° rise through the day, or even a little more, with sun-heat, will do no injury. No artificial heat is necessary in summer, except in extreme cold or wet weather, but a shaded moist location should be chosen, such as is afforded in the cattleya or palm department. When the plants are dormant, light syringing overhead will keep the compost moist and the plants in healthy condition, but as the growing season advances, a liberal quantity of water and copious syringing in bright weather will be necessary. The stock is increased by division, the most judicious method being to cut nearly through the rhizome with a sharp knife, about three pseudobulbs behind the lead, just before growth action, allowing the part to remain until the dormant eyes start to grow, when it may be removed and treated as an established plant. A little extra heat and moisture at this period will prove beneficial with the weak plants. All are of moderately easy culture. (Robert M. Grey.)

**Medusæ**, Lindl. Pseudobulbs ovoid, ribbed; lvs. 5-8 in. long, oblong-elliptic; scapes with large sheathing bracts; umbel many-fld.; fls. creamy, yellow-spotted; dorsal sepal lanceolate; lateral sepals with long pendent tails, 4-5 in. long; petals and lip minute. Singapore. B.R. 28:12. B.M. 4977. I.H. 39:154. G.C. III. 21:25.

**picturatum**, Lindl. Pseudobulbs ovoid, about 2 in. long, angled; lvs. 3-5 in. long, linear-oblong; scape with sheaths pale yellowish-green, red-speckled; umbel 10-15-fld.; sepals and petals green, the dorsal sepal erect, obtuse, red-spotted, with a thread-like purple-knobbed summit, the lateral sepals linear; petals small, rounded, curved; lip blood-red, obtuse. India. B.M. 6802.

*C. Andersonii*, Kurz. Dwarf habit; fls. in umbels; lateral sepals whitish, with fine rose dots; dorsal sepal marked with purple lines. Sikkim.—*C. appendiculatum*, Rolfe. Dorsal sepals and petals pale yellow; lip rosy purple. E. Indies.—*C. biflorum*, J. J. Smith. Sepals purple-spotted, the dorsal elliptic, about 1½ in. long, including the seta, the lateral sepals linear-lanceolate, 3-3½ in. long. Java. B.M. 8321.—*C. breviscapum*, Rolfe. Dorsal sepal oblong-lanceolate, about ¾ in. long, dull purple, the lateral sepals yellow, spotted red-brown, about 1 in. long, the lip rose-purple, broadly cordate, ovate-cuneate, hairy at base. Perak. B.M. 8033.—*C. caudatum*, King & Pantl. Dwarf species; dorsal sepals short;

lateral sepals tail-like, about as long as scape. Himalayas.—*C. chinense*, Lindl. Fls. pale fawn-color, the dorsal sepal hooded, crimson-spotted, the lateral sepals linear-lanceolate, the lip crimson-spotted. China. B.R. 29:49.—*C. chrysæum*, Kränzl. Scape filiform, 1-fld.; fls. yellow. Philippines.—*C. Cumingii*, Lindl. Umbel 9-12-fld.; fls. purple, the dorsal sepal glandular-ciliate, the lateral sepals 1 in. long, linear-oblong; lip with 2 erect processes. Philippines. B.M. 4996.—*C. Hookeri*, Duthie. Fls. 1 in. long, yellow, the dorsal sepal about ¼ in. long, obtuse, purple-streaked, the lateral linear-lanceolate, acuminate. Himalayas. B.M. 7869.—*C. lepidum* (*Bulbophyllum lepidum*, J. J. Smith). Dorsal sepal, erect, ciliate, ½ in. long, brownish yellow; lateral sepals united, spreading, bright brownish yellow, somewhat red-flushed, at base, the upper portion pale yellow, marbled with brown-red, about 1 in. long; petals ½ in. long, ciliate. Java.—*C. longissimum*, Riddell. Fls. whitish, rosy-streaked, the dorsal sepal lanceolate, ¾-¾ in. long, the lateral sepals linear, 8-12 in. long, with slender tails; petals falcate, ciliate. Siam. B.M. 8366.—*C. Micholitzii*, Rolfe. Umbels 8-12-fld.; lateral sepals deep yellow; dorsal sepal and petals blotched with dark purple on a pale ground. Annam.—*C. minusculum*, Rolfe. Fls. vermilion-colored with hairs of dorsal sepal and petals yellow; lateral sepals caudate, almost thread-like. Annam.—*C. papillosum*, Rolfe. Umbels usually 6-fld.; dorsal sepals and petals lined with dark purple on a pale ground; lateral sepals speckled with red-brown. Siam.—*C. pilchrum*, N. E. Br. I.H. 33:608. O.R. 17:328. A.F. 6:609.—*C. retusiusculum*, Reichb. f. Fls. ¼ in. length; upper sepals dark purple; lower coherent, yellow, marked with dark red. China.—*C. Roxburghii*, Lindl. Small, with ovate reddish green lvs. and almost globose umbels of cream-white fls. tinged with rose or purple. India. A pretty dwarf species.—*C. Thoursii*, Lindl. Umbel of 10-12 fls.; sepals and petals tawny yellow, the dorsal ovate, cuspidate, with purple warts, the lateral lanceolate, acute, stained claret; petals small, ovate-lanceolate, pale yellow, purple-spotted, with a thread-like tail at apex; lip oblong. Madagascar, Java, Philippines, Society Isls. B.R. 24:11. B.M. 4237.—*C. sinense*—*C. chinense*. GEORGE V. NASH.

**CIRSIIUM** (old Greek name, referring to the use of the plant in an ailment). *Compositæ*. THISTLE. Prickly-leaved plants (largely biennial) of bold habit and showy purple, pinkish, white or even yellowish heads, sometimes planted in wild gardens.

The thistles are botanically confused. By some authors, Cirsium is combined with Carduus, but others keep it distinct because of the plumose or feathery pappus (which is most constant on the inner florets); and this disposition is here accepted. The cirsiums are herbs or subshrubs, more or less spiny; lvs. alternate, sessile, often pinnatifid; fl.-heads large, mostly terminal; involucre ovoid or spherical, with many rows of imbricated often spiny-tipped scales, many-fld.; florets all tubular and alike (seldom more or less diœcious).—More than 120 species of annuals, biennials or perennials, widely spread in the northern hemisphere.

Other generic names partaking in the confused usage are Carbenia, now a synonym of Cnicus; Chamæpeuce, now a section of Cirsium; and Cnicus (which see), a genus of one species, distinguished by sterile marginal florets, pappus of ten long bristles and equal numbers of shorter ones and of hornyteeth, and achene attached obliquely near the base rather than squarely on the base.

A number of the thistles are field and pasture weeds. The most peniculous of these weeds is the Canada thistle, *C. arvense*, Scop. (*Carduus arvensis*, Rebs.), Fig. 795. The common bull thistle or pasture thistle (Fig. 966) is a stately biennial, and very decora-



966. Head of pasture or bull thistle. (×½)



tive. It is *C. lanceolatum*, Hill (*Carduus lanceolatus*, Linn.). Both these species are introduced from Eu., as well as two or three others of lesser distribution in this country. There are a number of showy native species, one of which, *C. muticum*, Michx., (*Carduus muticus*, Pers.) is shown in Fig. 967. This purple-fl. species occurs in low grounds from Newfoundland to W. Va.

A few species of *Cirsium* (as the genus is here defined) may be expected to occur in cult. *C. oleraceum*, Scop., (*Carduus oleraceus*, Vill.), of Eu., has very decorative foliage, and thrives in the moister parts of a garden; the fls. are not very handsome, whitish or yellowish; 3 ft. The *Chamæpeuces* are sometimes grown for the large prickly spreading rosettes of lvs. that are produced the first year, the bloom appearing the second year. They combine well with plantings made for subtropical effect: *C. Casabonæ*, DC. (*Chamæpeuce Casabonæ*, DC. *Carduus Casabonæ*, Linn.), has lvs. deep green veined white, spiny, the fl.-heads pale purple; *C. Diacantha*, DC. (*Chamæpeuce Diacantha*, DC. *Carduus Diacantha*, Labill.), has thick lvs. shining green with silvery lines, white beneath, linear-lanceolate, the principal nerve or rib terminated by a single spine and the lateral nerves usually 2-spined, and dense clusters of purple heads; *C. afrum*, DC. (*Chamæpeuce afra*, DC. *Carduus afer*, Jacq.), has dark green blotched white linear-lanceolate lvs. tomentose beneath, and large bright purple heads; *C. Sprengeri*, Hort., a garden hybrid, perennial, with dark green white-veined spiny lvs., and white fragrant heads; *C. tauricum*, Hort., is probably *C. Diacantha*.

L. H. B.

**CISSAMPÉLOS** (Greek for *ivy* and *vine*). *Menispermaceæ*. Mostly twining plants, shrubs and herbs, one of which is cultivated far south.

Leaves various, mostly cordate or reniform, often peltate, alternate: fls. in axillary racemes or clusters, the plant dioecious; sterile fls. with 4 sepals and 4 petals united, the anthers 2-5 on a staminal column or disk; fertile fls. with 2 united fleshy sepals, subtended by a sepal-like bract, and solitary ovary, with 3 styles: fr. a subglobose drupe, with a flattened and tuberculate stone. Many species or distinct forms in tropical regions, but many of them are evidently forms of the widely distributed *C. Pareira*, Linn. This plant, as *C. heterophylla*, DC., and under other names, is cult. in S. Fla. and the tropics. It is known as VELVET-LEAF and FALSE PAREIRA. It is an exceedingly variable vine, with downy round-cordate or peltate entire or lobed lvs., the very small sterile fls. in stalked corymbs and the fertile in large-bracted clusters, and a hairy or glabrate nearly globular red drupe. It occurs in all tropical countries. "*Pareira brava*" of the pharmacopœas is derived from the root of the related perennial climber, *Chondrodendron tomentosum*, of Peru and Brazil. Whether the genus *Cissampelos* contains 20 or 70 species depends mostly on the rank given to the many forms of the cosmopolitan *C. Pareira*.

L. H. B.

**CISSUS** (Greek name of *ivy*). *Vitaceæ*. Mostly tendril-climbing shrubs, a few of which are grown in the open, and others under glass for the handsome often colored foliage.

Very like *Vitis* (with which some authors unite it): at best a mixed group botanically, and capable of good definition only when certain groups or subdivisions are removed from it. For the characters of related genera, see *Ampelopsis*, *Parthenocissus*, *Vitis*. As constituted by Gilg in Engler & Prantl's "Pflanzenfamilien," the genus includes *Cayratia* but which might well be kept distinct. This subgenus, of which two or three interesting species from China and Japan are in cult., differs from *Cissus* proper in the always compound lvs., which are usually pedate, the axillary infl., the thin or even membranous disk, the 2-4-seeded fr., and the plants mostly herbaceous. Excluding *Cayratia*, *Cissus* is known by usually simple lvs., 1-seeded fr., and the disk being deeply 4-lobed or separated into 4 gland-like bodies. From *Ampelopsis*, as that genus is characterized in this work, *Cissus* differs in the 4-merous fls., often herbaceous, and fleshy st., the 1-seeded rather than 2-4-seeded fr. and in the disk not being cup-like and not irregularly lobed. From *Vitis*, it differs in its 4-merous fls., its expanding petals (the corolla not falling off as a cap), the 4-parted disk, its 1-seeded mostly dry and inedible fr., and other characters. *Cissus* comprises probably 200 species, widely dispersed in tropical regions and a few of them reaching extra-tropical areas (as in the southern U. S.): mostly climbers by means of tendrils without enlarged or disk-like ends, rarely erect shrubs or even perennial herbs, sometimes with greatly thickened sts. either under ground or above: lvs. alternate, simple or compound, with tendril (if present) opposite or at same node: fls. usually perfect, in mostly umbel-like cymes that are terminal or axillary; parts of the fl. in 4's, the petals at length spreading and falling separately; disk around the ovary 4-parted or -separated; style long and mostly slender rather than conical: fr. typically a dryish 1-seeded berry (2-4-seeded in *Cayratia*).

In cultivation there are very few species of *Cissus*, and these are mostly the tendril-climbing *Vitis*-like species grown under glass for the handsome foliage. The best known is *C. discolor*, although other species are likely to become widespread and popular in greenhouses. The fleshy-stemmed erect species are sometimes grown in botanical collections for the cactus-like forms and for illustrations in adaptive morphology. The species are readily propagated by cuttings.

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A. *St. herbaceous*.

1. *japonica*, Willd. (*Cayratia japonica*, Gagnep.). Herbaceous, glabrous or minutely puberulent, the branches striate, climbing by tendrils: lvs. pedately 5-foliolate, long-stalked, the lfts. lanceolate or obovate-oblong, serrate: fls. in a long-peduncled 2-3-forking cyme, greenish; petals ovate-triangular, blunt: berry size of a small pea, 2-4-seeded, the seeds 3-angled-ovate, keeled. Japan, Java, Austral.—Appears to be root-hardy N., when covered.

2. *oligocarpa* (*Vitis oligocarpa*, Lev. & Van. *Cayratia oligocarpa*, Gagnep.). Differs from the above in the acuminate and more sharply and closely serrate lfts., which are puberulous when young: anthers orbicular. China.—Very recently intro.

3. *adenopodus*, Sprague. Herbaceous, climbing by tendrils, slender, terete root tuberous: lvs. red and decorative, 3-foliolate, petioled, 3-6 in. long, hairy;

lfts. stalked, ovate, abruptly acuminate, coarsely serrate, green with sunken nerves above and red with prominent nerves beneath: fls. light yellow, in a loose panicle or cluster about 4 in. long, the pedicels recurved after flowering; petals oblong, much reflexed (about  $\frac{1}{2}$  in. long); berry globose,  $\frac{2}{3}$  in. diam., dark purplish black. Trop. Afr. (Uganda). B.M. 8278.—A quick-growing plant requiring greenhouse conditions. Readily prop. by cuttings or seeds, and of very easy cult. Thrives well in sunlight. A recent intro.

AA. *St. not herbaceous at maturity, although perhaps fleshy.*

B. *Lvs. fleshy, 3-lobed or 3-foliolate.*

4. *ácida*, Linn. Low glabrous climber, with slender and striate somewhat fleshy branches and long stout tendrils: lvs. rigid, petiolate; lfts. or lf.-divisions rather small, broad-cuneate and sharply toothed near the apex: fls. small, in corymb-like or umbel like clusters: fr. an ovoid and abruptly pointed dark purple berry, with 1 or 2 large seeds, the pedicel being recurved at maturity. S. Fla., and Trop. Amer.; also, in Ariz. and S.—Sometimes planted.

5. *incisa*, Desm. (*C. Rocheana*, Planch.). Climbing 20–30 ft., the sts. warty and very fleshy and the tendrils root-like: lvs. pale green, very fleshy; lfts. or divisions wedge-ovate, notched on both sides and top, the middle one sometimes again lobed and the lateral ones 2-lobed: fls. in umbel-like mostly 3-forking cymes opposite the lvs.: fr. an obovoid blackish berry, with 1 or 2 seeds, the pedicel being strongly recurved. Fla., to Ark. and Texas. R.H. 1884, pp. 272–3.—Often planted in the extreme S. Sometimes called “marine ivy.”

BB. *Lvs. not fleshy.*

C. *The lvs. 3–5-foliolate.*

6. *gongylodes*, Planch. (*Vitis gongylodes* and *V. pterophora*, Baker). Vigorous tendril-climber with 4-angled branches, desirable for large greenhouses where tropical effects are desired, sending down long bright red aerial roots: lvs. large, stalked, 3-foliolate; lfts. rhomboid or the middle one often 3-lobed, the lateral ones sometimes lobed on the outside at the base, hairy on margin and nerves: fls. red-brown, in pedunculate cymes opposite the lvs.: a tuber (reaching 5–6 in. long) is borne at the end of each branch when the season's growth has ceased, and this drops and produces new plants. Brazil. B.M. 6803. Gt. 37:1273. R.H. 1908:203.

7. *striata*, Ruiz & Pav. (*Ampelopsis sempervirens*, Hort.). Low, shrubby evergreen vine, tendril-climbing, the branches striate and usually lightly hairy: lvs. small, 3–5-foliolate, with cuneate-obovate or lanceolate coriaceous lfts., serrate above the middle: fls. yellowish, in many-fl. pedunculate cymes opposite the lvs.: fr. depressed-globose, size of small pea, often 2-celled and 2–4-seeded. Chile, S. Brazil.—Graceful small climber for the cool greenhouse; robust in S. Calif.

CC. *The lvs. not compound although perhaps lobed.*

8. *discolor*, Blume. Fig. 968. Tendril-climber, smooth, but not glaucous, the branches slender and with 4 or 5 ribs or angles, red: lvs. oblong-ovate or cordate-ovate, acuminate, bristly serrate, reddish beneath, velvety green and mottled with silvery white

above: fls. small and yellowish, in dense and very short axillary peduncled clusters: fr. globular, 1-seeded. Java. B.M. 4763. Lowe 13. F.S. 8:804–5.—One of the best of greenhouse foliage plants. Easily grown. Prop. by cuttings. It must have a season of rest, usually in spring or early summer. If wanted for winter growth, temp. must be about 75°. It thrives in rich somewhat moist soil and responds to small applications of fertilizer now and then. The plant is very susceptible to root-knot. Variable.

Known to some as “trailing begonia.”

Var. *mollis*, Planch. (*C. velutinus*, Lind.). Pubescent or velvety: lvs. green and boldly veined with white above, blood-red beneath: fls. intense bright red, in large laxer and longer-peduncled cymes. Habitat unknown. B.M. 5207.

9. *antártica*, Vent. (*C. Baudiniæna*, Brouss.). KANGAROO VINE. Upright shrub, but the branches climbing by tendrils, hairy: lvs. rather thick, glossy, ovate to oblong, sometimes more or less cordate, very short-acuminate, mostly toothed or notched,

green: fls. green, in few-fl., axillary clusters: fr. a globular- or few-seeded berry, said to be edible. Austral. B.M. 2488.—Valuable for cool greenhouses, but does not withstand frost. Grows well on walls in darkish and neglected places.

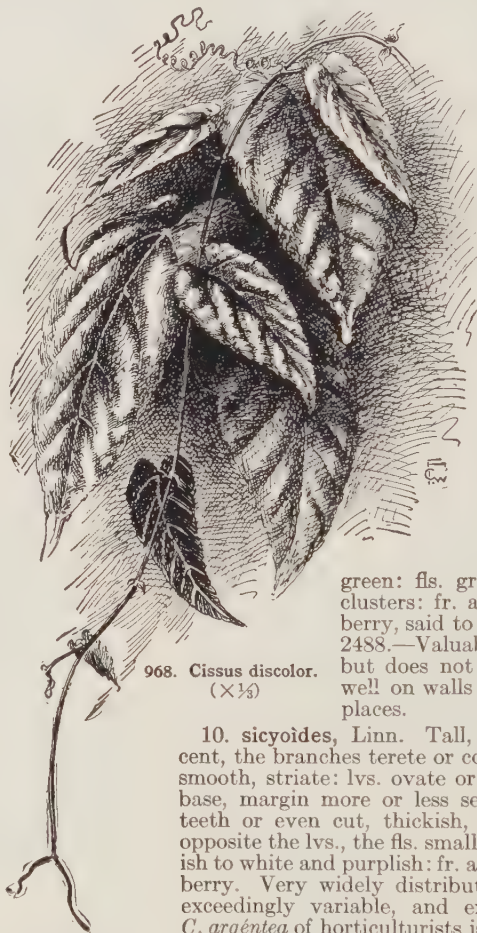
10. *sicyoides*, Linn. Tall, tendril-climbing, pubescent, the branches terete or compressed, tuberculate or smooth, striate: lvs. ovate or oblong, often cordate at base, margin more or less serrate with bristle-tipped teeth or even cut, thickish, green: infl. corymb-like, opposite the lvs., the fls. small, and varying from greenish to white and purplish: fr. an obovoid, 1-seeded black berry. Very widely distributed in Trop. Amer., and exceedingly variable, and extending into Fla. The *C. argentea* of horticulturists is var. *ovata*, Baker, which has glabrous ovate or ovate-oblong remotely serrate and somewhat glaucous lvs. Called “season vine” in tropics.

It is probable that some of the plants listed as *Cissus* belong to other genera, and some of the trade names are unidentifiable botanically.—*C. albo-nitens*, Hort. Lvs. oblong-acuminate, more or less cordate at base, silvery white and shining over the upper surface. Brazil. Warmhouse climber.—*C. amazónica*, Lind. Lvs. glabrous and glaucous, oval-acuminate and narrower, reddish beneath and silvery veined above. Brazil. Warmhouse climber.—*C. Davidiana*, Carr., is a *Vitis* (which see).—*C. Lindenii*, André (I.H. 17:2), has large ovate-cordate silver-blotched lvs.: a glabrous climbing shrub, with terete branches. Colombia.—*C. porphyrophylla*, Lindl., is a Piper.—*C. Verticillii*, Hort., is *Parthenocissus*.

L. H. B.

**CISTUS** (ancient Greek name). *Cistaceæ*. Rock ROSE. Low shrubs grown for their red or white hairy flowers.

Plants usually with villous and glandular tomentum, aromatic: lvs. opposite, mostly persistent, entire, the opposite petioles connate at the base: fls. large, in terminal and axillary cymes at the end of the branches, rarely solitary, white to purple; sepals 3 or 5; petals 5: stamens numerous; style elongated or short with a





large 5-10-lobed stigma: caps. many-seeded, splitting into 5 valves.—About 20 species in the Medit. region and many natural and garden hybrids. Monograph by Grosser in Engler, Pflanzenreich, hft. 14, pp. 10-32 (1903) and an illustrated monograph by R. Sweet, Cistineæ (1825-30) quoted below as S.C.

The cistuses are ornamental, free-flowering shrubs, usually only a few feet high, with very showy purple or white flowers similar to a small single rose, appearing in early summer. They are hardy only in warmer temperate regions, but many of them will stand 10° of frost without injury, and *C. laurifolius* and *C. villosus* var. *tauricus* even more. They thrive best in a well-drained light soil, mostly preferring limestone soil, and in a sunny position; the dwarfer species are well adapted for rockeries with southern aspect. They do not bear transplanting well, and should be grown in pots until planted out. Some species yield ladanum, a resin used in perfumery. Propagated by seeds sown in spring in pans or boxes and the young seedlings shaded; increased also by layers and cuttings in spring or late summer, inserted in sandy peat under glass. In the Old World, the cistuses are important garden plants, but they are little known in America.

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## A. Color of fls. purple or red.

## B. Fls. 1½-2 in. wide; petals imbricate.

## C. Lvs. penninerved, 3-nerved only at the base.

## D. Petals without a dark blotch at the base.

1. *villösus*, Linn. (*C. incanus*, Linn.). Erect shrub, 3-4 ft., villous or tomentose: lvs. penninerved, roundish-ovate or oblong, narrowed into a very short petiole, rugose above and grayish green, tomentose or villous beneath, 1-2 in. long: fls. 1-3, long-peduncled, reddish purple, 2 in. wide; petals light pink or yellowish at the base. May, June. Medit. region. B.M. 43. S.C. 35. Gn. 27, p. 571.—A very variable species. Var. *creticus*, Boiss. Lvs. smaller, more spatulate at the base, very rugose, undulate at the margin: fls. purple. S. E. Eu., Asia Minor. Sibthorp, Fl. Græca 5:495. S.C. 112. Gn. 27, p. 571; 33, p. 490.

Var. *rotundifolius*, Loud. Dwarfer, with more roundish lvs. S.C. 75. Garden form. Var. *tauricus*, Grosser (*C. tauricus*, Presl). Lvs. obovate-spatulate, the upper ones lanceolate, scarcely undulate: pedicels twice as long as sepals. Asia Minor. Var. *undulatus*, Dunal. Lvs. linear-oblong, acute, undulate: fls. solitary. S.C. 63. Garden form.

2. *heterophyllus*, Desf. Erect, to 2 ft.: lvs. short-petioled, elliptic- or oval-lanceolate, green on both sides and slightly hairy, ½-1 in. long: fls. 1-3, 2 in. wide; petals red, yellow at the base. N. Afr. S.C. 6.—More tender.

## DD. Petals with a dark blotch at the base.

3. *purpureus*, Lam. (*C. ladaniferus* × *C. villösus*). Shrub to 4 ft., somewhat glutinous: lvs. nearly sessile, lanceolate or oblong-lanceolate, acute, rugose above, slightly undulate and revolute at the margin, 1-2 in. long: fls. usually 3, lilac-purple, 3 in. across, the petals yellow at the base and with a maroon blotch. Of garden origin. Gn. 31:326; 45, p. 33; 53, p. 134. B.R. 5:408. S.C. 17. G.C. III. 48:118-19.—One of the most beautiful rock roses.

## CC. Lvs. 3-nerved to the apex.

4. *crispus*, Linn. Compact shrub, to 2 ft., villous: lvs. sessile, linear-lanceolate or oblong-elliptic, undulate,

rugose above, villous beneath: fls. 3-4, nearly sessile, 1½-2 in. wide, deep rose-colored. June-Aug. S.W. Eu. S.C. 22. Gn. 34:252.

5. *albidus*, Linn. Shrub to 4 ft., the young parts white-tomentose: lvs. sessile, elliptic or ovate-oblong, revolute at the margin, reticulate beneath, whitish tomentose, ½-2 in. long: fls. 3-6, lilac or rosy, 2½ in. across; style longer than stamens. S.W. Eu. N. Afr. S.C. 31. G.C. III. 45:117. G.M. 51:783.

## BB. Fls. 1 in. wide; petals not imbricate.

6. *parviflorus*, Lam. Much-branched shrub, 1-2 ft.; tomentose: lvs. 3-nerved, elliptic-ovate, undulate, rugose above, reticulate beneath, twisted, 1 in. long: fls. 3-5; petals pale rose, yellow at the base. June. Greece, Crete. S.C. 14.

## AA. Color of fls. white: lvs. 3-nerved.

## B. Sepals 3.

C. Lvs. nearly sessile: plant very glutinous: fls. usually solitary.

7. *ladaniferus*, Linn. Shrub, to 4 ft., glutinous: lvs. lanceolate, glabrous and viscid above, whitish tomentose beneath, 1½-4 in. long: fls. usually solitary, long-peduncled, 3-3½ in. wide; petals yellow at the base. June. S. W. Eu. S.C. 84. F.S.R. 2, p. 44. G. 22:213. Gn. 58, p. 171; 66, p. 257. F. 1874, p. 160. Var. *maculatus*, Sweet. Petals with a dark brownish crimson spot above the base. Gn. 30:30; 33, p. 490. S.C. 1. G. 26:598. Grosser 23.—Probably the most beautiful of all cistuses.

## CC. Lvs. distinctly petioled: fls. several.

8. *cyprius*, Lam. (*C. ladaniferus* × *C. laurifolius*). Erect shrub, to 6 ft., somewhat glutinous: lvs. oblong-lanceolate, glabrous above, villous-tomentose beneath: fls. 5-7, nearly 3 in. wide; petals blotched purple at the base. June. Garden origin. S.C. 39. Gn. 76, p. 438. B.M. 112 (as *C. ladaniferus*).

9. *laurifolius*, Linn. Fig. 969. Shrub to 6 ft.: lvs. petioled, ovate or ovate-lanceolate, glabrous above, whitish or brownish tomentose beneath, 1-2½ in. long: fls. 3-8, 2-3 in. wide; petals with yellow blotch. June-Aug. S. W. Eu. Gn. 53, p. 131; 64, p. 234. G.M. 34:95. S.C. 52.—The hardiest species.

## BB. Sepals 5.

10. *salvifolius*, Linn. Shrub, to 2 ft., sometimes procumbent: lvs. petioled, oval to ovate-oblong, rigid, very rugose above, tomentose on both sides, ½-1¾ in. long; bracts deciduous: fls. solitary or several, white, 1½ in. across. S. Eu., N. Afr., Orient. S.C. 54. Gn. 76, p. 352. G. 30:593.—A very variable species.



969. *Cistus laurifolius*. (× ½)

11. *populifolius*, Linn. (*C. cordifolius*, Mill. *C. Cupaniæ*, Presl). Shrub to 6 ft.: lvs. long-petioled, cordate-ovate, acuminate, penninerved, rugose, glabrous, 2-3½ in. long: fls. 2-5, white, 2 in. across. S. W. Eu. S.C. 23, 70.

*C. algarvensis*, Sims=Helianthemum ocyroides.—*C. candidissimus*, Dun.; S.C. 3=C. symphytiifolius, var.—*C. canescens*, Sweet (C. villosus var. canescens, Nichols. C. albidus×C. villosus), lvs. short-petioled, narrow-oblong or lanceolate, 3-nerved, obtuse, undulate: fls. dark purple. Of garden origin. S.C. 45.—*C. Clusii*, Dur.=C. rosmarinifolius.—*C. corbariensis*, Pourr. (C. populifolius×C. salviifolius). To 5 ft.: lvs. slightly cordate, glutinous: fls. 1-5, white, 1½ in. S.C. 8.—*C. florentinus*, Lam. (C. monspeliensis×C. salviifolius). Dwarf: lvs. lanceolate: fls. white, 2 in. S.C. 59. G. 11:183; 14:241. G.M. 32:277; 31:587. Gn. 27:570; 38, p. 177; 53, p. 130, 134; 75, p. 422. F.S.R. 2, p. 43.—*C. formosus*, Curt.=Helianthemum formosum.—*C. glaucus*, Pourr. (C. Ledon, Lam. C. laurifolius×C. monspeliensis). 1-2 ft.: lvs. lanceolate, glossy above: fls. 5-10, white, 1½ in. S. France.—*C. hirsutus*, Lam. 1-3 ft., clothed with spreading and glandular hairs: lvs. sessile, lanceolate: fls. 1-5, white. S.W. Eu. S.C. 19.—*C. latifolius*, Sweet, S.C. 15=C. populifolius var.—*C. laxus*, Ait.=C. nigricans.—*C. Ledon*, Lam.=C. glaucus.—*C. longifolius*, Lam.=C. nigricans.—*C. Loréti*, Rouy & Fouc. (C. ladaniferus×C. monspeliensis). Habit like C. monspeliensis: lvs. linear-lanceolate, revolute, grayish beneath, glutinous: fls. 1-5, white, 2 in. across. Of garden origin; also found spontaneous. Var. *maculatus*, Rouy & Fouc. Fls. with 5 dark red blotches. Gn. 75, p. 633; 76, p. 439.—*C. monspeliensis*, Linn. To 5 ft.: lvs. sessile, lanceolate: fls. white, cymose, 1 in. S. Eu. S.C. 27.—*C. nigricans*, Pourr. (C. longifolius, Lam. C. laxus, Ait. C. monspeliensis×C. populifolius). 2-4 ft., glandular: lvs. oblong-lanceolate, glossy above: fls. white, 1½ in. S.W. Eu. S.C. 12. Variable.—*C. oblongifolius*, Sweet; S.C. 67=C. nigricans var.—*C. obtusifolius*, Sweet, S.C. 42=C. nigricans var.—*C. rosmarinifolius*, Pourr. (C. Clusii, Dun.) Allied to C. ladaniferus. Lvs. linear, strongly revolute at the margin, viscid above while young, tomentose beneath: fls. 4-6, white, 1-1½ in. across. W. Medit. region. S.C. 32. G.M. 31:587; 32:277.—*C. symphytiifolius*, Lam. (C. vaginatus, Dry. Rhodocistus Berthelotianus, Spach). To 2 ft.: lvs. petioled, ovate, acuminate: fls. cymose, deep rose-colored, yellow in center. Canary Isls. S.C. 9. B.R. 3:225. F.S. 15:1501.—*C. vaginatus*, Dry.=C. symphytiifolius.

ALFRED REHDER.

**CITHARÉXYLUM** (*Zither-wood*: used for the making of certain musical instruments). *Verbenacæ*. Shrubs or trees, sparingly planted in southern California, and perhaps elsewhere South for ornament.

Spiny or unarmed, tomentose or glabrous, with opposite entire serrate often spinose-dentate lvs.: fls. white or sometimes yellow, odorless, small, in spiciform terminal or axillary racemes; calyx 5-toothed or -lobed; corolla-tube cylindrical, the limb broad and 5-lobed, the lobes spreading and obovate; stamens 5, included, one of them abortive, the 4 polliniferous ones didynamous; ovary more or less 4-celled, each cell 1-seeded; style often 2-lobed: fr. a fleshy drupe, partly included in the calyx.—About 20 species, Mex. to S. Amer.

*cinereum*, Linn. Tree, to 20 ft., the branches 4-angled and becoming cylindrical: lvs. elliptic-oblong or lance-oblong, usually obtuse, glabrous or nearly so beneath: fls. white, in long lax and nodding spike-like racemes; calyx unequally lobed; corolla-tube twice as long as calyx: fr. nearly globular, red becoming black. W. Indies. L.D. 7:493.

*quadrangulare*, Jacq. Larger tree, the branches permanently 4-angled: lvs. elliptic-oblong: fls. white; calyx nearly truncate. W. Indies.—These two species are here defined as understood by Grisebach, as it is probable that the plants in cult. were determined on that basis. Schulz, however (*Symbolæ Antillanæ*), refers *C. cinereum*, Linn., to *C. fruticosum*, Linn.; and *C. quadrangulare*, Jacq., to *C. spinosum*, Linn. *C. quadrangulare* of Grisebach, at least in part, he refers to *C. fruticosum*; and *C. cinereum*, Jacq., to *C. spinosum*. What are the plants catalogued cannot be determined without a bringing together of material.

*ilicifolium*, HBK. Low shrub, very branchy, not spiny, the branches 4-angled: lvs. elliptic-oblong, narrowed into a short petiole, entire or spinose-dentate, thick, the margin revolute, shining above and punctate beneath: fls. white, in a short terminal raceme; calyx 5-toothed; corolla scarcely exceeding the calyx, the lobes pilose: drupe size of a pea. Ecuador.

*barbinerve*, Cham. Spiny shrub, the branches 4-angled: lvs. obovate or elliptic-lanceolate, acute or obtuse or retuse, narrowed into a petiole, nearly entire, glabrous and shining above and paler and somewhat pilose beneath, bearded at the axils of the nerves: fls. white, in a terminal laxly-fld. raceme. Brazil, Uruguay. L. H. B.

**CITRANGE** (from *Citrus trifoliata* and orange by synecopation: *Citrus* [trifoliata] [or]ange). *Rutacæ*. A hybrid between the common orange and the hardy trifoliolate orange, *Poncirus trifoliata* (*Citrus trifoliata*).

Citranges have trifoliolate lvs., but the lateral lfts. are much smaller than the terminal one: lvs. semi-deciduous, falling completely only during a very severe winter: fls. borne on new wood in spring, very large, white, sometimes over 2½ in. diam., but with long and narrow petals, which vary much in size in different citranges: frs. variable, from 1-4 in. diam., globose, or depressed-globose, red-orange or lemon-yellow, smooth or hairy, the pulp abundant and very juicy, acid or subacid, with an agreeable aromatic flavor; peel often full of a disagreeably flavored essential oil.

The citranges are very cold-resistant if in a dormant condition, being able to stand temperatures as low as 15° or even 10° F. without injury. They are not adapted to commercial culture but are of much interest for home use in the cotton-belt of the southern states where the winters are too severe to permit of the culture of oranges or other citrus fruit. The flowers are showy and fragrant and the handsome fruits are used for making ade and for culinary purposes. The first successful hybrids between these plants were made by the writer at Eustis, Florida, in March, 1897, where eleven were secured. These remarkable hybrids were named citranges by H. J. Webber and the writer in 1905 (Yearbook, Department of Agriculture for 1904).

The principal varieties now grown in the southern states are:

*Rusk* (Fig. 970).—This is the most precocious of the citranges and has the smallest fls. and smallest (1½-2 in. diam.) and reddest frs. Young grafted trees often bear in 3 years. The foliage is dense and dark green. The frs. are thin-skinned, aromatic, juicy, and almost seedless. The peel contains a disagreeable oil and care must be taken to keep this out of the juice of the fr. Many thousand trees of this variety are now growing in the southern states and are prolific bearers.

*Colman*.—This is very unlike all the other citranges. The frs. are large, 3-3½ x 2¾-3½ in., flattened, light yellow, and with a thick fuzzy peel, usually nearly seedless; the pulp is greenish, juice abundant, strongly acid, agreeably aromatic. It can be used for ade.

*Morton*.—The largest of the citranges, fr. often weighing more than 1 lb. Fr. round, resembling a large orange, rind medium, pulp sprightly acid, with a peculiar taste, usually seedless. Tree a vigorous grower, cold-resistant.

*Saunders*.—A small-fruited variety. Frs. 2-2½ in. diam. with 5-10 seeds, orange-yellow, peel thick with prominent oil-glands. The thick skin of this hybrid makes it keep well.



970. Rusk citrange. (×½)



The juice is sharply acid. This is probably the most cold-resistant of the citranges tested as yet.

*Etonia*.—This hybrid is remarkable for its profuse bloom. The large white fragrant fls. make this a good ornamental in the cotton-belt; frs. small, very few.

*Cunningham*.—This resembles the Colman in having fuzzy frs. which are, however, small and nearly spherical. The juice is sharply acid, aromatic, and makes very good ade.

*Savage*.—Fr. similar to an orange in appearance, 2-3 x 2½-3½ in., light yellow, rind medium thick, bitter, pulp tender, translucent, juice with a sprightly acid flavor, aroma pleasant. Tree very vigorous and prolific. Foliage dense.

WALTER T. SWINGLE.

**CITRON** (*Citrus Medica*, Linn.). *Rutaceæ*. Fig. 971. A large lemon-like fruit with a very thick peel and a small amount of very acid pulp; the peel is candied and used in confectionery and for culinary purposes.

The citron is grown in the Mediterranean regions, especially in Corsica, and large quantities are preserved in brine and shipped to the United States to be candied. The Corsican citron of commerce was introduced into this country in 1894 by David Fairchild for the Division of Pomology of the United States Department of Agriculture, and it has been grown to some extent in California.

The plant usually is propagated by cuttings but it can be grafted on rough lemon or other stock. In the region of Valencia, in eastern Spain, the citron is used in propagating oranges, since citron cuttings strike root more easily than oranges. A piece of citron twig is grafted into branches of orange which are afterwards set as cuttings whereupon the citron strikes root and later on the orange.

Then the roots are exposed and the citron roots cut away, leaving the orange growing on its own roots.

The citron can be planted and cultivated much as the lemon in cool equable climates, such as in the coastal region of southern California. In Corsica, the trees are kept low and trained in vase form, but otherwise treated like lemons.

There are but few citron orchards in the United States; one at West Riverside, California, about 10 acres in extent, is perhaps the largest.

The Etrog or sacred Jewish citron, used by the Jews at the Feast of Tabernacles, has small greenish yellow fruits which, if they are of exactly the prescribed size, form and color, may bring as much as \$5 or \$10 each. This variety is grown principally in the island of Corfu. See *Citrus* and *Etrog*.

The word citron is also applied to the preserving watermelon: see *Citrullus* and *Melon*, *Water*.

WALTER T. SWINGLE.



971. Citron—*Citrus Medica*, Corsican variety. (×%)

**CITRÓPSIS** (*Limonia* § *Citropsis*, Engler). *Rutaceæ*. AFRICAN CHERRY ORANGE. Very interesting and as yet little-known citrus trees, of interest for use in hybridizing and for stocks, also promising as ornamentals.

Small spiny trees: lys. compound, 3-12 in. length; lfts. 3, 5 or even 7, coriaceous; petioles and rachis usually very broadly winged; fruiting twigs sometimes with unifoliate lvs.: spines usually paired, sometimes single: fls. large, white, in the axils of the lvs., tetramerous (rarely 5-merous), with 8 free stamens: frs. small, ¾-1½ in. diam., borne in tufts in the axils of the lvs., bright orange-colored, with an agreeable odor and a pleasant flavor, 3-4-celled, with a single seed in each cell; cells in some species filled with pulp-vesicles full of pleasantly flavored juice.

There are several species of this interesting genus in the tropical forests throughout central Africa. These plants, because of their sweet high-flavored fruits borne in tufts like cherries and their unusually large compound leaves, should prove very interesting for use in hybridizing. Tests made in the greenhouses of the Department of Agriculture, at Washington, have shown that at least two species of *Citropsis* can be budded readily and grow very well on the common citrus stocks. This genus is undoubtedly closely related to *Citrus*. See descr. in Journ. Ag. Research, 1:419-436, w. figs.

**Preüssii**, Swingle & M. Kellerman (*Limonia Preüssii*, Engler. *L. Demeusei*, De Wild?). Lvs. 3-5-foliate, with very broadly winged petioles and rachis; lfts. large, broadly oval: fls. large, axillary; style long, slender, broad at the base: frs. small, apiculate. Kamerun. W. Congo. Ill. Engler & Prantl, Nat. Pflanzf. III. 4:189, fig. 109, E. H. De Wildeman, Etudes Fl. Congo, pl. 41.

**Schweinfurthii**, Swingle & M. Kellerman (*Limonia Schweinfurthii*, Engler. *Limonia ugandensis*, Baker). Fig. 972. A species named from sterile leafy twigs collected by Schweinfurth at Uando at the headwaters of the Ghazal branch of the Nile. Lvs. 3-5-foliate; lfts. narrowly lanceolate, acute at both ends: fls. large, usually 4-merous; style rather short and thick: frs. lime-like, 1½ in. diam., sweet. Sudan, Uganda, Congo.

**gabonensis**, Swingle & M. Kellerman (*Limonia gabonensis*, Engler). Lvs. of medium size, sometimes unifoliate like orange lvs., sometimes 5-7-foliate; rachis narrowly winged; lfts. caudate: fls. small, borne on long pedicels, 4-merous; style not broad at base: frs. globose, small, about 1 in. diam., almost dry, having only rudimentary pulp-vesicles; seeds large. French Congo, Kamerun.

WALTER T. SWINGLE.  
MAUDE KELLERMAN.

**CITRÚLLUS** (diminutive of *Citrus*, said to be in allusion to the shape of fruits and color of flesh resembling those characters in fruits of the orange or citron). *Cucurbitaceæ*. Annual or perennial tendril-bearing herbs of three or four species, one yielding the watermelon and one the colocynth.

Climbing or long-trailing, hispid or rough, with 2-3-parted tendrils, often with a strong odor: lvs. alter-



972. *Citropsis Schweinfurthii*. ( $\times \frac{1}{4}$ )

nate, petiolate, mostly round-cordate in general outline, deeply 3-5-lobed, and the divisions often again lobed, and the segms. commonly obtuse: fls. monœcious, solitary and peduncled in the lf.-axils, the corollas 5-lobed; stamens 3, included and united or cohering by the anthers, and rudiments of stamens in the pistillate fls.; pistil 1, the ovary ovoid or globose, bearing a short style and 3-lobed stigma: fr. a globular pepo, morphologically 3-celled, usually smooth and with a hard rind.—Trop. Afr. and Asia, 2 of the species now widely distributed in warm and tropical countries.

**vulgaris**, Schrad. **WATERMELON** (see *Melon*, for culture). Annual, glabrous or pubescent: lvs. not rough, either deeply or moderately divided, the sinuses open and obtuse: fr. in the wild state from the size of an apple to that of a man's head, sweet or slightly bitter. Trop. and S. Afr.—When the fr. is sweet and edible (*C. Cáffer*, Schrad.), it is the watermelon, or "kaffir watermelon" of S. Afr.; when bitter (*C. amarus*, Schrad.), it is the "bitter-apple" of S. Afr. The fr. now varies widely in cult., in size, season, shape and quality. The soft pink flesh is much prized in its natural state for eating. A form with hard and inedible white flesh is known as "citron," and the rind is used for the making of preserves (as is the rind of the true citron).

**Colocynthis**, Schrad. (*Colocynthis officinalis*, Schrad. *Cucumis Colocynthis*, Linn.). **COLOCYNTH. BITTER-APPLE**. Perennial (in the wild), the st. angular and rough: lvs. rough, 2-4 in. long, 3- or 7-lobed, the middle lobe sometimes ovate, the sinuses open and the lf. in general form like that of *C. vulgaris*: ovary villous: fr. globose, green-and-yellow variegated, about 3-4 in. diam., intensely bitter; seeds small ( $\frac{1}{4}$  in. or less long), smooth. Trop. Asia and Afr., now widely distributed in

Afr. and the Medit. region.—The dried frs. are used in medicine (as purgative), being imported from Turkey and Spain. Sometimes cult in this country as a curiosity or in collections of economic plants; culture for official purposes has been attempted in New Mex., but the frs., although larger than the official product, are reported to be less active. L. H. B.

**CITRUS** (ancient name of a fragrant African wood, afterward transferred to the Citron). *Rutaceæ*. **CITRON. LEMON. ORANGE**. Small evergreen, more or less spiny trees or shrubs, grown for their edible fruits, and also attractive in foliage and flower.

Leaves glandular-dotted, persistent, apparently simple (in reality unifoliate compound lvs.), borne on more or less winged or margined petioles, which are usually articulated with the blade and at their attachment to the twig: spines usually present, borne singly at the side of the bud in the axils of the lvs.: fls. clustered or rarely solitary in the axils of the lvs., or in small lateral or terminal cymes or panicles, white or pinkish purple in the bud; petals 5 (rarely 4 or 6) thick, strap-shaped, not clawed at the base, imbricated; stamens numerous (16-60, usually 20-40) at least four times as many as the petals, polyadelphous, cohering toward the bases in a few bundles; ovary 8-15-celled, with a prominent usually deciduous style containing as many tubes as there are cells in the ovary: fr. a hesperidium, globose, oval or oblate-spheroid, the segms. filled with juicy pulp composed of stalked pulp-vesicles; seeds 1-8 in a cell, oval or oblong,  $\frac{1}{4}$ - $\frac{3}{4}$  in. long, with a pergameneous testa and thick fleshy cotyledons, usually with adventive embryos arising as buds from the nucellar tissue of the mother plant. Natives of Trop. and Subtrop. Asia and the Malayan Archipelago.—Half a dozen species are commonly cult. and have given rise to very many varieties as well as numerous hybrids, making the delimitation of the species exceedingly difficult. See *Citrange, Citron, Etrog, Grapefruit, Lemon, Lime, Limequat, Orange, Pomelo, Tangelo*.

The nomenclature here followed is based on the writer's treatment of the species of *Citrus* in "Plantæ Wilsonianæ." The fewest possible number of changes have been made consistent with presenting a clear account of the genus. A careful study of *Citrus* and the genera most nearly related to it has shown that the trifoliate orange differs in so many and such important characters that it seems necessary to recognize it as a separate genus (*Poncirus*). The same is true of the kumquats and the Australian limes.

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#### KEY TO THE SPECIES.

- A. Winged petiole nearly as large as the blade of the lf.: seeds very large, thick: fr. rough, oval, lemon-yellow when ripe: fls. solitary. . . . . 9. *ichangensis*
- AA. Winged petiole much smaller than the blade of the lvs.: seeds small or medium sized: fls. usually in clusters.
  - B. Lvs. apparently not jointed between blade and petiole, oblong-serrate: petiole wingless: fl.-buds tinted reddish: fr. with a very thick peel, fragrant, pulp acid . . . . . 1. *Medica*
  - BB. Lvs. with an obvious joint between the blade and petiole, crenate: peel thin or only moderately thick.
    - c. Fl.-buds tinted reddish on outside: petioles merely margined: lvs. crenate: frs. oval, more or less apiculate. . . . . 2. *Limonia*



CC. Fl.-buds white: petioles more or less winged.

D. Frs. oval, often slightly papillate, small, 1-1½ in. diam., greenish-yellow when ripe, thin-skinned, smooth: fls. small: petioles plainly winged: lvs. small, pallid above, crenate, more or less punctate, obtuse: spines short, very sharp..... 3. *aurantifolia*

DD. Frs. globose, depressed globose, rarely oval or pyriform, never papillate, orange-colored, or if yellow, frs. large and thick-skinned.

E. Size of fr. very large, pale yellow when ripe: twigs pubescent when young: petioles broadly winged..... 4. *grandis*

EE. Size of fr. medium or small, orange or orange-yellow.

F. The frs. with a solid core and a light skin; pulp sweet: petioles slightly winged... 6. *sinensis*

FF. The frs. with a hollow core when fully ripe, skin loose or, if tight, pulp acid and petioles broadly winged.

G. Skin tight: petioles broadly winged: pulp acid.... 5. *Aurantium*

GG. Skin loose: petioles only narrowly winged or margined.

H. The fr. borne singly at tips of branches, small; segms. 7-10, pulp very acid: lvs. pale beneath..... 8. *mitis*

HH. The fr. borne in axils of the lvs.; segms. 8-15, pulp sweet: lvs. dark green below..... 7. *nobilis*

1. *Médica*, Linn. (from *Media* whence the species first came to the notice of the ancient Greeks and Romans). CITRON. Fig. 971. A shrub or small tree, with long irregular branches: thorns short, stout and stiff: lvs. rather pale green, large, oblong, 4-6 or 7 in. long and 1½-2 in. wide, bluntly rounded at the tip with serrate margins, not articulated with the petioles, which are wingless: fls. large, reddish tinted when in the bud, usually in terminal panicles, or clustered, in the axils of the lvs.; petals large, white above, reddish purple below; stamens numerous, 30-40 or more; ovary tapering gradually into the often persistent style: fr. large, oval or oblong, 6-10 x 4-6 in., bluntly apiculate, often rough or bumpy, lemon-yellow when ripe; skin very thick, fragrant; pulp scanty, acid; seeds oval, smooth, white inside.—The citron is

very sensitive to cold because of its ability to grow at low temperatures, which causes it to start into a fresh and very tender growth after a few days of warm weather in winter. It is cult. in the Medit. region, especially in Corsica, whence large quantities of the peel are exported in brine to Amer. to be candied. The candied peel is much used in confectionery and in cakes. Sparingly cult. in Calif. and Fla. A number of ill-defined varieties are grown, the most important being the Corsican, intro. from Corsica in 1894 by David Fairchild. The Etrog or sacred Jewish citron is grown in Corfu. See *Citron*.

Var. *sarcodactylis*, Swingle (*Citrus sarcodactylis* v.



973. Fingered citron.—*Citrus medica* var. *sarcodactylis*. (× ½)

Nooten. *C. Médica* var. *digitata*, Auct., not Lour.). Fo SHU KAN (Chinese). BUSHUKAN (Japanese). Fig. 973. Differs from the common citron in having the segms. of the fr. separated into finger-like processes. The frs. are very fragrant and are used by the Chinese and Japanese for perfuming rooms and clothing. It is sometimes grown as a dwarf potted plant for ornament. It should be intro. into this country.

2. *Limònia*, Osbeck (from Arabic *limūn*, a lemon) (*C. Médica* var. *limon*, Linn. *C. limonium*, Risso).

LEMON. Fig. 974. A small tree with long irregular branches: thorns short, stout and stiff: lvs. rather pale green, elongate-ovate, pointed at the tip, with serrate or sub-serrate margins; petioles wingless but sometimes narrowly margined, articulated both with the blade and the twig: fls. rather large, solitary or in small clusters in the axils of the lvs., reddish-tinted in the bud; petals white above, reddish purple below; stamens 20-40; ovary tapering into the deciduous style: fr. oval or oblong, with an apical papilla, 3-5 x 2-3 in. with 8-10 segms., lemon-yellow when ripe, with a prominently glandular-dotted peel, often more or less rough and moderately thick; pulp very abundant, very acid; seeds small, ovate, smooth, often few or none, white inside.



974. *Citrus Limonia*. (× ¼, fr. ¼)

—The lemon is very sensitive to cold as, like the citron and the lime, it is readily forced into new growth by a few days of warm weather in winter. It is found in all tropical and warm subtropical regions and is cult. on a large scale in the Medit. region, especially in Sicily, whence large quantities of the frs. are exported to the U. S. In this country the lemon is widely cult. in Calif. and to a much smaller extent in Fla. The frs. are gathered just before they ripen while still green in color and often before they attain their full size and are then ripened in curing-houses, in which temperature and humidity are artificially controlled. The juice is used for making lemonade, for cooking, and the arts; the peel is used in cooking and the oil extracted from it is used in cooking and in perfumery. The principal cult. varieties have rather small smooth frs. The more important varieties are listed here: *Eureka*. Frs. oval-oblong, medium size, usually seedless, ripening early: tree small, nearly thornless. *Genoa*. Frs. oval, pointed at base and tip, ripening early, seedless: tree dwarf. *Lisbon*. Frs. oblong, with a large papilla at the tip, few-seeded: tree of medium size, thorny; a vigorous grower. *Villa Franca*. Frs. oval-oblong, medium to large, apex abruptly papillate, seeds numerous: tree of good size, nearly thornless. *Kennedy*. Frs. oval, with a very small papilla, thin-skinned, nearly seedless. *Ponderosa*. Frs. very large, sometimes weighing 2½ lbs., with a neck at the base; seeds numerous. *Everbearing*. Frs. large, abruptly papillate at the tip, with a narrowed neck at the base, rough all over; seeds rather numerous: everbearing, borne on a straggling bushy tree that sprouts from the roots. Grown for home use in Fla. *Rough* (Florida Rough). A tree of doubtful origin, occurring wild in the Everglades of S. Fla.: frs. round-ovate, very rough, apical papilla surrounded by a depressed ring; seeds numerous: tree large and vigorous. The frs. of this variety are useless for commercial purposes, but the seeds are in considerable demand by

nurserymen as the tree makes an excellent stock for very poor sandy or calcareous soils. See *Lemon*.

3. *aurantifolia*, Swingle (*Limonia aurantifolia*, Christmann. *C. limetta* Auct. not Risso). **LIME.** A small tree, with rather irregular branches: spines very sharp, short, stiff; lvs. small, 2-3 in. long, elliptic-oval, crenate, rather pale green; petioles distinctly but narrowly winged; fls. small, white in the bud, occurring in few-fl. axillary clusters; petals white on both surfaces; stamens 20-25; ovary rather sharply set off from the deciduous style; fr. small, oval or round-oval,  $1\frac{1}{4}$ - $2\frac{1}{2}$  in. diam., often with a small apical papilla, with 10 segms., greenish yellow when ripe; peel prominently glandular-dotted, very thin; pulp abundant, greenish, very acid; seeds small, oval, smooth, white inside.—The lime is perhaps the most sensitive to cold of any known species of *Citrus*. Even a few days of moderately warm weather in winter suffice to force it into a tender and succulent growth that is killed by the slightest frost. It is found in all tropical countries, often in a semi-wild condition. It is cult. in the warmest parts of Fla., especially on the Keys. Large quantities of the fr., picked when still green and often not full-sized, are packed in barrels and shipped to the cities of the N. U. S., where they are extensively used for making limeade. Large quantities of bottled lime juice are exported from Montserrat and Dominica Isls. in the W. Indies, and used on shipboard for preventing scurvy. Limes are too thin-skinned to keep well and are not processed as are lemons. It is usually prop. from seed—rarely from cuttings. The principal varieties grown in the U. S. are: *Mexican* (West Indian). Frs. small, smooth, often with a slight apical papilla; seeds few: tree small, very spiny, usually branching from the base. This variety, almost always grown from seed, is the only one planted on any considerable commercial scale. *Tahiti* (Persian?). Frs. large, smooth, with a broad apical papilla; seedless, about the size and shape of an ordinary lemon: poor keepers. See *Lime*. Hybrids: *Sweet* (*C. limetta*, Risso?). Frs. about the size of a lemon, with a sweet and insipid pulp. Commonly grown in the W. Indies and Cent. Amer. Limequats are new hardy hybrids between the common Mexican lime and a kumquat; these hybrids vary much in size, shape and flavor, but some are about the size of a lime and have abundant very acid pulp. See description under *Limequat*.

4. *grândis*, Osbeck (*C. Aurantium* var. *grândis*, Linn. *C. Aurantium* var. *decumâna*, Linn. *C. decumâna*, Linn.). **GRAPEFRUIT** (or **POMELO**). **SHADDOCK.** **PUMMELO.** Fig. 975. A large round-topped tree, with regular branches: spines, if present, slender and flexible, rather blunt; lvs. large, dark glossy green above, oval or elliptic-oval, with a broadly rounded base; petiole broadly winged, more or less cordate; fls. axillary, borne singly or in clusters, large, white in the bud; petals white on both sides; stamens 20-25, with large linear anthers; ovary globose, sharply delimited from the deciduous style; fr. very large, 4-6 in. diam., globose, oblate spheroid or broadly pear-shaped, smooth, with 11-14 segms., pale lemon-yellow when ripe, peel  $\frac{1}{4}$ - $\frac{1}{2}$  in. thick, white and pithy inside; seeds usually very numerous, large, flattened and wrinkled, white inside.—The grapefruit (or pomelo) is now one of the most appreciated citrus frs. grown in the U. S. The culture of this delicious fr. was limited to the Fla. pioneers until some 25 years ago, when the first commercial plantations were made. Since then, there has

been a steady increase in the area devoted to this fr. in Fla., and plantings have been made in Calif., Ariz., and the West Indies. The pummelo of India, called shaddock in Fla., is not grown on a commercial scale, but occurs in many tropical countries. The grapefruit is usually served as a breakfast fr. cut in half and seeded. It is a vigorous grower, even on light sandy loam soils and is coming increasingly into use as a stock upon which to graft other citrus frs. The young trees are tender, but the mature ones are well protected by a dense canopy of lvs. and may stand more cold than an orange tree. The grapefruit is much like the orange in its ability to resist cold and is much less easily forced into a new growth by a few warm days in winter than the lime or lemon. The varieties of grapefruit grown in the U. S. have almost all originated in Fla., where the early settlers prop. this tree from seed, thereby originating many slightly different varieties, the more important of which are listed here: *Duncan*. Fr. large, keeps well on the tree, seeds few: tree rather hardy. *Hall* (Silver Cluster). Frs. medium size, produced in large clusters; seeds numerous. *Triumph*. Fr. small or medium size, early: tree rather tender. Does not succeed well when budded on sour orange stock. *McCarty*. Fr. large, late borne singly; seeds numerous. A variety recently found in the Indian River region of Fla. Besides these standard varieties of grapefruit of the Fla. seedling type a large number of other similar varieties are cult. locally in the state, such as the Bowen, Excelsior, Josselyn, Leonardy, Manville, May, McKinley, Standard (or Indian River), Walters, and many others. The following varieties differ more or less widely from the old Fla. seedling type. *Marsh*. Frs. large, depressed globose, often seedless; pulp subacid, less bitter than in the other varieties. This variety, though it originated as a seedling in Fla., is best adapted to cult. in Calif., where many of the ordinary Fla. varieties do not succeed well. *Pernambuco*. Frs. large, skin very smooth, light-colored, late; seeds abundant. Intro. from Pernambuco, Brazil, to the U. S. by the U. S. Dept. of Agric.—The shaddocks or pummelos are seldom cult. in the U. S. The Tresca variety from the Bahama Isls. has large pyriform frs., with pink flesh of good flavor and abundant seeds: the tree is tender. A pummelo from near Canton, China, is imported into San Francisco on a small scale by the Chinese resident there. The frs. are pyriform, very thick-skinned, not pink within; seeds numerous. Some seedlings of this variety are to be found at various points in Calif. They are very leafy and of vigorous growth, and make excellent stocks upon which to graft other citrus frs. Many other sorts of pummelos are known from Asia and the Malayan Archipelago and some have been intro. for trial by the

Office of Foreign Seed and Plant Introduction of the U. S. Dept. of Agric. The true grapefruit seems to be scarcely known outside of U. S. and the W. Indies. See *Grapefruit* and *Pomelo*.

5. *Aurantium*, Linn. (*C. vulgâris*, Risso. *C. Bigarâdia*, Risso. *C. Aurantium* var. *Bigarâdia*, Hook. f.). **SOOR** or **SEVILLE ORANGE.** Fig. 976. A medium-sized tree, with a rounded top and regular branches: spines long but flexible and blunt; lvs. light green when young, medium-sized, 3-4 in. long, tapering to the somewhat wedge-shaped base, and more or less acuminate at the tip; petiole broadly winged; fls. medium-sized, axillary, single or clustered, white in the bud; petals white on both sides, very fragrant; stamens 20-24; ovary globular, sharply delimited from the deciduous style; fr.  $2\frac{3}{4}$ - $3\frac{1}{4}$  in. diam., globose, slightly flattened at the



975. *Citrus grandis*. ( $\times \frac{2}{3}$ )

976. *Citrus aurantium*. ( $\times \frac{2}{3}$ )



tip, with a hollow core when fully ripe; pulp acid, membranes with a bitter taste, segms. 10-12; seeds cuneate-oval, flattened, with raised lines, white inside.—The sour or Seville orange is grown all over the world. It is able to withstand more cold than most of the other citrus frs. and is rarely forced into new growth by warm weather occurring in winter. The sour orange is found in a thoroughly naturalized condition in many parts of Fla. where it doubtless was brought by the Spaniards. Most of these wild sour orange trees were dug up and transplanted for use as stocks when orange-culture was being rapidly extended some 25-30 years ago. The Seville orange, as its name would indicate, is grown on a commercial scale in the vicinity of Seville, Spain, whence the frs. are shipped in large quantities to England and Scotland for use in making orange marmalade, for which this species is best adapted. The petals yield a valuable perfume, oil of Neroli, which is produced in the south of France and the Italian Riviera. The peel of the fr. is sometimes candied and, when fresh, yields an essential oil. The sour orange is grown in a small way in Fla. for home use, the frs. being used for making "orangeade." In the U. S. the sour orange is used almost exclusively as a stock on which to bud other citrus fr. trees. The seeds are in demand by nurserymen at a good price for this purpose. The sour orange is well adapted to grow on a great variety of soils but is especially well fitted for low wet soils, where it is valuable because it is immune to the *mal di gomma* or foot-rot so destructive to the common orange and lemon on such soils. There are no named varieties of the sour orange in cult. in the U. S.—Mutations: The so-called *Citrus myrtifolia*, a narrow-lyd. form with spineless twigs and short internodes, bearing small flattened sour oranges is a mutation arising from the root of the sour orange. *Chinotto* (the Chinese of the French confectioners). This is a broader-lyd. form of the above described mutation. It is cult. along the northern shore of the Medit. from Genoa to Toulon, yields the small green frs. used for candying. This variety, which should be called the Chinotto, is being tested in the U. S. and may prove adapted for commercial culture on a small scale in this country. Hybrids: *Bittersweet*. A good-sized tree occurring wild in Fla., is undoubtedly a hybrid between this species and the following. Frs. oblong, flattened at the ends; pulp sweet, but the membranes separating the segms. have a bitter taste. The fr. ripens very late on some trees and keeps well on the tree.

6. *sinensis*, Osbeck (*C. Aurantium* var. *sinensis*, Linn. *C. Aurantium*, Lour. et Auct., not Linn.). COMMON OR SWEET ORANGE. Fig. 977. A medium-sized tree, with a rounded top and regular branches: spines, when present, slender, flexible, rather blunt: lvs. medium-sized, rounded at the base, pointed at the apex; petiole narrowly winged, articulated both with the blade and the twig: fls. medium-sized, smaller than those of the sour orange, white in the bud; petals white on both surfaces; stamens 20-25; ovary subglobose, clearly delimited from the deciduous style: fr. subglobose or oval, pith solid, pulp sweet, membranes not bitter in taste, segms. 10-12 or 13 in number; seeds cuneate-ovoid with rugose margined plane surfaces, white inside.—The common or sweet orange is widely cult. in all the tropical and subtropical regions of the world. It is rather tender, not so hardy as the sour or Seville orange, but much more cold-resistant than the lemon or lime. A very few orange trees occur in a semi-wild state in S. Fla. Sweet oranges were doubtless intro. into Fla. by the Spaniards nearly four centuries ago and, as they were prop. by seeds until within the last half-century, many local varieties have arisen there. Orange-culture has reached its highest development in S. Calif., where it constitutes one of the most important agricultural industries. Fla. is second only to Calif. in the extent and value of the orange groves,

while some oranges are grown in favored spots in La., Texas, and Ariz.—Oranges are the best known and probably the most highly esteemed dessert fr. A few are used in cooking and the peel is sometimes candied. An essential oil is also pressed from the peel. The sweet orange is commonly used as a stock on which to graft other species of citrus frs. It grows well on light well-drained loam or sandy loam soil. On heavy soil it



977. *Citrus sinensis*. ( $\times \frac{2}{5}$ )

is subject to the *mal di gomma* or foot-rot. Very many varieties are in cult. Some of the principal sorts grown in the U. S. are listed here. (1) Florida seedlings—varieties originated in Fla. as a result of prop. oranges from seed, mostly strong-growing trees: *Parson Brown*. Frs. medium-sized, very early. *Pineapple*. Frs. medium or large, very juicy; seeds rather numerous: midseason: tree a strong grower. *Homosassa*. Frs. medium-sized, very juicy: a good bearer and keeper; tree nearly thornless. *Madam Vinous*. Frs. medium or large; pulp coarse-grained, juicy; midseason. *Nonpareil*. Frs. rather large, flattened; pulp fine-grained, juicy: tree vigorous. Also *Arcadia*, *Summit*, *Foster*, *Hick*, *Magnum Bonum*, *May*, *Old Vini*, *Osceola*, *Stark*, *Whittaker*, and very many others of the same general type. (2) Florida mutations or hybrids—new sorts originated in Fla., usually differing in some striking way from the old Fla. seedling oranges, perhaps through hybridization with foreign varieties. *Boone* (Boone's Early). Frs. medium size, strongly oval or oblong, very juicy, very late, keeping well on the tree: lvs. with petioles varying in width. *Lue Gim Gong*. Frs. oval, juicy, ripening very late and holding very well on the tree, even until late summer. A variety newly intro. into cult. *Drake Star*. A rare variety with variegated foliage; usually a poor bearer but sometimes bearing a good crop of excellent fr. (3) Mediterranean varieties, largely intro. into Fla. by Sanford and Lyman Phelps, about 30-40 years ago: *Ruby*. Frs. small or medium-sized; peel red-orange; pulp streaked with red when fully ripe, juicy; seeds rather few: rather late: tree vigorous, nearly thornless, prolific. *St. Michael*. Frs. medium-sized, oblong, red-blotched when ripe; flesh wine-red; seeds few; rather early. *Jaffa*. Frs. large, oblong, juicy; seeds few. Possibly not the same as the celebrated orange of Jaffa, Palestine. *Mediterranean Sweet*. Frs. large, oval, juicy, late: tree nearly thornless. *Majorca*. Frs. round or slightly flattened, juicy: rather late. *Hart* (Hart's Tardiff). Frs. round or slightly oval, medium to large size, juicy; seeds few; ripens very late: similar to the next and thought by some to be identical. *Valencia* (Valencia Late). Frs. medium to large, oval or rounded, juicy, nearly seedless, very late. A prolific variety, largely grown in Calif. and held in cold storage until early autumn. There are many other Medit. varieties of nearly or quite as much value as some of the above, such as, *Centennial*, *Du Roi*, *Joppa*, *Paper Rind*, *Prata*, *Saul Blood*, *St. Michael* (Blood), etc.—The navel oranges all show a second smaller more or less included fr. formed at the tip of the main fr. Many varieties are of foreign origin. *Washington* (Bahia, Washington Navel). Fr. large, rounded slightly, pointed at apex; flesh firm, juicy; skin

very tough; seedless; early midseason. The most famous variety of oranges intro. from Bahia, Brazil, by Wm. Saunders of the U. S. Dept. of Agric. in 1870. Its cult. has steadily extended in Calif. until it is the principal variety grown there. It does not succeed well in Fla. *Thompson* (Thompson's Improved Navel). A smooth-skinned hard-fleshed variety found by A. D. Shamel to arise as a mutation from the preceding, to which it is inferior in quality though better in appearance. *Australian*. Frs. large, coarse; tree vigorous, but a shy bearer. Also found by Shamel as a variation of the Washington Navel (Bahia). *Surprise*. Fr. medium-sized, rounded or even slightly flattened, juicy, early, seedless. A variety originated by E. S. Hubbard, of Fla. *Double Imperial*. Fr. small or medium-sized, navel hidden; pulp firm; seeds few or none. A Brazilian variety, said to fruit well in Fla. when budded on trifoliate orange stock. There are many other varieties of navel oranges occasionally grown on a commercial scale. In Calif., among others, Golden Nugget and Navelencia; in Fla., Egyptian, Melitensis, and Sustain are known. There are doubtless many more navel oranges which should be tested. See *Orange*. Hybrids: Citranges are hardy hybrids between the common sweet orange and the trifoliate orange, *Poncirus trifoliata*. The principal varieties are the Rusk, Morton, Colman, Savage, Cunningham and Saunders. See description under *Citrang*.



978.  
*Citrus ichangensis*.  
( $\times \frac{5}{8}$ )

Magee, of Riverside, Calif., in 1880, from Saigon, Cochinchina, which introduction became known as the King orange. It has frs. of large size, very juicy, and of delicious vinous flavor. Its rough skin seems to be no obstacle to its ready sale at good prices.

Var. *deliciosa*, Swingle (*C. deliciosa*, Tenore). MANDARIN ORANGE. A small tree, with slender branches, willow-like lvs., with merely margined petioles: fls. small: frs. depressed globose, bright orange-yellow or reddish orange, with a very loose peel; seeds small, beaked, bright green within.—This variety comprises the many varieties of Mandarin oranges, including the so-called tangerine varieties. These are delicious dessert frs., attractive in appearance and easy to handle because of the loose skin and the easily separable segms. Aside from the greater ease of preparing them for the table, Mandarin oranges are used exactly as are common oranges. The principal varieties grown in the U. S. are the following: *Mandarin* (China, China Mandarin, Willow-leaved). Fr. medium-sized, 2–3 in. diam., depressed-globose, early, orange-yellow; very juicy; sweet; seeds abundant. *Oneco*. Fr. medium to large, orange-yellow, midseason. Intro. from India in 1888. *Tangerine* (Dancy's Tangerine). Fr. red-orange, medium size, depressed-globose, juicy; seeds rather

abundant: midseason: tree of good size: lvs. much broader than those of the Mandarin variety. Other Mandarin oranges are occasionally grown, especially in Fla., such as the Beauty, Cleopatra, Kino Kumi, and Mikado. Hybrids: Tangelos, are a striking new group of citrus frs. *Sampson*, the first tangelo to be grown commercially, was obtained by the writer in 1897 by crossing the tangerine with Bowen grapefruit; it is unlike either parent in quality, being more like a choice sprightly flavored sweet orange. Many other tangelos are now being tested. See *Tangelo*.

Var. *unshiu*, Swingle (*C. nobilis* subsp. *genuina* var. *unshiu*, Makino). SATSUMA or UNSHIU ORANGE. A small spineless tree, with a spreading dwarf habit: lvs. broad, abruptly narrowed toward the apex, with strongly marked veins on both faces: fls. small, very abundant: fr. depressed-globose, 2–3¼ in. diam., deep orange; pulp orange, very juicy, of a peculiar but agreeable flavor; pith hollow; segms. 9–13; seeds often lacking, when present only few in number, broadly top-shaped, not beaked as in the Mandarin oranges, greenish within.—This very marked orange seems to constitute a botanical variety distinct from the King or the Mandarin oranges. It is commonly grown in Japan, whence it was intro. into Fla. by Geo. R. Hall in 1876, according to H. H. Hume, "Citrus Fruits and Their Culture," p. 112. 1909. The Satsuma orange is one of the hardiest of all edible citrus frs. Budded on the trifoliate orange, it can be grown in many parts of the Gulf Coast region, where all other citrus frs. except citranges are killed by cold. The Satsuma can be grown best on the trifoliate orange stock. It grows on sweet stock but does not produce as much nor as good fruit and is not so hardy. It makes only a stunted growth on sour orange stock and soon dies. It cannot be grown satisfactorily on light sandy land or on black waxy lands with a marly subsoil where the trifoliate orange does not grow well. It could be grafted on Rusk citrange for the black waxy lime soils of Texas.

8. *mitis*, Blanco. CALAMONDIN ORANGE. A small tree, with upright branches: lvs. broadly oval, pale green below like those of kumquat; petiole narrowly winged: fls. small, angular in the bud, borne singly at the tips of the twigs: fr. small, depressed globose, deep orange-yellow when ripe, loose-skinned; segms. 7–10, easily separable; pulp very acid; seeds few, small.—This tree, a native of the Philippine Is., is commonly cult. in Hawaii, where it is wrongly called "China orange." It was intro. into Fla. by the U. S. Dept. of Agric. from Panama, and was for a time distributed by nurserymen under the erroneous name of To-Kumquat. It is very hardy, probably as hardy as the Satsuma, or even more so. It can be budded on sour orange or on trifoliate orange stock. A promising fr. for home use, for culinary purposes and for making ade.

9. *ichangensis*, Swingle. Fig. 978. A small tree, with long slender spines: lvs. narrow, with oblong broadly winged petioles nearly or quite as large as the blade: fls. white; stamens 20, cohering in bundles: fr. lemon-shaped, 3–4 in. long, with a very broad low apical papilla surrounded by a shallow circular furrow; segms. 8–11; pulp acid, of good flavor; seeds very large, thick, cuneate-ovate, ½–¾ in. long and ¼–¾ in. thick, white within.—This interesting new species, not closely allied to any other of the known members of the genus *Citrus*, is native in highlands of S. W. China. It is the northernmost evergreen tree of the citrus group and grows at high altitude, 3,000–5,000 ft. It is able to withstand considerable cold in winter, so it is very likely to prove of value in breeding new types of hardy substitutes for the lemon. E. H. Wilson, who collected excellent material of this plant for the Arnold Arboretum, is endeavoring to secure it for trial in U. S.

*C. bergamia*, Risso. BERGAMOT. A small tree: lvs. oblong-oval, with long, winged petioles: fls. small, white, very fragrant: frs.



pyriform, 3-4 in. diam., thin-skinned, pale yellow when ripe; pulp acid; seeds oblong, many. Extensively cult. in Calabria for the essential oil which is expressed from the peel and used in making Eau de Cologne and other perfumes.—*C. hirsuta*, see Papeda.—*C. japonica*, see Kumquat.—*C. taifensis*, Risso. OTAHEITE ORANGE. A dwarf plant, having lemon-like fls. and lemon-shaped fr. orange in color with a mawkish taste. Commonly grown by florists as an ornamental pot-plant. Rarely used as a stock for dwarfing common citrus frs. This plant is not a native of Tahiti as the name would indicate, but is probably of hybrid origin.—*C. trifoliata*=*Poncirus trifoliata*.

WALTER T. SWINGLE.

CIVE: *Chive*.

**CLADÁNTHUS** (Greek, *klados*, branch, and *anthos*, flower; alluding to the branching, which distinguishes this genus from *Anthemis*). *Compósitæ*. An annual yellow-rayed herb, sometimes planted in the open garden. Plant branched from the base in a forking manner; a fl. terminates each branch, whereupon 2 new branches start from directly beneath the fl.; each of these is temporarily stopped by a fl., and so on: involucre hemispherical; receptacle conical or oblong, with scales about fls; ray-fls. pistillate, disk-fls. perfect.—One species; allied to *Achillea* and *Anthemis*.

**arábicus**, Cass. (*C. proliferus*, DC. *Anthemis arábica*, Linn.). Glabrous, 2-3½ ft. high: lvs. alternate, pinnately parted; lobes linear, trifid: fl.-heads solitary, bracted. S. Spain and Morocco.—A free-flowering heavy-scented plant of easy culture. L. H. B †

**CLADOTHÁMNUS** (*klados*, branch, and *thamnos*, bush, from the Greek). *Ericaceæ*. Shrubs, rarely cult. for their handsome pink fls. Erect, with many virgate branches: lvs. deciduous, alternate, entire: fls. pink, terminal, 1-3, nodding; corolla divided to the base or nearly so into 5 oblong petals; stamens 10: caps. 5-6-celled.—One or 2 species in Pacific N. Amer., from Alaska to Wash. Hardy, with handsome rather large pink fls. in summer; rarely cult. They will probably grow best in peaty and sandy soil, in a half-shady position; prop. by seeds or by cuttings of soft wood under glass, and by layers.

*C. pyrolæiflorus*, Bong. Shrub, 4-10 ft.: lvs. nearly sessile, obovate-lanceolate, mucronulate, glabrous, pale green, 1½-2½ in. long: fls. solitary, with 5 separate petals, 1 in. across. Alaska to Ore. G.F. 10:215. B.M. 8353.—*C. campanulatus*, Greene. According to Greene, this species differs from the preceding chiefly in the petals being united at the base and the anthers opening with a pore at the apex, and occurs in Wash., while *C. pyrolæiflorus* is restricted to Alaska, but the specimens from Ore. and Wash. do not differ from *C. pyrolæiflorus*; possibly *C. campanulatus* was based only on an abnormal form.

ALFRED REHDER.

**CLADRÁSTIS** (Greek, *brittle branch*). *Virgilia* of gardens. *Leguminosæ*. YELLOW-WOOD Trees grown chiefly for their large panicles of white flowers and for their handsome foliage.

Deciduous: winter-buds naked, several superposed and concealed during the summer in the enlarged base of the petiole: lvs. alternate, odd-pinnate, with few rather large entire short-stalked lfts.: fls. in long, usually paniced racemes, white, papilionaceous; calyx campanulate, 5-toothed; stamens 10, nearly free: pod narrow-oblong, compressed, 3-6-seeded, with thin membranous valves.—Four species in N. Amer. and E. Asia. Hardy ornamental trees of medium size, with showy fls. and handsome foliage, turning bright yellow in fall. They thrive in almost any soil. Prop. by seeds, sown in spring, or by root cuttings, dug up in fall and kept in sand or moss, moderately moist and cool, until spring.

**lútea**, Koch (*C. tinctoria*, Raf. *Virgilia lútea*, Michx.). Tree, with yellow wood and smooth bark, sometimes 50 ft.: lfts. 7-9, oval or ovate, glabrous, bright green, 3-4 in. long: panicles loose, drooping, 10-20 in. long; fls. white, fragrant, over 1 in. long. June. Ky., Tenn., and N. C. S.S. 3:119-20. B.M. 7767. Mich. Hist. Arb. III. 266. Gng. 2:401; 5:98. F.E. 8:427. G.F. 1:92. Gn. 24, pp. 96-7; 34, p. 329. G.C. III. 42:186-7. M.D.G. 1899:444-5. G.W. 12, p.

397. V. 4:307. A.G. 15:270.—One of the most beautiful flowering native trees, with wide, graceful head and a short trunk, well adapted as single tree on the lawn. Hardy north to New England and Ont. The wood yields a clear yellow dye. There is a var. *aureo-variegata* with lvs. variegated with yellow.

**sinénsis**, Hemsl. Tree, to 80 ft.: lfts. 9-13, oblong to oblong-lanceolate, usually rounded at the base, yellowish green, pubescent beneath along the midrib, 2-4 in. long; rachis and petiole pubescent: fls. in loose, upright, much-branched panicles, 5-12 in. long and 4-8 in. across, white or pinkish, about ½ in. long. June, July. W. and China.

*C. amurénsis*, Koch = *Maackia amurensis*.—*C. platycarpa*, Makino (*Sophora platycarpa*, Maxim.). Tree: lfts. 9-15, ovate to elliptic-lanceolate, 2-3½ in.: panicles broadly pyramidal, upright; fls. ½ in. long, white; standard with yellow spot at the base; pod narrowly winged. Japan. S.I.F. 2:32. Very rare in cult.—*C. Tashiroi*, Yatabe = *Maackia Tashiroi*.—*C. Wilsonii*, Takeda. Tree, to 50 ft.: lfts. 7-9, elliptic-ovate to ovate-oblong, usually broadly cuneate at the base: panicles upright, 5-8 in. long; fls. ¾ in. long; ovary pubescent. Cent. China.

ALFRED REHDER.

**CLÁRKIA** (Capt. Wm. Clark, companion of Lewis, explorer of the Rocky Mt. region and beyond, 1806). *Onagraceæ*. Flower-garden annuals.

Herbs, with alternate mostly entire lvs., and showy fls. in the upper axils or in terminal racemes: fls. regular, the calyx tubular, the petals 4, narrow at the base and entire or lobed, wide-spreading; stamens 8, the alternate ones short or rudimentary; stigmas 4, large and spreading: pod oblong or linear, 4-sided.—Half dozen or more species in W. N. Amer. See also *Eucharidium*.

Clarkias are hardy annuals of easy cultivation. They thrive in a warm, light soil, either fully exposed to the sun or in partial shade. They are useful for low masses or for edgings; also for vases and baskets. They have been much improved by domestication.

A. Stamens (8) all perfect: lvs. broad.

**élegans**, Douglas (*C. unguiculata*, Lindl. *C. nerifolia*, Hort.). Fig. 979. From 1-6 ft. high, glabrous or nearly so, the sts. reddish and glaucous, simple or sparingly branched: lvs. broad-ovate to linear, remote-dentate: fls. purple or rose-colored, running into white vars.; double forms in cult.; claw of the petal about as long as its rhomboidal entire limb: caps. sessile. B.M. 3592. B.R. 1575. R.H. 1845:385. Mn. 1:22.—One of the commonest annual fls.

**rhomboídea**, Douglas. Not so tall and more slender: lvs. thin, lance-oblong or ovate-oblong, entire: claw



979. *Clarkia elegans*. (× ¾)

often toothed, shorter than the rhomboidal limb: caps. stalked. B.R. 1981. R.H. 1864:151(?).—Not much cult.

AA. *Stamens 4 perfect and 4 rudimentary: lvs. very narrow.*

**pulchella**, Pursh. Fig. 980. One ft. to 18 in. high, branchy, often tufted and dwarf, the sts. mostly puberulent: lvs. narrowly lance-oblong to linear, narrowed into a petiole, entire: fls. lilac, running into white vars.; petals  $\frac{3}{4}$  in. or less long in wild plants, with 3 wide-spreading lobes and a pair of recurved teeth on the claw: caps. stalked. B.M. 2918. B.R. 1100. R.H. 1845:385; 1886, p. 557.—Common in cult. There are semi-double and dwarf forms. Var. **holopétala**, Voss (*C. integripétala*, Hort.) is a garden form or race with entire petals. There are also dwarf forms of it. The garden names *kermesina* and *limbata* belong with *C. pulchella*. L. H. B.

**CLARY**. The dried leaves of *Salvia Sclarea*, which are used for seasoning. Other species of *Salvia* have been used for the same purpose. See *Salvia*.

**CLAUCÈNA** (a personal name). *Rutaceæ*. Small inermous trees: lvs. pinnate: fls. in terminal panicles or loose racemes; ovary raised on a short disk, 4-5-celled, with 1-2 ovules in each cell; style short, deciduous; stamens 8-10; fr. 4-5-celled, with usually 1 seed in each cell; cotyledons aerial in germination, first foliage-lvs. opposite or alternate.

**Lánsium**, Skeels (*Clau-sèna Wámpi*, Oliver. *Quin-ària Lánsium*, Lour. *Cookia Wámpi*, Blanco). **WAMPI**. Low spineless tree, with spreading branches: lvs. spirally arranged, pinnate; lfts. 5-9, ovate-elliptical, 3-5 in. long, petiolate, light green, shiny above: fls. 4-5-parted, small, white, in large terminal panicles; ovary villous, 5-celled, with 1 ovule in each cell; style short; stamens 10; fr. ovate-globose, about 1 in. long; skin glandular, pubescent; seeds green.—The wampi is a native of S. China, where it is commonly grown for its frs. It is cult. to some extent in Hawaii and could probably be grown in the warmer parts of Fla. and Calif. It can be grafted on grape-fruit and other species of *Citrus*, which makes it desirable to test it as a stock for common citrous frs.



980. *Clarkia pulchella*.  
(X1)

WALTER T. SWINGLE.

**CLAVIJA**, (Don José de Viera y Clavijo, of Madrid). Syn., *Horta*. *Myrsinacæ*; by Mez separated in the family *Theophrastacæ*. Thirty and more tropical American evergreen unbranched trees or shrubs, a few of which are sometimes grown in the warmhouse. The sts. are simple, often spiny, bearing at the top a cluster of large rigid, simple, entire or spiny-toothed lvs.: fls. polygamous-dioecious in axillary racemes; calyx 4-5-parted, the segms. round; corolla white, yellow or orange, the tube short and fleshy, the limb mostly spreading and 4-5-lobed; stamens 4 or 5, the filaments often united in the sterile fls.; staminodia 4 or 5, being scales in the throat; ovary fusiform, narrowed into a short style, the stigma obtuse or capitate; fr. several-seeded, berry-like. The clavijas thrive in a

peaty potting soil, and prop. by cuttings of half-ripened growths. They are odd plants. The features are here given as apparently understood by horticulturists.

A. *Lvs. entire, or only repand.*

**nóbilis**, Mez, (*C. clavata*, Decne). Plant 4-5 ft.: lvs. long-petioled thick,  $1\frac{1}{2}$  ft. or less, elliptic or oblong or oblanceolate, entire, acute or semi-acute: fls. yellow, with a very large disk,  $\frac{3}{4}$  in. long, the corolla fleshy, in drooping racemes 2-4 in. long. Venezuela. B.M. 6928 (as *C. Ernstii*, Hook., f.).

**integrifolia**, Mart. (*Theophrasta integrifolia*, Pohl). Allied to *C. longifolia*, differing chiefly in the less rigid, broader and entire leaves, longer petioles and larger fls. Lvs. distinctly petioled (petioles  $\frac{1}{2}$ -1 in. long), obovate-oblong to lanceolate-oblong, acute and mucronate, cuneate at the base, quite entire or slightly undulate, 8-18 in. long: racemes erect, 5-7 in. long; fls. larger than in *C. ornata*, on slender pedicels, 5-merous; appendages of the corolla rounded, short. Brazil.

**grándis**, Decne. (*Theophrasta macrophylla*, Lind., not Link. *T. grándis*, O. Kuntze). Lvs. large (to 3 ft.), long-oblong, narrowly pale-margined, entire or sinuate-repand; petiole thick and dark violet, the secondary nerves slender and simple or forked: fls. orange-yellow, in short and erect racemes; calyx-lobes orbicular and nearly glabrous, the corona 5-lobed. Colombia.

AA. *Lvs. serrate, often spiny-toothed.*

**longifolia**, Mez. (*C. ornata*, Don, *Theophrasta longifolia*, Jacq.). Plant 10-20 ft.: lvs. many, in a crowded head or tuft at the top of the st. oblong-spatulate to lanceolate, leathery, narrowed at base and stalked, acute, spiny-toothed,  $1\frac{1}{2}$  ft. or less long: fls. orange- or saffron-colored, fragrant, in drooping racemes 4-10 in. long. Venezuela, Colombia. B.M. 4922. B.R. 1764. Blooms in June and July.

**spinosa**, Mez (*C. Riedeliàna*, Regel). Plant 5-6 ft., glabrous, stout and erect: lvs. obovate-lanceolate, sessile, 20 in. or less long, spinose-serrate: fls. orange-yellow, in slender racemes 5-8 in. long. Brazil.

**fúlgens**, Hook. f. Plant 3 ft. or more, very stout: lvs. spatulate-obcuneate, narrow, remotely toothed near the apex, narrowed into a very short petiole, very coriaceous, 1 ft. or so long: fls. deep red, with yellow disk, handsome, in erect racemes 4 or 5 in. long. S. Amer. B.M. 5626.

*C. latifolia*, Radlk. (*Theophrastus latifolia*, Willd.). Lvs. gracefully elliptic, petioled, narrowed at both ends, mucronate-serrate: racemes erect. Colombia.

L. H. B.

**CLAYTONIA** (after John Clayton, of Virginia, one of the earliest American botanists upon whose collections Gronovius based the *Flora Virginica*). *Portulacacæ*. **SPRING BEAUTY**. Little smooth succulent herbs sometimes transferred to gardens for their bright flowers. Perennials with slender, 2-lvd. sts. from a deep, globular corm, and loose racemes of white or rose-colored fls. with deeper veins, appearing among the first wild fls. and lasting only a few days. The genus is characterized by its oval, persistent sepals and 5 stamens. Plants can be secured from dealers in native plants. They can be naturalized in moist places, and do well in half-shady spots at the bottom of a rockery. For *C. parvifolia*, *C. parviflora* and *C. perfoliata*, see *Montia*.



**virginica**, Linn. Plant 4-8 in. long, often forcing an irregular way through the leaf-mold of damp, rich woods; lvs. linear-lanceolate or linear, 2-6 in. long, including the gradually tapering base: fls. larger and more numerous than in *C. caroliniana*, whitish, tinged with pinkish. Colo. to Atlantic and south to Gulf. B.M. 941. L.B.C. 7:643.

**caroliniana**, Michx. Lower and fewer-fl'd.: lvs. 1-2 in. long, oblong, oblong-lanceolate, somewhat spatulate, or even ovate-lanceolate, with a blade 1-2 in. long, abruptly contracted into a marginal petiole: fls. smaller than in the preceding and more deeply colored. Minn. to Atlantic and south to mts. of N. C.—Should be grown only in cool places above 1,000 ft.

**lanceolata**, Pursh. About 4 in. high: lvs. oblong or lanceolate,  $\frac{1}{2}$ -1 $\frac{1}{2}$  in. long, the base broad or narrow; petiole as long as the blade: raceme short-peduncled; petals emarginate or almost orbiculate. N. W. N. Amer.—Considered by some to be a mere form of the preceding.

WILHELM MILLER.  
N. TAYLOR.†

**CLEISÓSTOMA** (Greek, *closed mouth*, referring to the structure of the spur). *Orchidaceæ*. Epiphytic orchids, adapted to the warmhouse.

Stems leafy: lvs. coriaceous, flat or nearly terete: sepals and petals adnate to the column, spreading; labellum with a large saccate spur; column short, thick; pollinia 2. From E. Asia and Austral.—A genus comprising in the neighborhood of 40 species, which suggest *Saccolabium*. The plants are little known in Amer. They require the treatment usually given *Aërides*. The leading species are *C. crassifolium*, Lindl., from India, with small green rosy-lipped fls. in nodding panicles, and thick recurved lvs. 10 in. long. J.F. 4:397; and *C. ringens*, Reichb. f., Philippines, with yellowish white purple-lipped fls. with orange spot on side lobes, spur large, in few-fl'd. racemes: lvs. 3-4 in. long. *C. Dawsonianum*, Reichb. f., is a *Trichoglottis*; *C. multiflorum*, Hort., is probably *Aërides multiflorum*. *C. secundum*, Rolfe, a recent introduction from Burma, has light rose-pink fls. that are turned sidewise, the front lobe of the lip rose-purple, borne on a scape 3-4 in. long: lvs. lance-oblong, about 4-5 in. long and  $\frac{1}{2}$  in. broad.

**CLEISTÁNTHUS COLLÏNUS**: *Lebidieropsis*.

**CLEISTOCÁCTUS** (*closed Cactus*, referring doubtless to the peculiar flowers). *Cactaceæ*. Slender columnar cacti, with few branches and many-ribbed: fls. short and narrowly curved, orange-red; ovary covered with small appressed bracts bearing hairs in their axils; filaments somewhat exserted and grouped together near the upper lip: fr. spineless; pulp white; seeds slightly punctate.—About 14 species have been described in this genus.

**Baumannii**, Lem. (*Cereus Baumannii*, Lem. *C. colubrinus*, Otto). Sts. dark green, slender, flexuose, columnar, reaching a height of 6 ft. and a diam. of 1-1 $\frac{1}{2}$  in., the few branches ascending, slender, parallel with the main st.: ribs 12-16, rounded: areoles close together, brown: spines fine, slender, very sharp, 15-20, fascicled, white to yellow or dark brown, about  $\frac{1}{4}$  in. long; sometimes a single one from the center reaches a length of  $\frac{3}{4}$  in.: fls. numerous, tubular, zygomorphous, 2 $\frac{1}{2}$ -3 in. long by about  $\frac{1}{2}$  in. diam. throughout, red or sometimes with orange-red petals and red tube. Uruguay, Paraguay and Argentina. J. N. ROSE.

**CLÉMATIS** (Greek name of a climbing plant). *Ranunculaceæ*. Familiar garden plants, prized for their handsome and often very showy flowers followed in many species by attractive feathery-tailed fruits.

Climbing vines, or erect or ascending perennial herbs, more or less woody: lvs. opposite, mostly slender-

petioled, usually pinnately compound, lobed, or in some species entire and rarely sessile: sepals usually 4 or 5, sometimes more, valvate in the bud, rarely imbricate, petaloid; petals none (or small in *Atragene* section, usually considered as petaloid staminodes); stamens many; pistils many: achenes in a head, 1-seeded; style persistent, long, plumose, silky or naked. Fig. 983.—About 150 species of very wide geographical distribution, most abundant in temperate regions. About 20 species found native in N. Amer. and about 80 in E. Asia. Les Clematites, Alphonse Lavallée, Paris, 1884; referred to below by "Lav."—The Clematis as a Garden Flower, Thomas Moore and George Jackman, London, 1872; referred to below by "M. & J."—Clematises, Dr. Jules le Bele, in Bull. de la Societe d'Hort. de la Sarthe; republished in The Garden (vol. 53), June-Oct., 1898.—O. Kuntze, Monogr. der Gattung Clematis in Verh. Bot. Ver. Brandenb. 26 (1885).—A. Gray, Fl. N. Amer. 1:4-9, 1895.—Finet & Gagnepain, Contrib. Fl. As. Orient 1:1-42 (1905).

*The culture of clematises.* (K. C. Davis.)

A rich soil of a light, loamy character is the best for clematises, and a little mixture of lime will make it better. The soil must be well drained, and must be kept rich by at least annual applications of horse- or cow-manure. On dry, hot soils cow-manure is best, while on heavy soils a thorough dressing of rich leaf-mold would best serve the purpose. Mulching with half-rotted manure on the approach of winter tends to increase the strength of the plants and the size of the flowers. In dry seasons, spraying is always helpful during the growing period.

Clematises belonging to the *Montana*, *Patens*, *Florida*, and *Lanuginosa* types should be pruned in February or March, by cutting away all weak, straggling and overcrowded branches. The first three mentioned flower from the ripened wood; it is essential, therefore, that in order to secure blossoms, enough of the strong one-year-old wood should be retained. *Viticella*, *Jackmanii* and *Lanuginosa* should be vigorously cut back, say in November; they blossom from the new shoots. Those of the *Patens* type should be pruned very little, soon after the flowers have disappeared, by simply trimming off useless branches and seed-bearing peduncles.

Clematises of the vigorous climbing varieties are used in many places to cover walls, root-fences, mounds, arbors, balconies, trellises, small buildings, and, in fact, many other places the ingenious gardener will think of. For pot culture in the greenhouse, and for conservatory walls, the less vigorous species are best suited. All the many varieties and hybrids of the *Patens* and *Lanuginosa* types, including *Henryi* and the forms of *Jackmanii*, are well adapted to this use, as well as for outdoor purposes. The dwarfier and more bushy species are used in greenhouses to some extent, but are found principally in borders or on large rockeries. Of the latter J. B. Keller says: "Their flowers are not so large as we see them in most of the climbers, yet they are indispensable in the flower-garden, being prolific bloomers and free growers in ordinarily rich, deep garden soil. There is room for improvement in this class, however, and specialists, who hitherto have done so much for the climbers, ought to direct their efforts now to the long-neglected bush clematises. A noble beginning has been made, resulting in the large-flowering *C. Durandii*, but we expect more of them in the future." See special notes on culture and hybrid-forming qualities after the descriptions of some of the species and varieties.

The most common method of propagation is by grafting. Roots of *C. Flammula* or *C. Viticella* are used; the cions are taken from plants that have been grown under glass, and are used before the wood is entirely ripe. Cions taken from plants grown in the

garden in summer are rarely successful. The grafts, in pots or trays, are grown in a moist coolhouse, over gentle bottom heat. Another method of propagation, involving less labor but usually successful, is to take cuttings of nearly ripe wood, grown under glass, and treat them as the cions first above mentioned, without the roots. The latter method is practised preferably in summer in gentle hotbeds; shading, spraying, and later on airing, must be strictly attended to. Layering is practised when large old stools are at hand. The knife is not used in the operation, but a twist of the stem will split the inner bark lengthwise. Every other joint is thus treated, pegged down, and covered with soil. It is best to leave the layers undisturbed until the following spring. Many of the species are often propagated by seed, and many new varieties have thus been secured. The number of hybrids is almost countless; in this account are carefully recorded those in the American trade which are traceable to their origin.

The clematis is subject to a very serious disease, due to the depredations of a nematode worm in the roots. This trouble is most serious under glass and alongside buildings where the ground does not freeze deep. The parasite is probably distributed in the soil adhering to pot-grown plants. It is probable that hard freezing kills the parasite. There is no remedy, so far as known, for affected plants. Using only soil which has been frozen is to be recommended to the propagator.

*The kinds of clematis.* (Jackson & Perkins Co.)

The hybrid varieties of *Clematis*, commonly known as the large-flowering sorts, are, when successfully grown, among the most beautiful of hardy climbing plants. The commercial propagation and growing of most of the large-flowering varieties, however, is attended with so many difficulties and disappointments that it has never been very generally attempted by nurserymen or florists in this country. At the present time there are scarcely half a dozen houses on this continent who attempt the propagation of clematis to any considerable extent, and it is only within the past thirty years that clematises have been commercially grown even by this limited number. Prior to that, practically all of the large-flowering clematises planted in this country were imported from Europe, the major part being supplied by Holland, whose moist atmosphere and black soil produces large, vigorous plants, but whose climatic conditions are so entirely different from those usually found in this country that the plants often failed to adapt themselves to their new surroundings, and did not thrive to the extent that their good size and vigorous condition seemed to give promise.

The propagation of clematis throughout Europe is usually effected by grafting pieces of well-ripened, year-old wood upon roots of almost any of the more

vigorous-growing species, *Clematis Flammula* being most commonly used. In this country, on the contrary, the method commonly pursued is by means of cuttings from young wood, stuck in sand, with gentle bottom heat, usually during May or June. So far as concerns the comparative vigor and desirability of plants produced by these two methods, there is small choice between them. Propagation by cuttings is, in this country, the more rapid and economical way, and further, it removes the possibility, sometimes realized in grafted plants, of sprouts being thrown up from the roots, and, if in the hands of an uninformed amateur, entirely "running out" the variety grafted in; thus considerable annoyance is avoided.

Clematises hybridize so readily that the number of varieties resultant from various crosses forms a long list. But while so many have been dignified with names and places in the catalogues of nurserymen, yet the varieties of large-flowering clematis that have proved so valuable as to secure permanent places for themselves in popular demand can almost be counted upon one's fingers. There are many varieties possessing most beautiful shades and variations of coloring that fail to attain popularity, chiefly on account of deficiency in two essential characteristics—vigorous habit of growth and abundance of bloom. *Clematis Jackmanii*, purple, originated in 1862, by Mr. George Jackman, was one of the first hybrid clematises introduced, and still stands as the most popular, and, of its color, the most valuable variety yet known. The variety, Madame Edouard André, a deep rich crimson, is distinct and novel, being at this time about the best large-flowering sort of a truly crimson shade. It is not quite so vigorous habit as the *Jackmanii*, but its flowers are similarly massed, though not produced in quite such profusion. *Clematis Madame Baron Veillard* is a distinct variety. It is of exceedingly vigorous habit, and the flowers are quite freely produced, though, being more dispersed over the plant, they do not make so much of a show as do varieties whose flowers are closely massed. The flowers are of very large size and of a light rose-color, shaded with lilac. Of white varieties, *Henryi*, Mrs. George Jackman and *Lanuginosa Candida*, all of them introduced long ago, still remain about the most desirable ones known. *Ramona*, deep sky-blue, is a variety which originated some twenty-five years ago. It is of extra-large size, often 9 to 10 inches across, of very vigorous habit and free-flowering.

Of double-flowered varieties, *Duchess of Edinburgh*, white, is the best known in this country, and about the most desirable. John Gould Veitch is a double sort with flowers of lavender-blue, but has seemed a shy bloomer and of weak habit. *Mme. Grange* (purplish violet), *Star of India* (purple), *Velutina Purpurea* (purple), and *Viticella Venosa* (reddish purple), are all desirable varieties.

Although they are in reality slightly less hardy than the Florida and Patens types, varieties of the *Lanuginosa*, *Viticella* and *Jackmanii* types, which produce their flowers from young growing wood, are recommended for northern localities. Plants of these types, even if frozen back to the ground, will still produce a good show of flowers, since, as stated, they bloom from the recent vigorous wood, even if the old tops are killed. Indeed, they need to be pruned back considerably anyway to induce a free growth of young vigorous blooming wood. With plants of the Patens and Florida types, however, which blossom from year-old wood, a severe freezing back of the plants would destroy the crop of flowers for the year.

Of the small-flowering varieties, *Clematis paniculata* (white), introduced from Japan, has proved to be a wonderfully valuable acquisition in this country, and has become exceedingly popular. It is of remarkably vigorous habit, often making a growth of 20 to 25





feet in a season. It seems thus far to be entirely free from disease, is delightfully fragrant, and so floriferous that the blossoms form a dense sheet of bloom, remaining in full beauty for several weeks. The foliage is very thick and heavy, thus making it very desirable for covering porches and arbors.

*Crispa* (blue) and *texasensis* (red) are species with very pretty, bell-shaped flowers. They are easily grown and do well in almost all situations.

The perennial, non-climbing varieties of clematis are most pleasing border plants, succeeding well in all ordinary soils and making a rich show of bloom at their flowering season. *Davidiana* (blue) and *recta* (white) are about the best known and most desirable varieties of this class.

To grow clematis most successfully, they should be given a good depth of loamy soil, with a fair supply of well-rotted manure spaded in and thoroughly distributed through the soil. In hot, dry weather, the plants should be regularly watered in order to obtain the greatest number of flowers possible, for the plants are very susceptible to injury by drought. A point of great importance, especially in caring for newly set plants, is to provide a firm support for them to climb upon. A solid wooden or metal trellis is preferable, for the reason that it prevents the plants from being whipped about by the winds, which often results in breaking the stalks just above the ground or else in cracking the outer bark of the stalks and rendering them more liable to the attacks of insects and fungous diseases. Training the vines upon strings, or a pliable support of any kind, is not to be advised for this reason. Propagation of the hybrid varieties is effected both by cuttings and by grafts. All of the type varieties grow readily from seed.

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## KEY TO THE SPECIES.

- A. Sepals upright, forming a tubular or urceolate fl.; stamens upright, appressed, pubescent; or sepals more spreading and fls. with petaloid staminodes.  
 B. Fls. without petaloid staminodes.  
 C. Lvs. simple: herbaceous, not climbing.  
 D. Color of fls. purple or blue.  
 E. The lvs. thin, acute, sessile . . . 1. *integrifolia*  
 EE. The lvs. subcoriaceous, reticulate, obtusish, short-petioled. . . . . 2. *Fremontii*  
 DD. Color of fls. yellow . . . . . 3. *ochroleuca*  
 CC. Lvs. compound.  
 D. Lfts. entire: fls. solitary.  
 E. Plants upright, herbaceous.  
 F. Shape of lfts. lanceolate: lvs. bipinnate or ternately compound . . . . . 4. *Douglasii*  
 FF. Shape of lfts. ovate: lvs. pinnate . . . . . 5. *aromatica*  
 EE. Plants climbing, shrubby.  
 F. Styles not plumose in fr.  
 G. The lvs. not reticulate, usually with terminal lft. . . . . 6. *crispa*  
 GG. The lvs. reticulate, usually without terminal lft. . . . . 7. *Simsii*  
 FF. Styles plumose in fr.  
 G. Fls. axillary, with the pedicels much longer than the fls.  
 H. Sepals outside pubescent, dull.  
 I. Lfts. subcoriaceous, reticulate. . . . . 8. *reticulata*  
 II. Lfts. membranous, indistinctly veined. 9. *Viorna*  
 HH. Sepals outside glabrous, bright scarlet. 10. *texasensis*  
 GG. Fls. terminal and axillary, the latter with the pedicels shorter than the fls. . . . . 11. *fusca*  
 DD. Lfts. serrate: fls. usually clustered or panicle.  
 E. Plants herbaceous, upright: fls. clustered, often nearly sessile.  
 F. Fls. blue or violet, in axillary clusters . . . . . 12. *heracleæfolia*  
 FF. Fls. whitish, usually in an elongated terminal panicle . . . . . 13. *stans*  
 EE. Plants climbing, shrubby.  
 F. Lvs. pinnate.  
 G. Fls. yellowish white, in panicles . . . . . 14. *nutans*  
 GG. Fls. reddish purple, 1-3, axillary . . . . . 15. *lasiandra*  
 FF. Lvs. bipinnate; lfts. small, deeply lobed, usually less than 1 in. long: fls. whitish. . . . . 16. *æthusifolia*  
 BB. Fls. with petaloid staminodes; sepals more or less spreading; stamens upright, appressed pubescent.  
 C. Lvs. always 3-foliate; lfts. ovate, subcordate . . . . . 17. *verticillaris*  
 CC. Lvs. partly biternate; lfts. ovate to ovate-lanceolate . . . . . 18. *alpina*  
 AA. Sepals spreading; stamens more or less divergent.  
 B. Stamens glabrous or only with a few hairs below the anthers (or hairy at the base only in No. 19).  
 C. Fls. solitary or in 3's or in axillary fascicles, blue, violet, red or white, usually large.  
 D. Lfts. entire: fls. on the new growth after the lvs., solitary or in 3's.

- E. Plant herbaceous, upright; sepals imbricate in bud; stamens pubescent at the base.....19. *Stanleyi*
- EE. Plants woody, climbing; sepals valvate; stamens glabrous.
- F. Achenes with short style; pedicels longer than the sepals.
- G. Number of sepals 4; fls. open campanulate, usually 1-2 in. across.
- H. Style glabrous; fls. 1-2 in. across, often in 3's.....20. *Viticella*
- HH. Style pubescent except at the apex; fls. 1 in. or less across....21. *campaniflora*
- GG. Number of sepals usually 5-6; fls. flat, 2-4 in. across.....22. *florida*
- FF. Achenes with long plumose style.
- G. Pedicels shorter than sepals; lvs. simple or ternate.....23. *lanuginosa*
- GG. Pedicels longer than sepals; fls. from last year's wood in spring or early summer; lvs. ternate or pinnate....24. *patens*
- DD. Lfts. or lvs. serrate; fls. in axillary clusters, or solitary on last year's branches with the lvs. in spring, white or pink.
- E. The sepals with a small involucre below their base; fls. nodding, open campanulate.
- F. Lvs. simple; fls. whitish...25. *cirrhusa*
- FF. Lvs. ternate; fls. greenish yellow, spotted red inside.26. *balearica*
- EE. The sepals without involucre.
- F. Lvs. pinnate; lfts. small, about 1/2 in. long.....27. *gracilifolia*
- FF. Lvs. ternate; lfts. 1-3 in. long.
- G. Lfts. glabrous or sparingly pubescent.....28. *montana*
- GG. Lfts. densely silky pubescent beneath, less so above.....29. *Spooneri*
- CC. Fls. in terminal or axillary panicles or cymes, rarely 3 (if solitary, with bracts about the middle of the pedicel) white, rarely pinkish; sepals 4 (sometimes 4-6 in No. 37), usually small (except in No. 37).
- D. Lvs. 3-foliate; lfts. always entire, often sub-coriaceous or coriaceous.
- E. The fls. from the old wood from scaly buds.....30. *Armandii*
- EE. The fls. from the new growth.
- F. Lfts. ovate or ovate-oblong.
- G. Filaments as long or shorter than anthers; lfts. rounded or subcordate at the base....31. *Meyeniana*
- GG. Filaments longer than the anthers; lfts. cuneate at the base.....32. *crassifolia*
- FF. Lfts. narrow-lanceolate or oblong-lanceolate.....33. *Pavoliniana*
- DD. Lvs. pinnate or bipinnate (if 3-foliate, lfts. lobed or dentate or fls. diæcious).
- E. The fls. perfect.
- F. Lfts. entire or nearly entire, or 3-lobed; anthers linear, much longer than broad.
- G. Plant herbaceous, upright.....34. *recta*
- GG. Plant climbing, half-woody.

- H. The lvs. pinnate....35. *paniculata*
- HH. The lvs. bipinnate....36. *Flammula*
- FF. Lfts. serrate, occasionally nearly entire; anthers oval or oval-oblong, not more than twice as long as broad (longer in Nos. 37 and 38).
- G. The fls. 1-3, long-stalked, 2-3 in. across; lvs. pinnate.....37. *Fargesii*
- GG. The fls. in panicles or cymes, not exceeding 1 in. diam.
- H. Lvs. ternate or biternate; fls. 1/2 in. across, in many-fld. cymes.....38. *apiifolia*
- HH. Lvs. usually bipinnate; lfts. ovate-lanceolate; tails of fr. about 3/4 in. long...39. *brevicaudata*
- HHH. Lvs. pinnate; tails longer.
- I. Sepals glabrous inside; lfts. pubescent beneath....40. *grata*
- II. Sepals pubescent inside and outside; lfts. glabrous or nearly so.....41. *Vitalba*
- EE. The fls. diæcious.
- F. Foliage deciduous; sepals 4.
- G. Fls. appearing on the young wood in summer, less than 1 in. across.
- H. Lvs. ternate; lfts. 2-3 in. long.....42. *virginiana*
- HH. Lvs. pinnate; lfts. 1-2 in. long.
- I. Plant glabrous; lfts. rounded or subcordate at the base.43. *ligusticifolia*
- II. Plant pubescent; lfts. truncate or cuneate at the base....44. *Drummondii*
- GG. Fls. on last year's branches from scaly buds in early spring, 1 1/2 in. across.....45. *lasiantha*
- FF. Foliage evergreen; lvs. ternate; sepals 5-7.....46. *indivisa*
- BB. Stamens pubescent; fls. yellow or yellowish, nodding; achenes with plumose tails.
- C. Lvs. pinnate or bipinnate.
- D. Fls. usually several, 1-2 in. across, pale yellow; lvs. bluish or grayish green; lfts. usually entire, often lobed.
- E. Lfts. often oblong or lanceolate; sepals pubescent inside.....47. *orientalis*
- EE. Lfts. usually ovate or oval, pale bluish green; sepals glabrous inside.....48. *glauca*
- DD. Fls. solitary, 2-3 in. across, on stalks to 10 in. long; sepals glabrous inside; lfts. usually lanceolate, serrate, green....49. *tangutica*
- CC. Lvs. biternate; lfts. serrate, green; fls. solitary.....50. *serratifolia*

## Section VIORNA.

## Group CRISPÆ.

1. *integrifolia*, Linn. Herbaceous, erect, becoming 2 ft. high; lvs. rather broad, entire, ovate-lanceolate; fls. solitary, nodding; sepals 4, rather narrow, blue, coriaceous, 1-2 in. long. June-Aug. Eu. and Asia. B.M. 65.

The following are supposed to be hybrids of this species: *C. cylindrica*, Sims (× *C. crispæ*, *C. integrifolia* var. *diversifolia*, Hort. *C. integrifolia* var. *pinnata*, Hort.). Lvs. more or less irregularly lobed or pinnate; fls. solitary, cylindric-campanulate with the sepals more or less recurved from the middle, blue or bluish-violet. B.M.



1160. Lav. 13. G.W. 14, pp. 562-3. R.H. 1856:341. Here also belongs probably *C. divaricata*, Jacq., with short-petioled pinnate lvs. and blue, less spreading sepals.

2. *Frémontii*, Wats. Fig. 981. Closely allied to *C. ochroleuca*, but with lvs. 3-4 in. long, nearly sessile, either entire or with a few coarse teeth: fls. often drooping; sepals thick, purple, nearly glabrous, except the tomentose edges; styles when young downy rather than feathery. July, Aug. Mo. to Colo. G.F. 3:381 (adapted in Fig. 981). G.W. 14, p. 563.

3. *ochroleuca*, Ait. Herbaceous, 1-2 ft. high, silky-pubescent, becoming glabrate: lvs. ovate, entire: fls. erect, solitary, terminal; sepals yellow outside, cream-colored within; styles becoming somewhat plumose. July, Aug. Dry grounds, N. Y. to Ga. L.B.C. 7:661.—Intro. 1883.

4. *Douglasii*, Hook. Has habit of *C. integrifolia*, about 2 ft. high: st. and petioles angled and ribbed: lvs. twice pinnately or ternately compound; lfts. narrow-linear or lanceolate: fls. tubular or bell-shaped, 1 in. long; sepals recurved, deep purple within, paler without. June. In mts., Mont. to New Mex.—Intro. 1881. Var. *Scottii*, Coulter, has the lfts. ovate- or oblong-lanceolate. A hybrid of *C. Douglasii* var. *Scottii* × *C. texensis* is *C. globulosa*, Hort., with deep purple pitcher-shaped fls. Gn. 75, p. 472.

5. *aromatica*, Lenné & C. Koch (*C. cærulea* var. *odorata*, Hort.). Slender, herbaceous or somewhat climbing, reaching 6 ft. high if supported: lvs. of 3-7 ovate, nearly entire lfts.: fls. solitary, terminal, very fragrant, 1½-2 in. across; sepals 4, spreading, reflexed, reddish violet; stamens white. July-Sept. Nativity, perhaps S. France. It is thought by some to be an old garden hybrid, probably *C. Flammula* × *C. integrifolia*. R.H. 1877, p. 15. Lav. 9.

6. *crispa*, Linn. A slender climber, reaching 3-4 ft.: lvs. very thin; lfts. 3-5 or more, variable in outline and sometimes undivided, often 3-5-lobed: fls. purple, varying to whitish, cylindrical or bell-shaped, 1-2 in. long; points of sepals recurved; styles of fr. hairy but not plumose. June-Sept. Va. to Texas. B.R. 32:60. B.M. 1892. I.H. 2:78 (as *C. campaniflora*). G. 30:503; 34:147. V. 6:379. Lav. 14.—This and the allied species are fragrant. A hybrid of this species is *C. cylindrica*, Sims (× *C. integrifolia*). See No. 1. A number of hybrid forms, the offspring of a cross between this species and *C. texensis* are figured and described in M.D.G. 1898:500 and one as "blue bells" in Gn. 49, p. 189.

7. *Simsii*, Sweet (*C. Pitcheri*, Torr. & Gray). High climbing: branchlets pubescent: lvs. of 3-4 pairs of lfts. and a terminal lft. reduced almost to a midrib; lfts. coarsely reticulated, lobed or 3-parted, usually mucronate: fls. 1 in. long and ¾ in. diam., with swollen base; sepals dull purple, recurved at the tips: achenes pubescent, styles not plumose. June-Aug. S. Ind. to Mo., southward to Mex. Lav. 15. B.M. 1816 (as *C. cordata*). Var. *Sargentii*, Rehd. (*C. Sargentii*, Lav.). Fls. smaller, paler: lfts. rarely lobed. Lav. 18.—A hybrid of this species with *C. texensis* is figured in R.H. 1893:376.

8. *reticulata*, Walt. A slender climber, allied to *C. crispa*: lfts. much reticulated and very coriaceous: fls. solitary in the axils of the lvs., nodding, bell-shaped; sepals recurved, crisp at the margin: mature fr. with plumose tails. June, July. S. C. to Ala. and Fla. B.M. 6574. Lav. 16.

9. *Viorna*, Linn. Fig. 982. Climbing, 8-10 ft., sparingly pubescent or glabrous: lvs. not glaucous nor coriaceous; lfts. subcordate-ovate to ovate-lanceolate, slightly reticulated: fls. solitary, on long peduncles, pitcher-shaped; sepals 4, 1 in. long, variable in color, often dull purple, thick and leathery, finely pubescent outside, tips often recurved; styles plumose when

mature, 1 in. long. June-Aug. Pa. to Ala. and westward. Lav. 17. Gn. 45, p. 240.

10. *texensis*, Buckl. (*C. coccinea*, Engelm. *C. Viorna* var. *coccinea*, Gray). Climbing, to 6 ft.; glabrous: lvs. glaucescent, subcoriaceous; lfts. broadly ovate, often obtuse, subcordate, 1½-3 in. long: fls. solitary, pitcher-shaped, nodding, carmine or scarlet, glabrous outside: achenes with plumose style, 1-2 in. long, glabrous at the tip. Texas. Lav. 19. B.M. 6594. Gn. 19:284. G.W. 10, p. 498. G.C. II. 15:405. W.G.Z. 2:111. F. 1880, p. 115. Gt. 32:86. R.H. 1878:10; 1888:348.—Much superior to the preceding because of its beautiful fls. Some of the garden hybrids of this species, which have been classed under *C. pseudo-coccinea*, Schneid. (× *C. Jackmanii*), are found under the names: *Countess of Onslow*, deep scarlet. Gn. 57, p. 376. M.D.G. 1898:481. G.M. 37:381. G.C. III. 16:9. *Countess of York*, white, tinted with pink. *Duchess of Albany*, clear pink. Gn. 52:304. See also No. 6 for hybrid forms of *C. crispa* with this species and No. 7 for a hybrid with *C. Simsii*.



982. *Clematis Viorna*. (× ¼)

11. *fusca*, Turcz. Climbing, to 15 ft.; sparingly pubescent: lvs. pinnate; lfts. usually ovate, to ovate-oblong, acute, glabrous or pubescent beneath and ciliate, 1½-2½ in. long, the terminal one usually wanting: fls. on rather short villous pedicels, nodding, urceolate, about 1 in. long; sepals with recurved tips, densely brownish pubescent outside, violet inside: pubescence of achenes and plumose tails fulvous. June-Aug. E. Siberia, Japan. Lav. 20. Var. *violacea*, Maxim. (*C. janthina*, Koehne). Less pubescent: fls. violet. Gt. 13:455.

#### Group TUBULOSÆ.

12. *heracleæfolia*, DC. (*C. tubulosa*, Hook.). Stout, erect, woody only at the base: lvs. ternate, large, bright green; lfts. broadly ovate, rounded at the base, slightly pubescent, mucronately toothed, 4-6 in. long: fls. numerous, in corymbs, either axillary or terminal, polygamous, tubular in form, with 4 light blue sepals, becoming reflexed; peduncles and pedicels downy; recurved stigmas club-shaped. Aug., Sept. China. M. & J. 17. B.M. 4269; 6801 (as var. *Hookeri*). P.M. 14:31. F.S. 3:195. R.H. 1858, p. 42.—Prop. by root division. Var. *Davidiana*, Hemsl. (*C. Davidiana*, Decne.). About 4 ft. high, hardly strong enough to stand without support: lvs. usually cuneate at the base, nearly glabrous: fls. brighter blue, fragrant, in clustered heads, 6-15 together, and also singly or clustered in the lf.-axils. R.H. 1867, p. 90. Gn. 31, p. 145; 45, p. 241; 49, p. 99; 68, p. 273. G.M. 37:48. G.W. 6, p. 124. Mn. 9:76. A.F. 25:1055. Var. *ichangensis*, Rehd. & Wilson. Lfts. broad at the base, sparingly pubescent above, densely beneath: achenes densely villous. Cent. China.

A hybrid of this species is *C. Joviniæana*, Schneid. (var. *Davidiana* × *C. Vitalba*). Half-climbing, to 6 ft.: fls. in large panicles, bluish white, first tubular with the sepals finally spreading. G.C. III. 51:34. Another hybrid is *C. Davidiana hybrida*, Lem. (var. *Davidiana* × *C. stans*) of which Lemoine advertises several named forms varying from light to deep blue; very floriferous.

13. *stans*, Sieb. & Zucc. (*C. heracleæfolia* var. *stans*, Hook.). Herbaceous, upright, to 6 ft.: branches grayish pubescent: lfts. broadly ovate, lobed and coarsely

toothed, more or less pubescent: fls. in terminal panicles sometimes 2 ft. long and in axillary clusters, whitish or bluish white, tubular, with revolute sepals, less than  $\frac{1}{2}$  in. long, dioecious. Sept., Oct. Japan. B.M. 6810.—Used chiefly because of the striking foliage and its late-blooming qualities. Var. *Lavallei*, Schneid. (*C. Lavallei*, Decne.). Fls.  $\frac{1}{2}$ – $\frac{3}{4}$  in. long, monocious.

#### Group CONNATÆ.

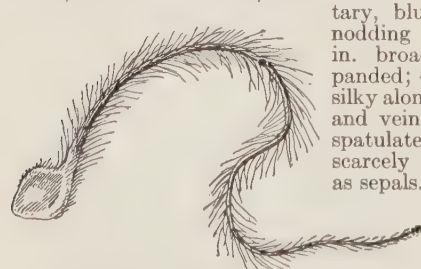
14. *nütans*, Royle. Slender woody climber: lvs. pinnate; lfts. ovate-oblong or lanceolate, deeply 3–5-lobed, rarely entire, 1–3 in. long: fls. nodding in many-fld. panicles, yellowish white, tubular,  $\frac{1}{2}$ – $\frac{3}{4}$  in. long, pubescent outside; filaments silky pubescent below the middle: achenes silky with plumose tails. July–Oct. Himalaya. Var. *thyrsoides*, Rehd. & Wilson. Climbing to 20 ft.: lfts. broadly ovate, usually cordate at the base, silky pubescent beneath: panicles larger and more compact, on upright stout peduncles 3–6 in. long. W. China. G.C. III. 48:310. Gn. 75, p. 557 (as *C. nutans*). R.H. 1905, p. 438 (as *C. Buchaniana vitifolia*). See page 3567.

15. *lasiandra*, Maxim. Climbing, to 12 ft.: young growth viscid: lvs. pinnate with 3-foliate or 3-fid segms.; lfts. ovate to ovate-lanceolate, long-acuminate, serrate, glabrous or sparingly pubescent on both sides,  $1\frac{1}{2}$ – $2\frac{1}{2}$  in. long: fls. axillary, solitary or in 3's on stalks 1–3 in. long, campanulate, reddish purple, about  $\frac{3}{4}$  in. long; sepals with recurved tips, as long as the stamens. Aug.–Oct. Cent. and W. China.

16. *æthusifolia*, Turcz. Slender, climbing: lvs. bipinnate, pubescent; lfts. finely cut, usually unequally 3-lobed and deeply incisely serrate with obtusish mucronulate narrow lobes,  $\frac{1}{3}$ – $\frac{3}{4}$  in. long: fls. 1–3, axillary, on slender stalks, whitish, tubular,  $\frac{3}{4}$  in. long; sepals with recurved tips: achenes pubescent with long plumose whitish tails. Aug., Sept. Mongolia, Manchuria. Var. *latisecta*, Maxim. Lfts. larger, to  $1\frac{1}{2}$  in. long with oval or oblong rounded lobes. Gt. 10:342. B.M. 6542. Gn. 6, p. 423; 31, p. 186; 45, p. 241. R.H. 1869, p. 10.—This is the form usually cult.; the type with much more finely divided foliage is very rare in cult.

#### Group ATRAGENEÆ.

17. *verticillaris*, DC. (*Atrágene americana*, Sims). Fig. 983. Trailing or sometimes climbing, 8–10 ft.: usually 4 trifoliate lvs. from each node; lfts. thin, ovate, acute, toothed or entire, somewhat cordate: fls. solitary, blue or purple, nodding at first, 2–4 in. broad when expanded; 4 thin sepals, silky along the margins and veins; staminodes spatulate, narrow, scarcely half as long as sepals. May, June. Woodlands, Va. to Hudson Bay, west to Minn. B.M. 887.—Intro.



983. Achene of *Clematis verticillaris*. (×1)

1881. Var. *columbiàna*, Gray. Sepals narrower and more pointed than in the type. Rocky Mts.

18. *alpina*, Mill. (*Atrágene alpina*, Linn.). Sts. 3–5 ft., slender, with prominent joints becoming swollen with age: lvs. once or twice ternate, with ovate or ovate-lanceolate lfts., serrate or incised; many petal-like stamens, which are devoid of anthers; sepals 4, bright blue. Spring. N. W. N. Amer., Siberia to S. and Cent. Eu. B.M. 530 (as var. *austriaca*). Gn. 46:318; 57, p. 481. R.H. 1855:321. L.B.C. 3:250. G.W. 10, p. 82.

H.W. 3, p. 16.—A very hardy climber, preferring a northern exposure. Var. *sibirica*, Kuntze (var. *alba*, Hort. *Atrágene sibirica*, Linn.). Fls. white or nearly so. B.M. 1951. L.B.C. 14:1358. R.H. 1855:321. Var. *occidentàlis*, Gray. Petal-like stamens very few, and often bearing rudimentary anthers. Rocky Mts.

#### Section PSEUDANEMONE.

19. *Stanleyi*, Hook. (*C. Stanleyana*, Hort.). Fig. 984. Erect robust herbs, 3 ft. high: lvs. biternate, lfts. sessile or petioled, variable in size, cuneate, silky:



984. *Clematis Stanleyi*. (× $\frac{1}{4}$ )

fls. 1–3 in. across, white to pink-purple; sepals becoming widely expanded; stamens yellow; styles becoming very plumose, white. July–Oct. Transvaal. Intro. 1893. B.M. 7166. Gn. 39:76. G.F. 3:513 (adapted in Fig. 984). G.C. III. 8:327. G.M. 34:320.—Suitable for greenhouse cult.; in the northern states it is apt to winterkill if left unprotected.

#### Section VITICELLA.

20. *Viticella*, Linn. Climbing 8–12 ft.: lvs. sometimes entire, but usually divided into 3 nearly entire lfts.: fls.  $1\frac{1}{2}$ –2 in. diam., growing singly on peduncles or sometimes in 3's; sepals 4, blue, purple or rosy purple, obovate, pointed, reflexed; stamens yellow: fr. with rather short glabrous tails. June–Aug. S. Eu. to Persia. R.H. 1860, p. 183; 1876:110; 1879:350 (vars.). B.M. 565. G. 22:310; 8:399. H.W. 3, p. 15. Lav. 7.—This is the type of one of the leading groups of garden clematises, and is one of the parents of the Jackmanii type of hybrids.

The following are garden varieties:

Var. *albiflora*, Kuntze. Fls. white.

Var. *rubra*, Hort. Fls. purple.—Var. *rubra grandiflora*, Jackman, has larger bright crimson fls. and 6 sepals. F.S. 20:2053 (1873). F. 1872:265.

Var. *kermesina*, Lem. (*C. kermesina*, Hort.). Fls. of bright wine-red color, purple being absent. Gn. 39:30.

Var. *ilicina-floribunda*, Hort. (*C. ilicina-floribunda*, Hort. *C. floribunda*, Hort.). Fls. pale gray-lilac, conspicuously veined. Gn. 18, p. 389 (note).—An abundant bloomer. Produced in an English garden in 1880.

*Lady Bovill*, Jackman (*C. Lady Bovill*, Hort.). Fls. cup-formed, sepals being concave and little or not at all recurved at the ends, fls. 4 in. across; sepals 4–6, grayish blue; stamens light brown. M. & J. 15. R.H. 1876:190.

Var. *marmorata*, Jackman (*C. marmorata*, Hort.). Fls. rather small, with 4 broad sepals, light grayish blue with darker veins, 3



longitudinal bars. M. & J. 1, f. 2; same plate in F.S. 20:2050-55 (2008). F. 1872:265.

Hybrids of *C. Viticella* which are closely allied to that type:

*C. eriostemon*, Decne. (× *C. integrifolia*; *C. Hendersonii*, Henderson. *C. Chandleri*, Hort.) Fig. 985. St. and habit of *C. Viticella*: lfts. and fls. much like *C. integrifolia*: climbing 8-10 ft.: 4 blue sepals, spreading, reflexed at the tips. R.H. 1852: 341. F.S. 13:1364 (as var. *venosa*). Lav. 12. Here belongs also: *C. intermedia*, Bonamy, smaller, with more pubescent branchlets and paler fls. *C. Bergeronii*, Lav., resembling more *C. integrifolia*: lvs. usually entire: fls. pink, about 2 in. across in terminal panicles. Lav. 10. *C. distorta*, Lav., with rosy-lilac twisted sepals. Lav. 11. *C. Boskoop*, Hort. (*C. Boskoop* Seedling, Hort. = *C. V.* × *C. integrifolia*). A new race in 1892: growing 3-5 ft.: fls. blue, lavender, rose or reddish rose.

*C. violacea*, DC. (× *C. Flammula*). Fls. in several to many-fld. terminal panicles, pale violet, about 1 in. across; petals sometimes 6. Here belongs also: *C. Othello*, Cripps (= *C. V.* var. *rubra* × *C. Flammula*). Fls. of medium size, of a deep velvety purple; continues blooming until Oct.—*C. rubro-marginata*, Jouin (*C. Flammula* var. *rubro-marginata*, Cripp.). Similar to *C. Flammula*; sepals white bordered reddish violet.

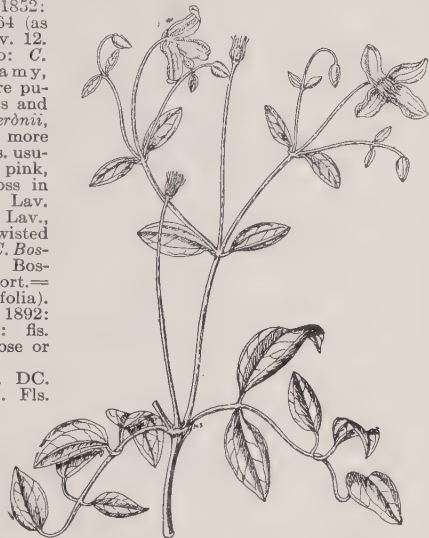
*C. parviflora*, DC. (× *C. campaniflora*; *C. revoluta*, Desf.). Fls. white, small, scarcely 1 in. across, sometimes larger; achenes with the tail usually pubescent at the base. A.P. De Candolle, Pl. Rar. Geneve, 12.—Of no ornamental value.

*C. venosa*, Krampen (× *C. florida*; *C. florida* var. *venosa*, Lav.). Similar to *C. florida*, but petals obovate. Lav. 6. R.H. 1860, p. 183. G. 2:251. G.Z. 6:160. F.S. 13:1364. Here also belongs *Louise Carriere*; fls. lilac with paler veins. R.H. 1880:10 and several forms described by Carriere as *C. contorta*, *C. atroviolacea* and *C. Viticella alba*. R.H. 1879:350.

For other hybrids of this species see *C. Guascoi*, Lem., under *C. patens*, *C. splendens* under *C. lanuginosa* as form of *C. Jackmanii*.

21. *campaniflora*, Brot. Climbing, 10-15 ft.: fls. reflexed and bell-shaped as in the above type or more so, usually 1 in. or less diam., purple or whitish: fr. with short pubescent tail. June, July. Native of Portugal. L.B.C. 10:987. Gn. 31, p. 187. Lav. 8. This has been called *C. Viticella* because of its close resemblance in fl., fr. and lf.; but the lvs. are often twice ternate, and the plant is much more slender in habit.

22. *florida*, Thunb. (*C. japonica*, Makino, not Thunb.). A slender plant, climbing 9-12 ft.: lvs. variable, more or less ternate or biternate; lfts. small, ovate-lanceolate: fls. 2-4 in. across, flat when expanded; the 5-6 broad, ovate sepals creamy white, barred with purple beneath; stamens purplish. May, June, Japan. B.M. 834. R.H. 1856:41. Lav. 5. J.H. III. 44:321. G.C. III. 35:51. Var. *bicolor*, Steud. (*C. Sieboldii*, D. Don). Fig. 986. Like the type, but with the purple stamens somewhat petal-like, and forming a dense, purple head in the center. F.S. 5:487.



985. *Clematis eriostemon*. (× 1/2)



986. *Clematis florida* var. *bicolor*. (× 1/2)

Lav. 5. M. & J. 16. B.R. 24:25. P.M. 4:147. Gn. 22: 142. R.H. 1856:401. S.B.F.G. II. 4:396. F. 1872, p. 200. Var. *Fortunei*, Moore (*C. Fortunei*, Hort.). Fls. large, very much doubled; sepals creamy white, becoming pink. F.S. 15:1553. G.C. 1863:676. I.H. 10, p. 86. M. & J. 13. F. 1863:169. F.M. 3:153.

*Belle of Woking*. A hybrid form: fls. very full and double; sepals purple.

*John Gould Veitch* (*C. Veitchii*, Hort.). Fls. velvet, double, resembling var. *Fortunei*, except in the color of the sepals. From Japanese gardens. F.S. 18:1875-6.

Hybrids of this species are: *C. venosa*, Krampen, see *C. Viticella*; *C. Lawsoniana*, see *C. lanuginosa*.

23. *lanuginosa*, Lindl. (including var. *pallida*, Hort.). Climbing only 5 or 6 ft.: lvs. simple or of 3 lfts., cordate-acuminate, woolly beneath: fls. erect on stout stalks shorter than the sepals, woolly in the bud, the largest of the wild species, being 6 in. across; sepals 5 or 6, broadly ovate, leathery, rather flat, overlapping, lavender or bluish gray; center of stamens pale reddish brown; styles plumose. Summer. Native near Ningpo, China. F.S. 8:811. I.H. 1:14. Lav. 1. M. & J. 4. J. F. 4:363. H.F. 1855:1. 1854:225. G.C. III. 29:23. G. I, p. 257. Gng. 5:38.—It is to this species, more than to any other, that the beauty and popularity of the garden varieties and hybrids are due. The finest hybrids, including *C. Jackmanii* and its section, and *C. Lawsoniana*, contain more or less of the blood of *C. lanuginosa*.

Forms of *C. lanuginosa* are:

Var. *candida*, Lemoine (*C. candida*, Hort.). Like the type, except that the simple lvs. and lfts. of the compound lvs. are much larger, and the fls. are larger, being 7-8 in. across, and white with a purplish shading around the margins. F.M. 5:310. V. 6:225.—Perhaps a hybrid of *C. patens*.

Var. *nivea*, Lemoine (*C. nivea*, Hort.). Sepals 6-8, narrowish, pure white; anthers pale brown.—Thought to be of same origin as the above var.

*alba magna*, Jackman. Fls. very large, pure white, with about 6 broad sepals and purplish brown anthers. G.C. II. 3:685.

*Lady Caroline Nevill*, Cripps. Fls. often 7 in. across; sepals 6, nearly white, with mauve-colored stripe down center of each. Gn. 46, p. 33.—One of the finest light-colored varieties.

*Princess of Wales*, Jackman. Fls. 6 in. across; sepals 8, satiny bluish mauve, very broad. G.C. III. 27:53. Gn. 59, p. 366.

*Marie Lefebvre*, Cripps. Resembles the last, but has 8 sepals, more pointed, and darker in shade.

*Perfection*, Froebel. Fls. very large; sepals 8, very broad, lilac-mauve. R.B. 6:193.

*Sensation*, Cripps. Fls. like the type, but with 6-7 grayish blue sepals, 6 in. across.

*Madame Emile Sorbet*, Paillet. Fls. bright blue. R.H. 1878:291.

*Madame Van Houtte*, Cripps. Late-blooming; sepals pale blue, becoming white.

*Madame Thibaut*. Fls. very abundant.—Thought to be a hybrid with *C. Viticella*.

*The Presiaent*, Noble. A rich violet-blue fl.

*Excelsior*, Cripps. Fls. double; sepals grayish purple, with a reddish bar down the center of each. F.S. 20:2055.

*violacea*, Noble. Fls. violet-blue, 7 in. across. F.M. 1876:217.

*Robert Hanbury*, Jackman. Sepals bluish lilac, flushed at the edges with red, and the bar slightly tinted with red. Gn. 16:128.

This species has given rise to numerous beautiful hybrids which in many cases are the product of so much intercrossing that it is impossible to recognize the exact parentage. By far the most important group of these hybrids may be classed under *C. Jackmanii*, which, however, by some is considered not a hybrid, but a species intro. from Japan.

*C. Jackmanii*, Moore (*C. lanuginosa* × *C. Hendersonii* and *C. lanuginosa* × *C. Viticella*. *C. hakonensis*, Franch. & Sav.). Fig. 987. Habit and lvs. of *C. lanuginosa*: fls. flat, 5-6 in. broad, usually in 3's and forming



panicles at the ends of the branches; sepals 4-6, very broad, velvety purple, with a ribbed bar down the center; broad, central tuft of pale green stamens. M. & J. 5, 6, 9, 10, 11, 12, 14. I.H. 11:414. F.S. 16:1629. Gn. 22:142; 53, p. 262; 71, p. 107. A.G. 12:125; 19:269. A.F. 10:1329; 14:995-7; 16:282. R.H. 1865:390. Gng. 4:261; 9:17; 7:230-2. C.L.A. 5:379. Gn. M. 4:226. G.M. 47:102. G.Z. 9:96. F. 1864:193. V. 6:129; 9:340. 18:70. Lav. 4. Var. *alba*, Hort. Fls. nearly pure white. G. 23:185.



987. Clematis Jackmanii.

France, Gégou (C. lanuginosa × C. Jackmanii). Lvs. smooth; buds woolly; sepals deep cobalt-blue, pointed, with wavy edges. *Reine des Bleues*, Boisselot (same cross as the last). Fls. large, blue, with broad, recurved sepals. *devoniensis*, Lem. (same cross). Fls. 8-9 in. across; sepals 8, delicate lavender-blue. Gn. 9, p. 563 (note). *splendida*, Simon-Louis (× C. Viticella). Fls. very dark purple, changing to reddish violet. R.H. 1865:71.

*Gipsy Queen*, Cripps. Deep violet. *Alexandra*, Jackman. Reddish violet. *Star of India*, Cripps. Five in. across, purple, barred with red. *tunbridgensis*, Cripps. Reddish purple, barred with light blue. Lav. 4 bis. I.H. 18:50. *magnifica*, Jackman. Rich purple, shaded with crimson, 3 bars of red in each sepal. F.M. 8:453. R.H. 1876:110. *Madame Grangé*, Hort. Sepals very concave, purple-crimson. R.H. 1877:150. Mrs. *James Bateman*, Noble. Pale lavender; a probable cross of C. J. with C. lanuginosa. M. & J. 2, f. 1. F.S. 20:2053 (1779). Mrs. *Moore*, Jackman. Eight to 9 in. across, sepals rather narrow, white. *Thomas Moore*, Jackman. As large as the last, rich violet, with white stamens. *Madame Baron Veillard*, Baron Veil. Rose-lilac. *Madame André*, carmine-violet. R.H. 1893:180. *velutina-purpurea*, Jackman. Fls. 4-6 in. across, usually 4, sometimes 5 or 6 sepals, blackish purple. *François Morel*, Morel. Fls. 4 in. across; sepals usually 4, bright violet-red. R.H. 1884:444. *Ville de Lyon*, Morel. Fls. 5 in. across; sepals usually 6, broad, deep amaranth-red. R.H. 1899:184.

Other hybrids of C. lanuginosa are the following:

C. *Durandii*, Kuntze (C. integrifolia or possibly C. Jackmanii × C. integrifolia). Upright, to 6 ft.; lvs. simple, petioled; fls. and infl. similar to C. Jackmanii; fls. blue, 4-5 in. broad, flat, with usually 4, rarely 5 or 6 recurved sepals. June-Sept. Gn. 49:98. Gng. 5:276. G. 31:257.—Here belongs probably C. *Pellieri*, Carr., though the author gives C. lanuginosa × *recta* as the parents. R.H. 1880, p. 228.

C. *Lawsoniana*, Anderson-Henry (× C. florida var. Fortunei). Fig. 989 (adapted from Floral Magazine, 1872). Fls. very large;

sepals 6-8, broad, rose-purple, marked with darker veins. Aug.-Nov. G. 33:411. Var. *Symesiana* (C. Symesiana, Anderson-Henry. × C. florida var. Fortunei). Fls. 7 in. across; sepals 6-8, pale mauve; a profuse bloomer. Var. *Henryi* (C. Henryi, Anderson-Henry). Fig. 988. Robust plant; free bloomer; fls. creamy white, becoming fully expanded when grown in the open sun or under glass. Aug.-Nov. Gn.M. 13:348. G.M. 43:318.—It resembles more the lanuginosa parent. It is not to be confused with C. Henryi, Oliv., a Chinese species allied to C. orientalis and not in cult.

C. *Glabilensis* (× C. patens; C. patens var. *Glabilensis*, Hort.). Lvs. simple or 3-parted, ovate, subcordate; fls. large deep violet-blue; sepals 6-8. G.Z. 14:80.—Here belong also:

Otto Froebel, Lemoine. Lvs. leathery, simple or 3-parted; fls. of fleshy texture, grayish white, sometimes becoming bluish; sepals 8, blunt, broad; anthers brownish. *Imperatrice Eugénie*, Carré (C. l. var. pallida × C. patens). Lvs. simple or 3-parted; fls. broad and woolly; fls. 8-9 in. across, with 8 broad, white sepals. *Jeanne d'Arc*, Dauvesse. Same cross as last and much like it, but the sepals are grayish white, with 3 blue bars down the center of each. *Gloire de St. Julien*, Carré. (× C. patens var. plena). Plant much like C. lanuginosa, but with larger fls.: sepals 6-8, white or pale gray at first; stamens yellow. *Gem*, Baker (× C. Standishii). Lvs. 3-parted or simple; fls. like C. lanuginosa in form; grayish blue.

24. *patens*, Morr. & Decne. (C. *cærulea*, Lindl. C. *azurea*, Hort., ex Turcz.). Taller and more slender, and fls. smaller and narrower than C. lanuginosa; fls. appearing on last year's branches on slender stalks longer than the sepals, spreading; sepals about 8, rather narrow, delicate lilac; stamens purple. Spring. Isle of Nippon, Japan. M. & J. 3. Lav. 2 and 3. B.R. 23:1955. P.M. 4:193. B. 3:126. H.B. 4:78. R.H. 1856:261.—Should be grown on a northern exposure to preserve the color of the fls. It is almost as prolific as C. lanuginosa in producing garden varieties and hybrids, and it is the most likely of all to produce double-fl. forms. Var. *grandiflora*, Davis (C. *cærulea* var. *grandiflora*, Hook.). Fls. larger than the type. B.M. 3983. Var. *Standishii*, Moore (C. *Standishii*, Hort.). Fls. about 5 in. across; sepals light lilac-blue, elliptic, of metallic luster; fls. 3, ovate, acuminate, small.—A fine variety from Japanese gardens flowering profusely in spring.

The following other garden varieties or crosses belong here:

Mrs. *James Baker*. Sepals nearly white, ribbed with dark carmine. *Miss Bateman*, Noble. Fls. more compact than the type, 6 in. across; sepals ovate, shortly acuminate, pure white, with cream-colored bars; anthers brown. Probably of hybrid origin; allied to var. *Standishii*. *Stella*, Jackman. Fls. not so large as the last; sepals deep mauve, with a red bar down the center of each. F.S. 22:2341. *Amalia*, Sieb. Sepals 6 or more, oblong-lanceolate, light lilac. From Japanese gardens. F.S. 10:1051. *Lord Lanesborough*, Noble. Sepals bluish lilac, each with a metallic purple bar.—A good variety to gradually force to blossom in the greenhouse by March. *Lady Lanesborough*, Noble. Sepals silvery-gray, the bar being lighter colored.—It will blossom in March in the greenhouse. *Marie*, Simon-Louis. Fls. darker than the type. Mrs. G. *Jackman*, Jackman. Sepals bluish-white with indistinct wine-red bars. Gn. 16:128. *The Queen*, Jackman. Fls. rather compact, the sepals being broader than the type. *John Murray*, Jackman. Habit and foliage bolder than the type; fls. somewhat later. Gn. 46:32. *Fair Rosamond*, Jackman. Sepals apiculate, broader than the type, and of the same color. F.S. 22:2342. Gn. 16:128. *Countess of Lovelace*, Jackman. Fls. double, blue-violet; sepals much imbricated. In the second crop of blooms the fls. are single, as is often the case in other double varieties. *Albert Victor*, Noble. Fls. much like the type, but large and more compact.—Suitable for forcing under glass. *Duchess of Edinburgh*, Jackman. Fls. double, white, strongly imbricated. *Marcel Moser*, Moser. Fls. 7 in. across; sepals 8, mauve with a reddish violet bar. J. 1897:104; 1900, p. 85. *Nelly Moser*, Moser. Fls. 5 in. across; sepals 8, mauve-pink, with a darker red bar. R.H. 1898:236. *Louisa van Houtte*, Hort. Semi-double, rosy white. *Vesta*, Endl. Sepals gray; anthers red. Gt. 39:1333. Gn. 9:408. R.B. 6:193. *Helena*, Sieb. Fls. pure white, with yellow stamens. F.S. 11:1117. I.H. 1:21. R.H. 1855:341. *Louisa*, Sieb. Fls. pure white, with purple stamens. F.S. 10:1052. *monströsa*, Planch. Fls. semi-double, pure white. F.S. 9:960. R.H. 1856:9. *Sophia*, Sieb. Sepals deep lilac-purple on the edges, with light green bars. F. S. 8:852. I.H. 1:21. B.H. 4:97. R.H. 1855:461. *violacea*, Lem. Fls. violet-blue; stamens yellow. I.H. 7:254.

Some double-flowered varieties which possibly belong here are: *Snowdrift*, with white, very double fls. Gn. 49, p. 189. M.D.G. 1898:496. *Ostrich Plume*, also white and very double with narrower wavy sepals. M.D.G. 1898:496. *Waverly*, blue, semi-double. M.D.G. 1898:497.

Hybrids of this species are the following: C. *Gudscoti*, Lem. (× C. Viticella). Branches pubescent; fls. 5, nearly glabrous; fls. solitary, violet-purple, 3 in. across, with 4-6 sepals, strongly 3-nerved, tomentose outside. J.H. 4:117. I.H. 7:226.—C. *francofurtensis*, Lav., supposed to be a hybrid of C. Jackmanii (C. *hakonenensis*) and C. patens, is hardly different. Lav. 7 bis.—C. *lanuginosa* × C. *patens*, see the preceding species.—C. *florida* × C. *patens*. Some believe that C. patens var. *Standishii* represents this cross



## Section VITALBA.

## Group CIRRHOSÆ.

25. *cirrhosa*, Linn. Climbing, to 10 ft.; glabrous: lvs. persistent, slender-petioled, simple, ovate to ovate-oblong, crenately serrate, 1-1½ in. long: fls. 1-2 on the old wood, axillary, whitish, open campanulate, nodding, 1½ in. across, with a short involucre below the sepals: achenes with long plumose tail. Spring. S. Eu., Asia Minor. B.M. 1070. L.B.C. 19:1806.—Tender, only for warmer temperate regions.

26. *baleárica*, Rich. (*C. calycina*, Ait.). Closely allied to the preceding: lvs. ternate; lfts. incisely serrate, often deeply 3-lobed, ½-1 in. long: fls. greenish yellow, spotted red inside. Spring. S. Eu. Asia Minor. R.H. 1859, p. 190; 1874, p. 289. G.C. II. 9:500. Gn. 6, p. 425; 31, p. 187; 45, p. 240. L.B.C. 8:720. B.M. 959.—Tender.

## Group MONTANÆ.

27. *gracilifolia*, Rehd. & Wilson. Climbing, to 10 ft.: lvs. deciduous, pinnate; lfts. 5-7, ovate to oblong-ovate, cuneate at the base, coarsely serrate, pubescent, about ½ in. long: fls. 1-4, axillary, fascicled, white, 1-1½ in. across, on slender stalks 1-2 in. long; sepals 4, spreading, obovate to oblong-obovate: achenes glabrous, with long plumose tail. June. W. China.—Very graceful and floriferous species; has proved hardy at the Arnold Arboretum.

28. *montana*, Buch.-Ham. (*C. odorata*, Hort., not Wall.). A vigorous climber, often reaching a height of 15-20 ft.: lvs. ternate, with oblong-acuminate cut-toothed lfts.: fls. several in each axil, following each other in succession of time, resembling white anemone blossoms, sweet-scented; sepals 4, elliptic-oblong, 1 in. long, spreading, becoming pink; stamens conspicuous, yellow: achenes glabrous with plumose tails. May. Himalaya region. B.R. 26:53. M. & J. 8. Gn. 30, p. 309; 49, p. 39; 51, p. 349; 60, p. 79; 68, p. 379; 75, p. 371. A.G. 19:391. R.H. 1856:161; 1899, p. 529. G.C. III. 18:303; 20:589. M.D.G. 1902:423. Lav. 22. J.H. III. 49:533. G. 27:237. G.M. 38:661; 46:121; 51:319. Var. *grandiflora*, Hook. (var. *anemoniflora*, Kuntze). Fls. larger, 3-4 in. across. B.M. 4061. M.D.G. 1902:422. G. 34:477. Var. *rubens*, Wilson. Foliage reddish, particularly when unfolding: fls. pink or light pink. June. R.H. 1909:35. R.B. 33:232. F.S.R. 3:252. Gn. 77, p. 84. G.M. 50:395; 54:168. J.H. III. 59:325.—Offsprings of a cross between this variety and the preceding are: Var. *lilacina*, Lemoine, with bluish lilac fls. G. 34:345. Var. *perfecta*, Lemoine, and var. *undulata*, Lemoine, with bluish white very large fls. Var. *Wilsonii*, Sprague (*C. repens*, Veitch, not Finet & Gagnep.). Lfts. ovate, usually rounded or subcordate at the base, puberulous on the veins beneath; sepals obovate-oblong, ¾-1 in. long: fls. in July and Aug., nearly 2 months later than the type. B.M. 8365. M.D.G. 1912:26. R.B. 35:108. See page 3567.

29. *Spođneri*, Rehd. & Wilson (*C. montana* var. *sericea*, Franch.). Climbing, to 20 ft.: lvs. ternate; lfts. ovate or oval, usually rounded at the base, with 1 or few teeth on each side, silky pubescent above and beneath, 1-3 in. long: fls. 1 or 2, white, 3-4 in. across on pedicels 3-6 in. long; sepals broadly obovate, densely pubescent outside: achenes pubescent, with long plumose tail. Spring. W. China.—Beautiful species; has proved fairly hardy at the Arnold Arboretum.

## Group RECTÆ.

30. *Armandii*, Franch. Climbing, to 15 ft.: lvs. ternate, evergreen, glabrous; lfts. ovate to ovate-oblong, acuminate, rounded or subcordate at the base, entire, 4-5 in. long, coriaceous: fls. white, 1-2½ in. across, with oblong-obovate sepals, in loose axillary

cymes in the axils of last year's branches, with persistent bud-scales at the base: achenes hairy, with long plumose tails. April, May. Cent. and W. China. G.C. III. 38:30. R.B. 35, p. 281. R.H. 1913, p. 65. Var. *Farquhariana*, Rehd. & Wilson. Fls. light pink, large, about 2 in. across: lfts. oblong-ovate.—This handsome species is like the following 3 species, adapted only for warmer temperate regions.

31. *Meyeniāna*, Walp. Climbing rapidly; glabrous or slightly pubescent: lvs. ternate; lfts. coriaceous, ovate to ovate-lanceolate, cordate or rounded at the base, entire, 2-3 in. long: panicle loose and many-fl'd.; fls. white, less than ½ in. across: sepals 4, obtusish; anthers as long or longer than filaments: achenes with long feathery tails. Japan, E. China and Indo-China. Summer. B.M. 7897.—Hardy only in warmer temperate regions.

32. *crassifolia*, Benth. Closely allied to the preceding species: climbing; quite glabrous: lfts. thicker, cuneate at the base, usually obtusish; sepals acuminate; anthers shorter than the filaments. Late summer. China.—Suitable for greenhouse, more tender than the preceding.

33. *Pavoliniāna*, Pampanini. Climbing, glabrous: lvs. subcoriaceous ternate; lfts. long-petioled, lanceolate or oblong-lanceolate, acuminate, 2-3 in. long: fls. slender-pedicelled, white, 1-1½ in. across in axillary racemes; sepals linear-oblong: achenes fulvous-pubescent, with a long plumose tail. May. Cent. China.

34. *recta*, Linn. (*C. erecta*, Linn.). Herbaceous, somewhat tufted, 2-3 ft. long: lvs. pinnate; lfts. stalked, ovate, acuminate, entire: fls. numerous, on a large, branching terminal panicle, white, sweet-scented,



988. *Clematis Lawsoniana* var. *Henryi*, a derivative from *C. lanuginosa*. (×¼)

1 in. across. June–Aug. S. Eu. Gn. 52, p. 510; 53, p. 547; 66, p. 152. R.H. 1899, p. 528. G.M. 45:866. G.W. 14, p. 561. Var. *plèna*, Lemoine. Fully doubled, button-like blossoms. H.F. 1860:13. R.H. 1860, pp. 512–13. Var. *mandshùrica*, Maxim. (*C. terniflora*, DC. *C. mandchùria*, Rupr.). Taller and slenderer: lfts. 3–5, ovate, subcordate at the base, rarely cuneate, obtuse, reticulate beneath: fls. pure white in axillary and terminal panicles. R.H. 1909, p. 423.

35. *paniculata*, Thunb. Figs. 990, 991. A vigorous climber: lfts. 3–5, often lobed, acuminate, 1–4 in. long, glabrous: fls. fragrant, 1–1½ in. across, in axillary and

numerous, in axillary and terminal panicles; sepals 4, linear-oblong, white; stamens white: fr. bearing white plumes. Aug.–Oct. Medit. region. Gn. 52, p. 499; 55, p. 114; 58, p. 319; 76, p. 23. Gn. M. 13:347. H.W. 3, p. 14. V. 5:321.—Must have a sunny exposure; very beautiful. Var. *rubella*, Bele (*C. rubella*, Pers., not Hort.). Differs from the type in having the fls. red outside. Var. *rotundifolia*, DC. (*C. fragrans*, Tenore). Lfts. broader, obtuse: fls. fragrant. S. Eu. R.F.G. 4:62 (4666).

There are hybrids of this species with *C. integrifolia* for which see No. 5, *C. aromatica*, and with *C. viticella*, see *C. violacea* under No. 20.

#### Group EUVITALBÆ.

##### 37. *Fargesii*, Franch.

Climbing, to 20 ft.: lvs. pinnate; lfts. 5–7, ovate, incised-serrate, sometimes 3-lobed or 3-parted, nearly glabrous or sometimes sparingly silky-pubescent, particularly beneath, 1–2 in. long: fls. 2 in. across, white, in 3-fld. axillary cymes, long-stalked; sepals 4–6, obovate, finely pubescent outside: achenes glabrous with feathery tails. July. W. China. Var. *Souliei*, Finet & Gagnep. Fls. larger, 3 in. across, solitary.—A handsome species, resembling *C. montana*.

38. *apiifolia*, DC. Climbing, to 10 ft.: branchlets pubescent: lvs. ternate, long-petioled; lfts. usually ovate, coarsely serrate and sometimes 3-lobed or occasionally the terminal ternate, glabrous above, pubescent on the veins beneath: fls. in axillary, many-fld. short cymes, white, about ½ in. across; sepals pubescent on both sides: achenes pubescent with plumose tails. Sept., Oct. Japan. Var. *obtusidentata*, Rehd. & Wilson. Lfts. broader, usually truncate or subcordate at base, less deeply serrate with shallow rounded teeth, more pubescent. Cent. China.—Resembles *C. grata* in the shape of the lfts.

39. *brevicaudata*, DC. (*C. brevicaudata*, Hort.). Climbing vigorously: lvs. pinnate to bipinnate; segms. ovate-lanceolate, acuminate, coarsely toothed, sometimes nearly entire, nearly glabrous or pubescent: fls. in axillary panicles, white, ½–¾ in. across: achenes hairy, rarely glabrous, with rather short plumose tails. Aug.–Oct. China. G.F. 5:139.—A very variable species, but little used. Var. *tenuisepala*, Maxim. Segms. with only 1–3 teeth on each side or sometimes entire: fls. about 1 in. across with glabrous sepals.

40. *grata*, Wall. High climbing: young branchlets pubescent: lvs. pinnate; lfts. usually 5, broadly ovate, usually cordate at the base, incisely serrate, sometimes 3-lobed, 1–2 in. long, pubescent on both sides or glabrous above: fls. ¾–1 in. across, creamy white, in large panicles; sepals tomentose outside: achenes densely pubescent, with long feathery tails. Sept., Oct. Himalayas. G.M. 47:642. Gn. 66, p. 365; 71, p. 506. Var. *lobulata*, Rehd. & Wilson. Lfts. with coarser and fewer



989. *Clematis lawsoniana*, one of *C. lanuginosa* derivatives. (× ½)

terminal panicles; sepals 4, dull white. Sept. Japan. G.F. 3:621 (adapted in Fig. 990); 5:91; 9:75 and 185. F.R. 2:581; 6:471. Mn. 7:113. Gng. 1:101 and 165; 4:161, 229; 6:291; 7:246. A.F. 13:1314. M.D.G. 1898:487–9. G.W. 11:127. V. 16:18. A.G. 20:847. F.E. 16:375. Gn. 57, p. 155; 61, p. 91. R.H. 1874, p. 465 and 1899, p. 527 (as *C. flammula robusta*): 1902, p. 86. Prop. by seed. By far the most common of the fall-blooming species in American gardens. Thrives best in sunny situations. Will stand severe pruning in winter.

36. *Flammula*, Linn. (*C. Pallasii*, J. F. Gmel.). A slender but vigorous climber, reaching 10–15 ft.: lvs. usually bipinnate, dark green, remaining fresh till mid-winter; lfts. small, ovate, oblong or linear: fls. small,



rounded teeth, often 3-lobed or 3-parted, densely pubescent on both sides. Cent. China. Var. *grandidentata*, Rehd. & Wilson. Lfts. occasionally only 3, incisely dentate, usually rounded at base, glabrescent above, silky pubescent beneath, chiefly on the veins, 2-3½ in. long. Cent. China.



990. *Clematis paniculata*. (×½)

41. *Vitalba*, Linn. In England called TRAVELER'S JOY. The most vigorous climber of the genus, ascending 20-30 ft.: lvs. pinnate; lfts. ovate to ovate-lanceolate, acuminate, cordate at the base, partly cut, 2-3½ in. long; fls. numerous, in axillary panicles, dull white, ¾ in. across, with a faint odor of almonds: styles of fr. long and feathery, from which it is given the name "old man's beard." July-Sept. Eu., N. Afr. Caucasus region. Gn. 31, p. 187; 45, p. 389; 53, p. 546. M. D.G. 1898:319. J.H. III. 54:441. H.W. 3, p. 13.—There is a hybrid of this species with *C. heracleæfolia*, for which see No. 12.

42. *virginiana*, Linn. Fig. 992. Climbing 12-15 ft.: lvs. ternate; lfts. glabrous, cut-toothed, bases often cordate, 2-3 in. long; fls. white, in leafy panicles, often monœcious or dioecious, about 1 in. across when expanded; plumose styles 1 in. or more in length. July-Sept. Nova Scotia to Ga., westward to Kan. G.W.-F.A. 12. V. 3:19; 9:36. Var. *Catesbyana*, Brit. (*C. Catesbyana*, Pursh). Lvs. somewhat pubescent, often biternate. Southeastern states. Intro. 1883.

43. *ligusticifolia*, Nutt. Allied to *C. virginiana*, but having 5-7 lfts., of firmer texture, rather more pubescent, variable in form and margin, but usually 3-lobed or coarsely toothed, 1-2 in. long; fls. white, ¾ in. across, in terminal and axillary panicles; styles densely silky-pubescent, with long, straight hairs. Aug. Mo. to New Mex. and Brit. Col. Intro. 1881. Var. *californica*, Wats., has no marked difference: lvs. usually smaller and perhaps more tomentose.

44. *Drummondii*, Torr. & Gray. Climbing: st. and lvs. ashy pubescent: lvs. pinnate; lfts. coarsely cleft, with the segms. more or less flaring and sometimes toothed, ½-1 in. long; fls. dioecious, white, ¾ in. across, in 3-fld. cymes or sometimes solitary; styles becoming 2-4 in. long. Sept. Dry ground, Texas to Ariz.

45. *lasiantha*, Nutt. Climbing; tomentulose: lvs. ternate; lfts. roundish, few-toothed, tomentulose on both sides or glabrous above, 1-2 in. long; fls. 1-3, axil-

lary from scaly buds on last year's branches, white, fragrant, 1½ in. across; sepals tomentose outside: achenes pubescent, with long feathery tails. Spring. Calif.

Group HEXAPETALÆ.

46. *indivisa*, Willd. Large woody climber: lvs. ternate, coriaceous; lfts. ovate-oblong to narrow-oblong, subcordate, 1-4 in. long, usually entire: fls. in axillary panicles, white, 2-4 in. across with 6-8 oblong sepals: achenes pubescent with a long plumose tail. New Zeal.—Only the following var seems to be in cult.: Var. *lobata*, Hook. Lfts. more or less lobed or even 3-parted. B.M. 4398. R.H. 1853: 241. F.S. 4:402. Gn. 12:400; 41, p. 336; 53, p. 547; 74, p. 527; 77, p. 67. H.F. 1853:144. G.C. III. 29:215; 38:135. G.M. 50: 267. G. 8:289; 32:281-3. J.H. III. 62:387. A.F. 13:879; 16:56; 30:221. Gng. 16:199; 8:356. G.F. 6:167.—Only for warm or temperate regions, often cult. as a greenhouse plant and flowering profusely in winter and early spring.



991.  
Flower of *Clematis paniculata*. (×¾)

Group ORIENTALES.

47. *orientalis*, Linn. (*C. graveolens*, Lindl.). A rapid climber, reaching 12-15 ft.: lvs. thin, glaucous and shiny, pinnate; lfts. 3-parted or -lobed, with small, ovate or oblong-ovate, entire or cut-toothed divisions ½-1½ in. long; fls. in few-fld. cymes, sometimes solitary, becoming erect or nearly so, 1½ in. across; sepals 4, yellow, tinted with green, pubescent on both sides, spreading, somewhat reflexed; styles plumose. Aug., Sept. Himalaya region to Persia. Lav. 21. B.M. 4495. Gn. 31, p. 186; 45:240; 52, p. 501. F.S. 4:374b (pl. 336); 6:548. R.H. 1855:321; 1899, p. 530. J.F. 2:128. P.F.G. 2, p. 67. Gng. 5:227. V. 3:362.

48. *glauca*, Willd. (*C. orientalis* var. *glauca*, Maxim.). Slender climber, glabrous: lvs. pinnate, very glaucous; lfts. usually oblong, obtusish, entire or sometimes 3-lobed or 3-parted, 1-2 in. long; fls. yellow, open, campanulate, nodding, 1½ in. across, in few-fld. axillary cymes; sepals quite glabrous inside and nearly so outside, not reflexed; achenes with long plumose tails. Aug.-Oct. Siberia to W. China. R.H. 1890, p. 561.—Hardier than the preceding species. Var. *akebioides*, Rehd. & Wilson. Lfts. usually 3-lobed with broad rounded lobes often coarsely crenate, about 1 in. long; fls. usually in 3's, rarely solitary. W. China. Var. *angustifolia*, Ledeb. (*C. intricata*, Bunge). Lfts. usually 3-parted with narrow generally linear-lanceolate segms. Mongolia.



992. Leaf of  
*Clematis virginiana*.  
(×¾)

49. *tangutica*, Korshinsky (*C. orientalis* var. *tangutica*, Maxim. *C. eriopoda*, Koehne, not Maxim.). Climb-

ing, to 10 ft.: young branchlets slightly villous or nearly glabrous: lvs. green, pinnate; lfts. oblong-lanceolate or lanceolate, acuminate, irregularly serrate with spreading teeth, sometimes 3-lobed or 3-parted, 1-3 in. long: fls. solitary, bright yellow, nodding, 3 in. across; sepals glabrous, except at the margin, acuminate or obtusish: achenes with very long plumose tails. June, sometimes again in Aug. Mongolia to W. China. B.M. 7710. R.H. 1902:528. G.W. 14, p. 651.—Very handsome with its large heads of feathery frs.; hardy.

50. *serratifolia*, Rehd. (*C. koreana*, Hort., not Komarov). Shrubby climber: lvs. biternate, bright green, glabrous; lfts. ovate-lanceolate to lanceolate, acuminate, inequally serrate, 1-2½ in. long: fls. 1-3, axillary, long-stalked, yellow, nodding, 2 in. across; sepals glabrous, except at the margin: achenes with long plumose tails. Aug., Sept. Korea.—Handsome and quite hardy. The true *C. koreana* belongs to the Atragene group and has petaloid staminodes.

*C. acutangula*, Hook. f. & Thoms. Allied to *C. lasiandra*. Sts. deeply grooved: lvs. bipinnate, with ovate or ovate-lanceolate crenate lfts.: fls. axillary, brownish yellow, with the sepals winged on the back. Sept., Oct. Himalayas. Not hardy N.—*C. Addisonii*, Brit. Allied to *C. Viorna*. Upright herb; glabrous: lower lvs. simple, upper pinnate: fls. purplish. May, June. Va. and N.C. G.F. 9:325.—*C. angustifolia*, Jacq. Allied to *C. recta*. Lvs. pinnate with simple or 3-parted linear lfts.: fls. solitary or in 3's with 4-8 sepals. S. Eu. R.F.G. 4:62 (4665).—*C. aristata*, R. Br. Allied to *C. indivisa*. Evergreen: lvs. ternate, with ovate to ovate-lanceolate, cordate lfts.: fls. dioecious, white, in few-fld. axillary corymbs, 2 in. across, fragrant. Austral. B.R. 3:238 and L.B.C. 7:620 (pistillate plant). G.C. III. 32:55 (staminate plant). Var. *Dennisae*, Guilf. (C. Sanderi, Wats.). Fls. with salmon-red filaments. B.M. 8367. Tender.—*C. barbellata*, Edgew. Allied to *C. montana*. Lfts. ovate-lanceolate, toothed: fls. solitary, large, dull purple: achenes glabrous. Himalaya. R.H. 1858, p. 407. B.M. 4794. F.S. 9:956.—*C. Benthamiana*, Hemsl. (*C. terniflora*, Benth. not DC.). Allied to *C. Meyeniana* and *C. chinensis*. Lfts. 5, broadly ovate, subcordate, sparingly pubescent, 1½-2 in. long: fls. in axillary and terminal panicles, white, ½ in. across. China.—Of no particular ornamental value.—*C. brachiata*, Thunb. Climbing; pubescent: lvs. bipinnate or the upper pinnate; lfts. ovate, coarsely toothed: fls. greenish white, in axillary panicles, fragrant, 1-1½ in. across; sepals spreading obtuse: filaments hairy at the base. S. Afr. B.R. 2:97, G.C. III. 30:367. Tender.—*C. brachyura*, Maxim. Similar to *C. recta*. Herbaceous, upright: lvs. pinnate with 3-5 ovate, 3-nerved lfts.: fls. axillary, solitary, white; sepals glabrous except at the margin: achenes few with short pubescent style. Korea.—*C. Buchananiana*, DC. Allied to *C. nutans*. Large climber, hairy: lvs. pinnate; lfts. broadly ovate, serrate or lobed: fls. in panicles, tubular; sepals ribbed. Himalaya. See also *C. nutans* var. *thyrsoides*.—*C. chinensis*, Retz. Allied to *C. Meyeniana*. Lfts. 5, ovate to ovate-lanceolate, nearly glabrous, ¾-1½ in. long: fls. in axillary and terminal panicles. China.—*C. chrysocoma*, Franco. Allied to *C. montana*. Upright shrub: lfts. obovate with few coarse teeth, ¾-1¼ in. long, yellowish silky-pubescent beneath: fls. axillary, 1-3, 2 in. across; sepals white with pink margin. China. B.M. 8395.—*C. connata*, DC. Allied to *C. nutans*. Large climber; glabrous: lfts. 3-7, broadly ovate, slightly pubescent or nearly glabrous, cordate at base, coarsely serrate, often 3-lobed, 2-4 in. long: fls. ¾-1 in. long, in many-fld. panicles. Himalayas. G.F. 4:235.—*C. Delavayi*, Franch. Allied to *C. recta*. Upright shrub: lvs. pinnate; lfts. 9-11, ovate, entire, silvery white beneath, ½-¾ in. long: fls. white, slender-stalked, 3-5, terminal, about 1 in. across. W. China. Very distinct, but apparently not hardy N.—*C. Geberiana*, Bong.—*C. songarica* var. *Geberiana*.—*C. Gouriána*, Roxbg. Allied to *C. grata*. Tall climber; usually glabrous: lvs. pinnate or bipinnate; lfts. ovate-oblong, glabrous above, pubescent or sometimes glabrous beneath: fls. ½-¾ in. across, white, in large panicles. Himalayas. S. Asia, Philippine Isls. Wight, Icon. 933-4.—*C. grevilliflora*, DC. Allied to *C. nutans*. Tall woody climber; densely tomentose: lfts. 3-5, broadly ovate, cordate, serrate, usually deeply 5-lobed, 3-4 in. long: fls. 1½ in. long, tubular-campanulate, tawny yellow. Himalayas. B.M. 6369.—Very distinct, but only for warmer regions.—*C. hexapétala*, Forst. (*C. hexasepala*, DC.). Allied to *C. indivisa*. Lvs. ternate; lfts. coarsely dentate or lobed: fls. dioecious, in axillary cymes, greenish white, fragrant, 1 in. across. New Zeal. B.R. 32:44.—*C. koreana*, Komarov. Allied to *C. alpina*. Lvs. ternate or biternate; lfts. ovate, cordate, coarsely toothed: fls. yellow or violet; sepals about 1 in. long; staminode, spatulate, narrow. Korea. Act. Hort. Petrop. 22:6.—*C. macropétala*, Ledeb. Allied to *C. alpina*. Lvs. ternate or biternate; lfts. coarsely serrate or nearly entire: fls. large, violet; petaloid staminodes lanceolate, little shorter than sepals. N. China. Gt. 19:651.—*C. mendocina*, Phil. Allied to *C. ligusticifolia*. Lower lfts. 3-parted or 3-lobed, segms. lanceolate: fls. monœcious, white, in panicles; sepals sparingly hairy inside: tails of achenes very long. Sept., Oct. Chile. Tender.—*C. Pierdii*, Miqu. Allied to *C. brevicaudata*. Slender climber: lvs. biternate; lfts. ovate-oblong, coarsely serrate, 1¼-2½ in. long: fls. white, ¾ in. across, solitary, or in 3-fld., rarely many-fld. cymes: achenes glabrous, with rather short plumose tails. Aug. Japan.—*C. quinquefoliolata*, Hutchinson (*C. Meyeniana*

var. *heterophylla*, Gagnep.). Allied to *C. Meyeniana*. Lfts. 5, lanceolate or oblong-lanceolate, about 3 in. long: cymes few-fld., shorter than the lvs.: tails of fr. fulvous. Cent. China. V.F. 3.—*C. Sanderi*, Wats.—*C. aristata* var. *Dennisae*.—*C. smilacifolia*, Wall. Tall woody climber: lvs. simple, ovate usually cordate, entire, 3-10 in. long, rarely ternate: fls. 1-1½ in. across, brownish tomentose outside, purple inside, in axillary panicles: achenes with long feathery tail. B.M. 4259. F.S. 2, pt. 12:3. G.C. III. 30:466.—*C. songarica*, Bunge. Allied to *C. recta*. Shrubby, upright: lvs. simple, thickish, grayish green, usually lanceolate, entire or sparingly serrate: fls. yellowish white, in terminal and axillary cymes: sepals glabrous inside. Turkestan, Mongolia. Var. *Geberiana*, Kuntze (*C. Geberiana*, Bong.). Lvs. thinner, more serrate, green.—*C. Suksdorfii*, Robins. Allied to *C. ligusticifolia*. Lfts. 5, ovate, to ovate-oblong, 1-1½ in. long: fls. in axillary racemes or panicles, white, 1 in. across; sepals reflexed: achenes few. Brit. Col. G.F. 9:255.—*C. Thunbergii*, Steud. Climbing, pubescent or glabrous: lvs. pinnate with ovate to lanceolate, often 3-lobed or 3-parted lfts.: fls. in axillary panicles; sepals spreading, lanceolate; filaments hairy at the base. S. Afr. G.C. III. 50:253.

K. C. DAVIS.

ALFRED REHDER.†

CLEMATIS, MOCK: *Agdestis clematidea*.

CLEMATOCLETHRA (*Clematis* and *clethra*, referring to the similarity of the flower to that of *Clethra* and to the climbing habit). *Dilleniaceæ*. Shrubs grown for the profusely produced fragrant flowers and the attractive black or red berries.

Deciduous climbing plants: branches with solid pith: winter-buds conspicuous, free, with several imbricate scales: lvs. petioled, usually serrate: fls. in axillary cymes or panicles, sometimes solitary, white; sepals 5, imbricate, persistent; petals 5, imbricate; stamens 10, short; ovary 5-celled, each cell with 10 ovules; style simple, cylindric: fr. berry-like, with thin flesh, subglobose, usually 5-seeded.—About 12 species in Cent. and W. China. Closely allied to *Actinidia* which is easily distinguished by its numerous stamens, many styles, many-seeded fr. and in the winter state by its winter-buds being hidden by a swelling of the tissue around their base. Several species have been recently intro., but the names of most of them have not yet been determined. They are apparently harder than the Chinese actinidias and superior from an ornamental point of view on account of their profusely produced fls. and frs. though the foliage as a rule is smaller and not quite so handsome. Prop. by seeds and probably, like actinidias, by greenwood cuttings in summer and also by hardwood cuttings and layers.

Hémsleyi, Bail.

Climbing, to 20 ft.: young branches pubescent at first, soon glabrous: lvs. slender petioled, ovate to oblong-ovate, acuminate, denticulate, glabrous above, brownish pubescent on the veins beneath, 2-4 in. long: fls. white, about ½ in. across, 4-12 in stalked axillary cymes: fr. globose, black, about ½ in. across. Cent. China. H.I. 29:2808.

*integrifolia*, Maxim. Quite glabrous: lvs. ovate to ovate-lanceolate, acuminate, finely serrulate or entire, dark green above, glaucous beneath, 1½-3 in. long:



993. *Cleome spinosa*.



fls. solitary or in 2- or 3-fl. cymes on slender stalks, white,  $\frac{1}{3}$ – $\frac{1}{2}$  in. across: fr. globose, black. W. China.

ALFRED REHDER.

**CLEOME** (meaning uncertain). *Capparidaceæ*. Odd spider-flowered plants sometimes grown in the flower-garden.

Sub-shrubs or annual herbs, simple or branched, glabrous or glandular, with simple lvs. or 3–7 lfts., and white, green, yellow or purplish fls. borne singly or in racemes; petals entire, with claws.—Seventy tropical species, in both hemispheres. The genus is distinguished from *Gynandropsis* by its short torus, which often bears an appendage, and by the 4–6, rarely 10, stamens.

The garden cleomes are chiefly interesting for their long purple spidery stamens and showy rose-colored petals. They succeed in sandy soils and sunny situations, and can be used like castor-oil plants to fill up large gaps in a border. *C. spinosa* is the best, and has lately been planted considerably in public parks amongst shrubbery. Propagated by seeds, which are produced freely in long slender pods borne on long stalks.

A. Lfts. more than 3.

*spinosa*, Jacq. (*C. pungens*, Willd. *C. gigantea*, Hort., not Linn.). GIANT SPIDER PLANT. Figs. 993, 994. Clammy, strong-scented, 3–4 ft. high: lfts. usually 5, sometimes 7, oblong-lanceolate, with a pair of short stipular spines under the petioles of most of the lvs., and in the tropics some little prickles on the petioles also: fls. rose-purple, varying to white; petals 4, obovate, clawed,  $\frac{1}{2}$  in. long; stamens 2–3 in. long, blue or purple. N. C. to La. (naturalized from Trop. Amer.) and escaped from gardens. B.M. 1640. G.C. III. 45: 115.—A tender biennial north, but annual in the tropics. The plant recently intro. as *C. gigantea* is not the true species, which is a green-fl. S. American plant as yet apparently unknown in the trade in this country. *C. spinosa* differs widely in the extent and character of its spines. The fls. vary in the development of the style; Fig. 994 shows a fully perfected style.

*speciosissima*, Deppe. Annual or half-shrubby, sometimes 5 ft. high: sts. strongly hairy without spines; lfts. 5–7, lanceolate, dentate, narrowed at the base, conspicuously hairy on both sides: fls. light purple or purplish rose. July to fall. Mex. B.R. 1312.—Said to be the showiest of cleomes. Under this name a very different plant is passing, the lfts. of which have only minute hairs but rather numerous spines.

AA. Lfts. 3.

*serrulata*, Pursh (*C. integrifolia*, Torr. & Gray). ROCKY MOUNTAIN BEE-PLANT. Glabrous, 2–3 or even 6 ft. high: lfts. 3, lanceolate to obovate-oblong, entire, or rarely with a few minute teeth: bracts much narrower than in *C. spinosa*: petals rose.

rarely white, 3-toothed; receptacle with a flat, conspicuous appendage. Along streams in saline soils of prairies.—In cult. over 30 years as a bee-plant.

*C. dendroidea*, Schult. Tree-like, 10–14 ft.: fls. blackish purple. Brazil. B.M. 3296.—*C. gigantea*, Linn. Shrubby, 3–5 ft., downy: lfts. 7, lanceolate, lance-oblong or oblanceolate, the entire lf. shorter than petiole: fls. greenish; petals linear, 2 in. or more long, cohering by their margins and opening only on one side; sepals long-linear, glandular, becoming revolute. Trop. Amer. B.M. 3137.—*C. speciosa*, HBK.=*Gynandropsis*.

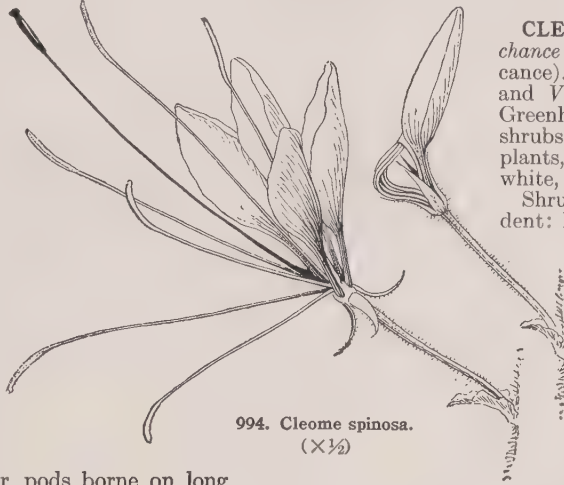
N. TAYLOR.†

**CLERODENDRON** (Greek, *chance* and *tree*: of no significance). Includes *Siphonantha* and *Volkameria*. *Verbenaceæ*. Greenhouse climbers and hardy shrubs and other ornamental plants, grown for the showy white, violet or red flowers.

Shrubs or trees, often scandent: lvs. opposite or verticillate, mostly entire or not compound: fls. in mostly terminal cymes or panicles; calyx campanulate or rarely tubular, shallowly 5-toothed or 5-lobed; corolla-tube usually slender and cylindrical, the limb 5-parted and spreading, the lobes somewhat unequal; stamens 4, affixed on the corolla-tube, long-exserted and curved; style exserted, 2-cleft at the end; ovary 4-loculed: fr. a drupe inclosed in the calyx.—About 100 species, in the tropics, mostly of the eastern hemisphere.

Clerodendrons are divided into two garden sections, —those with a shrubby habit, and the twining kinds. The culture is about the same for both kinds. They may be grown from seeds or from cuttings of the half-ripened wood. In either case, use 2-inch pots filled with a mixture of equal parts of leaf-mold or peat and good sharp sand. Place a cutting or a seed in each pot, and press moderately firm. Leave the pots in a tight case with a temperature of 70°, and keep the soil at all times fairly moist. When the pots are filled with roots, shift into a 4-inch pot, using a compost consisting of fibrous loam two parts, leaf-mold and sand one part each, and a fifth part of well-rotted manure. Pot rather firm, as this insures a stronger growth, and during the growing season keep in a night temperature of 65°.—Clerodendrons may be flowered in any size pot desired, and some of the species, notably *C. Balfourii* (or properly *C. Thomsonæ*), can be had in flower from Easter until late September. This species is probably the best and most useful, either for decorative work or exhibition purposes; when it is grown in large pots, a good rough material may be used for potting. A good stiff fibrous loam

with about one-third part of decayed manure is best. When the season's growth is completed, gradually withhold water for two months and lower the night temperature from 65° to 55°. Many of the leaves under the above treatment will drop and the wood will become firm. If plants are wanted in flower about Easter.



994. *Cleome spinosa*. ( $\times \frac{1}{2}$ )



995. *Clerodendron Thomsonæ*. ( $\times \frac{1}{2}$ )

give them a thorough soaking with water about January 1, and raise the temperature again to 65° by night, letting it rise during the day to 75° to 80°. Syringe the plants two or three times a day, which will encourage the young growths to start all over the ripened wood. When this takes place, the plant will either have to be repotted or fed liberally with liquid manure and fertilizers, repotting usually resulting in larger panicles of flowers. If feeding is resorted to, a handful of green cow-manure to a watering-pot containing two and a half or three gallons of water is sufficient; and if any of the popular fertilizers are used for a change, a small handful to the same amount of water will answer. Water twice in between with clean water. Plants for a succession may be started when the first are beginning to show the crimson at the end of the flower, and so on until the end of July or first of August. —Clerodendrons are not subject to insect pests if kept thoroughly syringed during their growing season. If this is neglected, the shrubby kinds may become affected with brown-scale or mealy-bug, which should be immediately treated with the usual hydrocyanic gas fumigation. (George F. Stewart.)

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## A. Plant of twining habit.

1. *Thomsonae*, Balfour (*C. Balfourii*, Hort.). Fig. 995. Tall, twining, glabrous evergreen shrub: lvs. opposite, oblong-ovate and acuminate, strongly several-nerved, entire, petioled: fls. in axillary, and terminal forking lax cymes; calyx strongly 5-angled, narrowed at the apex, white; corolla-limb light crimson and spreading; corolla-tube 1 in. long; stamens  $\frac{3}{4}$  in. long. W. Afr. B.M. 5313. R.H. 1867:310; 1902:504. G.M. 46:173. G.W. 4, p. 439; 8, p. 173; 13, p. 340. F.E. 28:261.—A warmhouse plant of great merit, and the most popular of the tender species. Blooms profusely on the young wood. Var. *delectum*, Hort. (*C. delectum* and *C. delicatulum*, Hort.). Fl.-clusters very large; calyx pure white or green-tinged; corolla large, rose-magenta.

2. *splendens*, Don (*Siphonanthus splendens*, Hiern). A most excellent stove climber: sts. slender, woody, glabrous, slightly angled: lvs. opposite, variable, oblong-cordate, or elliptic, 4–6 in. long, dark green; petiole rather short: fls. in dense many-flowered cymes on leafy growths from the ripened wood of the previous year, bright scarlet passing into bright yellow, an inch or more in diam.; stamens 1 in. long. Trop. Afr. B.R. 28:7. R.H. 1902:504. H.U. 5, p. 325.

3. *speciosum*, Hort. A garden hybrid between *C. splendens* and *C. Thomsonae*, intermediate in habit and foliage: the fls. are produced in profusion, are dull red, and are continuously borne throughout the summer months; old calices more or less persistent, and ornamental pale red after fls. are past.—As figured in R. H. 1873, 471 and Gn. 1877, 404, this recedes very little from typical *C. splendens*, according to Baker, but the *C. speciosum hybridum* of I. H. 1869, t593 is intermediate between *C. splendens* and *C. Thomsonae*.

AA. Plant of erect or self-supporting habit.

B. Corolla-tube not much if any longer than the large calyx: fls. white or light blush.

4. *fragrans*, Vent. (*C. coronaria*, Hort.? *Volkameria fragrans*, Vent.). Pubescent, half shrubby, with angled branches, 3–5 ft.: lvs. broadly ovate, with truncate or cordate base, acuminate, coarsely toothed: fls. white or blush, in terminal, compact, hydrangea-like corymbs, usually double, delicately scented. China, Japan. B.M. 1834.—Very desirable and fragrant plant for the coolhouse. Hardy in S. Lvs. ill-scented.

5. *infortunatum*, Gaertn. (*C. viscosum*, Vent.). Height 5–7 ft., pubescent, with square branches: lvs. opposite and stalked, cordate-ovate, acuminate, entire or toothed, hairy: fls. in a loose villous terminal panicle, white, with a flesh-colored center, flaring, the tube projecting beyond the loose, hairy, large, 5-angled calyx. E. Indies. B.M. 1805.—Fls. sweet-scented. Greenhouse.

6. *trichotomum*, Thunb. (*C. serotinum*, Carr. *Volkameria japonica*, Hort., not Thunb.). Fig. 996. Slender but erect, graceful, pubescent sub-shrub, 4–10 ft. high or even higher: lvs. mostly opposite, soft and flaccid, ovate-acuminate, narrowed at the base, very closely serrate or entire, hairy: fls. white, with a reddish brown calyx, on forking, slender, reddish peduncles, the corolla-tube

996. *Clerodendron trichotomum*.  
 (×  $\frac{1}{2}$ )

sometimes twice as long as the calyx; segms. of calyx turning red and affording pleasing contrast to bright blue frs. Japan. B.M. 6561. Gn. 43:504; 51, p. 320; 75, pp. 67, 447. G. 26:492. J.H. III. 55:355. F.E. 29:653. R.H. 1867, p. 351.—A very handsome, hardy shrub or small tree. In the N. it kills to the ground, but sprouts up if the crown is protected.

7. *Fargesii*, Dode (*C. trichotomum* var. *Fargesii*, Hort.). A recent shrub, reported as being hardy in England, rapid-growing: lvs. dark green or purplish, opposite, petioled, the blade ovate and acute or acuminate, strongly veined, abruptly narrowed at the base, entire: fls. in panicles in summer, whitish, fragrant; sepals lance-ovate, becoming reflexed: fr. globular,



size of a sweet pea seed, peacock-blue, set on the purple or crimson old calyx. China. G.M. 54:817. R.H. 1911, p. 522, 523.

8. *inérme*, Gärtner. Tall shrub or becoming small tree: lvs. opposite or ternate, obovate or elliptic, entire, scentless, privet-like,  $1\frac{1}{2}$  in. or less long; fls. white, fragrant, on 3-7-fld. axillary peduncles; corolla-tube  $\frac{3}{4}$  in. long, the lobes very short; fr.  $\frac{1}{2}$  in. long, smooth, separating into 4 parts. India, where it is said to be used for hedges.—Offered in S. Calif.

BB. Corolla-tube markedly longer than the small calyx (usually 2-3 times or more longer).

c. Fls. white.

9. *tomentosum*, R. Br. Shrubby and erect (often becoming a small tree), pubescent, often purplish: lvs. opposite and petioled, ovate-elliptic to sub-lanceolate, short-acuminate, 2-4 in. long, entire or sparingly toothed, pubescent on both sides, but thickly so on the under side; fls. in opposite, forking compact clusters, the calyx not enlarged, the slim, corolla-tube

long-exserted (3-4 times length of calyx), and the clear white corolla-lobes reflexed-curved; anthers yellow, protruding. Austral. B.M. 1518.—Cult. in S. Calif.

10. *macrósiphon*, Hook. f. (*C. incisum* var. *macrósiphon*, Baker). Elegant erect shrub, finely pubescent: lvs. opposite, oblanceolate-oblong, acuminate, notched or pinnatifid; fls. in a nearly sessile terminal cyme or head, pure white; calyx green, very small; corolla-tube very narrow, 4-5 in. long, hairy, the limb 1-sided,  $\frac{1}{2}$  in. long; filaments 2 in. long, red. E. Afr. B.M. 6695.—Warmhouse plant of merit, but the handsome fls. are short-lived.

11. *Siphonánthus*, R. Br. (*Siphonánthus indica*, Willd.). TURK'S TURBAN. TUBE-FLOWER. Shrub, 2-8 ft. high, open-branched: lvs. opposite or verticillate, nearly sessile, narrowly lanceolate, entire or nearly so; fls. long-tubed and white (tube 3-4 in. long) in very large terminal racemes, the lobes  $\frac{2}{3}$  in. long, obovate-oblong; fr. a showy, red and purple berry, which persists a long time. E. Indies. Hardy in Fla.

cc. Fls. red, orange or distinctly lilac.

12. *squamatum*, Vahl (*C. Kaempferi*, Sieb.). Shrub 6-10 ft., thinly pubescent: lvs. large, opposite, round-cordate, entire or denticulate, acuminate; infl. and fls. brilliant scarlet; fls. with small red calyx and reflexed, spreading, unequal corolla-lobes; corolla-tube 1 in. or less long, very slender; drupe blue-black or greenish blue, rather fleshy. China. B.R. 649. R.B. 22:253. Gn. 42:562. Gt. 5:352.—Very showy. Cult. in warm greenhouses, and in the open in S. Calif. and S. Fla. The fls. are in an erect branchy, panicle-like cluster.

13. *fallax*, Lindl. Fig. 997. A highly ornamental species: st. erect, shrubby, branching after flowering, bluntly 4-angled; lvs. large, cordate-ovate, hairy, rich

dark green, often 1 ft. in length and supported by a stout hairy petiole; infl. erect, often 18 in. or more in length; fls. bright scarlet, numerous,  $1\frac{1}{2}$ -2 in. diam., tube narrow, lobes reflexed. Java. G.C. III. 45:324. Gn. 59, p. 179, desc. G.W. 10, p. 247.—Should be in every collection of warmhouse plants, as it may be induced to bloom practically all the year round; it should be given a fairly light position, with slight shade from strong sun.

14. *myrmecophilum*, Ridley. Shrub, sparingly branched, 3 ft., with terete sts. and white bark: lvs. opposite and alternate, 1 ft. long, linear-oblong, shining dark green, with a dozen pairs of conspicuous nerves, short-petioled; fls. yellow-red, in a large, showy terminal pubescent panicle; calyx about  $\frac{1}{2}$  in. long; corolla-tube considerably longer than calyx; corolla-lobes  $\frac{1}{2}$  in. long, obovate to oblong and obtuse; filaments red, much exserted. Singapore. B.M. 7887. G.C. III. 33:291; 35:237. R.H. 1907, p. 443. G. 26:359. G.M. 47:259. Gng. 13:376. A.F. 25:78.—The hollow sts. afford nesting-places for ants, whence the name *myrmecophilum* ("ant-loving").—Blossoms well in 6-in. pots in a warmhouse, producing panicles 8 in. long on plants 2 ft. high.

15. *foetidum*, Bunge (*C. Bungei*, Steud.). Shrub, 3-6 ft., pubescent, spiny, of a dwarf spreading habit, sparsely branched: lvs. opposite, broad-ovate and acuminate, stalked, coarsely toothed, often 1 ft. long, dark green above and red-hairy beneath; fls. rosy-red,  $\frac{3}{4}$  in. across, tube 3-4 times as long as calyx, in a dense capitate corymb 4-8 in. across. China. B.M. 4880. F.S. 9:863. G. 27:452; 30:361.—Cool greenhouse; hardy in middle and southern states. August. Killed to the ground in the latitude of Philadelphia, but sprouts up and blooms. Fls. not fetid, but name given because of the odor of the bruised lvs. Spreads by suckers from the root, and soon forms a mass of beautiful free flowering growths.

L. H. B.

CLÉTHRA (ancient Greek name of the Alder, transferred to this genus on account of the resemblance of the leaves). *Clethraceæ*. WHITE ALDER. Shrubs or small trees grown for their handsome spikes of white fragrant flowers appearing in summer.

Leaves alternate, usually serrate, deciduous or persistent: fls. white, in terminal often paniced racemes; petals 5, erect; stamens 10; caps. splitting into 3 valves, many-seeded.—

About 25 species in Amer., E. Asia, Madeira. Only a few hardy deciduous species are generally cult.; valuable for their showy spikes of white fragrant fls., appearing late in summer. They grow best in a moist, peaty or sandy soil. Prop. by seeds, sown in spring in pans in sandy and peaty soil, and by greenwood cuttings under glass, growing best if taken from forced plants in early spring and placed in slight bottom heat; also, in-



998. *Clethra tomentosa*. ( $\times \frac{1}{2}$ )



997. *Clerodendron fallax*. ( $\times \frac{1}{2}$ )

creased by layers and by division of large plants. Handsome when forced under glass.

A. *Lvs. deciduous: stamens exserted.*

B. *Racemes usually solitary; stamens pubescent.*

**acuminata**, Michx. Tall shrub or small tree, to 15 ft.: lvs. petioled, oval or oblong, acuminate, rounded or narrowed at the base, sharply serrate, pubescent beneath at least on the veins, 3-7 in. long: racemes usually solitary, nodding; sepals acute; style glabrous. July-Sept. Alleghany Mts., Va. to Ga. L.B.C. 15:1427.

BB. *Racemes usually paniced.*

c. *The lvs. with 7-10 pairs of veins, 1½-4 in. long: sepals obtusish; stamens glabrous.*

**tomentosa**, Lam. (*C. alnifolia* var. *tomentosa*, Michx.). Fig. 998. Shrub, 2-8 ft.: lvs. short-petioled, obovate, acute or short-acuminate, cuneate, serrate usually above the middle, pubescent above, tomentose beneath, 2-4 in. long: racemes few or solitary; style pubescent. Aug., Sept. N. C. to Fla. and Ala. B.M. 3743. G.F. 4:65 (adapted in Fig. 998). R.H. 1912, p. 519.

**alnifolia**, Linn. SWEET PEPPERBUSH. Shrub, 3-10 ft.: lvs. short-petioled, cuneate, obovate or oblong, sharply serrate, mostly glabrous or nearly so, 2-4 in. long: fls. fragrant, in erect, usually paniced racemes. July-Sept. Maine to Fla. M.D.G. 1890:65; 1903:473, 474. G. 26:63. J.H. III. 31:375. Em. 426. Var. **paniculata**, Arb. Kew. (*C. paniculata*, Ait.). Lvs. cuneate-lanceolate, less toothed, green and glabrous on both sides: racemes paniced. Var. **rosea**, Rehd. With pinkish fls.

cc. *The lvs. with 10-15 pairs of veins, 3-6 in. long.*

**barbinervis**, Sieb. & Zucc. (*C. canescens*, Authors, not Reinw.). Shrub or tree, to 30 ft.: branches glabrous: lvs. petioled, cuneate, obovate or oblong-obovate, acuminate, sharply dentate-serrate, pubescent beneath at least on the veins, 3-6 in. long: racemes paniced; fls. fragrant; pedicels about as long as the fls.; sepals obtuse; filaments glabrous. July-Sept. E. Asia. Gt. 19:654.

**Fargesii**, Franch. Shrub, to 12 ft.: young branchlets tomentose or nearly glabrous: petioles ½-1 in. long: lvs. oblong-ovate or elliptic-oblong, acuminate, broadly cuneate or rounded at base, sharply serrate, slightly pubescent beneath or nearly glabrous, 3-6 in. long: fls. white, in paniced racemes 5-7 in. long; sepals pointed; filaments hairy, style glabrous. Cent. China.—One of the most ornamental species on account of its very long racemes.

AA. *Lvs. evergreen: stamens included.*

**arborea**, Ait. Shrub or small tree, to 20 ft.: lvs. cuneate, narrow-elliptic, acuminate, serrate, almost glabrous, shining above, 3-4 in. long: racemes paniced; fls. fragrant. Aug.-Oct. Madeira. B.M. 1057. G.C. III. 52:100. J.H. III. 64:245. G.M. 49:97; 52:127. Gt. 52, p. 209. Gn. 76, p. 428.—It stands only a few degrees of frost.

*C. monostachya*, Rehd. & Wilson. Allied to *C. Fargesii*. Lvs. cuneate, elliptic-oblong to oblong-lanceolate, glabrous or nearly so: racemes usually solitary; style appressed pilose. Cent. China.—*C. quercifolia*, Schlecht. Shrub: lvs. obovate-oblong, tomentose beneath: racemes paniced. Mex. B.R. 28:23.—*C. tinifolia*, Swartz. Shrub: lvs. oblong, entire, tomentose beneath: racemes paniced. Jamaica.—The last two are evergreen and hardly only in subtropical regions.

ALFRED REHDER.

**CLEYÈRA** (after Andrew Cleyer, Dutch physician of the seventeenth century). *Ternstramedaceæ*. Greenhouse evergreen shrubs distinguished by the petals free or scarcely coalesced, the pilose anthers, numerous ovules, and scarcely bracted fls.: sepals 5, with 2 bractlets; petals 5; stigmas 2-3; berries 2-3-celled.—About 9 species

**ochnácea**, DC. (*C. japonica*, Sieb. & Zucc.). Height about 6 ft.: lvs. oval-oblong, acute at both ends, veined above, entire. Himalayas.—A tender shrub rarely cult. in northern greenhouses. In the S. it is cult. outdoors. It has glossy foliage, numerous creamy white, fragrant fls., borne in June, and red berries, which last all winter.—*C. japonica* was distinguished by DeCandolle by its oblong-lanceolate lvs., which are veinless, and minutely serrate at the apex. Var. **tricolor**, Hort., has dark green lvs., with grayish markings, and a margin of white and rose, the variegation being more brilliant in younger lvs.

WILHELM MILLER.

**CLIANTHUS** (Greek, *glory-flower*). *Leguminosæ*. GLORY PEA. GLORY VINE. PARROT'S BILL. Tender half-trailing shrubs, with large, showy flowers of unique appearance. Swainsona is an allied genus, but its general appearance is very different and it has acuminate, not obtuse petals. interesting plants, with pinnate lvs. of many lfts., and fls. in racemes; scarcely papilionaceous: pod stalked, many-seeded.—Two or 3 species.

*Clianthus Dampieri* is somewhat difficult to grow on its own roots. In Germany, a method has been found whereby it is as easy to succeed with this species as with the better-known *C. puniceus*. The method consists of using small seedling plants of *Colutea arborescens* as stocks; these are cut over near the soil and seedlings of *C. Dampieri*, while in the cotyledon stage, are separated from the root, the base cut wedge-shape and inserted in a cut made in the *colutea* stock. While the union is taking place, the pots should be placed under a bell-jar. *C. puniceus* is an old-fashioned greenhouse plant, grown sometimes to cover rafters or trellis work, but more frequently trained around sticks placed about the edge of the pot. The flowers, not very unlike those of the common *Erythrina*, are freely produced in hanging clusters. Cuttings rooted in early spring may be grown into good-sized plants during the summer. Water should be given sparingly during the dull months. Pruning, repotting and tying the shoots should be done just before the growth begins. A sharp lookout should be kept for the red spider, frequent syringings being the only remedy for this pest. Propagated by seeds and cuttings. (G. W. Oliver.)

999. *Clianthus Dampieri*. (× ½)

**Dampieri**, A. Cunn. GLORY PEA. Fig. 999. Height 2-4 ft.: plant glaucous and hoary, with long whitish silky hairs: sts. slightly tinged with red: petioles longer than in *C. puniceus*; lfts. 15-21, nearly opposite, sessile, usually acute; stipules larger than in *C. puniceus*: fls. 4-6 in a raceme, large, drooping, about 3 in. long, rich crimson or scarlet, with a handsome velvety, purple-black area on the raised center. Austral. B. M. 5051. R.H. 1868:230. Gt. 48, p. 272. Gn. 20:86. Var. **germanicus**, Hort., is also sold, and is probably var. **marginatus**, Hort., which has one petal white, margined scarlet. See Gn. 37:298 and p. 299 for an account of grafting this species on stocks of *C. puniceus*. Var. **tricolor**, Hort. Keel white except the tip, which is bright scarlet. Gn. W. 20:409 (desc.).

**puniceus**, Banks & Soland. PARROT'S BILL. RED KOWHAI. Height 3-6 ft., much branched: plant glabrous: lfts. 16-28, each with a very short petiole, alternate (at least toward the end of the lf.), blunt or









XXVIII. Stowell Evergreen sweet corn.



slightly notched: fls. 8 or more in a raceme, crimson, fading with age, at least 3 in. long. New Zeal. B.M. 3584.—Cult. in eastern greenhouses, and a favorite Californian outdoor shrub. Blooms all winter in Golden Gate Park, San Francisco. A white-fl. form has been grown in Calif., but is not so popular as the type. It is commonly cult. in New Zeal. Var. *magnificus*, Hort. Clusters of bright scarlet fls.

WILHELM MILLER.  
N. TAYLOR.†

**CLIDÈMIA** (old Greek name). *Melastomaceæ*. About 100 Trop. American species of horticulturally rather unimportant plants in a family famous for its foliage plants. Lvs. broad, entire, 5–7-nerved, opposite, petioled: fls. in panicles or axillary clusters, white, pink, or purple; petals 5 or 6; stamens 10 or 12; branching shrubs, mostly hairy. *C. vittata*, Lind. & André, has large, oval, pointed lvs. with 5 strong nerves, and a narrow band of white down each side of the midrib. I.H. 22:219. R.H. 1876, p. 233.

CLIFF BRAKE: *Pellaea*.

**CLIFTÒNIA** (after Dr. Francis Clifton, an English physician, d. 1736). *Cyrtillacæ*. BUCKWHEAT TREE. Glabrous evergreen shrub or small tree, rarely cult. for its early appearing racemes of white or pinkish fragrant fls.: lvs. alternate, short-petioled, without stipules, entire: fls. in terminal racemes; sepals and petals 5–8; stamens 10, shorter than the petals, the filaments flattened below; ovary superior, 3–4-celled, with a 3–4-lobed nearly sessile stigma: fr. indehiscent, ovoid, with 3–4 wings and as many seeds. The only species is *C. monophylla*, Sarg. (*C. ligustrina*, Spreng. *C. nitida*, Gaertn. *Mylocaryum ligustrinum*, Sims). Occasionally 50 ft. tall: lvs. oblong-lanceolate, obtuse, cuneate at the base, dark green above,  $1\frac{1}{2}$ –2 in. long: racemes 1–2½ in. long; fls. white or pinkish, fragrant, about ½ in. across: fr. ¼ in. long. Feb., March; fr. in Aug., Sept. Ga. to Fla. and La.; swamps. S.S. 2:52. B.M. 1625.—Little known in cult. and now not in the trade, but well worth cult. for its early, delicate and fragrant fls.; also the buckwheat-like frs. are attractive. Hardy as far north as Philadelphia. Thrives best in humid sandy and peaty soil. Prop. by seeds and probably like *Cyrtilla* by cuttings of half-ripened wood under glass with slight bottom heat.

ALFRED REHDER.

**CLIMBERS** are distinguished from twiners by having some means of attachment, as tendrils or other special devices, while twiners rise by twisting their stems round their support. In a wider sense, the word is often used synonymously with “vines,” including all plants that use other plants or other objects for support, by whatever mechanism or method. By “trailers,” nurserymen commonly mean low-growing vines, and by “climbers,” tall-growing vines. See *Vines*.

**CLIMBING FERN:** *Lygodium*. Climbing Fumitory: *Adlumia fungosa*. Climbing Hempweed: *Mikania scandens*. Climbing Lily: *Gloriosa superba*.

**CLINOSTÍGMA** (Greek, *inclined stigma*). *Palmaeæ*, tribe *Arécæ*. Low spineless palms with the habit and somewhat the appearance of small kentias; feather-leaved.

Trunks not over 8 ft., usually conspicuously ringed: lvs. usually 3–4 ft. long, rarely more, and pinnate; lfts. scythe-shaped, or lanceolate, 2-parted or obliquely truncate at the apex, not revolute at the base; rachis scaly, convex beneath, grooved above: fls. monœcious in the same spadix, sessile along its branches, the male usually 2 together, the female solitary; spadix long and usually much branched; in the male there are 3 imbricate outer segms. and 3 valvate inner segms. to the perianth, with 6 stamens surrounding an abortive ovary: fr. obliquely globular.—Species 3, one from

Austral., one from Samoa, and another from Fiji. Only the following is known in cult., and it is a rare palm. Its graceful lvs. and convenient dwarf habit should commend it to the trade. For cult. see *Kentia*.

**Mooreànum**, F. Muell. (*Kentia Mooreàna*, F. Muell.). Dwarf palm, 3–4 ft. high: lvs. 3–4 ft. long; segms. numerous, about 1 ft. long, longitudinally plicate when young: spadix at first closely sessile, very much branched when older. New S. Wales, confined to Lord Howe's Isl.—This graceful and recent palm resembles *Howea Forsteriana* somewhat in habit of growth, but its arching lvs. spread wider, and its sts. are dark purplish, and its pinnæ tough and leathery. The palm is free and clean in growth.

N. TAYLOR.

**CLINTÒNIA** (after DeWitt Clinton, the famous Governor of New York and promoter of the Erie Canal). *Liliacæ*. A small group of low-growing, herbaceous plants of North America and Asia, with a few tufted, broad shining leaves, and usually umbels of flowers.

Perianth-segms. equal or nearly so; stamens 6, inserted at the base of the perianth-segms.: ovary 2–3-celled with 2 to several ovules in each cavity: fls. on scapes: root-stocks slender: fr. a globose or oval berry. For *C. pulchella* and other species of the abandoned genus *Clintonia* of Hort., see *Downingia* a very different genus belonging to Campanulaceæ.

Clintonias grow in cool, moist woods, and fanciers can secure them from some dealers in native plants. It is difficult to tell the species apart by the leaves.

A. *Scape bearing an umbel of fls.*

B. *Fls. greenish yellow.*

**boreàlis**, Raf. Height 1–2 ft.: fls. 3–6, nodding, green, margined yellow. Labrador to Winnipeg and south to N. C. B.M. 1403 (as *Smilacina borealis*).—This is one of the choicer plants of cool, moist woods, known to plant lovers chiefly by its handsome umbels of blue berries found in autumn, which are borne above the large, dark green, shining lvs. The commonest species, but not easily grown below elevations of 1,000 ft.

BB. *Fls. white, with green spots.*

**umbellulàta**, Torr. Fls. 10–20 or more, smaller than in *C. borealis*, erect or nearly so, white, with green or purplish spots. Alleghany Mts. from N. Y. to Ga. B.M. 1155 (as *Smilacina borealis*).—This species has the smallest fls. of the group, and is the only one that has but a single pair of ovules in each cell of the ovary.

BBB. *Fls. deep rose.*

**Andrewsiàna**, Torr. One to 1½ ft. high, bearing 4 sessile, oblong, acute lvs., and 20 or more nearly erect fls. which are in dense umbels. Calif., to S. Ore., in deep, cool woods, in clayey soil rich in mold. B.M. 7092.—The showiest of the group. Cult. to some extent.

AA. *Scape bearing 1 white fl.*

**uniflòra**, Kunth. The only species in which the scape is shorter than the lvs.: fls. nearly erect; rarely there are 2 fls.: lvs. narrow, obovate-lanceolate, hairy. Calif. to Alaska.

WILHELM MILLER.  
N. TAYLOR.†

**CLITÒRIA** (derivation *recondite*). *Leguminosæ* BUTTERFLY-PEA. Glasshouse vines with pea-like flowers; and also hardy perennials.

A widespread and variable genus of 30 species allied to *Centrosema*, and characterized by the calyx-tube being cylindrical and longer than the lobes: standard narrowed at the base, not appendaged on the back; stamens in one group, the anthers all alike; style often bearded. The most important garden plant is *C. Ternatea*, a warmhouse annual twiner, reaching 15 ft., and requiring no special cult. It has very showy blue fls.

A. *Lfts. 5.*

**Ternatèa**, Linn. (*C. cærùlea*, Hort. *Ternatèa vulgàris*, HBK.). Lfts. 5, oblong, obtuse, short-petioled: fls. 1 in. or more long, rich blue, with beautiful markings, especially on the standard. B.M. 1542. Gn. 38:132. P.M. 7:147 and 13:79.—Name from Ternate, one of the Molucca Isls. and not from ternate, meaning 3-leafleted.

1000. *Clivia miniata*.

Hardy in Cent. Fla., where it is usually a biennial. *C. álba*, Hort., is a white form. More or less double forms have been known for over a century.

AA. *Lfts. 3.*

**mariàna**, Linn. Hardy perennial, smooth, erect, or slightly twining 1–3 ft. high: lfts. 3, obovate or ovate-lanceolate: fls. light blue, 2 in. long, on short peduncles: pod straight, few-seeded. Summer. Dry banks, N. Y. to Fla. and west to Mo. Also India and Burma.—Rarely sold by dealers in native plants.

**arboréscens**, Ait. St. shrubby, the rusty colored branches twining: lvs. trifoliate, the lfts. elliptical or oval: fls. racemose, showy, purple, the standard more than 2 in. long. Trop. Amer. B.M. 3165.—An excellent warmhouse climber, grown chiefly in botanic gardens.

WILHELM MILLER.  
N. TAYLOR.†

**CLÌVIA** (after a Duchess of Northumberland and member of the Clive family). Syn., *Imantophyllum*. *Amaryllidaceæ*. Tender bulbous plants with handsome evergreen foliage and showy, bright red or red and yellow flowers in large umbels.

Bulb imperfect, mostly of old lf.-bases: perianth funnelliform, curved or straight, the segms. much longer than the tube; ovules 5–6 in each cell: fr. a berry, differing in this from the capsular fr. of Nerine.—Three species from S. Afr. J. G. Baker, *Amaryllidæ*, p. 61.

Clivias make excellent house plants, but, like amaryllis, are too costly to be very popular. They have the advantage over amaryllis of having attractive foliage all the year round, and are more certain to bloom well. They have thick, fleshy roots, like an agapanthus. All the species are well worth growing, because of their handsome umbels of flowers, produced during the

spring and early summer months. *Clivia miniata* is the species most commonly grown. There are several distinct forms of this, with larger and deeper colored flowers. Established plants may be grown in the same pots for several years, if the plants are fed during the growing period with weak liquid manure. In potting, the soil given should be of a lasting nature, not easily soured, nor likely to become sodden. In arranging the drainage, place one large piece, concave side down, over the hole, and around this arrange several smaller pieces. Over these place one or two handfuls of pieces small enough to go through a No. 2 sieve. The best time to pot is after the flowers have been produced. The plants should then be kept for some time in a humid atmosphere to encourage growth, receiving an abundance of water after they are well started. After growth has been completed, they will winter safely in an ordinary greenhouse temperature (not under 40°), if kept rather dry at the root. For propagation, choose old plants which have become crowded in their pots, so that the entire plant can be pulled to pieces. After trimming the roots, put the growths in small pots and keep in heat, to encourage root action. Clivias are well suited for planting permanently in the front part of greenhouse borders. The soil for this purpose should be rich and well firmed about the roots. Withhold water as much as possible during the resting period, or the plants will produce leaves at the expense of the flowers. (G. W. Oliver.)

A. *Fls. erect; perianth broadly funnel-shaped.*

**miniàta**, Regel (*Imantophyllum miniatum*, Hook.). Fig. 1000. Lvs. 16–20, in a tuft, sword-shaped, tapering to a point, 1½ ft. long, 1½–2 in. broad: fls. 12–20, in an umbel; perianth erect, bright scarlet, with a yellow throat; tube broadly funnel-shaped, longer than *C. nobilis*; segms. about 2 in. long, the inner ones broader than the outer; stamens shorter than the segms.; style not exserted: berries ovoid, bright red, 1 in. long. Natal. B.M. 4783. R.H. 1859, pp. 126–7; 1869:250, and 1894, p. 572. F.S. 9:949; 23:2373. I.H. 26:343; 36:80; 37:102; 40:177.—*I. cyrtanthiflorum*, Van Houtte (F.S. 18:1877), is a hybrid between this species and the next. It has a curved perianth, with the inner segms. of the limb twice as broad as the outer; stamens longer than the corolla. R.H. 8:259 (desc.). Var. **àurea**, Hort. Fls. yellow with a deeper shade at base of the segms. Var. **striàta**, Hort. Lvs. freely variegated.

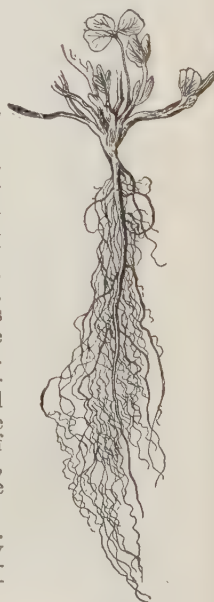
AA. *Fls. pendulous; perianth narrowly funnel-shaped.*

**nóbilis**, Lindl. (*Imantophyllum Aitoni*, Hook.). Lvs. about 12, strap-shaped, very obtuse, with a roughish edge: fls. 40–60, in an umbel; perianth curved and drooping; tube narrowly funnel-shaped, shorter than in *C. miniata*; segms. tipped with green, about 1 in. long; stamens as long as the segms.; style exserted. Cape Colony. B.M. 2856. L.B.C. 20:1906. Intro. to cult. 1828.—*I. cyrtanthiflorum*, Van Houtte (F.S. 18:1877), said to be a hybrid between this and the above, shows little if any influence of *C. miniata*. It has the narrow-tubed, pendulous fls. and the greenish tinge of *C. nobilis*. R.H. 1894, p. 573.

*C. Gårdenis*, Hook. Very much as in *C. nobilis* but with the corolla-lobes obviously spreading: stamens as long as the perianth-segms.; anthers oblong, yellow. B.M. 4895.—A desirable plant.

WILHELM MILLER.  
N. TAYLOR.†

CLOTBUR, a weed: *Xanthium*.



1001.  
*Trifolium pratense*.  
Root-system.



**CLOVE PINK:** The carnation, *Dianthus Caryophyllus*.

**CLOVER.** Species of *Trifolium* (Leguminosæ), particularly those that are useful in agriculture. The word is also applied to species of related genera, as *Medicago*. The sweet clover is *Melilotus*. Bush and Japan clover are *Lepedezas*. Prairie clover is a *Petalostemon*.

About 300 species of *Trifolium* have been described. These are widely dispersed in temperate climates. The flowers are papilionaceous but small, and are disposed in dense heads or spikes. The leaves are digitately or palmately 3-foliolate. The common European red clover is *T. pratense*, Linn., now thoroughly naturalized in North America, but supposed not to be native here. It is valuable both for stock feed (as pasturage and hay), and also as a green manure. As a manure crop, to be plowed under, it is particularly useful because of its deep root-system and its power (in common with other leguminous plants) of fixing the nitrogen of the air by means of its roots. Fig. 1001 illustrates the root system. Fig. 1002 shows the root of a fifteen-months-old plant that grew in hard clay soil. It is 22 inches long, and some of the root was left in the ground. The mammoth red clover (*T. medium*, Linn.) is perhaps an offshoot of *T. pratense*. It is usually a larger plant, with zigzag stem, entire and spotted leaflets, and longer-stalked head. White clover, or shamrock, is *T. repens*, Linn., introduced from Europe, and supposed to be native to North America as well. Alsike clover, *T. hybridum*, Linn., is of

Old World nativity. The crimson or scarlet clover (*T. incarnatum*, Linn.), Fig. 1003, an annual from southern Europe, is now much grown as a catch- or cover-crop in orchards. See *Cover-crops*. It is also highly ornamental, and is worthy the attention of the florist. For agricultural discussion of the clovers, see Vol. II, *Cyclo. Amer. Agric.* L. H. B.

**CLOVES** are the dried flower-buds (Fig. 1004) of a handsome tree of the myrtle family *Jambosa Caryophyllus* or *Eugenia caryophyllata*, better known as *Caryophyllus aromaticus*, a native of the Spice Islands, but now cultivated in the West Indies and elsewhere. See *Eugenia*. *Caryophyllus*, the ancient name of the clove, means "nut-leaf." The carnation, or "clove pink," was named *Dianthus Caryophyllus* because of its clove-like odor, and it has become the type of the great order Caryophyllaceæ, which, however, is far removed botanically from the Myrtaceæ. The word "gilliflower" is a corruption of *caryophyllus*, and, until Shakespeare's time and after, was applied to the carnation, but now-a-days it usually refers to certain cruciferous plants of the genera *Cheiranthus* and *Matthiola*.

The clove bark of pharmacy is secured from *Dicypellium caryophyllatum*, of Brazil, one of the Lauraceæ. The word clove is used among gardeners for a small secondary bulb employed for propagating, specially for the little bulb that forms in a scale-axil of a larger bulb.

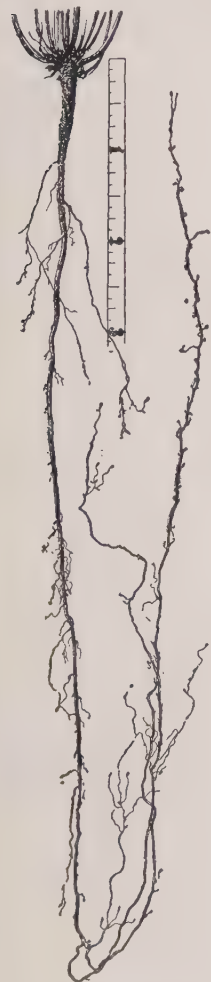
**CLUB-MOSS:** *Lycopodium*.

**CLÛYTIA** (after Cluyt, Dutch botanist of 16th century). *Euphorbiaceæ*. Evergreen greenhouse shrubs from S. Afr., rarely cult., chiefly in botanical gardens. Habit often ericoid; lvs. alternate, small, entire; fls. clustered in the axils, staminate with petals; calyx imbricate; stamens about 5; ovules 3. Prop. by cuttings. *C. pulchella*, Linn., is a small shrub; lvs. ovate and somewhat acute, petioled, glabrous, entire; fls. axillary, small, white. B.M. 1945.

J. B. S. NORTON.

**CLYTOSTOMA** (Greek *klytos*, splendid or beauteous and *stoma* mouth; alluding to the beautiful flowers). *Bignoniaceæ*. Ornamental vines, grown for their beautiful flowers.

Evergreen shrubs, climbing by leaf-tendrils: lvs. opposite, with 1 pair of short-stalked entire lfts., the rachis elongated into a slender simple tendril, sometimes wanting: fls. in 2's, axillary, or terminal or in panicles; calyx campanulate with 5 small or subulate teeth; corolla funnelform-campanulate with imbricate rounded lobes; stamens 4, with spreading anther-cells; disk short; ovary conical, warty, 2-celled, with



1002. The penetrating root of the red clover.



1003. Crimson clover.—*Trifolium incarnatum*. ( $\times \frac{1}{2}$ )



1004. Clove.

1. Spray of leaves and flowers; 2. The expanded flower; 3. An unopened bud, or clove.

the ovules in 2 rows: caps. compressed, prickly, septoid, with numerous nearly orbicular winged seeds.—About 8 species in S. Amer., usually described under *Bignonia* in horticultural writings. Closely related to *Bignonia*, from which it differs chiefly in its simple



1005. *Cnicus benedictus*.

slender tendrils, the short disk, the small or subulate calyx-teeth and the prickly pod. Suited for cult. in subtropical or tropical regions only, or as a stove plant in the N. For cult. and prop., see *Bignonia*.

*callistegioides*, Bur. & Schum. (*Bignonia callistegioides*, Cham. *B. speciosa*, Graham. *B. picta*, Lindl. *B. Lindleyi*, DC.). Large climber: lfts. elliptic-oblong, acuminate, undulate, glabrous, lustrous, reticulate below, about 3 in. long; fls. on 2-fld. terminal peduncles; calyx campanulate, with subulate teeth; corolla pale purple, streaked, about 3 in. long, the tube yellowish streaked purplish, limb 2-3 in. broad, with the lobes spreading, broadly oval, obtuse and wavy; disk crenate. Spring and early summer. S. Brazil, Argentina. B.M. 3888. B.R. 28:45. H.U. 3:227. P.M. 10:125. F.S. 9:907.—Will stand a little frost, when grown in the open in the S.

*purpureum*, Rehd. (*Bignonia purpurea*, Lodd.). Large climber: lfts. sometimes 3, ovate-oblong or obovate-oblong, short-acuminate, bright green above, paler below, entire, occasionally toothed, about 3 in. long; fls. on axillary 2-fld. peduncles or sometimes in clusters; calyx tubular-campanulate, with short triangular teeth; corolla mauve-colored with white eye, with a rather slender tube 1 in. long, lobes spreading, orbicular-obovate. Uruguay. B.M. 5800. G.C. III. 24:399.

ALFRED REHDER.

**CNICUS** (Latin name of Safflower, early applied to thistles). *Compositæ*. BLESSED THISTLE. A monotypic genus allied to *Centaurea*, and distinguished from it botanically by its heads being quite sessile and surrounded just below by bristly leaves. Its habit in the garden is very different from the bachelor's button, being thistle-like, and more interesting than ornamental. A hardy annual low-growing herb, rough, branching and pilose. Once thought to counteract poison. Culture easy. Fit for wild gardens and rockeries.

*benedictus*, (Linn. *Carduus benedictus*, Authors. *Centaurea benedicta*, Linn. *Carbènia benedicta*, Adans.).

Fig. 1005. Height 2 ft.: lvs. alternate, sinuate-pinnatifid, oblong, the lobes and teeth spiny; heads terminal, yellow, 1 in. wide, the fls. exclusively tubular. Medit. regions and Caucasus. Sometimes cult.; also seen in waste places of S. Atlantic states and Calif. as a weed adventive from Eu.

*C. raphilèpis*, Hemsl., S. Mex., has recently been cult. abroad. It is described as a handsome plant with deeply cut spiny-toothed lvs. about 2 ft. long, gray-tomentose beneath: st. colored, much branched: fl.-heads 3-3½ in. long, the involucre bracts scarlet and spine-tipped; fls. scarcely exserted, the filaments carmine. Under the above definition of *Cnicus*, this plant must fall in another genus. It has been placed in *Carduus* by E. L. Greene, as *C. raphilèpis*.

N. TAYLOR.†

**COBÆA** (after Father Cobo, Spanish Jesuit of the seventeenth century, naturalist, and resident of America for many years). Syn. *Rosenbergia*. Sometimes incorrectly spelled *Cobæa*. *Polemoniaceæ*. Attractive climbers, one or two species commonly grown in the open and under glass for the large bell-shaped flowers.

Shrubby plants climbing by lf.-tendrils, but known in cult. as herbs: lvs. alternate, pinnate; calyx large, 5-parted; corolla bell-shaped, the limb 5-lobed: caps. 3-valved, angled: fls. solitary on long peduncles, bracted at the base.—A genus of about 10 Trop. American climbers (monographed by Brand in Engler's *Pflanzenreich*, hft. 27, 1907), of which *C. scandens*, a tender perennial plant, is amongst the dozen most popular vines commonly treated as annuals. This is the only genus of climbers in the order. Prop. by seeds which should be placed in moist earth, edge down. It is a rapid grower.

*scandens*, Cav. (*Rosenbergia scandens*, House). Figs. 1006-1008. Height 10-20 ft.: lfts. in 2 or 3 pairs, the lowest close to the st., and more or less eared: fls. bell-shaped, 1-1½ in. across, light violet or greenish purple, with protruding style and stamens: tendrils



1006. *Cobæa scandens*. (×½)



branched. Mex. B.M. 851. F.S. 14:1467.—There is a white-fl'd. form (*C. alba*, Hort.), and one with variegated lvs., var. *variegata*, Hort.—The terminal lft. is represented by a tendril (Fig. 1007). Sometimes there are indications of tendrils on other lfts. (Fig. 1008), making the plant an interesting one for students of morphology.

*stipulàris*, Benth. (*Rosenbergia stipulàris*, House). Resembles the preceding species but the sepals ovate, tapering to a broadly acuminate apex (the sepals of *C. scandens* being broadly ovate or suborbicular). Mex.



1007. Normal leaf of *Cobæa scandens*.

*macrostoma*, Pav. (Sometimes erroneously written *macrostema* and *macrostemma*.) Sts. climbing 6–10 ft.: lvs. alternate, of 3 pairs of obovate lfts.: fls. solitary, on a 2-lvd. long peduncle, the petals yellow-green; stamens at least  $1\frac{1}{2}$  in. longer than the corolla. Guatemala. B.M. 3780.

*C. minor*. Marten & Galleotti. A small vine of which little is known, but cult. in Amer. in botanic gardens and fanciers' collections. It has small fls., borne on stalks shorter than the lvs. Mex.—*C. Pringlei*, House (*Rosenbergia Pringlei*, House). A glabrous, high-twining vine: lfts. 6, the basal pair oblong-lanceolate, hastately clasping; peduncles 4–5 in. long; calyx-lobes green, herbaceous, scarcely 1 in. long and half as broad; corolla pure white, 2 in. long; stamens exserted less than  $\frac{1}{2}$  in. Mex.

WILHELM MILLER.  
N. TAYLOR.†

COBNUT: *Corylus*.

COBÚRGIA: *Stenomesson*.

COCA. The leaves of *Erythroxylon Coca*, used in medicine. Sold chiefly as a fluid extract. Cocaine is the famous local anesthetic. See *Erythroxylon*.

COCCÍNIA (Latin, *scarlet*; referring to the ornamental gourds). *Cucurbitaceæ*. Tender perennial vines, usually with tuberous roots, grown for ornament mostly indoors.

Leaves angled or lobed, sometimes glandular: fls. white or yellowish, large, staminate and pistillate on different plants or sometimes on different branches of the same plant; calyx short, often campanulate: fr. a small, scarlet gourd, sometimes marbled, with an insipid pulp.—Twenty species from the tropics of Asia and Afr. A. Cogniaux in DC., Mon. Phan. 3:528. *C. cordifolia* is treated as a tender annual, requiring an early start and no special cult. The genus is sometimes referred to *Cephalandra*.

A. *Tendrils simple*: male fls. solitary: lvs. small.

*cordifolia*, Cogn. (*C. indica*, Wight & Arn.). Height about 10 ft., perfectly smooth: lvs. small, 1–2 in. long, glossy, ivy-like, short-petioled, obtusely 5-angled: fl. white, bell-shaped, the staminate solitary: fr. roundish at both ends, about 2 in. long, 1 in. thick. India.

AA. *Tendrils bifid*: male fls. in racemes: lvs. large.

*palmata*, Cogn. (*Cephalandra palmata*, Lond.). Attaining 30 ft.: lvs. large, 3–4 in. long and wide, long-

petioled, palmately 5-lobed: fls. yellowish: fr. ovate, acute. Natal.—Intro. by P. Henderson & Co., 1890. A rare greenhouse plant.

*C. Dinteri*, André, with palmate lvs. and handsome scarlet frs., may be in cult. S. Afr. R.H. 1900:268.

WILHELM MILLER.  
N. TAYLOR.†

COCCÓLOBA (Greek, *lobed berry*, referring to the ends of the pear-shaped fruit). Sometimes spelled *Coccolobis*. Including *Campderia*. *Polygonaceæ*. Tropical shrubs, trees or rarely tall woody climbers, grown for their fruits and usually large glossy leathery leaves.

Leaves alternate, always entire: fls. small, in axillary or terminal spike-like racemes, usually some shade of green or yellow-green; sepals 5, herbaceous; petals 0; stamens 8, exceeding the perianth: fr. berry-like, with a small stone, often edible.—About 125 species in the American tropics and reaching to Fla. *C. platyclada* is now referred to *Muehlenbeckia*, which see.

*Coccoloba uvifera*, the sea-grape or shore-grape of the West Indies, bears an edible fruit, and has particularly beautiful foliage. It is the most important of the genus and is offered by dealers in tropical plants. It will not stand the frost and its cultivation out-of-doors is limited to the frostless region of California and Florida. It can be easily grown in any greenhouse North. All species are easily propagated by seeds, which are very plentiful with most of the species. Some species may be increased by cuttings of ripe wood, which root easily in sand under the usual conditions, in a frame or propagating-house. Layering may also be employed to increase the stock. The various species grow naturally in both clayey and sandy soils, preferring moist rich earth, and a high temperature. *C. uvifera* frequents the seashore, and is found growing in sand and broken shells apparently lacking altogether in plant-food. Rich sandy soil of a light character seems to be best for all the species so far known in cultivation. Plants are readily transplanted from the open ground, but pot-grown plants are to be preferred. (E. N. Reasoner.)

*uvifera*, Linn. SEA-GRAPE. SHORE-GRAPE. UVADEL MAR. Fig. 1009. Tree, reaching 20 ft. or more, with many flexuous branches: lvs. large, often 5 in. long by 7 in. wide, broadly heart-shaped, wavy margined,



1008. Monstrous or abnormal leaf of *Cobæa*.

glossy, leathery, glabrous, the midrib red at the base; petioles short, with sheathing stipules at the base: racemes 6 in. long, erect in fl., nodding in fr.; fls.  $1\frac{1}{2}$  in. across, white, fragrant; petals 5; stamens 8; styles 3: berries 9 or more in a raceme, small, about  $\frac{3}{4}$  in. long, pear-shaped, reddish purple, dotted green, sweetish acid: nut roundish, with a short, sharp point on top, and vertical wrinkles. Sandy seashores of Trop. Amer. especially S. Fla. and W. Indies. B.M. 3130.—The wood is used in cabinet-work, and, when boiled, gives a red color.

**floridana**, Meissn. (*C. laurifolia*, Jacq.). **PIGEON PLUM.** Tree, 25–30 ft.: lvs.  $1\frac{1}{2}$ –3 in. long, 1–2 in. wide, ovate or elliptical, glabrous, narrowed at both ends, obtuse, margin slightly recurved: berries small,  $\frac{1}{2}$  in. long, pear-shaped, edible, but not marketable. S. Fla., the Bahamas, and northern coast of S. Amer.



1009. *Coccoloba uvifera*. ( $\times \frac{1}{2}$ )

**pubescens**, Linn. (*C. grandifolia*, Jacq.). A high, sparingly branched tree: lvs. cordate-orbicular, 3–6 in. long, rusty-pubescent beneath, chiefly on the prominent veins: fls. racemose: fr. berry-like, about  $\frac{3}{4}$  in. diam. Trop. Amer. April. B.M. 3166.

*C. caracasana*, Meissn., or a closely related species, has recently been intro. to the trade by Franceschi, of Santa Barbara, Calif. It is described as having "larger frs. than other known species, like a good-sized plum." Venezuela.

WILHELM MILLER.  
N. TAYLOR.†

**COCCOTHRINAX** (a berry and *Thrinax*, in reference to the berry-like fruit). **Palmaceæ.** Small or medium-sized palms, with fan-leaves.

Trees (or rarely stemless) with slender sts., clothed above with the persistent petiole-sheaths; lvs. terminal, pale beneath, thin and brittle, divided into narrow, acute, 2-parted obliquely folded lobes; petioles compressed, slightly rounded and ridged on the 2 surfaces, thin and smooth on the margins: spadix interfoliar, paniculate, shorter than the petioles: fls. perfect, minute, solitary; perianth cup-like, obscurely 6-lobed, deciduous; stamens 9, exserted; ovary superior, ovoid, 1-celled: fr. berry-like, subglobose, 1-seeded, in ripening becoming thick and juicy, shining black or purple-black; albumen channeled.—A genus of a few species, made from *Thrinax*; Fla. and S.

**Gárberi**, Sarg. (*Thrinax Gárberi*, Chapm. *T. argentea* var. *Gárberi*, Chapm.). **SILVER-PALM.** Stemless: lvs. only 10–12 in. across, fan-shaped, silvery beneath. An attractive dwarf palm, early showing its characteristic form, native on shore of Biscayne Bay, Fla.; perhaps a depauperate form of *C. jucunda*, Sarg. (*Thrinax argentea*, Chapm., not Roem. & Sch.), which has lvs. 20–32 in. across; it bears the fls. on rigid spreading short pedicels, the perianth is white, anthers light yellow, and ovary orange: fr.  $\frac{3}{4}$  in. or less diam., becoming succulent and bright violet and later almost black

and shining, ripening 6 months after the flowering: petiole slender, flexible, rounded on upper side and obscurely ribbed on lower side, extending as a thin undulate rachis that ends in a short obtuse point.

L. H. B.

**CÓCCULUS** (diminutive of *kokkos*, berry; the fruit being berry-like). Syn., *Cébatha*, *Epibatèrium*. **Menispermaceæ.** Shrubs grown for their handsome foliage and the ornamental red or black fruits.

Twining or erect: lvs. alternate, petioled, entire or lobed, with entire margin, deciduous or persistent, palminerved: fls. inconspicuous, dioecious, in axillary panicles or racemes, sometimes terminal; sepals, petals and stamens 6: carpels 3–6, distinct, developing into berry-like, 1-seeded drupes; seed reniform.—About 12 species in N. Amer., E. and S. Asia, Afr. and Hawaii, chiefly in tropical and subtropical regions. Only a few species are cult., thriving in almost any somewhat moist soil; the evergreen kinds are sometimes grown in pots, in a sandy compost of peat and loam. Prop. by seeds or by cuttings of half-ripened wood in summer, under glass, with bottom heat.

"*Cocculus indicus*" is the trade name of the berries used by the Chinese in catching fish. The berries contain an acrid poison, which intoxicates or stuns the fish until they can be caught. The berries are imported from the East Indies to adulterate porter, and "*Cocculus indicus*" is a trade name with druggists, not a botanical one, just as "*Cassia lignea*" is a trade name of a kind of cinnamon bark, derived, not from a cassia, but from a species of *Cinnamomum*. The name "*Cocculus indicus*" was given by Bauhin, but binomial nomenclature began later, with Linnæus, in 1753. The plant which produces the berries is *Anamirta Cocculus*.

**carolinus**, DC. (*Cébatha carolina*, Brit. *Epibatèrium carolinum*, Brit.). **CAROLINA MOONSEED.** A rapid-growing, twining shrub, attaining 12 ft., with pubescent branches: lvs. long-petioled, usually ovate, sometimes cordate, obtuse, entire or 3-, rarely 5-lobed, pubescent, glabrous above at length: petals emarginate: fr. red,  $\frac{1}{4}$  in. diam. Along streams from Va. and Ill. to Fla. and Texas.—Decorative in fall, with its bright red fr. Not hardy north of N. Y.

**trilobus**, DC. (*C. orbiculatus*, Schneid. *Cébatha orbiculata*, Kuntze. *C. Thünbergii*, DC.). Slender climber with pubescent branches: lvs. broadly ovate to oblong-ovate, truncate or subcordate at the base, obtuse, often emarginate, usually entire, pubescent on both sides: petals bifid at the apex: fr. bluish black, about  $\frac{1}{4}$  in. thick, in short-stalked axillary clusters. Japan. B.M. 8489. I.T. 6:231.—Quite hardy at the Arnold Arboretum; keeps its lvs. green until very late in autumn.

*C. diversifolius*, Miq., not DC.=*Sinomenium acutum*.—*C. heterophyllum*, Hensl. & Wilson=*Sinomenium acutum*.—*C. japonicus*, DC.=*Stephania hernandifolia*.—*C. laurifolius*, DC. Erect shrub, to 15 ft., glabrous: lvs. evergreen, oblong, acute at both ends. Himalayas. Decorative, with its bright green, shining foliage. Only hardy in subtropical regions.

ALFRED REHDER.

**COCHLEÀRIA** (Greek, *cochlear*, a spoon; referring to the leaves). **Cruciferae.** More or less fleshy seaside small herbs, including scurvy-grass and related things; scarcely cultivated.

Annual or perennial: lvs. simple: fls. small, white, yellowish or purplish, in racemes: fr. an inflated silicle, with very convex valves, the seeds several in each cell and usually 2-rowed.—About 15 species in Eu. and N. Amer. Formerly the horse-radish was referred here, but it is now placed by some in *Radicula*, by others in *Roripa*, and by still others in *Nasturtium*.



1010. *Cochlearia danica*.



**officinális**, Linn. SCURVY-GRASS. Hardy biennial, 2–12 in. high, but cult. as an annual; root-lvs. petioled, cordate; st.-lvs. oblong, more or less toothed and sometimes with a short-winged petiole: fls. early spring; calyx-lobes erect. Arctic regions.—Prop. by seed, which is small, oval, slightly angular, rough-skinned, reddish brown. The germinating power lasts 4 years. The green parts of the plant are strongly acrid, and have a tarry flavor. The seed is sown in a cool, shady position, where the plants are to stand. The lvs. are rarely eaten as salad, but the plant is mostly grown for its anti-scorbutic properties. Not to be confounded with water-cress.

**dánica**, Linn. Fig. 1010. Annual, scarcely 6–8 in. high: lvs. rounded, kidney-shaped, scarcely 1 in. long in large specimens, usually much smaller. North temperate and arctic regions. L.B.C. 15:1482.—It is covered in early summer with a profusion of small white fls. A valuable plant for ornament northward.

N. TAYLOR.†

**COCHLIÒDA** (Greek for *spiral*, in reference to the structure of the lip). *Orchidaceæ*. A small group of orchids found at high elevations in South America, little grown, requiring treatment given *Odontoglossum*.

Pseudobulbous: fls. bright rose-color or scarlet, in long racemes; sepals equal or the side ones more or less joined; petals all much alike; lip clawed, the blade spreading and the side lobes rounded and perhaps reflexed, the middle lobe narrow.—Some of the species are retained by various authors in *Odontoglossum* and *Mesopidinium*.

**Noetziàna**, Rolfe. Pseudobulbs ovate-oblong, compressed, about 2 in. long, monodiphyllous: lvs. linear: peduncles arcuate; fls. numerous, in graceful racemes, orange-scarlet, about 1 in. across; sepals oblong; petals rather ovate; labellum 3-lobed, disk yellow, otherwise similar in color to the petals. Andes. B.M. 7474. Gt. 43:1403. G.C. III. 16:71. O.R. 12:309.

**rõsea**, Hort. Plants similar to *C. Noetziàna*: fls. rose-color. Peru. B.M. 6084. I.H. 18:66.

**vulcànica**, Benth. & Hook. Peduncles more or less erect: fls. larger than in the preceding, bright rose-color; labellum 3-lobed, provided with 4 ridges. Peru. B.M. 6001.

*C. brasiliensis*, Rolfe. Pseudobulbs tufted, oblong: lvs. oblong-lanceolate; scapes erect or arching, with 6–13 greenish fls. Brazil.—*C. Flóryn*, Rolfe. Natural hybrid between *C. Noetziàna* and *C. rosea*. Fls. cinnamon-red with yellow crest; sepals lanceolate; petals elliptic oblong.

OAKES AMES.

**COCHLIOGLÓSSA**. *Orchidaceæ*. A garden hybrid between *Cochlioda Noetziàna* and *Odontoglossum sceptrum* or *O. prænites*, known as *Cochlioglossa moortbeekiensis*. Fls. star-shaped, the petals and sepals yellow with pale brown spots; lip has the characters of that of *Odontoglossum sceptrum*, but a little longer and less attractive. Shows no marks of *Cochlioda Noetziàna*.

**COCHLIOSTÈMA** (Greek, *spiral stamens*). *Comelinaceæ*. Curious and gorgeous plants cultivated under glass.

Cochliostemas are epiphytes, with the habit of *Billbergia* and great axillary panicles of large fls. of peculiar structure and beauty. They are stemless herbs from Ecuador, with large, oblong-lanceolate lvs., sheathing at the base, and fls. which individually last only a short time, although a succession is produced for several weeks; sepals 3, oblong, obtuse, concave; petals 3, nearly equal, wider than the sepals, margined with long hairs; staminodes 3, villous, 2 erect, linear, the third short, plumose; staminal column hooded, with incurved margins, inclosing 3 spirally twisted anthers; style slender, curved.—Gardeners recognize 2 species, although they are considered by some botanists as forms of one. Recorded as the most beautiful cult. plants of the family.

These are handsome stove-flowering perennial plants, closely related to the *commelinas*, and are of comparatively easy culture, thriving well in ordinary stove temperature in a mixture of two parts loam and one part fibrous peat, with a little well-decayed cow- or sheep-manure added when potting mature plants. They like a copious supply of water at the roots during the summer months, and at no season must they be allowed to become dry. Propagation is effected by division of the plants in early spring, or by seeds, to obtain which the flowers must be artificially fertilized.—They seed freely when fertilized at the proper time. Only a few of the stronger or larger flowers should be allowed to bear seed. Sometimes a simple shaking of the flower-stalk will accomplish the necessary work of fertilizing, but it is safer to employ the regular method to insure thorough impregnation. The seeds ripen within six weeks' time, and they can be sown soon thereafter, in shallow pans of light, peaty soil, and placed in a warm, close atmosphere until germinated. As soon as the seedlings are large enough, they should be potted singly into thumb-pots, and shifted on as often as they require it, when they will flower in six to twelve months. The chief reason why cochliostemas are grown in America so little is, probably, that it is necessary to keep a much more humid atmosphere in stove-houses than in England, and this is very much against all stove-flowering plants, causing the season of blossoming to be very short. (Edward J. Canning.)

A. *Lvs. red beneath: panicle hairy; fls. very fragrant.*

**odoratissimum**, Lem. Lvs. lighter green above than in *C. Jacobianum*, and deep purplish red beneath, narrower, and with a similar margin: fls. very numerous: sepals more leaf-like, hairy, green, with a reddish tip. I.H. 6:217. R.H. 1869, p. 170.

AA. *Lvs. green beneath: panicle not hairy; fls. less fragrant.*

**Jacobiànum**, C. Koch and Lind. Height 1–3 ft.: lvs. in a rosette, spreading or recurved, dilated and sheathing at the base, margined brown or purplish, 3–4 ft. long, 6 in. broad at the base, 4 in. broad at the middle: peduncles stout, white, tinged purple, 1 ft. long: bracts large, opposite and whorled, 3–4 in. long, acuminate, concave: panicle-branches 4–6 in. long; fls. 2–2½ in. across; sepals purplish; petals violet-blue. Autumn. B.M. 5705. R.H. 1868:71. G.C. 1868:323, desc. F.S. 18:1837–9.

WILHELM MILLER.

**COCHLOSPÉRMUM**: *Mazimilianea*.

**COCKLE**. In North America, a name for *Lychnis Githago*, or corn-cockle, a familiar handsome-flowered weed of wheat-fields. The name is also applied to the darnel, *Lolium temulentum*.

**COCKLE-BUR**: *Xanthium*, a weed.

**COCKSCOMB**: *Celosia*.

**COCKSFOOT GRASS**: Barnyard Grass, *Panicum Crus-Galli*.

**COCOA**: Products of *Theobroma Cacao*.

**COCOA PLUM**: *Chrysobalanus Icaco*.

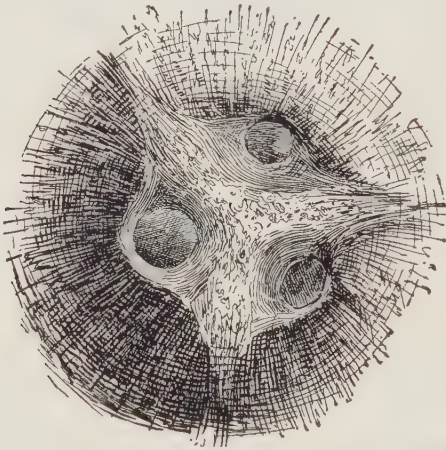
**COCO-GRASS**: *Cyperus rotundus*.

**COCONUT**. Plate XXVII. Figs. 1011, 1012, 1014, 1015. The coconut, *Cocos nucifera*, is the most important of cultivated palms. Its nearest relatives, whether or not regarded as in the same genus, are natives of tropical America. For this and for other reasons which have been presented by Cook, it must be believed that the coconut is a native of America, and that it was carried westward across the Pacific in prehistoric times. While the nut will float and retain its power of germination for a considerable time, its propagation from island to island in known cases has practically always been the deliberate work of men, and it is probable that men were

also responsible for its crossing the Pacific. It was a cultivated plant in Polynesia and Malaya, and in many places the chief crop, at the time of the discovery of this part of the world by Europeans. But it reached Ceylon recently enough so that its introduction is a matter of fairly reliable legend. It is now grown in all tropical countries except the interior of continents. Its cultivation extends somewhat beyond the tropics, both north and south, but its growth at these extremes, in Florida, India and Madagascar, is not thrifty enough to give it any industrial importance. Within the last two decades, the rise in the price of oils and the discovery of new uses for coconut-oil have caused a tremendous increase in the area devoted to the plantation and cultivation of coconuts.

*Climatic conditions favorable for the coconut.*

The coconut makes on the climate the characteristic demands of a typically tropical plant. It thrives where the mean annual temperature is 72° F. or higher, and where there are no great differences in temperature between seasons. Except where supply of ground water



1011. End of a mature coconut. The nut sprouts usually from the largest eye.

makes it independent of local rainfall, the coconut demands an annual rainfall of at least one meter (about 40 in.); and this precipitation should be well distributed through the year. In most of the best coconut countries, the rainfall is considerably more than one meter. The coconut can endure exceedingly drying conditions for short periods, and is accordingly adapted to the intense light of the seashore, to resisting strong winds, and to enduring salt water about its roots for short periods of time. Moreover, it will live through prolonged droughts. But long dry seasons cut down the crops; and the damage done by droughts lasts for as much as two or three years after the return of rain. A dry season of five or six months every other year will keep the crop at all times down to not more than 40 per cent of what it would be if the supply of water were constant. If there is an ample supply of soil-water, dryness of the atmosphere is favorable to the best production. Seacoasts usually have higher land back of them, and the ground-water from the higher country circulates through the soil toward the sea. Near the shore it comes near enough to the surface to be reached by the roots of the coconut. For this reason, coconuts thrive on the seashore under climatic conditions that prevent good development in the interior. This is the principal ground for the idea that coconuts thrive only near the sea. Around the bases of volcanoes in the interior, similar soil conditions are met with, and such localities are admirably adapted to this crop.

*Propagation and cultivation.*

The coconut is produced only by seed. Nuts for this purpose should of course be selected from conspicuously good trees. They are usually planted in seed-beds, although, on a small scale, there are various other local methods of handling them during germination. The best treatment is to take them from the seed-bed when the plumule is not more than 6 inches high, which will usually be after about six months. To avoid the expense of keeping the groves clean while the trees are small, it is common practice to leave the nuts for a longer time in the seed-beds, but the transplanting of older seedlings, even with the greatest practicable care, sets them back for several months. In the Jaffna district of northern Ceylon, the nuts are transplanted from the first seed-beds to others in which they have more room, and are not put in their permanent places until they are three or four years old.

In the first years after the coconuts are transplanted, it is good policy to raise catch-crops between the trees. But these crops should be so chosen that they will not compete with the coconut for light or water; and from the profit they pay, a return should be made to the soil of fertilizers at least sufficient to replace what they have removed. By the time the grove is four years old, the coconuts will shade the ground and it will no longer be possible to raise catch-crops on a large scale. Then, but not before this time, it is good practice to use the grove for pasture. The returns from live-stock should be at least sufficient to pay for keeping the plantation in good condition and cattle will themselves do a large part of the work in keeping down the other vegetation. Pasturing of other live-stock in coconut groves is in general not to be recommended. It is not customary anywhere in the tropics to give to coconut plantations such cultivation as is given to orchards in temperate countries. It has even been believed that any but the most shallow cultivation would be detrimental by destroying the roots near the surface, and that machine-cultivation was likely to be too expensive to be profitable, in view of the time that it would have to be kept up before the coconut begins to pay returns. Limited experience in the Philippines indicates that real cultivation produces very much the same results with coconuts as it does with other crops. Coconuts respond, as do other crops, to the application of manures containing potash, nitrogen, and phosphorus. So far as the very limited evidence shows, the demand for these three fertilizing elements is in the order given. With ordinarily good treatment, coconuts come into bearing in seven or eight years. Single trees of standard varieties will bear fruit in five years, while others will require ten. If the coconut is treated as a wild crop, which is by no means uncommon, and little or no attention is given it after the first three years, it will be ten or fifteen years, as a rule, before a full crop is produced and even then the crop will be an inferior one.

*Pests.*

With the increase in the industry in the tropical world, and with the increase in commerce, there have been created conditions favorable to the development and spread of pests. Twenty years ago, serious coconut pests were practically unknown, and only eight years ago, Prudhomme, in an excellent general treatment of the coconut industry, listed as serious pests only two or three insects and no other organisms. There are now known as serious pests various species of Rhynchophorus, known as palm weevils; *Oryctes*, called the rhinoceros beetle; a scale, *Aspidiotus destructor*, closely related to the San José scale; at least two fungi, and the organisms causing bud-rot. The latter have been determined in the West Indies to be *Bacillus Coli*, and in India to be a fungus, *Pythium palmivorum*. Besides these, there are a large number of minor or local pests, including weevils and other beetles, the



larvæ of moths and butterflies, insects of other groups, and fungi. Damage is also done in places by crustaceans, and by rats and other higher animals. Forests made up of one kind of tree practically do not exist in nature in the tropics; and when such forests are made, as has been done with the coconut, the prevention of devastation by pests will be accomplished only by greater care than is ordinarily demanded to protect the crops of temperate lands.

#### Varieties.

A very large number of varieties of coconuts is known in different parts of the tropics, but a careful comparative study of their merits has never been made on a large scale and with nuts from many different sources. The best experiment began less than a decade ago in Madagascar. In several localities in the Philippines, there are strains of very large nuts, of which, as a plantation average extending over years, 3,300 produce a ton of copra. In favorable seasons the production has been at the rate of a ton from 2,800 nuts. There are reports of similar large nuts from other countries, but no data as to their yield on a plantation scale. In the parts of the Philippines having the greatest coconut industry, it requires 5,600 to 6,000 nuts to produce a ton of copra, and the same figures apply to Ceylon and various other coconut countries. In still other places the nuts are so small that 7,000 are required to the ton. There are varieties characterized by shape and by color, but these characteristics seem not to be related to the yield either of copra or oil. The nuts of the Laccadive and Maldive Islands are reputed to produce a particularly good fiber. Throughout the eastern tropics, coconuts are locally used to produce liquor. For this purpose, early maturing varieties that are likely also to produce very small nuts, but numerous clusters, are selected. There are varieties in Ceylon and the Philippines which bear at the age of four years, while the varieties in extensive cultivation and used for the production of copra can none of them be relied upon to produce a crop in less than seven years and not in less than ten years unless properly treated. A Philippine variety known as Makapunô has the interior of the nuts completely filled with a soft, sweet tissue, used as a table delicacy. Such nuts sell locally for about 10 cents, while the ordinary nut is worth 2 or 3 cents.

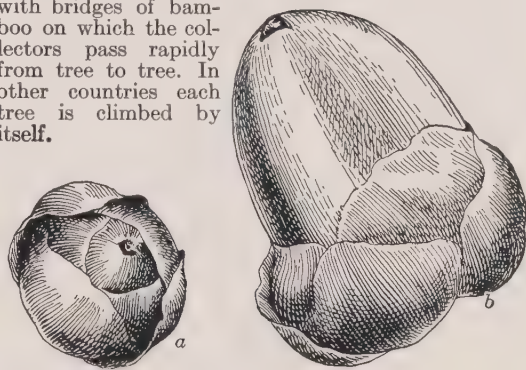
#### Uses and products of the coconut.

The local uses of the coconut are almost unlimited. Besides being of practical utility in a very large number of ways to the people of the Malay-Polynesian region, it has, as a result of its practical importance, acquired a prominent place in the rites and superstitions of the people of this part of the world. Thus Murray tells of a tribe of Papuans, among whom it is not proper for a man to eat a person whom he has killed, this privilege being reserved for his associates; but a man may eat the heart of his own victim if he sits on one coconut and balances himself with his feet on two others while he prepares and devours it.

The products of great industrial importance are toddy and its derivatives, coir, and copra and its products.

*Toddy* is an usual English name of the fresh beverage obtained from the unopen flower-clusters. In the Philippines it is known as "tubâ." The mode of securing it differs somewhat in the three countries in which it is secured on an industrial scale, the Philippines, Java and Ceylon. In all of them, the spathe is bent down gradually and the tip is then cut off. A thin slice is afterward cut off with a sharp knife, usually twice a day. After a few days of this treatment, the irritation results in a flow of sap from the cut surface. This sap falls into a jar or bamboo tube from which it is collected, as a rule twice a day, and a very thin slice is removed from the end at each time of collection.

This continues until the whole inflorescence has been removed by the series of slices. The amount of toddy collected depends on the vigor of the tree, on the weather, and on the skill of the workman. Under fairly favorable conditions, a good workman will secure a quart or more a day from one inflorescence. The technique of this business seems to be better developed in the Philippines than elsewhere, with the result that more toddy is secured in a given time from the tree. The toddy is used as a fresh beverage or as a source of alcohol, or less frequently of sugar, or still more rarely of vinegar; it is also a common source of yeast in the East Indies. The toddy, as it falls from the cut branch, contains about 16 per cent of sucrose. This inverts very rapidly if permitted to do so, and the invert sugar is in turn rapidly fermented to alcohol. In parts of the Philippines, the production of strong liquor in this way is a business of some importance. If sugar is to be produced, care is taken to keep the vessels clean and approximately sterile, and the inversion is often prevented by the use of tanbark from one of the mangroves, usually *Bruguiera*. If alcohol is the product desired, the same bamboo tubes are used over and over without cleaning. In the Philippines it is common practice to connect the trees used for this purpose with bridges of bamboo on which the collectors pass rapidly from tree to tree. In other countries each tree is climbed by itself.



(Nat. size at this stage.)

(Nat. size.)

1012. Stages in the growth of a coconut.

*Coir* is produced for local use in many parts of the world, but as an article of commerce comes chiefly from Ceylon. This fiber was the old staple cordage material of the Polynesian region. As a fiber material, it is conspicuous for its elasticity, being able to stretch 20 or 25 per cent without exceeding the limit of elasticity. It is also remarkable for lightness, for resistance to decay, and for the short length of the individual cells. It is accordingly a valuable fiber for use in ropes subject to abrupt strains, for calking boats, and for a stuffing fiber. Its stiffness and durability make it especially serviceable for the manufacture of mats, and this is its chief commercial use.

*Copra*.—The principal coconut product exported from most producing regions is copra, which is the dried meat or hard endosperm of the fruit. To produce the best copra, nuts should be thoroughly and uniformly ripe, and this condition is best guaranteed by permitting them to ripen on the trees until they fall, and then to collect and use them at frequent intervals. However, it is far more common practice to harvest them before they fall, going through the groves at regular intervals. This is most commonly done every three months. The nuts are cut down in various ways. The simplest method is the use of a long pole made of detachable joints of bamboo and bearing at the top a sharp and recurved knife. A nut-gatherer then goes from tree to tree and cuts down the nuts that are ready, without leaving the ground. This method is the local one used in certain parts of the Philippines.

Elsewhere in the Philippines and in many other places, the practice is to climb each tree, using notches cut at convenient heights for this purpose. If these notches are cut with sufficient care, it probably can be done without real damage to the tree, but in practice such care is not usually taken, and the notches are very often centers from which decay of the trunk begins. In other places the nut-gatherers climb the trees without notches. To do this easily, they usually bind their ankles together with a thong, or pass a rope around the hips and around the tree, or use both of these devices. The old story of the harvesting of coconuts by the use of monkeys is not altogether a myth. In the Sunda islands and in Sarawak, monkeys are sometimes trained for this purpose; and from Sarawak, these trained monkeys are occasionally exported to the Straits settlements. In some of the islands of the south seas, the entire nuts, husk and all, are split into halves with an axe, and in Ceylon a machine for this purpose has come into limited use. Elsewhere, the first step in the preparation of copra is the removal of the husks. This is usually done with the aid of a piece of iron, three cornered and moderately sharp, mounted on an erect stick and standing at about the height of the knee. This implement is in universal use in the Philippines, and elsewhere in the East, and has of late years come into use in the tropics of the New World. A machine to remove the husks has also been invented, but the most that is claimed for it is that a workman can husk a thousand nuts a day, and this is only the standard day's work for a nut-husker in the Philippines by the old method. After the removal of the husk, the nut is split into two halves by a sharp blow with a heavy knife. The water is allowed to run out on the ground.—Methods of drying copra fall under three heads: sun-drying, grill-drying, and kiln-drying. Centrifugal dryers have also been tried and are said to give good results. Sun-drying is the oldest method, and is a good one where the climate is such that the drying can be trusted to go on without interruption. Under favorable conditions it produces the finest grade of copra, Cochin sun-dried being the standard of excellence. Most Philippine copra is grill-dried. A hole is dug in the ground on which is placed a grating usually made of bamboo, and the whole protected by a roof. Coconut husks and shells are used for fuel. The heat and smoke rise directly from the fire to the coconuts. Sun-drying takes usually five to nine days; if more than this is required, the method is unsafe. Smoke-drying is finished as a rule in a single day or in parts of two days. Smoke-dried copra is unsuited for the manufacture of food products and accordingly sells at a lower price than the best copra. It is a good way of making poor copra; for if any copra is imperfectly dried or is even in part the product of unripe nuts, it ferments with a considerable loss of oil, and this fermentation is decidedly checked by smoking. Kilns for drying coconuts are of various patterns in different countries, and if properly handled always produce a high grade of copra. There is one kiln in the Philippines which handles more than three tons of copra at a charge, and dries it in six or eight hours. By all methods, it is customary to make two stages of the drying, one immediately after the nuts are opened, and the other after the meat has shrunk enough to be easily removed from the shells. The ultimate use of copra is the manufacture of oil, an industry which has been developed to the greatest extent in France. In all coconut countries there is a local business in manufacturing oil. This is done by various primitive methods, some of which produce a food or toilet product of the highest possible quality. In the manufacture of such oil, the utmost care is taken and the product is of purely local use. Oil for wider distribution is manufactured with less care, by methods characteristic of the different countries. To prepare oil for world com-

merce, such establishments as have long been used in European countries, and to a less extent in the United States, have more recently been founded in the producing lands. The oil has a variety of uses. It was formerly consumed almost entirely in the manufacture of soap and candles. Principally during the last decade, methods of refining and separation have been developed, by which excellent butter-substitutes are made. As the butter produced in this way is palatable and most digestible, and is cheaper than real butter, these products have found a ready sale, with the result that there has been a great increase in the demand for good grades of copra and a consequent improvement in the general quality produced in most countries, and an increase in the price of all grades. It seems probable that the market will for some time continue to increase more rapidly than the supply.

*Other products.*—A well-known product is desiccated coconut. Among producing countries, Ceylon is the only one which has taken up the manufacture of this article. It is prepared directly from the fresh meat of ripe nuts. Very large numbers of coconuts are also put upon the market of temperate countries as "coconuts," usually after the removal of the husk. The United States is the chief market for these nuts and the export of them is accordingly a conspicuous feature of the business in lands situated where delivery in the United States is economically possible, that is in the West Indies and to a much less extent in the islands of the Pacific. An exportation of this kind is also assuming large proportions with Australia as a market. For all kinds of coconut produce, Ceylon long held first place and the business of producing coconuts, copra and oil, as well as coir, and desiccated coconut, has reached a better development in Ceylon than anywhere else. However, during the last few years, the Philippines have far outstripped Ceylon in the production of copra. The export from the Philippines in the year ending June 30, 1912, was more than 160,000 tons. In this year, copra was for the first time the foremost export of the islands, taking from abacá the place which it has held almost without interruption for the last fifty years.

E. B. COPELAND.

**CÔCOS** (Portuguese, *monkey*, from the nut, which suggests a monkey's face). *Palmaceæ*. This genus includes the coconut tree, *C. nucifera*, and a few pinnate palms cultivated for ornament in the North under glass, and in southern Florida and southern California as avenue and ornamental trees. See page 3567.

Low or tall palms, with slender or robust ringed spineless trunks, often clothed with the bases of the lvs.: lvs. terminal, pinnatisect; segms. ensiform or lanceolate, equidistant or in groups, 1- to many-nerved, entire at the apex, or with 1 lateral tooth, or more or less deeply lobed, the margins smooth, recurved at the base; rachis 3-sided, acute above, convex on the back; petiole concave above, smooth or spiny on the margins; sheath short, open, fibrous: spadices erect, at length drooping, the branches erect or drooping; spathes 2, the lower one the shorter, split at the apex, the upper one fusiform or clavate, woody, furrowed on the back; bracts variable; fls. white or yellow: fr. large or medium, ovoid or ellipsoidal, terete or obtusely 3-angled, often fibrous-coated as in the coconut.—Species 56 in Trop. and Subtrop. S. Amer., 1 in the tropics around the world. The genus is allied to Maximiliana and Attalea, and distinguished by its male fls. having lanceolate petals, 6 included stamens, and a 1-seeded fr. G.C. II. 23: 439.

The coconut is the example most commonly cited of dispersal of seeds by water. Its buoyant, impervious husk is said to enable it to cross an ocean without losing its germinating power. Its structure is interesting and at first puzzling. Although it is a dry, indehiscent, one-seeded fruit, it seems very unlike an achene, as



for example, in the Compositæ. Structurally, it is more like a drupe, for the fibrous husk is formed from the outer part of the pericarp, and the hard shell inclosing the meat from the inner. In other words the husk is exocarp and the shell endocarp. The milk of the coconut is unsolidified endosperm. In the cereal grains it is the endosperm which affords most of the material used for human food. Only a part of the liquid matter of the coconut solidifies, and the milk is left in the center. The eyes of the coconut (Fig. 1011) mark the positions of the micropyles, and germination takes place only through the larger one. Palm pistils are three-carpelled and each carpel in Cocos has one ovule. The marks of the three carpels are seen in Fig. 1011, but only one ovule develops into a seed. Fig. 1012 tells the story of the growth of a coconut. In *a*, the young nut is enveloped by three petals and three sepals. At *b*, the pericarp has far outgrown the sepals and petals. Sometimes the floral envelopes remain when the nut is picked. Coconuts, like many other fruits, often grow to a considerable size without pollination, and then perish.

Of the species cultivated for ornament, *C. Weddelliana* is by far the most important. It is sold in great quantities from 3- and 4-inch pots when the plants are 12 to 15 inches high. They are favorite house-plants, as their culture is easy, and they grow slowly and retain their beauty a long while. They are much used in fern-dishes. As a house-plant, *C. Weddelliana* is probably the most popular species of all the smaller palms. It is especially suitable for table-decoration. In distinguishing tropical from subtropical regions, the coconut is an excellent guide. It flourishes best where frost is never known, although there are magnificent specimens at Miami and Palm Beach, Florida, both places having rare but sharp frosts. The oil extracted from the nuts is an important article of commerce. The fiber refuse is much used by florists and gardeners. Being open, spongy, very retentive of moisture, clean and easily handled, it is a favorite material in which to root bedding-plants and to start very small seeds; but it is not used for permanent potting. See U. S. Dept. Agric., Bull. of Div. of Ent. (new series) 38:20-3, for a report of diseased coconuts. For culture of Cocos under glass, see *Palms*.

*Cocos in Florida*.—The species of the *C. australis* group (as known in the trade) are dry-land palms, the best and most beautiful palms adapted to poor sandy soils in Florida. In moist and rich ground they are subject to diseases, particularly to blight. On dry land, they thrive with great vigor, and although slow growers, they are strikingly beautiful specimens when only a few years old. They look best in groups of five or even a dozen planted together (about 12 to 15 feet apart). After they have formed trunks 5 to 10 feet high they are very impressive, particularly when the background consists of tall bamboos or dark evergreens such as *Magnolia grandiflora* or live-oaks. All the species of this group have leaves more or less glaucous, silvery white or bluish green. The leaflets are often very hard to the touch—very rigid. The petiole at its base is provided with short blunt spines. The roots are brown and quite numerous, but the root-system is very shallow, the trunks do not rest deep in the ground as is the case with the *Sabal* and *Phoenix* species, and for this reason they are easily blown over or they acquire a leaning disposition. In planting these palms, they should be set in a saucer-like cavity, which can be filled up gradually. Both young and old plants are easily transplanted in November and December, but it is always advisable to plant only young specimens. Few palms require so little care and fertilizer as these Cocos species. A good application of stable manure as a mulch when the rainy season begins helps them along wonderfully, or they may be fertilized with a combination consisting of equal parts of ammonia, phosphoric acid and potash. The flowers are always inclosed

in a club-like spathe varying in size from a large walking-stick to a baseball club. These spathes burst open with a crack and reveal the much-branched flower-spike, varying in color from a creamy white, yellowish, lavender-crimson to a deep violet. The fruits also vary in size and color. Some of them are not larger than a large pea, others as large as a plum, some are yellowish and others orange and red in color. (H. Nehrling.)

*Cocos in California*.—After passing through a severe test during the first week in January of the year 1913, the several species of Cocos palms are in a condition in which one may safely judge of their comparative hardiness. In the Cocos palms found in local gardens are two very distinct groups. These two groups may each contain but one species having several varie-



1013. *Cocos Weddelliana*.

ties, or they may consist of several species as they are known "in the trade," and it is upon the latter basis they are here dealt with. (1) The dwarf group is commonly and widely represented by the one known as *C. australis* and the other and less-known kinds are catalogued as *C. Alphonssi*, *C. Bonnetii*, *C. campestris*, *C. Gaertneri*, and *C. Yatai*. Occasionally two others, *C. odorata* and *C. pulposa*, are listed. All those named are quite hardy and may safely be planted from Los Angeles to San Francisco without fear of losing them through freezing, though in places some may get "scorched" while young. With age all become quite hardy. (2) To a taller and more striking group, belong those of which *C. plumosa* is the best known and, unfortunately, most widely planted type. These are *C. botryophora*, *C. coronata*, *C. Datil*, *C. flexuosa*, *C. plumosa*, and *C. Romanzoffiana*. Of these six four have proved quite tender and three quite hardy, the latter lot resistant to at least a half-dozen degrees more of cold than the former. The tender ones are: *C. botryophora*, *C. coronata*, *C. plumosa*, and *C. Romanzoffiana*. Those proving hardy over all of southern California in 1913 were *C. Datil* and *C. flexuosa*, the latter the

only one at all common. To these may be added the true *C. australis*, not known here in the trade at all, a tall-growing species, and not the dwarf one commonly sold under this name. J. Harrison Wright, of Riverside, has grown this novel species and assures the writer of its hardiness in his garden where *C. plumosa* succumbs in comparatively mild winters. These notes are based upon a close study of these species and varieties as observed during the past few winters in the gardens of Los Angeles and Pasadena in Southern California. (Ernest Braunton.)

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## A. Filaments present on the rachis.

1. *eriospatha*, Mart. St. 9–15 ft. high, 10–14 in. thick, capitately thickened with the persistent bases of the petioles: lvs. ample, glaucous, finely pectinate; margins of the rachis with excurrent filaments; segms. about 1 in. apart, the lower elongated, linear, 20–24 in. long, very long-acuminate, the upper narrowly linear, short, attenuate, 1 ft. long, 2 lines wide, all rigid, faintly nervose-striate: spadix thick, branched but very compact. S. Brazil.—“The hardest of the genus and one of the hardest palms in S. Calif. Fronds bluish: fr. pulp tastes like apricots.”—F. Franceschi, Santa Barbara. Some of the *C. australis* of the trade may belong here.

## AA. Filaments absent.

## B. Rachis abruptly contracted above the insertion of the lowest lfts.

2. *flexuosa*, Mart. St. 9–12 ft. high, 2–3½ in. diam., arcuate-ascending, naked just above the base, thence densely clothed with dead petiole bases: lvs. lax, 3–6 ft. long; petiole flat above, arcuate, at first tomentose, later smooth; rachis abruptly narrowed above the insertion of the lowest lf.-segm., thence linear-filiform at the apex, excurrent; segms. 70–90 on each side, rigid in opposite groups, the middle 10–14 in. long, ½ in. wide, the upper 4 in. long, ¼ in. wide; spadix long-peduncled and rather loose. Brazil.—Cult. in northern greenhouses. Similar in habit to *S. plumosa*, but with more finely cut lvs., and in S. Eu. considered to stand more frost. Probably the *C. flexuosa* planted in this country is not the true species *C. flexuosa* of Martius, but of Hort., a hardy form of *C. Romanzoffiana*, Cham., which latter according to the late Barbosa-Rodriguez is a polymorphic species including, besides this *flexuosa* type, all our garden forms known as *C. plumosa*, Hook., *C. coronata*, Hort., not Mart., *C. botryophora*, Hort., *C. Datil*, Griseb. & Drude, and *C. australis*, Mart. The foregoing description has been drawn from Martius and not from cult. specimens. The true *C. flexuosa* of Martius is a slender-stemmed palm from tropical Brazil.

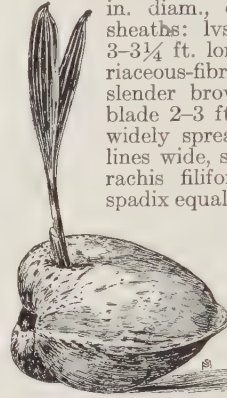
The true *C. australis* of Martius is native in Paraguay; it is like *C. plumosa* in appearance but hardier.

## BB. Rachis not abruptly contracted.

## c. Lfts. flaccid.

## D. Arrangement of lfts. equidistant.

3. *Weddelliana*, Wendl. (*Glazioua Martiana*, Glaz., to which genus Martius considers the species to belong). Fig. 1013. St. 4–7 ft. high, 1¼ in. diam., densely covered with persistent sheaths: lvs. equally pectinate-pinnatisect, 3–3¼ ft. long; petiole 8–20 in.; sheath coriaceous-fibrous, glabrous or tomentose, with slender brown hairs, at length evanescent; blade 2–3 ft.; segms. about 50 on each side, widely spreading, the middle 5 in. long, 2 lines wide, subequidistant, glaucous beneath; rachis filiform at the apex, brown-scaly: spadix equaling the lvs., stiff and erect. Trop. Brazil. R.H. 1879, p. 434. I.H. 22:220. A.G. 16:345.—The most important of small ornamental palms for the N.



1014. Coconut germinating.

## DD. Arrangement of lfts. in groups of 2–4.

4. *plumosa*, Hook. St. 30–36 ft. high, 10–12 in. thick, ringed at intervals of a foot, clothed near the apex with remnants of the dead petioles: lvs. erect-spreading, 12–15 ft. long, recurving; petiole a third to half as long as the blade; segms. linear-acuminate, sparse, solitary or mostly in groups of 2–4, 1½ ft. long, deflexed near the apex: spadix usually 3 ft. long and much branched, the branchlets pendular. Cent. Brazil. B.M. 5180.—The chief avenue palm of the genus. A quick grower, ultimately 50 ft. high in S. Fla. and Calif. The slender smooth boles and heads of graceful recurving lvs. make this a very attractive tree.

## cc. Lfts. rigid.

## D. Form of lfts. sword-shaped.

5. *butyracea*, Linn. Sts. very tall, naked: lvs. pinnate; lfts. simple: spathe cylindrical-oblong, 4–6 ft.; spadix as long as the spathe, 4–6 ft.; branches of the spadix about 1 ft., thickly clustered and somewhat pendulous. Venezuela.—Rare and perhaps confused with *Scheelea butyracea*. Little known, although long ago described.

6. *Romanzoffiana*, Cham. Sts. 30–40 ft. high, somewhat fusiform above: lvs. about half as long as the caudex, the withered ones deflexed, pendent, the upper spreading, often arching; segms. conduplicate at the base, ensiform: spadix about 6 ft. long, at first inclosed in a stout pendulous spathe which appears among the lowest lvs. S. Brazil near the sea; according to recent characterizations, it comprises a wide variety of forms, as explained under No. 2.



1015. Coconuts.



DD. *Form of lfts. linear: apex obtuse: petiole glaucous.*

7. *austrâlis*, Mart. PINO PALM. Height about 30 ft.: st. erect, columnar, equal, strongly annular above: lvs. 9-12 ft. long, the sheath fibrous and glabrous; petiole naked; segms. linear, glaucous, rather rigid: fr. as large as a pigeon's egg, outer pulp sweet, edible, seed oily. Paraguay. G.C. III. 18:739. A.F. 5:515; 7:805. R.H. 1876, p. 155.—A good grower. Cult. under glass and outdoors in Fla. and Calif.

8. *nucifera*, Linn. COCO PALM. COCONUT TREE. Figs. 1014 (adapted from Cook), 1015. Caudex 40-100 ft. high, flexuous, thickened at the base: lvs. 12-18 ft. long; lfts. linear-lanceolate, 2-3 ft., coriaceous, flaccid; petiole 3-5 ft., stout. Seashores within the tropics and at Miami and Palm Beach, Fla. Indigenous to Cocos or Keeling Isls. of the Indian Ocean, but recently thought to be native of Trop. Amer. See O. F. Cook, Contr. U. S. Nat. Herb., 7:257-93 (1901); 14:271-342 (1910). R.H. 1895, p. 457. Mn. 2:171. G.F. 7:15.—Produces the coconuts of commerce. Var. *aûrea*, Hort., is a form remarkable for its orange-yellow sheaths, petioles and midribs." It is known in cult. only in England.

DDD. *Form of lfts. narrowly lanceolate.*

E. *Lvs. long, 6-15 ft. in mature specimens.*

F. *Petiole spinose-serrate: segms. of lf. less numerous.*

9. *Yatây*, Mart. St. 12-15 ft. high, over 1 ft. diam., naked below, covered with dead sheaths above: lvs. recurved, spreading 6-9 ft.; sheath 1 ft. long, fibrous at the mouth; petiole 1½ ft. long, spinose-serrate, the spines increasing in length towards the lower end of petiole; segms. 50-60 on a side, crowded below, then equidistant, linear-lanceolate, the uppermost long-setaceous filiform, the middle ones 2½ ft. long, 2-5 in. wide, the upper 20 in. long, ¼ in. wide, all rigid, glaucous beneath: spadix about 4½ ft. long with at least 150 branches. Brazil, Argentina.

FF. *Petiole not spinose-serrate: segms. of lf. very numerous.*

10. *Dâtîl*, Drude & Griseb. St. 30 ft. high, 8-12 in. diam.: lvs. 12-15 ft. long; sheath about 16 in. long; petiole 1½ ft. long, 1½ in. wide, ½ in. thick; segms. linear-acuminate, glaucous, densely crowded in groups of 3 or 4, 150-160 on each side, the lowest 2 ft., middle 2½ ft. and apical 1 ft., the uppermost filiform, all narrow, stiff and rigid, the dried lvs. glaucous green or whitish: spadix 3-3½ ft. long with at least 300 spirally twisted branches. Argentina; isls. and river banks.—The frs. are edible, resembling those of the date palm. Hardier in S. Calif. than *C. plumosa*, *C. flexuosa*, and *C. Romanzoffiana*.

11. *coronâta*, Hort., not Mart. Trunk at length 18-30 ft. high, 8 in. diam., erect, deeply ringed: lvs. erect-spreading, 6-9 ft. long, short-petioled, arranged in a close, 5-ranked spiral, the long-persistent bases of the petioles forming a spiral-twisted column below the crown; lf.-segms. in groups of 2 or 3, folded together from the base (conduplicate), linear-lanceolate, coriaceous, densely crowded, about 100 on each side; midrib 4-sided below, 3-sided above: spadix about 2½-3 ft. with not more than 60 branches. Brazil.

EE. *Lvs. shorter, 3-4½ ft. in mature specimens.*

F. *Apex of lfts. obtuse.*

12. *campêstris*, Mart. St. 8-10 ft. high, thickened, scaly: lvs. spreading-recurved, rigid, 3-4½ ft. long; rachis elevated, triangular above, convex below; segms. narrowly lanceolate, 30-40 on each side, obtuse at the apex and shortly cordate-acuminate: spadix about 2½ ft. long, with 10-14 branches. Brazil.—Hardier than *C. nucifera*, but scarcely known in cult. in N. Amer. Perhaps hardly as far north as N. C.

FF. *Apex of lfts. acuminate.*

13. *insignis*, Mart. (*Glaziôva insignis*, Hort.). St. 3-6 ft. high, 1½ in. diam.: lvs. 4½-6 ft. long; sheath densely brown-lanate; petiole shorter than or equaling the sheath, a fourth or fifth as long as the rachis; segms. equidistant, 50 on each side, narrowly lanceolate, obliquely acuminate and caudate, silvery glaucous beneath: spadix about 3 ft. long, with about 50 branches. Brazil.

The following are trade names of rare or botanically little-known plants not sufficiently described: *C. Alphônsei*.—*C. Arechavaletana*, Barb., is described as somewhat like *C. Romanzoffiana* but taller and making larger crowns. It is a native of Uruguay.—*C. Blumen-dvi*=*C. eriospatha*.—*C. Bonnetii*.—*C. Gärtneri*=(?).—*C. Geriva*, Hort. G.C. III. 27:293 figures *C. Geriva*, a remarkable *Cocos* (?) with 4 branches. Nothing further is known of this plant. It may be *C. Geriba*, Rodr.=*C. botryophora*, Mart.—*C. Maximiliana*, Hort.=(?).—*C. odorata*, Rodr. St. short: lfts. in 3's or 5's, linear-lanceolate; petioles spiny: fr. yellowish green or pink, pulp scented. Brazil. R.H. 1893, p. 345.—*C. pulposa*, is supposed to be very like *C. eriospatha*. This species is scarcely known in this country.—*C. Yurumajnas*=(?).

N. TAYLOR.†

**CODIÆUM** (probably from Greek for *head*, the colored leaves being used for crowning-wreaths, or from the Malayan name). *Euphorbiaceæ*. CROTON. VARIEGATED LAUREL. Tropical shrubs or trees grown for the variegated and interesting foliage, as greenhouse plants or for summer bedding outdoors.

Leaves alternate, simple, somewhat thick and leathery, pinnately veined, glabrous: juice somewhat milky: fls. monœcious, in slender axillary racemes; staminate fls. with petals, calyx imbricate, stamens 20-30, erect in the bud; pistillate fls. apetalous, ovary 3-celled, 3-ovuled.—Six species of Malaya and Pacific Isls., not closely related to any other commonly cult. *Euphorbiaceæ*. Differs from the true crotons in the erect stamens, glabrous foliage and more or less milky juice.

The almost endless variety of codieums (or crotons of gardens) are probably all from one botanical species, greatly varied by selection and crossing. Although a great many of these bear Latin binomials they intergrade so that it is often difficult to separate them or to make a reliable classification; however, they may be grouped conveniently as below. Totally different leaf forms and color variations often appear on the same plant. The latest botanical treatment is by Pax in *Das Pflanzenreich*, hft. 47, and is followed in this article.

The crotons are prized chiefly for the varied and brilliant markings of the leaves. The young leaves are usually green and yellow, changing later to red, although in some the markings remain yellow or with red only in the petiole. They are usually kept not over 2 to 3 feet high, but if given opportunity will grow into considerable trees in the greenhouse. They are good subjects for massing in the open and develop most brilliant colors in our bright hot summers; however, they will not stand frost.

Codieums (or crotons, as they are popularly known in America) are beautiful plants with many forms of handsome and odd foliage of the most brilliant coloring. The colors range from almost pure white to light and deep yellow, orange, pink, red and crimson, in the most charming combinations. In some cases one color predominates, as in *Carrièrei* (yellow), *Czar Alexander III.* (crimson), *Hawkeri* (light yellow). These varieties of distinct coloring make beautiful specimen plants for jardinières; and their beauty is enhanced when used in jardinières of appropriate color. As exhibition plants they are very effective, and may be grown to specimens 5 or 6 feet high, or even larger. In smaller sizes, codieums are much used as table plants, for which purpose well-colored tops are rooted and grown on until they are from 12 to 15 inches high. The narrow-leaved varieties are most used for this purpose. Codieums are very attractive in vases and window-boxes and for mantel and table decorations. They are also

very valuable as bedding plants. Planted in clumps or masses, the effect of the combination of rich colors is charming. They should be planted in any good, rich, not too heavy soil, and regularly syringed to keep down red spider. They color best when fully exposed to the sun, and should not be planted out until about the 10th of June in the neighborhood of New York and Philadelphia. If something is needed to make the beds look attractive early in the season, it is a good plan to plant pansies in April, to remain until it is time to plant the codieums. Some of the tender varieties, such as Reedii, albicans, and a few others, are inclined to burn in the extremely hot weather, but nearly all the sorts do well bedded out. Among the very best for this purpose are Queen Victoria, Dayspring, Baron Rothschild, Andreanum, Lady Zetland, Carrièrei, Barryi, Hawkeri, fasciatum, anietumense.—The house culture of codieums is very simple. It is neces-



1016. *Codiæum variegatum* Baronne de Rothschild.  
(An example of form *platyphyllum*.)

sary that a night temperature be maintained of 70° to 75°, and that the air be kept moist by frequent syringings. Cuttings of half-ripened wood may be easily rooted at any time from October until June, a bottom heat of 80° being just what they need. When very fine specimens are desired, root strong and shapely tops by making an incision in the stem and tying moss around the wounded part; it will be rooted ready to pot in about three weeks. By this method all the foliage may be retained, and a perfect plant will result. The more light the plant receives, the better will be the color; but with some kinds of glass it is necessary to shade lightly to prevent burning of the leaves. They may be grown finely in a house glazed with ground glass, which admits the light and does not require shading. It is well to syringe two or three times a week with tobacco water, to kill mealy bug and red spider. Little's Antipest, or any emulsion of coal-oil, is a good insecticide for codieums. New varieties from seed, the result of crossing existing sorts, are continually being raised. Seed ripens freely under glass in North America, and there is no doubt that the list of about eighty choice varieties now in cultivation will be largely added to in the near future. (Robert Craig.)

*variegatum*, Blume, var. *pictum*, Muell. Arg. (*C. medium*, Baill. *C. variegatum* var. *genuinum*,

Muell. Arg., in part. *C. pictum*, Hook. *Crôton variegatus*, Linn. *Crôton pictus*, Lodd. *Phyllaurea Codiæum*, Lour.). Lvs. ovate to linear, marked with various colors, entire or lobed.—Cult. throughout the Old World tropics as well as in Eu. and Amer. The wild form with green lvs. is var. *molluccanum*, Muell. Arg. (*C. molluccanum*, Decne.). B.M. 3051. L.B.C. 9:870.

A. *Foliage plane or recurved, entire, not appendiculate.*  
B. *Lvs. 2-3, rarely 4 times as long as broad, usually broadest above the middle. Form platyphyllum, Pax.*

c. *The lvs. with practically no red coloration.*

Hort. vars.: *aureo-maculatum*, *aureo-marmoratum*, Baron Frank Seilliere, Barryi, Bergmanii, Bruce Findlay, Carrièrei, Delight, Exquisite, fasciatum, fucatum, Golden Queen, grande, Hawkeri, Henryanum, Hookeri, invictum, Jamesii, lacteum, magnolifolium, maximum, medium variegatum, Orvilla, ovalifolium, Princess Waldeck, superbien, tournfordensis, Truffautii.

cc. *The lvs., at least when older, red colored.*

Hort. vars.: *Andreanum*, *acubæfolium*, *Austinianum*, Baronne James de Rothschild (Fig. 1016), B. Compte, Beauty, Dayspring, Dormannianum, Hilleaum, Le Tzar, Magnificent, Marquis de Guadiaro, Me. Lucien Linden, Mortii, Mrs. Icton, Nestor, Newmannii, Pennincki, pictum, Pilgrimii, Prince Henry, recurvifolium, Reidii, Regina, roseo-pictum, Stewartii, Williamsii.

ccc. *The lvs. broad, color not specified.*

Hort. vars.: *Compte de Germiny*, d'Haenei, Dr. Friedenthal, Henderonii, Kreutzanum, Makoyanum, marmoratum, Prince Royal, Sanderi, Seemannii, Sinai, Stroemer, verum, Watsonii.

BB. *Lvs. lanceolate to narrowly lanceolate, 5 or more times as long as wide. Form ambiguum, Pax.*

c. *The lvs. with practically no red coloration.*

Hort. vars.: *albo-lineatum*, *angustissimum*, *anietumense*, *bellulum*, *Burtonii*, *concinnum*, *Countess*, *Crown Prince*, *Davisii*, *Duvallii*, *eburneum*, *elongatum*, *eminens*, *Goednoughtii*, *irregulare*, *latimaculatum*, *maculatum*, *Monarch*, *Mooreanum*, *Mrs. Swan*, *volutum*, *Weismanii*, *Wilsonii*.

cc. *The lvs., at least when older, red-colored.*

Hort. vars.: *albicans*, *amabile*, *Broomfieldii*, *Challengerii*, *Chantrieri*, *chrysophyllum*, *Cooperi*, *Drouetii*, *Duvivieri*, *Flamingo*, *Hanburyanum*, *imperiale*, *inimitabile*, *insigne*, *Jubilee*, *Lady Zetland*, *lancifolium*, *Macfarlanei*, *magnificum*, *Massangeanum*, *multicolor*, *musaicum*, *Neவில்*, *princeps*, *Queen Victoria*, *recurvatum*, *Sunshine*, *triumphans*, *triumphans* *Harwoodianum*, *Vervæti*, *Victory*, *Veitchii*, *Youngii*.

ccc. *The lvs. medium width, lanceolate, color not specified.*

Hort. vars.: *Boucheanum*, *Eckhautei*, *Eclipse*, *Excelenz*, *Flambeau*, *Gaerdtii*, *Grusonii*, *Imperator*, *Leopoldii*, *Margarete Daniel*, *marginatum*, *neriifolium*, *Oberstleutnant Brode*, *Ohlendorffii*, *Pres. Chereau*, *Said Pascha*, *Spindlerianum*, *splendidum*, *undulatum*.

BBB. *Lvs. linear, 1 cm. (2/3 in.) or less broad. Form teniosum, Muell. Arg.*

c. *The lvs. with practically no red coloration.*

Hort. vars.: *aigburthiense*, *aureo-punctatum*, *Dodgsonæ* (in part), *elegantissimum*, *Elvira*, *gloriosum*, *Hermion*, *Johannis*, *Phillipsii*, *superbum*, *Van Oosterzeei*.

cc. *The lvs. with red color, at least when old.*

Hort. vars.: *Bragæanum*, *elegans*, *majesticum*, *Mrs. Dorman*, *nobile*, *Princess of Wales*, *Rodeckianum*, *ruberrimum*, *septræ*.

ccc. *The lvs. narrow linear, color not specified.*

Hort. vars.: *Donai*, *Fascination*, *Grayii*, *Klissingii*, *lineare*, *pendulinum*.



AA. *Foliage lobed, or with margin crisped or spirally twisted, or with a hair-like or lf.-like apical appendage.*

B. *Lvs. entire, with margin crisped, or the whole lf. spirally twisted, without appendage. Form crispum, Muell. Arg.*

Hort. vars.: *caudatum tortile*, *Chelsonii*, *Cronstadii*, *Elysian*, *Eyrei*, *Katharina*, *Madam Seilliere*, *Rex*, *spirale* (in part) (Fig. 1019), *Warrenii*.

BB. *Lvs. more or less 3-lobed, at least constricted in the middle (panduriform). Form lobatum, Pax.*

c. *The lvs. panduriform or indistinctly lobed.*

Hort. vars.: *Bismarckii*, *irregulare*, *lyratum*, *monti-fontainense*, *multicolor*, *Princess Matilda*, *Russelii*, *Thomsonii*.

cc. *The lvs. distinctly 3-lobed.*

Hort. vars.: *Craigii*, *Disraeli*, *Evansianum*, *Fred Sander*, *Goldie*, *hastiferum*, *illustre*, *Lord Derby*, *maculatum Katonii*, *trilobum*.

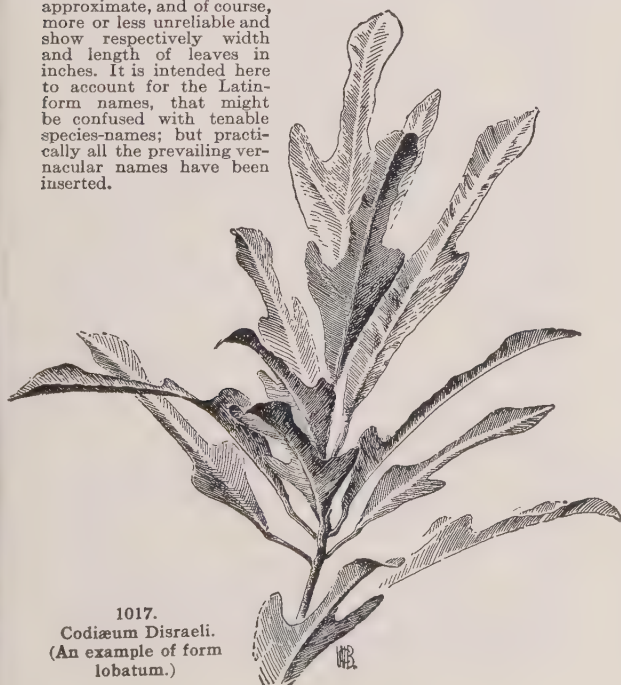
BBB. *Lvs. entire or nearly so, the midrib projecting, usually below the apex, as a horn-like appendage. Form cornutum, André.*

Hort. vars.: *appendiculatum*, *chrysophyllum* (in part), *cornutum*, *excurrens*, *Mrs. McLeod*, *paradoxum*, *Prince of Wales*, *spirale* (Fig. 1019).

BBBB. *Lvs. constricted to the midrib, or with the apically projecting midrib, bearing a second or even third plane, or cucullate, lamina. Form appendiculatum, Celak.*

Hort. vars.: *Dodgsonæ*, *interruptum* (Fig. 1018), *elegans*, *irregulare*, *Laingii*, *Mrs. McLeod* (in part), *multiforme*, *mutabile*, *picturatum*, *Rodeckianum* (in part), *Sintizianum*.

The following varieties are in the American trade or frequently cultivated in this country. A great many variations in spelling of names occur, chiefly due to different terminations to agree with either *Croton* or *Codiaeum*. Such slightly different forms of names have been omitted. The brief descriptive phrases do not include the more important characters given in the above classification. When yellow and red are both mentioned, the foliage is generally at first yellow-marked and later the yellow changing to red with ground-color green or dark red-green. The measurements are approximate, and of course, more or less unreliable and show respectively width and length of leaves in inches. It is intended here to account for the Latin-form names, that might be confused with tenable species-names; but practically all the prevailing vernacular names have been inserted.



1017.  
*Codiaum Disraeli*.  
(An example of form  
lobatum.)

*Aigberth Gem* (= following?).  
*Aigburthiense*. Yellow midrib and spots,  $\frac{1}{2} \times 11$ . A.F. 16:255 Gng. 9:19.  
*Albicans*. White variegated, crimson beneath,  $3 \times 18$ .  
*Albo-lineatum*. Yellow center changing to white,  $1 \times 12$ . A.F. 16:255. Gng. 9:19.  
*Amabile* ("often called *variabile*"). Lvs. often distorted and curved to one side, variegated with yellow and two distinct shades of green and red,  $1 \frac{1}{2} \times 11$ .  
*Andreanum*. Yellow to red veins,  $2 \frac{1}{2} \times 9$ . I.H. 22:201. A.F. 23:241. Gng. 13:81. R.H. 1876, p. 234.



1018. *Codiaum interruptum*.  
(An example of form *appendiculatum*.)

*Angustissimum* (*Angustifolium*). Yellow margin and ribs,  $\frac{1}{4} \times 15$ . G.C. 1871:612.  
*Anietumense*. Yellow midrib and cross veins,  $1 \times 11$ .  
*Aucubafolium*. Yellow, red-blotched,  $2 \frac{1}{2} \times 8$ . I.H. 19, p. 327.  
*Aureo-maculatum*. Yellow-spotted,  $1 \frac{1}{2} \times 3 \frac{1}{2}$ .  
*Aureum*. Yellow-marked.  
*Baron Adolph Seilliere*. Lvs. large, veins pale yellow, soon white.  
*Baronne James de Rothschild* (Baron Rothschild, etc., Baron A. de Rothschild (?)). Fig. 1016. Yellow, red veins, etc.,  $2 \frac{1}{2} \times 7$ . A.F. 23:242. R.H. 1879:450; 1898:180. F.E. 18:379. I.H. 26:365.  
*Barryi*. Yellow, changing to white, midrib, veins and dots,  $2 \times 7$ .  
*B. Comple*. Large, yellow, red blotches,  $2 \frac{1}{2} \times 7$ .  
*Beauty*. Yellow to pink center, margin and mottling, ovate,  $2 \times 6$ .  
*Bergmanii*. Cream-yellow with green blotches. I.H. 27:389.  
*Broomfieldii*. Various yellow marks, midrib red-tinted,  $2 \times 10$ .  
*Burtonii*. Yellow mottled, lanceolate,  $3 \times 15$ .  
*Cartierei*. Margin, midrib, dots and some veins yellow, oblong,  $1 \frac{1}{2} \times 11$ . I.H. 27, p. 90, desc.  
*Caudatum tortile*. Yellow variegated with some red, long, narrow, spiral lvs. R.B. 35:240. Gn. 11, p. 83. Gt. 33:9.  
*Challenger* (*Challengerii?*, *Imperator?*). Midribs creamy white changing to red.  
*Chelsonii*. Yellow, red midrib and mottling,  $\frac{3}{8} \times 10$ . A.F. 16:255. Gng. 9:19.  
*Chrysophyllum* (perhaps two vars. under this name). Irregular, large, yellow, red blotch,  $2 \times 12$ .  
*Compte de Germiny*. Lvs. broad.  
*Cooperi*. Yellow, red center and spots,  $\frac{3}{4} \times 10$ . Gn. 10, p. 139.  
*Cornutum*. Yellow midrib and dots, often wavy, spiral or even lobed,  $\frac{3}{4} \times 4$ . I.H. 19, p. 188.  
*Countess* (*Countess Superba?*). Yellow spotted, tapering,  $\frac{2}{3} \times 14$ .  
*Cronstadii*. Yellow variegated, tapering, spiral,  $\frac{2}{3}$  in. wide. A.F. 16:255; 23:275. Gt. 31:309.  
*Crown Prince*. Yellow veins,  $2 \times 16$ .  
*Czar Alexander III*. See *Le Tzar*.  
*Davisii*. White midrib and variegation,  $\frac{3}{4} \times 12$ .  
*Dayspring*. Yellow, red-mottled, margin green, ovate,  $1 \frac{1}{2} \times 8$ .  
*Delight*. Yellow changing to white, with green margin, lanceolate,  $2 \times 8$ .  
*Disraeli*. Fig. 1017. Variously lobed, yellow, red veins and spots,  $3 \times 12$ . Gn. 10, p. 141. F.M. 1876:207.  
*Dodgsonæ*. Yellow midrib, margin and spots, often spiral, excurrent midrib often foliaceous,  $\frac{2}{3} \times 12$ .  
*Dormannianum*. Lvs. small, bronze-red and yellow.  
*Earl of Derby*. See *Lord Derby*.  
*Earls court*.  
*Edmontonense*. Lvs. narrow, brilliantly colored.  
*Elegans* (*Parvifolium*, see *Interruptum*). Yellow, red midrib and margin,  $\frac{1}{2} \times 6$ .  
*Elegantissimum*. Yellow center and dots, petiole red, rarely with apical seta,  $\frac{1}{2} \times 14$ . I.H. 29:469.  
*Elvira*. Yellow center and variegation, sometimes with apical seta and twisted,  $\frac{1}{2} \times 10$ .  
*Elysian*. Yellow midrib and dots,  $\frac{2}{3} \times 14$ , twisted.  
*Evansianum*. Yellow, red-veined and mottled, 3-lobed. Gn. W. 4:409.  
*Excelsior*.  
*Excurrens*. Greenish yellow variegated, oblong, midrib projecting.

*Eutrype*.  
*Fasciatum*. Yellow veins, broad ovate. A.F. 23:241.  
*Flambeau*. Medium width, lanceolate.  
*Flamingo*. Irregular yellow central stripe,  $1\frac{1}{2} \times 8$ .  
*Gloriosum* (Prince of Wales). Lvs. long-narrow, variously yellow-marked, sometimes spiral and appendaged. Gng. 9:19. Gn. 14, p. 543. A.F. 16, p. 255.  
*Golden Ring*.  
*Goldiei*. Yellow veins, 3-lobed,  $3 \times 10$ .  
*Grande*. Yellow veins and spots.  
*Grayii*. Resembling Majesticum.  
*Hanburyanum*. Yellow, rose marks and blotches,  $2\frac{1}{2} \times 15$ . Gng. 7:324.  
*Harwoodianum* (Triumphans Harwoodianum). Yellow, crimson midrib.  
*Hawkerii*. Light yellow, green margins and tips, broad-lanceolate, 6 in. long. J.H. III. 61:129. G.Z. 23, p. 265.  
*Henryanum*. Yellow-mottled, ovate,  $3 \times 9$ .  
*Hermion*. Yellow midrib and spots,  $\frac{1}{2} \times 10$ .  
*Hillebrandum*. Purplish green, crimson marks, oblong or spatulate,  $3 \times 9$ . I.H. 19, p. 326.  
*Hookerianum* (Hookeri). Irregular yellow center and blotches, broad lance-ovate. G.C. 1871:1067. Gn. 3, p. 45. I.H. 19, p. 40. G. 7:137. F. 1871, p. 199.  
*Illustris*. Yellow markings, 3-lobed, midrib excurrent. G.Z. 28:2.  
*Imperator*. See Challenger.  
*Inimitabilis*. Yellow, red midrib and veins all dark red,  $1 \times 6$ .



1019. *Codium spirale*. (An example of forms crispum and cornutum.)

*Insigne*. Yellow midrib and veins, margin red, narrow-oblong.  
*Interruptum*. Fig. 1018. Yellow, red midrib,  $\frac{3}{4} \times 12$ . Sometimes distorted or spiral, midrib excurrent. I.H. 19, p. 170. F. 1872, p. 209. A.F. 16:1510. Journ. Bot. 19:220.  
*Invicta*. Lemon-color, broad lf.  
*Irregularis*. Lf. form irregular, often contracted below middle, midrib and spots yellow. I.H. 19, p. 135.  
*Jamesii*. Irregular yellow blotch changing to white,  $3 \times 10$ .  
*Johannis* (Taeniosum). Center and margin yellow: lvs. long, narrow. F. 1872, p. 161. Gng. 9:19. I.H. 19, p. 169. F.S. 19, p. 12. Gt. 34:24. A.F. 13:1070.  
*Katonii* (Maculatum Katonii). Lvs. partly trilobed, yellow-spotted. F. 1879, p. 27.  
*Lady Zealand*. Yellow, red margin, midrib and veins,  $\frac{3}{4} \times 11$ .  
*Lainqui*. Lf. base yellow, remainder green to dark red, spiral, midrib excurrent or appendaged.  
*Le Tsar*. Lf. broad, veins and most of lf. yellow, red. I.H. 35:70.  
*Lord Derby* (Earl of Derby?). Trilobed, base and center yellow, red,  $\frac{1}{2} \times 8$ .  
*MacFarlanei*. Yellow, red-blotched,  $1 \times 12$ .  
*Majesticum*. Yellow, red margin, midrib and mottling, linear, 15 in. long. G.Z. 18, p. 97. G. 2:163. F. 1876, p. 53. F.M. 1874:103.  
*Makoyanum*. Broad lvs. chocolate and carmine marking.  
*Marquis de Castellane*.  
*Maximum*. Border and veins yellow or yellow with green blotches, 12 in. long. I.H. 14, p. 534; 19, p. 168. B.H. 19:65.  
*Memphis*.  
*Montfontainense* (Montfortiense?). Somewhat 3-lobed, veins yellow, red,  $1\frac{1}{2} \times 6$ .  
*Mortii*. Midrib and veins yellow, light red,  $3 \times 10$ .  
*Mrs. Chas. Heine*.  
*Mrs. Craige Lippincott*. Lvs. lance-ovate, veins colored. A.F. 23:274. Gng. 13:98.  
*Mrs. Dorman*. Midrib scarlet, margins green, linear,  $\frac{1}{2} \times 12$ . A.F. 16:255. Gng. 9:19.  
*Mrs. H. F. Watson*. Lvs. large, variously marked with yellow and red.  
*Mrs. Icelon*. Very dark red with rose mottling,  $2 \times 4\frac{1}{2}$ .  
*Mrs. McLeod*. Constricted in middle, midrib yellow, red, projecting,  $\frac{1}{2} \times 10$ .  
*Mrs. Swan*. Central yellow stripe and blotch, petioles red,  $1 \times 12$ .  
*Multicolor*. Like Irregularis but with red coloration developed. I.H. 19, p. 120. F. 1872, p. 89.  
*Musaicum*. Yellow, red-veined and mottled, or with green blotches on colored ground,  $1\frac{1}{2} \times 8$ . R.H. 1882:240.  
*Nestor*. Serrated central yellow, red blotch and spots,  $2\frac{1}{2} \times 12$ .  
*Nevillii*. Green-red mottling or yellow.  
*Newmannii*. Lvs. short, broad, dark crimson.  
*Nobile*. Lvs. linear, yellow, red variegated. A.F. 16:255. Gng. 9:19. F. 1878, p. 133.  
*Orville*. Green mottling on yellow,  $1 \times 4\frac{1}{2}$ .  
*Onalifolium*. Yellow variegated. Gt. 24, p. 221. F. 1875:8.  
*Pictum*. Lvs. broad oblong-acuminate, less than 10 inches long, blotches of green and blackish on red. B.M. 3051.  
*Picturatum*. Similar to Interruptum. Gt. 25:375.  
*Pilgrimii*. Yellow-blotched, overspread with pink,  $3 \times 9$ .  
*Princes* (mutabile). Yellow, red midrib and margins, lvs. narrow, variable in form, sometimes appendaged. F. 1879, p. 69. Gn. 13:621, desc.  
*Princess Matilda*. Lvs. subtrilobed, yellow, red blotch, base nearly white, petioles red.  
*Princess of Wales*. Yellow midrib and mottling, changing to white, with pink reverse, linear,  $\frac{1}{2} \times 12$ . Gng. 13:84. A.F. 23:275.  
*Punctatum*.  
*Queen Victoria*. Yellow, red veins and mottling,  $1\frac{1}{2} \times 10$ . A.F. 23:241.  
*Recurvifolium*. Lvs. acuminate, recurved at the tip, yellow, red veins and blotches.  
*Reginae*. Lvs. short and broad, yellow, crimson and brown colored. F. 1879, p. 59.  
*Reidii*. Yellow, red variegation and veins, rose tints,  $4 \times 8$ . A.F. 23:242.  
*Rodeckianum*. Variously mottled and marked with yellow and red,  $\frac{3}{4} \times 12$ , sometimes twisted and appendaged.  
*Roseo-pictum*. Yellow, red, with green blotches between veins. I.H. 26:364; 43, p. 159.  
*Ruberrimum*. Crimson marked with creamy white, linear.  
*Rubro-lineatum*. Yellow, with crimson tints, oblong-lanceolate, "1 in. to  $1\frac{1}{4}$  in. long."  
*Rubro-striatum*.  
*Sceptre*. Lvs. linear, yellow spots, red midrib.  
*Sinclairianum*. Yellow spots changing to white, projecting midrib appendaged,  $\frac{1}{2} \times 10$ . Gt. 30:278. G.Z. 26:145. J.H. III. 48:435.  
*Sollerii*.  
*Spirale*. Fig. 1019. Midrib yellow, red or green, lvs. spiral, midrib excurrent,  $\frac{3}{4} \times 10$ . V. 9, p. 203. F. 1874, p. 211. F.M. 1874:126. A.F. 23:242. Gt. 24:26.  
*Splendens*. "Lvs. broad, yellow and dull red on green."  
*Stewartii*. Yellow veins and margin, midrib and petiole red.  
*Sunshine* (Sunbeam?). Yellow, red veins and mottling,  $2 \times 9$ .  
*Superbissimum*.  
*Superbum*. Lvs. linear, drooping, green and yellow mottled. A.F. 16:255; 23 p. 275; 21:674. Gng. 12:471; 9:19.  
*Thomsonii*. Irregular central yellow area or all yellow, subtrilobed,  $2 \times 6$ .  
*Tortilis*. See Caudatum tortile.  
*Tricolor*. Lvs. oblong spatulate, margin sinuous, center yellow, lower surface reddish.  
*Triumphans*. Lvs. oblong, green and red.  
*Undulatum*. Lvs. long and broad, undulate, veins red to purple. I.H. 19, p. 265. F. 1870, p. 207. G. 9:106. Gn. 3, p. 118.  
*Veitchii*. Yellow, red midrib and wide veins, some mottling,  $1\frac{1}{2} \times 10$ . Gn. 17, p. 565. F. 1870, p. 206. I.H. 19, p. 134. R.H. 1867, p. 190. V. 9, p. 203.  
*Victory*. Yellow, red midrib and blotches,  $2\frac{1}{2} \times 12$ .  
*Volutum*. Yellow midrib and veins,  $1 \times 6$ , with long tip rolled backward. Gt. 24:61. V. 9, p. 202. F. 1874, p. 138. G.Z. 20, p. 33. F.M. 1875:154.  
*Warrenii*. Yellow, red variegated,  $1 \times 20$  spiral. P.F.G. 1882:111. G. 11:123; 13:705. A.F. 16:255. G.W. 12:62. Gn.W. 6:457. Gn. 36, p. 337.  
*Weismanii*. Yellow midrib and veins, petiole red, margin undulate,  $1 \times 10$ . I.H. 20, p. 80. F.S. 19, p. 14. F. 1873:55. Gt. 22, p. 149.  
*Williamii*. Yellow, red and pink variegated, ovate-oblong,  $3 \times 12$ .  
*Wilsonii*. Green overspread with yellow, linear lanceolate,  $1 \times 18$ .  
*Youngii*. Irregular yellow, red blotches,  $1 \times 15$ . Gn. 4, p. 129.  
 Others not in American trade: *appendiculatum*. Horned, green. G.Z. 21:241. F. 1879, p. 67. R.H. 1877, p. 88. F.W. 1877, p. 136.—*aureo-lineatum*. Yellow margins and veins.—*Baron Frank Seilliere*. Yellow to white veins on reddish green. I.H. 27, p. 72, desc. Gn. 21, p. 289.—*bellulum*. Yellow, green margins. I.H. 22:210.—*Bræganum*. Yellow and green, red midrib, linear, 18 in. long.—*Chantrieri*. Linear, yellow red spots. I.H. 27, p. 73, desc.—*contortum*.



Lvs. ovate, tips recurved, veins and margins yellow.—*Craigii*. 3-lobed. Gng. 13:97. A.F. 23:238.—*Cræsus*. Oblanceolate, yellow-blotched.—*Drouetii*. Linear, border and veins yellow, red. I.H. 27, p. 73, desc.—*Duvallii*. Lvs. lance-linear, veins light yellow. I.H. 27, p. 73, desc.—*Duvivieri*. Short-oblong, chiefly red.—*eburneum*. Central irregular, white band.—*elongatum*. Narrow lanceolate, yellow veins, margins, and spots. I.H. 24:299.—*eminens*. Lanceolate, midrib and pair of veins white.—*Exquisite*. Broad-ovate, margins and variegation yellow.—*Eyreii*. Recurved and spiral, yellow variegated, petiole red.—*Fascination*. Long-linear. A.F. 23:243. Gng. 13:119.—*formosum*. Yellow, red-spotted.—*fucatum*. Obovate, yellow blotched, petiole red.—*Goedenoughii*. Yellow variegated.—*Golden Queen*. Yellow midrib and few veins and dots, petiole red,  $2\frac{1}{2} \times 9$ .—*hastiferum*. Two acute lobes at broad base, yellow veins and blotches. I.H. 22:216. *heroicum*. Yellow, red.—*imperiale*. Oblong, yellow, red margins and veins, horned. F. 1876, p. 209.—*interruptum elegans*. I.H. 27, p. 90, desc. R.H. 1880:170.—*Jubilee*. Center, veins and margins, yellow, red,  $2 \times 13$ .—*Junius*. Long, narrow, yellow and red-colored.—*Katharina*. Spiral, red variegated,  $2 \times 10$ .—*lacteam*. Oblanceolate, margin sinuous, midrib and veins yellow. F.S. 19, p. 8.—*lanceifolium*. Lanceolate, yellow- and red-marked,  $1\frac{1}{2} \times 15$ .—*latimaculatum*. Lanceolate, yellow-marked, petiole red. I.H. 27, p. 73, desc.—*limbatum*. Yellow margins and spots.—*Lord Belhaven*. Lanceolate, Gng. 7:323. F.E. 18:379.—*lyratum*. Slightly 3-lobed, yellow veins. I.H. 24:293.—*maculatum*. Lanceolate, 12 in. long, yellow-spotted.—*magnificum*. Yellow, red irregular central mark. I.H. 29:447.—*Magnificent*. Central part yellow, red,  $2\frac{1}{2} \times 7$ .—*Marquis de Guadiaro*. Irregular yellow, red center. I.H. 37:96.—*Massangeanum*. Lanceolate, 10 in. long, yellow, and, with green blotches. I.H. 26:347. S.H. 1:124.—*medium variegatum*. Obovate, margins and veins yellow.—*Me. Lucien Linden*. Yellow, red-variegated. I.H. 38:140.—*Monarch*. Lanceolate,  $2\frac{1}{2} \times 12$ , yellow spots.—*Mooreanum*. Oblanceolate, yellow edge and veins. G.Z. 22:25.—*ornatum*. Yellow, red center, veins and blotches.—*patulum*. Horned, yellow variegated. F. 1879, p. 68.—*Penninecki*. Obovate, red with green marks. R.B. 33:304.—*Philipsii*. Lance-linear, base and center yellow,  $\frac{3}{4} \times 9$ .—*Prince Henry*. Tip recurved, variously red- and yellow-marked.—*Princess Waldeck*. Obovate, 4 in. long, yellow center.—*recurvatum*. Tip recurved, yellow along the red midrib.—*Rez*. Spiral, yellow, red mottled,  $\frac{3}{8} \times 10$ .—*Russellii*. Constricted in the middle, yellow, red spots and veins. J.H. III. 27, p. 493.—*Sanderi*. Obovate, large, irregular blotches. G. 22:197.—*splendidum*. Lvs. broad, lanceolate, yellow, red.—*superbiens*. Oblong, yellow, red-variegated. Gng. 13:84.—*Torquetum*.—*Torriganum*. Yellow, red veins, ribs and margins.—*townfordense*. Obovate, wide yellow center and base. Gn. 65, p. 42.—*trilobum*. Lobed, yellow blotched. R.H. 1877, p. 89. F. 1877, p. 56. G.Z. 21:97.—*Truffautii*. Yellow to white veins, lvs. broad.—*Van Oosterzeel*. Lance-linear, yellow-spotted. I.H. 30:502.—*Vervetii*. Yellow, red midrib and spots, lanceolate. I.H. 23:253.—*vittatum*. Irregular yellow center, petiole red.—*Wigmannii*. Yellow blotches,  $\frac{1}{2} \times 9$ .

J. B. S. NORTON.

**CODLIN.** Used in England to mean a small, green, half-wild, inferior apple. It is used in distinction to grafted or dessert fruit. It is about equivalent to the American popular use of the word "crab." The word is also used in England as the name of a particular variety or group of varieties, as Keswick Codlin. The word codlin is known in America only in connection with the apple-worm insect, the codlin-moth. Sometimes written *Codling*.

**CODONANTHE** (Greek for bellflower). *Gesneriaceæ*. A dozen or more trailing or scandent herbs or subshrubs of Brazil, Guiana, Cent. Amer., and W. Indies, 1 or 2 of which may be found in choice collections of stove plants. Plants with long branches, opposite entire and fleshy or thick mostly small lvs., and whitish fls. borne singly in the axils: corolla with a declined or curved tube, the throat broad or open, and the limb with 5 rounded nearly equal lobes, exceeding the 5 narrow lobes of the calyx; stamens attached in corolla-tube, not exerted: fr. berry-like. *C. gracilis*, Hanst., with creamy white spotted orange fls. and lvs. often blotched red beneath, is the species most likely to be seen. Cult. of Gesneria and similar things. L. H. B.

**CODONOPSIS** (Greek, bell-like, alluding to the shape of the flowers). *Campanulaceæ*. Twinning or decumbent perennials, more or less hardy in the open, with showy blue, whitish or greenish flowers.

Herbs, with tuberous rhizomes: lvs. alternate or irregularly opposite, petiolate, mostly crenate: fls. axillary or terminal, stalked; calyx-tube hemispherical, the limb 5-parted and the lobes leafy; corolla-tube broadly tubular or bell-shaped, 5-parted (rarely 4- or 6-parted); stamens free, the filaments dilated at base; stigma 3-5-lobed: fr. a dry or somewhat fleshy 3-5-

valved caps.—Eighteen or 20 species in Cent. and E. Asia. A few of the species may occur in choice border-collections; they need protection N.

**ovata**, Benth. Six to 12 in., decumbent and branches becoming erect: lvs. ovate, small ( $\frac{3}{4}$  in. or less long), both alternate and opposite, acute or obtuse, hairy, short-petioled: fls. pale blue, speckled inside,  $1\frac{1}{4}$  in. or less long, broadly bell-shaped, on long terminal peduncles. Himalayas.—Offered in England; half-hardy to hardy.

*C. clematidea*, Schr. Two to 3 ft., from mts. of Asia; one of the hardest: lvs. ovate-acuminate, petioled: fls. white tinged blue. Much like *C. ovata*.—*C. convolvulacea*, Kurz. Sts. thin and wiry: fls. bright blue, 1 in. across, numerous. Upper Burma.—*C. lanceolata*, Benth. & Hook. (Campanumæa lanceolata, Sieb. & Zucc.). Twinning, 2-3 ft.: fls. hanging, greenish white and purple-veined, 1-2 in. long and 1 in. wide, in a short simple raceme: lvs. alternate, oblong-lanceolate, nearly or quite entire. Burma, China. F.S. 9:927.—*C. Tängshen*, Oliver. Climbing, with long thickened rhizome, the sts. slender and 2 ft. or more long: lvs. ovate or broad-lanceolate, toothed: fls. solitary, stalked, bell-shaped,  $1\frac{1}{2}$  in. long, greenish, spotted and striped purple inside. China. B.M. 8090. Root used in China as a tonic.—*C. vinciflora*, Fedde. Allied to *C. convolvulacea*: twining, slender: lvs. mostly opposite, ovate or oblong-acuminate, sinuate-dentate: fls. solitary, very long-peduncled, rather small, rotate, and deeply parted, lilac. W. China.—*C. viridiflora*, Maxim. Small climber, free-flowering: fls. bell-shaped, whitish green, gray and violet. E. Asia. L. H. B.

**CÆLIA** (Greek, *koilos*, hollow: referring to the pollen masses). *Orchidaceæ*. Epiphytic orchids of minor importance; culture of Epidendrum.



1020. Cœlia Baueriana.

The cœlias are divided into 2 strongly marked groups with widely different kinds of infl. *C. macrostachya* is a type of the first section, with long racemes of numerous small, horizontal fls., which are much exceeded by the long spreading bracts, and the base of the column short. *C. bella* is typical of the second section, with the fls. few, larger, erect, in groups of about 3, longer than their bracts, and the base of the column produced to twice its own length, which gives the fls. a tubular appearance.—A half-dozen species in Cent. and S. Amer.

A. Fls. small, in a long raceme.

**macrostachya**, Lindl. Pseudobulbs  $2\frac{1}{2}$  in. long, almost round, with brown scales at the base: lvs. about 3, from the top of the pseudobulb, 1 ft. or more long, lanceolate, arching, broader than in *C. bella*, and not channeled: sepals red; petals white. Mex. R.H. 1878:210. B.M. 4712. J.F. 4:423.

**Baueriana**, Lindl. Fig. 1020. Pseudobulbs 1-2 in. long, 2-3-lvd.: lvs. 10-18 in. long, linear, acute: racemes of numerous small white fragrant fls.; ovary 3-winged; sepals ovate-lanceolate, the petals ovate-oblong; lip with the claw yellow, the blade triangular. W. Indies and Mex. B.R. 28:36.

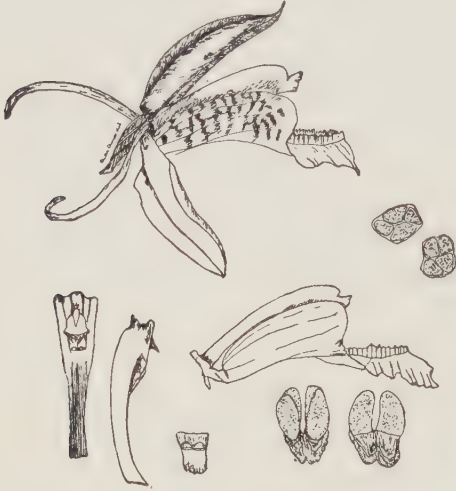
AA. Fls. white, tipped purple, few, large.

**bella**, Reichb. f. Pseudobulbs smaller and more constricted at the top: lvs. 6-10 in. long, narrower, chan-

neled above, arching: fls. 2 in. long, erect, 3 or 4 in number, with the mid-lobe of the lip orange-colored. Guatemala. B.M. 6628.

*C. densiflora*, Rolfe. Characterized by a dense-fl. raceme, wingless ovary and oblong mentum. Cent. Amer.

GEORGE V. NASH.†



1021. Details of *Cælogyne speciosa*.

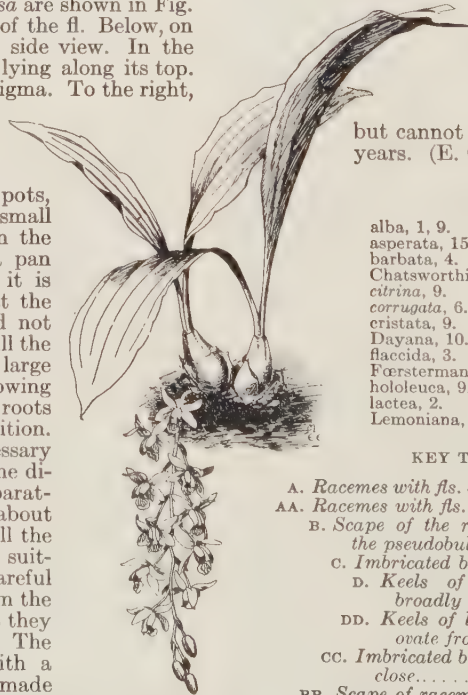
**CÆLÓGYNE** (*hollow pistil*). *Orchidaceæ*. Popular epiphytic warmhouse orchids of the eastern hemisphere.

Pseudobulbs tufted or at intervals on the st.: fls. in racemes, opening simultaneously or in succession; sepals and petals similar, spreading or reflexed; lip 3-lobed, the lateral lobes erect, inclosing the slender column, the middle lobe flat or recurved, keeled; column slightly curved, winged above; pollinia 4.—Species about 115, distributed from N. India to Ceylon, middle China, and in the islands of the Indian Ocean. The botanical details of *Cælogyne speciosa* are shown in Fig. 1021. At the top is a general view of the fl. Below, on the left, is the column, front and side view. In the center is the lip, with the column lying along its top. Below the lip, on the left, is the stigma. To the right, on the bottom row, are the pollinia, front and back view; and at the right center are separate pollen masses.

Cælogynes may be grown in pots, baskets or pans, using pots for small plants, and larger receptacles when the plants require them; but when a pan larger than 12-inch is necessary, it is best to use perforated ones so that the material may be well aerated and not become unsuitable for the roots. All the species are of rambling habit and large specimens may soon be had by growing on, provided the material at the roots is kept in a sweet healthy condition. When, however, it becomes necessary to divide a plant, this is best done directly after flowering, carefully separating the running shoots, cutting off about three of the last-made bulbs with all the roots attached, planting these in suitable-sized receptacles, being very careful to point the growing end away from the edge, or toward the center, so that they will not so readily outgrow again. The material to use is osmundine with a little sphagnum moss if it can be made to grow, packing all very firm about the roots so that too much water will not

be held about the roots. Place in the shady part of a warm house until root-action begins; but, during the hot summer months, the varieties of *C. cristata* may with great benefit be placed in a frame in a shady place outdoors, there to remain until danger of frost in October. Treated in this way, the plants will bloom much better. They should all be placed on inverted pots when outside to exclude vermin. When brought indoors the bulbs will be finishing up for bloom, and as they are terrestrial plants, weak manure-water should be given at every watering. A glance at the roots and their structure will show how they differ from the epiphytal orchids such as the cattleyas. Cælogynes, being evergreen, should never be quite dry at the roots, or shriveling will result; this always is the case after flowering or repotting; but, when growth commences, they soon plump up again. It is often desired to grow these plants in baskets. Space can then be made for them overhead in the cool-houses in winter, bringing a few at a time into warmth, thus having succession of bloom for three months for cutting, house or conservatory decoration, where they last a long time. There are more than 100 kinds of cælogynes, many of which are but of botanical interest. *C. pandurata*, *C. Dayana* and *C. Sanderiana* are warm-house plants and should be kept at a minimum temperature of 60° in winter. *C. nervosa*, *C. flaccida*, *C. nitida*, and *C. Massangeana* are coolhouse plants, often grown in collections; but *C. cristata* and its forms are the most valued, especially the variety *maxima* once so scarce, but now plentiful; this makes large bulbs and longer spikes of bloom. The Chatsworth variety, by some considered the same as *maxima*, *hololeuca* or *alba* as it is most often known in gardens, is a pure white form, perhaps the whitest of all orchids. This is inclined to ramble, owing to the length of rhizome between each bulb or growth, and needs attention in repotting frequently; it is also the latest to flower. *C. Lemoniana* has a pretty lemon-yellow blotch on the lip instead of the usual orange and is very pretty by

contrast with the other forms. When it is desired to increase the stock of plants, the back bulbs taken off at potting time may be planted similar to the other pieces and will grow on, but cannot be expected to bloom for two years. (E. O. Orpet.)



1022. *Cælogyne Massangeana*. (× ¼)

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KEY TO THE SPECIES.

- A. Racemes with fls. opening in succession. 1. *speciosa*  
 AA. Racemes with fls. opening all at once.  
 B. Scape of the raceme naked between the pseudobulb and lowest fl.-bract.  
 C. Imbricated bracts below fls. none.  
 D. Keels of lip extending into broadly ovate front lobe..... 2. *lactea*  
 DD. Keels of lip not extending into ovate front lobe..... 3. *flaccida*  
 CC. Imbricated bracts below fls. several, close..... 4. *barbata*  
 BB. Scape of raceme with 1 or few scales between pseudobulb and lowest fl.-bract.



- c. Lip with a large eye-like spot.... 5. *nitida*  
 CC. Lip with no eye-like spot.  
 D. Keels of lip lacerated or fimbriated.  
 E. The scape arising from large lvs.  
 F. Fl.-bracts persistent..... 6. *nervosa*  
 FF. Fl.-bracts deciduous..... 7. *Sanderiana*  
 EE. The scape without large lvs.  
 F. Sepals about as long as broad; keels of the lip only slightly cut..... 8. *Förstermannii*  
 FF. Sepals about twice as long as broad; keels of lip strongly cut..... 9. *cristata*  
 DD. Keels of lip warty.  
 E. Peduncle, rachis and ovaries tomentose.  
 F. The scape arising from large lvs..... 10. *Dayana*  
 FF. The scape without large lvs.  
 G. The keels in middle lobe of lip papillose..... 11. *tomentosa*  
 GG. The keels in middle lip cut into tooth-like segms..... 12. *Massangeana*  
 EE. Peduncle, rachis and ovaries glabrous.  
 F. Pseudobulbs elliptic to ovate-oblong, compressed.  
 G. Middle lobe of lip separated from lateral lobes by a distinct claw..... 13. *pandurata*  
 GG. Middle lobe of lip sessile..... 14. *Mayeriana*  
 FF. Pseudobulbs fusiform, 4-sided.  
 G. Raceme many-fld., nodding..... 15. *asperata*  
 GG. Raceme few-fld., erect..... 16. *Parishii*

1. *speciosa*, Lindl. (*C. salmonicolor*, Reichb.). Pseudobulbs ovoid, distinctly angled, 2-3 in. long, 1-lvd.: lvs. up to a foot long; racemes with 1, 2 or 3 fls.; sepals oblong, translucent, pale yellow-brown; petals pale yellow-brown, linear, reflexed; lateral lobes of lip erect, reticulated, with dull copper-brown on a bluish-salmon ground, mid-lobe roundish, partly broad-margined with white; disk with 2 fringed ridges and umber-brown markings. Java. B.M. 4889. Gn. 49, p. 62. B.R. 33:23. C.O. 3. Var. *alba*, Hort. A light-colored form.

2. *lacteæ*, Reichb. f. Pseudobulbs ovate, somewhat 4-sided, sulcate, 2-lvd., 3 in. long; lvs. up to 10 in. long, 2 in. broad; fls. 6-12; sepals and petals spreading, cream-white, the sepals oblong-ovate, acuminate, the petals much narrower, linear-lanceolate; lip about as long as petals, the lateral lobes semi-ovate, truncate, the middle lobe about equaling one-half the whole length of the lip, triangular at the apex, acute, reflexed; keels 3, undulate, extending to the center of middle lobe. Burma.

3. *flaccida*, Lindl. Pseudobulbs ovate, angulate, 2-3 in. long; lvs. lanceolate, about 8-10 in. long; raceme 7-12-fld., cream-white, the sepals oblong, the petals linear-oblong; fls.  $1\frac{1}{2}$  in. across; sepals and petals pendulous; lip with 3 ridges, the lateral lobes white, streaked red-brown inside, the middle lobe reflexed, acute, a bright yellow blotch on the disk. Nepal. B.M. 3318. B.R. 27:31. C.L.A. 6:166.

4. *barbata*, Griff. Pseudobulbs about 2 in. long, ovate; lvs. broadly lanceolate, 10-12 in. long; raceme 6-10-fld.; sepals and petals white, the sepals ovate-oblong, the petals linear; mid-lobe of lip brownish inside, curiously fringed with brown; crests 3. Khasia hills.

5. *nitida*, Hook. f. (*C. ocellata*, Lindl.). Pseudobulbs pyriform or nearly so; lvs. up to 1 ft. long, narrowly lanceolate; racemes erect, 5-8-fld.; fls. 2 in. across, white, the sepals oblong, the petals linear-oblong; lip with bright orange-yellow spots on each of the lateral

lobes and 2 smaller spots at the base of the mid-lobe; disk with 3 keels, the front lobe of lip with 5. Himalayas, at an elevation of 7,000 ft. B.M. 3767. C.L.A. 1:55. Var. *máxima*, Reichb. Racemes longer; fls. larger. J.H. III. 52:25.

6. *nervosa*, A. Rich. (*C. corrugata*, Wight). Pseudobulbs ovate-pointed,  $2\frac{1}{2}$ -3 in. long; lvs. 6-12 in. long; racemes 3-6-fld.; fls. white, 2-2 $\frac{1}{2}$  in. across; sepals and petals nearly equal, oblong and acute; lip with the lateral lobes striped red inside, the middle lobe ovate, acuminate; disk yellow, with 3 white fringed keels. India. B.M. 5601.

7. *Sanderiana*, Reichb. f. Pseudobulbs ovate and wrinkled or costate, 2-3 in. long; lvs. a foot long; fls. about 6 in a pendulous raceme, 2-3 in. across, white; sepals lanceolate-acuminate; petals narrower; lip with the side lobes striped with brown inside and with a yellow blotch, the middle lobe oblong, acute, reflexed, undulate; disk bright yellow, with 6 fringed keels. India. J.H. III. 44:75.

8. *Förstermannii*, Reichb. f. Pseudobulbs cylindric or fusiform; lvs. up to  $1\frac{1}{2}$  ft. long; racemes many-fld.; fls. 2 in. across, white; sepals and petals lanceolate; lip with 3 denticulate keels, the middle lobe elliptic, acute; disk marked with yellowish brown. India.



1023. *Cœlogyne cristata*.  
( $\times \frac{1}{4}$ )

9. *cristata*, Lindl. Fig. 1023. Pseudobulbs  $1\frac{1}{2}$ -2 in. long, ovoid-oblong, scattered on a scaly rhizome; lvs. 8-12 in. long; racemes 5-9-fld., drooping; fls. white; sepals and petals lanceolate-oblong, undulate, acute, with 5 orange fringed keels, the lateral lobes slightly incurved, the mid-lobe transversely oval, denticulate. Nepal. J.H. III. 31:349. P.G. 1:55. A.G. 14:331; 15:513. A.F. 4:497; 6:87; 9:1111; 13:1133; 16:1445. C.L.A. 6:163. F.E. 9:331. B.R. 27:57. G.C. III. 47:40. O.R. 18:169. Gng. 2:393; 4:225. Var. *hololeuca*, Hort. (var. *alba*), has white fls., labellum without yellow. C.O. 1a. Var. *Lemoniana*, Hort. (var. *citrina*, Hort.), has citron-yellow fringes. J.H. III. 57:537. Var. *Chatsworthii*, Hort., has large pseudobulbs and large fls. of good substance. Var. *máxima*, Hort., has very large fls.—*C. cristata* is one of the best and most popular of orchids. It is one of the easiest to grow. Can be grown with cattleyas.

10. *Dayana*, Reichb. f. Pseudobulbs cylindric-fusiform, 5-10 in. long; lvs. up to  $2\frac{1}{2}$  ft. long, oblong-lanceolate; racemes many-fld., pendulous; fls. 2-2 $\frac{1}{2}$  in. across; sepals and petals pale yellow, margins reflexed, the petals much narrower than sepals; lip with 6 erect ridges fringed with brown, the lateral lobes brown, streaked with white inside, the middle lobe nearly quadrate, reflexed, apiculate. Borneo. G.C. III. 15:695. A.F. 35:380.

11. *tomentosa*, Lindl. Pseudobulbs elongated, ovoid, 2-3 in. long; lvs. up to a foot long, 3-5-nerved; racemes pendulous, tomentose; fls. 15-20, 2-2 $\frac{1}{2}$  in. across; sepals

and petals pale orange-red, sepals lanceolate, petals linear-lanceolate; lip with lateral lobes oblong, rounded, streaked with red on inside, the middle lobe reniform or transverse-elliptic, sessile; keels 3, crenulate, lateral ones converging in the middle lobe and sometimes bearing 2 branches. Perak, Borneo, Sumatra.

12. *Massangeana*, Reichb. f. Fig. 1022. Pseudobulbs pyriform, 3-5 in. long; lvs. elliptical, large, tapering toward the base, up to 20 in. long; racemes many-fl., pendulous, pubescent; fls. 2-3 in. across; sepals and petals pale yellow, the sepals oblong-lanceolate, the petals linear-oblong; lip with lateral lobes brownish within, lined or streaked with yellow, mid-lobe with a verrucose brown and yellow disk from which extend 3 denticulate keels. Assam. B.M. 6979. C.O. 4.

13. *pandurata*, Lindl. Pseudobulbs 3-4 in. long, oval-oblong, compressed; lvs. 15-20 in. long, cuneate-oblong; racemes many-fl., pendulous; fls. up to 4 in. across; sepals and petals green, linear-oblong, acute; lip fiddle-shaped, with black veins and stains on yellowish green ground, the mid-lobe crisped, black-warty; disk 2-keeled. Borneo. B.M. 5084. F.S. 20:2139. J.H. III. 30:377. A.F. 6:633. C.O. 6. Gt. 49:1480.

14. *Mayeriana*, Reichb. f. Pseudobulbs ovate-oblong, about 2 in. long, compressed, 2-lvd.: lvs. 8-10 in. long, cuneate-obovate; raceme 8-10-fl., erect or nodding; fls. about 2½ in. across, green, veined black-brown; sepals oblong, acuminate, the petals shorter and narrower, the margins reflexed; lip nearly as long as sepals, the lateral lobes concealing only the base of the column, the middle lobe sessile, oblong-elliptic, crisped; keels 3, papillose. Singapore.

15. *asperata*, Lindl. (*C. Loddii*, Paxt.). Large species (18-24 in. high); pseudobulbs ovate-oblong, 5-6 in. long or more; lvs. up to 2½ ft. long, lanceolate, acute; raceme 7-10-fl., pendulous; fls. 3 in. across, cream-colored; sepals and petals lanceolate, lip with the lateral lobes white, streaked red-brown inside, the middle lobe nearly orbicular, the crisped margin pale yellow streaked red-brown; disk with 2 or 3 orange-red warty ridges. Borneo. P.M. 16:227. G.C. III. 46:34.

16. *Parishii*, Hook. f. Like No. 13, but racemes not drooping, pseudobulb 4-angled, 4-6 in. long; lvs. up to a foot long, lanceolate, acuminate; racemes 4-7-fl., erect; fls. about 2 in. across, pale yellow-green; sepals lanceolate, acuminate; petals linear-lanceolate; lip fiddle-shaped, black-spotted, the middle lobe apiculate, undulate; disk with 5 raised lines. Moulmein. B.M. 5323.

*C. albo-lutea*, Rolfe. Fls. showy, very fragrant, pure white, with lobes yellow. Mts. of N. India.—*C. Brymeriana*, Hort. A garden hybrid between *C. Dayana* and *C. asperata*.—*C. burfordiensis*, Hort. (*C. pandurata* × *C. asperata*). Fls. pale green, the spiny crest black, the ridges green and yellow. G.C. III. 49:331.—*C. chrysotrópis*, Schltr. Scape much shorter than the lvs., few-fl. Sumatra.—*C. Colmanii*, Hort. A garden hybrid between *C. speciosa* major and *C. cristata* alba.—*C. Cumingii*, Lindl. Fls. white, the disk citron-yellow; sepals and petals lanceolate. Singapore. B.R. 27:29. B.M. 4645.—*C. fragrans*, Hort. A trade name.—*C. fuliginosa*, Lindl. Fls. appearing in succession, 2 in. across, light brownish white, the lip fringed. N. India. B.M. 4440. J.F. 1:7.—*C. Garderiana*, Lindl.—*Neogyne*.—*C. Lawrenceana*, Rolfe. Fl. single; sepals and petals yellow, 2-2½ in. long, the sepals lanceolate-oblong, the petals linear; lateral lobes of lip brown, the middle lobe white, the disk marbled with brown. Annam. B.M. 8164. G.C. III. 47:335.—*C. Mooreana*, Sander. Racemes 4-8-fl.; fls. white; disk golden yellow, covered with clavate processes. Annam. B.M. 8297.—*C. ochracea*, Lindl. Fls. about 2 in. across, fragrant, white, the lip blotched and streaked orange-yellow. N. India. B.R. 32:69. B.M. 4661. J.F. 4:342.—*C. perakensis*, Rolfe. Racemes many-fl.; sepals light buff, lanceolate-oblong, about ½ in. long; petals light green, linear, a little shorter than sepals; lip light yellow, with a deep yellow blotch on disk. Perak. B.M. 8203.—*C. præcox*, Lindl., var. *alba*. A nearly white form.—*C. Sanderæ*, Kränzl. Fls. white; sepals oblong-lanceolate; petals narrower, linear; lip yellow, marked with golden, the keels red-brown. Burma. G.C. III. 13:361.—*C. Veitchii*, Rolfe. Racemes many-fl., pendulous; fls. nearly globose, white, the sepals and petals much incurved; lip longer than sepals, the lateral lobes obtuse, the middle lobe ovate, revolute; disk obscurely 3-keeled. New Guinea. B.M. 7764.—*C. venusta*, Rolfe. Racemes many-fl., pendulous; fls. pale yellow, the lip white, marked with yellow. S. W. China. B.M. 8262.—*C. viridescens*, Rolfe. Resembling *C. Parishii*. Fls. pale green with dark dots on the lip. Annam. GEORGE V. NASH.

**COFFÈA** (from the Arabian name for the drink, itself conjecturally derived from Caffa, a district in southern Abyssinia). *Rubiaceæ*. Woody plants, producing the coffee of commerce; as a horticultural subject, sometimes cultivated for the ornamental appearance; and also in collections of economic plants.

Shrubs or small trees, natives of Trop. Asia and Afr.: lvs. mostly opposite, rarely in whorls of 3, elliptical, acute, usually coriaceous and glossy; fls. clustered in the axils, cream or cream-white and fragrant; calyx-limb 5-, rarely 4-, parted, the corolla salver-shaped, the corolla-tube cylindrical, the throat sometimes villous; stamens inserted in or below the throat of the corolla: fr. a berry; seeds 2, horny, which are the well-known coffee of commerce.—From 25-40 species, in Trop. Afr. and Asia, the species not yet clearly defined, nor well understood horticulturally.

Coffee-production is based mostly on *C. arabica* and *C. liberica*, both widely cultivated throughout the tropics, and in greenhouses northward. The coffee industry, one of the most important industries in the tropics, reaches the enormous figure of \$200,000,000 or sometimes a little more than this. See the treatment in Vol. II Cyclo. Amer. Agri.

*The coffee plant and its product.* (T. B. McClelland.)

The main source of coffee is *Coffea arabica*, an ever-green shrub, growing 10 to 15 feet high. The younger plants have one main trunk or stem, but from this others frequently develop later, which are similar in form and habit to the first. The lateral branches are opposite, horizontal and in pairs, very rarely in whorls of three. The pairs of branches are in whorls on the main stem. The leaves, which are opposite and borne in pairs, are 4 to 7 centimeters (about 1½ to 3 inches) broad by 10 to 20 centimeters (4 to 8 inches) long, the length being usually slightly more than two and a half times the breadth. They are elliptical, acuminate at tip and attenuate at base. There are eight to eleven pairs of main lateral veins. In the axils where the veins join the midrib are small pores, open below and slightly swollen above. The tip of the leaf is frequently curled and is rather abruptly contracted. The margin is entire and wavy. The leaves, which are perennial, are a dark glossy green, and though thin are firm in texture.

There are usually two or three large blossomings and several small ones extending over a period of several months. The pure white and delicately fragrant star-like flowers are borne on very short pedicels in one to four axillary clusters of one to four flowers each. These flower-clusters are subtended by two to four common calyculi. The tube of the corolla is 8 to 10 millimeters (about ½ to ⅔ inch) long. Its segments are about 7 millimeters (nearly ⅓ inch) broad by 15 to 18 millimeters (⅔ to ¾ inch) long. The style is 17 to 22 millimeters (⅔ to nearly 1 inch) long. The stigma is two-branched, each branch being 5 millimeters (about ½ inch) long. The linear anthers, corresponding in number to the petals, are 9 millimeters long and are supported on filaments 5 to 7 millimeters long. The size varies somewhat with favorable or unfavorable conditions. The short annular calyx with its denticulate limb is so small as almost to escape notice.

Under *Coffea arabica* are included a number of varieties quite distinct in growth and product from the other varieties of the same species, such as Maragogipe, Mocha, Pointed Bourbon (sometimes classified as *C. laurina*) and others.

Maragogipe coffee, as its name indicates, is of Brazilian origin, having been discovered in 1870 near the town from which its name is derived. On account of the large size of the bean it has commanded a fancy price on the market, but this variety is considered to be a small yielder. The flowers, fruits, and leaves are all larger than the ordinary Arabian coffee and the

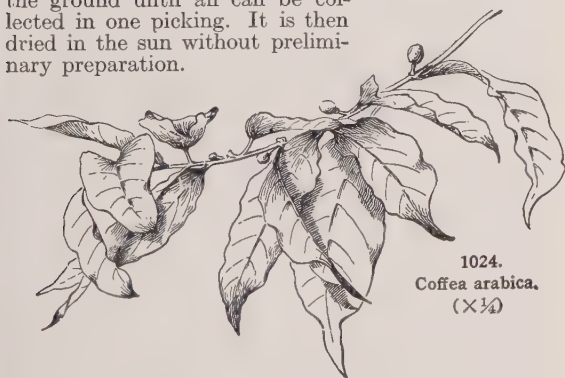


leaves curl noticeably. Its flavor is not considered superior to that of the ordinary Arabian coffee.

Mocha coffee, with its shorter internodes and smaller flowers, fruits, and leaves is a distinct variety. The "beans" are much less oval and are more rounded and hold a high reputation for quality.

Normally two coffee "beans", or seeds are produced in each red cherry-like drupe. Some drupes, however, contain three beans and others only one. When only one is formed it is called "peaberry," and is oval in shape instead of being flat on one side and convex on the other as is the bean when two are produced. The peaberries are sorted out by machinery and are sold at a fancy price on account of being a little different in appearance from the other coffee, but any claim to superiority of flavor is without foundation. There is one variety of coffee that produces a number of beans in each drupe, and the corolla-segments may range up to ten. As the number of beans increases, the size and the attractiveness of appearance decrease, so that this is a very undesirable variation.

The fruits require six and one-half to seven months to mature. The ripening of the coffee, in relation to the blossoming, extends over several months. Where the West Indian or wet process for curing the coffee is followed, the ripe cherries are picked every fortnight. While fresh they are passed through a machine which pulps and separates the coffee in its parchment from the pulp. The former is then fermented and washed to remove a slimy covering. After thorough drying in the sun or in heated driers, the parchment coffee may be stored or it may have the thin brittle parchment or horn-skin and the silver-skin removed by special machinery. If desired it may be further polished and artificially colored. After being sized and having the better grades cleaned of inferior beans, it is ready for roasting. In some places where the dry or old preparation is followed the coffee is allowed to ripen and much of it to fall from the trees and lie on the ground until all can be collected in one picking. It is then dried in the sun without preliminary preparation.



1024.  
*Coffea arabica*.  
( $\times \frac{1}{4}$ )

Although coffee has been used as a beverage for hundreds of years by a few persons, as a world beverage it is comparatively modern. In 1825 the estimated production did not exceed 218,255,400 pounds. In 1906-1907 the production was estimated as 3,164,041,920 pounds, or an increase of 1,350 per cent in eighty-one years.

Brazil produces about three-fourths of the world's coffee crop. Then follow in order of importance Venezuela, Colombia, Guatemala, Mexico, Haiti, Salvador, Dutch East Indies, Porto Rico, British India, Costa Rica, Nicaragua, and other countries.

In Bulletin No. 79, Bureau of Statistics, United States Department of Agriculture, may be found a very extensive bibliography of coffee. In the Netherlands the per capita consumption is more than 15 pounds; in the United States under  $11\frac{1}{2}$  pounds; in Japan .003 pound.

A. Corolla 5-parted, sometimes 4-parted.

B. Segms. of corolla narrow: lvs. oblong, 4-5 in. long,  $1\frac{1}{2}$  in. wide.

**arábica**, Linn. COMMON OR ARABIAN COFFEE. Fig. 1024. Lvs. 3-6 in. long, rather thin, oblong, nearly 3 times as long as broad, more or less abruptly contracted near the apex to a point about  $\frac{1}{2}$  in. long; segms. of corolla over twice as long as wide: fr. a 2-seeded, deep crimson berry, but the "berries" or beans of commerce are the seeds. The commercial varieties of coffee are based largely on the size, shape, color and flavor of the seeds, and hence the fr. is very variable, but the typical fr. may be considered to be oval and  $\frac{1}{2}$  in. long. Indigenous in Abyssinia, Mozambique and Angola; supposed to have been intro. in early Mohammedan times from Abyssinia to Arabia, whence it became known to Europeans in the 16th century. This species furnished until recently the entire commercial product. B.M. 1303. Gng. 6:55.—A variegated form, var. **variegata**, Hort., is more showy than the type. It is offered by dealers in tropical plants. As coffee grows wild in Afr. it is a small tree 10-15 ft. high, with the trunk 9-12 in. thick at the base. Often cult. under glass in the N. for its economic interest, and in S. Calif. it is a good outdoor ornamental shrub, esteemed for its shining lvs., fragrant white fls., and red berries.

BB. Segms. of corolla wide: lvs. ovate.

**bengalensis**, Roxbg. BENGAL COFFEE. Lvs. ovate, barely twice as long as broad, acute, but not having a long, abrupt point: fls. in 2's or 3's; segms. of corolla barely twice as long as wide. E. Indies, Malaya. B.M. 4917.—This has much showier fls. than *C. arabica*. A small shrub with glabrous, dichotomous branches. Mts. of N. E. India, whence it was brought to Calcutta and much cult. for a time. It is now neglected, the berries being of inferior quality and the plants not productive enough.

AA. Corolla 6-, 7-, or 8-parted.

B. Fls. in dense clusters or glomes: lvs. short-pointed.

**libérica**, Hiern. LIBERIAN COFFEE. Lvs. longer than in *C. arabica*, and wider above the middle, with a proportionately shorter and less abruptly contracted point: fls. 15 or more in a dense cluster; corolla-segms. usually 7. Trop. Afr. Trans. Linn. Soc. II. 1:171 (1876). G.C. II. 6:105. R.H. 1890, pp. 104-5.—Said to be more robust and productive than *C. arabica*, with berries larger and of finer flavor. It is a more tropical plant than the common coffee, and can be grown at lower levels.

**Zanguebariæ**, Lour. (*C. zanzibarensis*, Hort.). A glabrous, erect, closely branched shrub or small tree, to 6 ft., the branches ash: lvs. ovate or obovate, obtuse or shortly pointed, 2-4 in. long,  $\frac{3}{4}$ - $1\frac{1}{2}$  in. wide, the lateral veins about 6 pairs: fls. white, axillary, in dense clusters; corolla-lobes 6-7: berry red, turning black.

BB. Fls. solitary or in 3's: lvs. long-pointed,  $2\frac{1}{2}$ -5 in. long.

**stenophylla**, Don. Lvs. 4-6 in. long,  $1-1\frac{1}{2}$  in. broad, narrower than in *C. arabica*, with a relatively longer and more tapering point: corolla-segms. usually 9. W. Afr. B.M. 7475.—This is said to yield berries of finer flavor than the Liberian coffee, and quite as freely, but the bush is longer in coming into bearing. This is a promising rival to the *C. arabica* of commerce. Seeds have been distributed by British botanical gardens, but are not known to be for sale at present in Amer.

*C. madagascariensis*, Hort., and *C. robusta*, Hort., are names of uncertain status.

WILHELM MILLER.  
N. TAYLOR.†

COFFEE: *Coffea*.

**COFFEE BERRY.** A name of *Glycine hispida*, which should be abandoned in favor of soybean. Various leguminous seeds are used as coffee substitutes and are so named; cf. *Cassia*, *Canavalia* and others.

**COFFEE PEA.** A western name for chick pea, *Cicer arietinum*, which is used as a substitute for coffee.

**COFFEE-TREE:** *Gymnocladus*.

**COHOSH:** *Actæa*. The blue cohosh is *Caulophyllum*.

**COHUNE:** *Attalea Cohune*; it is a source of oil.

**COIR:** Fiber of coconut, which see.

**CÔIX** (an old Greek name). *Gramineæ*. Tall, broad-leaved, branched grasses with bead-like inflorescence, one of them grown in gardens.

Plant loose-growing: at the end of each peduncle is an indurated, globular, or oval, hollow bead, developed from a lf.-sheath; from an orifice at the tip projects the staminate spike: pistillate fls. inclosed in the bead, the styles projecting.—Species about 3, E. Indies, the following widely distributed in all tropical countries.

**Lácryma-Jôbi**, Linn. **JOB'S TEARS**. Fig. 1025. Annual, 2-4 ft.: the beads or "tears," pearly white to lead-color, containing the seed, are about  $\frac{1}{2}$  in. long. Dept. Agric., Div. Agrost., 20:14.—Cult. for ornament and as a curiosity. The hard bony frs. are used as beads and made into necklaces, to which are attributed marvelous properties. Var. *aurea zebrina*, has yellow-striped blades. A. S. HITCHCOCK.

**CÔLA** (native name). *Sterculiææ*. **COLA**. Also called Kola, Korra, Gorra. One species is much grown in the tropics for the stimulating cola nut.

The genus consists entirely of plants with unisexual or polygamous fls. in axillary or terminal clusters: calyx 4-5-cleft; petals none: fr. of 4-5 leathery or woody oblong carpels.—Probably about 40 species, of Trop. Afr. trees chiefly interesting for the cola nuts, which are said to sustain the natives in great feats of endurance. The tree grows on the east coast of Afr., but is very abundant on the west coast, and is now cult. in the W. Indies. Within the tropics the trade in this nut is said to be immense. It has become famous in the U. S. through many preparations for medicinal purposes and summer drinks. The seeds are about the size and appearance of a horse-chestnut, and have a bitter taste. Although repeatedly intro. to Kew, England, the plant never flowered there until 1868.

Colas require a rich, well-drained soil. Those introduced into the West Indies and other parts of America, especially *C. acuminata*, thrive best on a sandy loam. The trees are grown from seeds, which are large and fleshy, keeping well for some weeks after ripening. As the tree is difficult to transplant, the seeds may be planted singly in small pots, and the young trees kept growing thus until wanted for permanent planting. Propagation may also be effected by cuttings of ripe wood, which should be placed in bottom heat, and treated in the usual way. (E. N. Reasoner.)

*acuminata*, Schott & Endl. About 40 ft. high in Afr., resembling an apple tree: lvs. alternate; petiole 1-3 in. long; blade 4-6 in. long, 1-2 in. broad, leathery, with prominent ribs below; older lvs. entire, obovate, acute; younger lvs. often once or twice cut near the base about half way to the midrib: fls. yellow, 15 or more in axillary and terminal panicles, about  $\frac{1}{2}$  in. across, with a slender green tube and a showy yellow 6- or 5-cut limb, which is a part of the calyx: fr. 5-6 in. long. B.M. 5699.

N. TAYLOR.†

**CÔLAX** (Greek, *parasite*). *Orchidææ*. Epiphytic orchids, much like *Lycaste*.

Pseudobulbous: fls. in an upright raceme, arising from the base of the new shoot; sepals and petals similar, the lateral sepal forming a distinct foot with the base of the column; lip 3-lobed, clawed, with a transverse hairy process; pollinia 4.—A Brazilian genus of 2 species.

*jugôsus*, Lindl. (*Maxillaria jugôsa*, Lindl. *Lycaste jugôsa*, Benth.). Pseudobulbs ovoid, 2-3 in. long, 2-lvd.: lvs. 5-9 in. long, lanceolate: raceme 2-3-fl.; fls. 2-3 in. across; sepals white, obtuse, oval-oblong; petals white, obovate-oblong, spotted and barred with violet-purple; lip white, shorter than petals, the side lobes streaked violet-purple, the middle lobe semi-circular, with numerous pubescent keels, streaked and blotched violet-purple. B.M. 5661. I.H. 19:96.

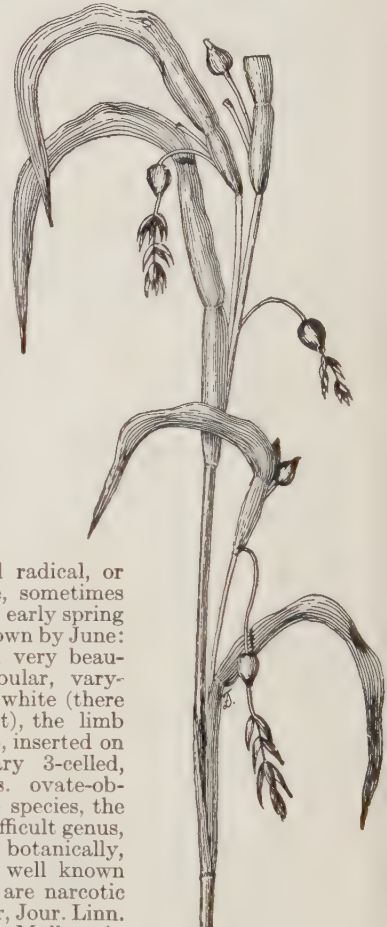
*C. tripteris*, Rolfe. Ovary 3-winged; disk of lip bearing a broad fleshy callus. Brazil.

GEORGE V. NASH.

**CÔLCHICUM** (from Colchis, a country in Asia Minor, where the genus is most plentiful). *Liliææ*. **MEADOW SAFFRON**. **AUTUMN CROCUS**. Autumn flowering, rarely spring-flowering, bulbous plants with crocus-like blossoms.

Leaves either all radical, or radical and cauline, sometimes ciliate, appearing in early spring and usually dying down by June: fls. various colored, very beautiful; perianth tubular, varying from purple to white (there is 1 yellow-fl. sort), the limb 6-parted; stamens 6, inserted on the perianth; ovary 3-celled, many-ovuled: caps. ovate-oblong in most of the species, the seeds globose.—A difficult genus, very much confused botanically, but horticulturally well known and popular. They are narcotic poisons. J. G. Baker, Jour. Linn. Soc. 17. 1880. G. B. Mallett, in Flora and Sylva, 1:108, 1903, has an excellent horticultural account of the genus.

Colchicums are most charming and interesting plants of easy culture. The bloom comes in August and September, at a season when the herbaceous beds begin to lose their freshness, and, although individual flowers are fugacious, others follow in quick succession, thus prolonging the time of flowering. Opening, as they do, without foliage, some help is required from the greenery of other plants; for this purpose any low-growing, not too dense kind, may be used, such as the dwarf artemisias, sedums, or *Phlox subulata*. Colchicums are most effective in masses, which can be established by thick planting, or as the result of many years' growth. They can be grown in rockwork, in beds, or in grass which is not too thick nor too often mown; they will thrive in partial shade, but succeed best in an open sunny border. They should be planted in August or early September, in deep well-enriched soil, a light sandy loam, with the tip of the long bulbs 2 to 3 inches below the surface; some protection should be given in winter. They remain in good condition for many years, and should not be disturbed unless they show signs of deterioration, fewer flowers and poor foliage. Then



1025.  
Coix Lacryma-Jobi.  
( $\times \frac{1}{2}$ )



they should be lifted and separated, just after the leaves die, end of June or early July. This is the usual method of propagation, but they can also be increased from seeds, sown just after ripening, June to July; the seedlings may not appear until the following spring. Seedlings bloom when three to five years old. The bulbs are obtainable from the Dutch growers at moderate prices, and they must be imported early; otherwise they are apt to bloom in the cases. *C. autumnale*, with rosy purple flowers, is a well-known and the most commonly cultivated species. There are numerous varieties, of which the best are the white, the double white and the double purple. Belonging to this same group and not differing much except in size and shading of the flower, are *C. byzantinum*, *C. montanum*, and *C. umbrosum*. *C. speciosum*, a native of the Caucasus, is the finest in every way of the genus. The flowers are much larger and of better shape, and the color, a rosy pink, is much more delicate; the habit of growth is robust, and the plant is most easily handled. *C. Parkinsonii* is distinct from the above varieties inasmuch as the flowers are tessellated, purple and white, giving a curious checker-board appearance which is unique; the leaves are much smaller and are wavy. *C. agrippinum*, *C. Bivonæ*, *C. cilicicum* and *C. Sibthorpii*, are other species having checkered flowers more or less similar to *C. Parkinsonii*. *C. Bulbocodium*=*Bulbocodium vernalis*. Monograph by J. G. Baker in Jour. Linn. Soc., vol. 17 (1880). (B. M. Watson.)

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*cilicicum*, 11.  
*crociflorum*, 2.  
*Decaisnei*, 14.  
*fasciculare*, 16.  
*luteum*, 4.  
*maximum*, 10.  
*montanum*, 1, 18.  
*Parkinsonii*, 6.

*Sibthorpii*, 9.  
*speciosum*, 10.  
*Stevenii*, 3.  
*superbum*, 8.  
*tessellatum*, 6, 7.  
*Troodii*, 15.  
*umbrosum*, 17.  
*variegatum*, 5.

## A. Blooming in spring: lvs. appearing with the fls.

## B. Color rosy lilac: size of anthers small.

## C. Anthers oblong, purple.

1. *montanum*, Linn. (*C. Bertolonii*, Stev.). An important and variable species, with many synonyms and variations. Baker makes 7 forms. Corm ovoid,  $\frac{1}{2}$ -1 in. thick, the tunics brown, membranaceous, the inner ones produced to a point 2-4 in. above the neck: lvs. 2-3, rarely 4-6, linear or lanceolate, about 2-3 in. long at the time of flowering, finally 6-9 in. long: fls. 1-4, in spring and autumn. Oct.-June. Medit. region, from Spain to Persia. B.M. 6443.—It appears in early spring with the snowdrops and crocuses.

2. *crociflorum*, Regel, not Sims nor Schott & Kotschy. Corm ovate-oblong: lvs. all radical, sheathing at the base, a few sometimes on the st., flat and linear, margins minutely and usually distantly toothed: corolla white, with violet-purple stripes, especially within, the tube about 2 in. long, the limb scarcely  $1\frac{1}{3}$  in. long; style exceeding the stamens. Feb., March. Cent. Asia.

## CC. Anthers linear, yellow.

3. *Stevenii*, Kunth. Corm narrower than in No. 1, about  $\frac{1}{2}$ - $\frac{3}{4}$  in. thick: lvs. at length 4-5 in. long: fls. Oct.-Jan. Syria, Arabia, Persia.—Less popular than No. 1.

## BB. Color yellow: size of anthers large.

4. *luteum*, Baker. This is the only yellow-fl. form in the genus, all the others ranging from purple to white. Although it belongs to the Medit. group, with lvs. and fls. produced at the same time and in spring, it is a native of W. India at an elevation of 7,000-8,000 ft. Corm tunics dark brown, sometimes almost black: lvs. 3 or 4, wider and less tapering than in No. 1, at the time of flowering 3-4 in. long, finally 6-7 in. long. B.M. 6153.—Very desirable.

## AA. Blooming in autumn: lvs. appearing after the fls.

## B. Perianth tessellated or checkered.

## C. Tessellation distinct.

## D. Lvs. spreading or prostrate.

5. *variegatum*, Linn. Lvs. 2-3, lanceolate, about 6 in. long, 12-15 lines wide, lying flat on the ground; margins wavy: fls. 2-3 from each spathe, 4 in. across, rose-color with a white tube. Isls. of the Levant and Asia Minor. B.M. 1028. Variable. The plant known as *C. chionense* is apparently a form of it. Corm size of walnut.

6. *Parkinsonii*, Hook. f. (B.M. 6090) (*C. tessellatum*, Authors), is the best of all the tessellated forms, the tessellation being more sharply defined and more delicate

than the type. It is a smaller plant, and has shorter and more strongly undulated lvs., which lie closer to the ground. Of this plant Parkinson said in his "Paradiseus Terrestris," 1629: "This most beautiful saffron flower riseth up with his flowers in the Autumne, as the others before specified doe, although not of so large a size, yet farre more pleasant and delightfull in the thicke, deep blew, or purple

1026. *Colchicum autumnale*. ( $\times \frac{1}{2}$ )

coloured beautiful spots therein, which make it excell all others whatsoever: the leaves rise up in the Spring, being smaller then the former, for the most part 3 in number, and of a paler or fresher green color, lying close upon the ground, broad at the bottome, a little pointed at the end, and twining or folding themselves in and out at the edges, as if they were indented. I have not seen any seede it hath borne: the root is like unto the others of this kinde, but small and long, and not so great: it flowereth later for the most part then any of the other, even not untill November, and is very hard to be preserved with us, in that for the most part the roote waxeth lesse and lesse every yeare, our cold Country being so contrary unto his naturall, that it will scarce shew his flower; yet when it flowereth any thing early, that it may have any comfort of a warm Sunne, it is the glory of all these kindes."

## DD. Lvs. ascending.

## E. Margin of lvs. wavy.

7. *agrippinum*, Baker (*C. tessellatum*, Hort.). Corms a trifle thicker than in No. 5: lvs. 3-4, 6-9 in. long, 12-15 lines wide, margin wavy: fls. 2-4 from each spathe. F.S. 11:1153.—This is a marked form of *C. variegatum*, of garden origin, which has similar fls., but a more robust habit and more nearly erect lvs.

## EE. Margin of lvs. flat, not wavy.

8. *Bivonæ*, Guss. Lvs. 6-9, nearly 1 ft. long, 9-15 lines wide, rather hooded at the apex, margin flat, not wavy: fls. 1-6 from each spathe, rose-purple faintly checkered with a darker color, 4-6 in. long. Medit. region. Var. *superbum*, Hort., an excellent form, is advertised in English catalogues. F.S.R. 1:108.

cc. *Tessellation less distinct.*

9. *Sibthorpii*, Baker. Easily distinguished from Nos. 5, 7, and 8 by the much broader segms. of the perianth, and by the lvs., which are nearly erect, obtuse, and not at all wavy: lvs. 5-6, dull green, finally 1 ft. or more long,  $1\frac{1}{2}$ - $2\frac{1}{2}$  in. wide, narrowed gradually to the base: spathe striped with green, and tinged with lilac at the tip: fls. 1-5 from each spathe; perianth-tube often 6 in. long. Mts. of Greece. B.M. 7181. F.S.R. 1:108. —A large, cup-shaped fl., showing no open spaces between the broad, overlapping segms. Very handsome.

bb. *Perianth not tessellated.*

c. *Size of fls. large, 3 in. or more across.*

d. *Lvs. broad, 3-4 in. wide.*

e. *Number of fls. 1-4.*

10. *speciosum*, Stev. Corm 2 in. thick, the largest of the genus: st. 1 ft. high: lvs. 4-5, 12-15 in. long, 3-4 in. wide, narrowed from the middle to the base, shining green: fls. 1-4 from each spathe, violet, with a white eye, but varying almost to pure pink, often 6 in. across. Caucasus. B.M. 6078. F.S. 23:2385. F.M. 1876:235. Gn. 11:80.—Commonly considered the finest species of the genus; blooms Sept. and Oct. Var. *maximum*, Hort. Plant  $7\frac{1}{2}$  in. high.

ee. *Number of fls. 12-20.*

11. *byzantinum*, Ker-Gawl. Closely allied to the above, but with wider lvs., smaller and paler fls., and broad, short anthers: st. 6 in. high: lvs. 5-6, oblong, dark green, striate, 9-12 in. long, 3-4 in. wide: fls. smaller than in No. 10, usually 3-4 in. across, lilac-purple, and often 12-20 from each spathe. Transylvania and Constantinople. B.M. 1122.—Corm large, depressed. *C. cilicicum*, Hort., has rosy fls., somewhat tessellated. G.C. III. 23:35.

dd. *Lvs. narrow, 1-2 in. wide.*

12. *Bornmülleri*, Freyn. Lvs. elliptic-lanceolate, 3-4 in. long, 1-2 in. broad: fls. 8 in. long and 5 in. across, the limb pale rose or lilac-rose at first, subsequently deeper purple, the corolla-tube white. Asia Minor. Early spring.—One of the rarest and finest of the group, suitable for the rock-garden.

13. *autumnale*, Linn. Fig. 1026; 442, p. 433. St. 3-4 in. high: lvs. 3-4, rarely 5-6, 9-12 in. long,  $1\frac{1}{2}$ -2 in. wide: fls. 1-4, rarely 5-6, from each spathe, purple, with a white variety, about 4 in. across; perianth veined. Eu. and N. Afr. B.M. 2673 (as *C. crociflorum*). —Possibly the commonest in the American trade. It has beautiful double forms in purple and pure white. F.S. 19:1936.

14. *Decaisnei*, Boiss. Corm ovate, membranaceous: lower lvs. broadly lanceolate, the upper ones narrower and acutish, entire, 1- $1\frac{1}{2}$  in. broad: fls. pale-rose, or flesh-colored, the tube elongate-elliptic, the stamens a little shorter than the perianth; anthers yellow, linear; style only slightly exceeding the stamens. N. Afr. and the eastern Medit. region. Nov.-Jan.—Planted in masses with *C. crociflorum* for rock-gardens, it is very effective.

cc. *Size of fls. small, about 2 in. across.*

d. *Number of fls. from each spathe more than 1 or 2.*

e. *Perianth-segms. acute.*

15. *Troëdii*, Kotschy. Corm medium-sized: lvs. 3-4, 6-12 in. long, 9-12 lines wide, dark green above: fls. 4-5 or even 12, lilac-purple, about 2 in. across; perianth segms. lanceolate-acute. Cyprus. B.M. 6901 shows a pure white variety.

16. *fasciculare*, Boiss. Corm oblong: lvs. 5-7, broadly lanceolate, channeled, the apex acutish, frequently ciliate, about 1 in. wide: fls. many, in clusters,

the corolla  $2\frac{1}{2}$  in. long, white, 6-10-nerved; stamens equalling the corolla, but slightly exceeded by the style branches. Feb. Syria.

ee. *Perianth-segms. obtuse.*

17. *umbròsum*, Stev. Corm small: lvs. 4-5, 6-9 in. long, 9-12 lines wide: fls. 1-5 from each spathe, lilac, about 2 in. across; perianth-segms. oblanceolate, obtuse, with 8-12 veins. Caucasus.

dd. *Number of fls. from each spathe 1 or 2.*

18. *alpinum*, DC. (*C. montanum*, All. not Linn.). Lvs. 2, rarely 3, nearly erect or spreading, 4-8 in. long, 3-6 lines wide, obtuse, channeled, shining green, narrowed from the middle to the base: fls. 1 or 2 from each spathe, about 2 in. across, lilac; segms. oblanceolate, obtuse, 3-4 lines wide, with 10-15 veins. Mts. of France and Switzerland.

*C. gigantum*, Hort. A plant with magnificent pink fls.—Is not certainly referable to any species. The name appears in several catalogues, but is unknown in botanical literature. See F.S.R. 1:108.—*C. hydrophilum*, Hort. An early spring-flowering species; bulb size of a walnut: lvs. and fls. appearing together, the fls. bright clear rose and taller than the lvs., the latter growing after the fls. are gone and attaining a length of 6 in.; fls. in clusters of 3-15; stamens half as long as the segms. Taurus Mts. G.C. III. 29:102.—*C. siehdanum*, Hort. A late autumn-flowering species with rich reddish purple fls. Asia Minor.—*C. veratrifolium*, Hort. Similar to some of the forms of *C. speciosum*, but earlier in flowering.

WILHELM MILLER.

N. TAYLOR.†

**COLDFRAME.** An unheated covered frame (see *Frame*) used (1) for the starting of plants in spring in advance of settled weather but not so early as in a hotbed; (2) for receiving plants from a hotbed or greenhouse, holding them as an intermediate station until they may go in the field; (3) carrying hardy plants over winter, as spinach, lettuce; (4) providing a general store-place for hardy or semi-hardy stuff from greenhouse and garden; (5) affording a propagating-bed in spring and summer for seeds or cuttings. Usually the coldframe is topped with glass, as is the hotbed, but prepared paper or cloth is sometimes used. Coldframes are usually of temporary construction. L. H. B.

**COLD-STORAGE, REFRIGERATION, RETARDING.** Dealers in bulbs, cut-flowers, nursery stock, fruits and vegetables employ cold-storage to retard the growth of bulbs and plants, or to preserve cut-flowers and produce, by using specially constructed sheds, refrigerators, ice-boxes, or the public cold-storage warehouses. The nursery stock thus stored can be packed and shipped from the cold to warmer parts of the country in good season for planting, when it would be impossible to dig and ship such stock without the storage system. Sheds for the storage of nursery stock have earthen floors, are ventilated and lighted from the ridge-and-furrow roof and heated to exclude frost, the maximum temperature being 35° to 40°. Large trees are stood upright, the smaller stock usually laid lengthwise in compartments. The roots are covered with sphagnum, or a mixture of sphagnum and excelsior or cedar shingletow: the shingletow or excelsior alone will not make good covering for this purpose. See *Nursery*.

The roots and bulbs commonly placed in cold-storage are those used by florists for forcing, such as lily bulbs, lily-of-the-valley pips, and the like. By placing these in cold-storage, growers can secure a continuous succession of bloom throughout the year. Lily bulbs are stored in the original cases packed in soil, the cases being cleated to provide circulation of air, and held at 34°. The *multiflorum* and *formosum* varieties of *Lilium longiflorum* can be held in storage three to four months, and the *giganteum* type of this lily ten to eleven months, *L. auratum* four months, *L. speciosum* and varieties eight months. The sizes (circumference) of storage lily bulbs and number of bulbs to the case are as follows:



*L. longiflorum* and its varieties *multiflorum*, *formosum* and *giganteum*, 6- to 8-inch, 400; 7- to 9-inch, 300; 9- to 11-inch, 200; in *L. longiflorum giganteum* there is an 8- to 10-inch size which runs 225 to the case; *L. auratum* 8- to 9-inch, 160; 9- to 11-inch, 100; 11- to 13-inch, 75; *L. speciosum*, 8- to 9-inch, 200; 9- to 11-inch, 100; 11- to 13-inch, 75. Lily-of-the-valley pips are packed in a mixture of sphagnum and sand, one-fourth of the latter being used to three-fourths of the moss and held at 28°. These are packed 500, 1,000 and 2,000 to the case and

can be kept in storage eleven months. Canna roots, dahlias and gladioli should be held at 35° to 40°.

Cut-flowers, such as roses, carnations, orchids, violets, and lilies, used by florists, are preserved for varying periods in ice-boxes or refrigerators, the usual temperature being 35° to 40°. Peonies cut when the buds show color, leaves removed

from the lower part of the stem, wrapped in paper, and the lower bare portions of the stems placed in water, will keep several weeks at a temperature of 32° to 33°. *Lilium candidum* in bud can be treated the same way.

Fruits and vegetables are stored at 33° to 35°. Warehousemen say that cold-storage merchandise keeps best and is easiest to handle in packages containing about a bushel. See *Storage*. MICHAEL BARKER.

**COLE.** A generic name, little known in North America, for plants of the cabbage tribe; cole-oil is secured from species of *Brassica*.

**COLEA** (Sir G. Lowry Cole, Governor of Mauritius). *Bignoniaceæ*. Glabrous evergreen trees or shrubs of Madagascar, Mauritius and the Seychelles, members of which may occur in collections of warmhouse (or stove) plants. Lvs. opposite or verticillate, pinnate, with many entire lfts.; fls. medium-sized, yellow, white or rose-color in lax or dense cymes or fascicles; corolla funnelform, somewhat bilabiate, with 5 rounded spreading lobes; perfect stamens 4, didynamous.—Probably 15 species, but little known in cult. They thrive in a fibrous earth and prop. by means of mature shoots in sand over bottom-heat.

**COLEUS** (Greek for *sheath*, referring to the monadelphous stamens). *Labiataæ*. Common window-garden and greenhouse showy-leaved herbs, and a few less known species grown for the handsome flowers.

Herbs or small shrubs, annual or perennial, upright: lvs. opposite, dentate or serrate, petioled or sessile: st. 4-angled: fls. mostly blue or lilac, in terminal spike-like racemes, small and middle-sized and usually bluish, the 5-toothed calyx deflexed in fr.; corolla bilabiate, the lower lobes longer and concave, and inclosing the essential organs; stamens 4, didynamous and declinate, the filaments united into a tube, the anther-cells confluent; ovary 4-parted, subtended by a gland-like disk, the style 2-lobed.—Probably 150 species, in the tropics of the eastern hemisphere, being especially abundant in Afr., E. India and adjacent isls. Some species produce tubers that are eaten in the same way as potatoes.

The common coleuses are of the most easy culture. They root readily from short cuttings, cut either to a joint or in the middle of an internode (Fig. 1027). Few conservatory plants are more ready to root than this. They may be rooted at any time of the year when new

wood is to be secured. Formerly coleuses were much used for bedding, but the introduction of better plants for this purpose has lessened their popularity. They require a long season; they are likely to burn in the hot summers of the interior country; they have a weedy habit. However, they withstand shearing and therefore are useful for carpet-bedding. The leading variety for this purpose is still the old Golden Bedder, whose golden yellow foliage is used as filling for fancy designs.—Coleus plants make excellent specimens for the window-garden and conservatory. Best results are secured when new plants are started from cuttings each spring. They also grow readily from seeds, many interesting leaf-forms and colors arising. The old plants become leggy, lose their leaves, and lack brightness of color. They are very subject to mealy-bug. They are also liable to root-gall (the work of a nematode worm), as shown in Fig. 1028. When plants are thus affected, take cuttings and burn the old plants, and either bake or freeze the earth in which they grew.

A. Common garden coleus, with red, purple, yellow, green and variegated foliage.

**Blumei**, Benth. (*C. Verschaffeltii*, Lem. *C. scutellarioides* var. *Blumei*, Miq.). This species, founded on cult. plants in Java, is probably to be regarded, as now understood, as an assemblage or combination of species. The horticultural forms are perhaps derived in part (as suggested by Briquet and by Koorders) from *C. laciniatus*, *C. bicolor*, and others; and perhaps they are to be considered also in connection with *C. atropurpureus*, Benth., of Malaysia, and its relatives. The entire garden material needs to be worked over in

comparison with authentic native oriental specimens. Portraits of *C. Blumei* of botanical interest are: B.M. 4754. I.H. 27:3-7; 35:46; 39:164. F.S. 22:228778. A soft perennial herb or sub-shrub, growing 2-3 ft. high, little branched: lvs. ovate, narrowed or broad at base and long-acuminate, sharply and nearly regularly toothed, variously colored with yellow, dull red and purplish. An extreme form of this is var. *Verschaffeltii*, Lem., Fig. 1030, which is more robust and branchy, the lvs. more brilliantly colored, acute but not acuminate, truncate or even cordate at base, and irregularly cut-dentate, with rounded teeth, giving the margin a crispy effect (I.H. 8:293). In some forms, the lvs. are lacinate.



1027. Coleus cutting.



1028. A coleus attacked by root-galls.



1029. A good young coleus plant.

AA. *Other species of Coleus, now and then in cult. (Still other species may be expected to appear in the trade.)*

**thyrsoides**, Baker. Tender shrub, 2-3 ft. high: sts. pubescent; lvs. cordate-acuminate, coarsely crenate, lower ones 7 in. long; fls. bright blue, in racemes which contain as many as 18 forking cymes with about 10 fls. in each. Cent. Afr. B.M. 7672.—Considered to have much merit for cult., either under glass, or in the open far S. Winter.

**shirënsis**, Baker. Perennial herb, densely pubescent, 3 ft., much like the above in habit: sts. angular, pale green turning to brown: lvs. glandular, pungently aromatic, broadly ovate, acuminate, membranous, 2-3 in. long, deeply crenate, pubescent beneath but scantily so above: fls. dark blue (also described as light blue), in large erect terminal panicles. Cent. Afr. B.M. 8024.—Winter.

**Mahônii**, Baker. Shrub, to 2 ft., pubescent, the branchlets slender: lvs. petioled, ovate, acute, 2-3 in. long, crenate, membranous, pale and finely pubescent beneath and green and nearly glabrous above: fls. small, purple with golden anthers, in a large graceful panicle. Cent. Afr.—Winter.

**Pénzigii**, Damm. Soft perennial herb, white-hairy: lvs. ovate, membranous, narrowed abruptly at base, crenate; petiole winged: fls. bright lilac (also described as ashy blue) in a long and lax racemose panicle, the whorls being about 8-fld. Nile Land. L. H. B.

**COLIC-ROOT:** *Aletris farinosa*.

**COLLABIUM** (*neck and lip*, referring to a peculiarity of the fl.). *Orchidaceæ*. Two terrestrial orchids, of Java and Borneo, rarely cult., requiring the treatment given *Catasetum*. Lf. single, plicate: fls. or clusters racemose, on a tall scape; lateral petals attached to the foot or base of the incurved column; lip at its base encircling the column (whence the generic name); pollinia 2. *C. nebulosum*, Blume. Sts. fleshy, about 2 in. long; lf. broadly ovate, acuminate, the petiole rounded: scape about 2 ft., erect; fls. numerous in scattered clusters or whorls, spurred, about ½ in. long, the lip 3-lobed, white and a little fringed, the sepals and



1030. *Coleus Blumei* var. *Verschaffeltii*.

petals greenish with reddish margins. Java. *C. simplex*, Reichb. Lf. oblong, acute, wavy, green with darker blotches: fls. racemose at the apex of the scape; lip white; sepals and petals greenish yellow with purple and brown blotches. Borneo.

**COLLARDS**. A kind of kale. Probably several somewhat different plants pass as collards, the characteristic being that they produce tufts or rosettes of leaves that are removed and used as greens. Usually referred to *Brassica oleracea* var. *acephala*. See *Brassica*.

In the South, a form of the plant known as Georgia collards is much grown for domestic use and the southern market. The plant grows 2 to 4 feet high and forms no head, but the central leaves often form a kind of loose rosette.

These tender leaves are eaten as a pot-herb, as all other kales are. Fig. 1031, shows a Georgia collard, with a heavy crown. The seeds of collard may be started in a frame under glass, or in a seed-bed in the open. As far south as the orange-belt, they are usually started in February and March, in order that the plants may mature before the dry, hot weather. Farther north they are started in July or August and the plants are ready for use before cold weather. Trans-



1031. Collards.

plant to rows 3½ to 4 feet apart, and 3 feet apart in the row. Till as for cabbage.

Young cabbage plants are sometimes eaten as "greens" under the name of collards; and cabbage seeds are sown for this specific purpose. In the North, where heading cabbages can be raised, collards of whatever kind are not greatly prized.

L. H. B.

**COLLETIA** (Philibert Collet, 1643-1718, French botanist). *Rhamnaceæ*. Odd spiny shrubs grown under glass, and in the open in California and other warm regions.

Leaves small and simple (or wanting), opposite: branches short, often flattened, arranged in opposite pairs, thickened, spiny (sometimes called lvs.): fls. small, perfect, yellowish or white, nodding on 1-fld. pedicels, single or fascicled in the axils or beneath the flattened divaricate spines; calyx bell-shaped or tubular, 4-5-parted; petals 4-6 or 0, inserted on the calyx; stamens 4-6; disk joined to calyx-tube, inconspicuous or the margin rolled-in; ovary 3-lobed and 3-celled, standing in the disk, the stigma 3-lobed: fr. a coriaceous dry drupe-like caps.—About a dozen species in S. Amer., mostly in the tropical parts. The colletias are said to start readily from cuttings of half-ripened wood, as well as from seeds. They are to be grown as single or detached specimens, because of their oddity.

**cruciata**, Gill. & Hook. (*C. horrida*, Hort.). Very curious shrub, 3-4 ft., with elliptic flattened very broad-spiny decurrent branches: lvs. few, elliptic, entire: fls. small, white, a few together at the base of the spines, borne profusely in spring. S. Brazil, Uruguay. B.M. 5033.

**spinosa**, Lam. Shrub, to 10 ft., with strong awl-shaped very sharp spines: lvs. elliptic, small, sessile, serrate, mostly vanishing at blooming time: fls. larger, urn-shaped, borne singly or nearly so beneath the spines. S. Brazil, Uruguay.

**ulicina**, Gill. & Hook. Smaller, 3-4 ft.: spines as in *C. spinosa*, but more numerous, thicker, and hairy: fls. cylindrical, in clusters near tops of the branches. Andes of Chile.

**Ephédra**, Vent. Small stiff bush: branches erect, spiny: lvs. wanting: fls. (in very early spring) sessile at



the nodes, spicate-glomerate; calyx top-shaped, the lobes spreading. Peru, Chile. L.B.C. 19:1830.—Reported as cult. in Calif.

L. H. B.

**COLLIGUÀYA** (Chilean name). *Euphorbiaceæ*. Small trees of the Chilean region, scarcely in cult., although the fragrant wood of some species is used. Seeds of this and related genera which have springing movements, due to contained insect larvæ, are sometimes known as "jumping beans." Juice milky; fls. monocious, apetalous; calyx imbricate or none in staminate fls.; stamens 1-5; ovary 2-4-celled, cells 1-ovuled. The following may be expected in botanical collections, although probably not in the trade: *C. odorifera*, Molina. Lvs. serrate, ovate to oblong. *C. brasiliensis*, Klotzsch. Lvs. serrulate, linear-lanceolate. *C. integririma*, Gill. & Hook. Lvs. linear, entire.

J. B. S. NORTON.

**COLLÍNSIA** (after Zaccheus Collins, American philanthropist and promoter of science, Philadelphia, 1764-1831). *Scrophulariaceæ*. Hardy flower-garden annuals mostly from California and western North America.

Leaves simple, verticillate in 3's, or opposite; fls. in the axils, solitary or in whorls, racemose in some species; calyx bell-shaped; corolla deeply bi-labiate; stamens 4, the fifth rudimentary and glandular.—About 25 species. They are not far removed botanically from *Pentstemon* and *Chelone*. From the former, the genus differs in having the fifth sterile stamen reduced to a mere gland.

The collinsias are free-flowering and of the easiest culture. They may be sown outdoors in the fall in well-drained soil, and will bloom earlier than if sown in spring. Their flowers borne in midsummer range in color from white through lilac and rose to violet, with clear, bright blue also, at least on one lip of the flower. There is no yellow.

A. Fl.-stalks very short, giving the clusters a dense appearance.

B. Corolla strongly declined; throat as wide as long.

*bicolor*, Benth. Fig. 1032.

Height 1-2 ft.: hairy, glabrous, or sticky; sts. weak and bending; lvs. more or less toothed, and oblong or lanceolate, sessile, finely toothed, opposite or in 3's; fls. typically purple and white, with 5 or 6 well-marked color varieties. Var. *álba*, Hort. (Fig. 1033), has pure white fls., or the lower lip greenish or yellowish. Var. *multicolor*, Voss (*C. multicolor*, Lindl. & Paxt.), has variegated fls., the same fl. being white, lilac, rose or violet on either lip or both. Var. *multicolor marmorata*, has the lower lip white, suffused lilac, and upper lip light lilac, spotted and striped carmine. Calif., below 2,000 ft. B.M. 3488. P.M. 3:195. B.R. 1734.—This is the most widely distributed and variable species, and the one on which the genus was founded.

1032. *Collinsia bicolor*.

Calif., mostly in moist ground.

BB. Corolla less strongly declined; throat much longer than broad.

*bartsiaefolia*, Benth. Height  $1\frac{1}{2}$  ft., the st. usually stiff and simple; sticky and somewhat glandular, rarely

hairy; lvs. from ovate-oblong to linear; fl.-whorls 2-5, purplish or whitish; seeds not wrinkled. Calif.

AA. Fl.-stalks  $\frac{1}{2}$  in. long or more, giving the clusters a looser look.

*vérna*, Nutt. Height about 6 in.: lvs. ovate or oblong or the lowest rounded and slender-stalked, and the upper ovate-lanceolate and partly clasping; whorls about 6-fld.; fl.-stalks longer than the fls.; throat of the corolla as long as the calyx-lobes; lower lip bright blue; upper lip white or purplish; seeds thick, not flattened, oblong, arched. Moist woods, W. N. Y. and Pa. to Wis. and Ky. B.M. 4927.

*grandiflora*, Douglas. Height 4-12 in.: lvs. thickish, the lowest, roundish and stalked; whorls 3-9-fld.; fl.-stalks about as long as the fls.; lower lip deep blue or violet; upper lip white or purple; throat of the corolla sac-like, as broad as long, or as long as the upper lip; seeds roundish, smooth. Shady hills of Calif. B.R. 1107.

WILHELM MILLER.

N. TAYLOR.†



1033. *Collinsia bicolor* var. *alba*. ( $\times\frac{1}{2}$ )

**COLLINSÒNIA** (after Peter

Collinson, English botanist, correspondent of Linnaeus and John Bartram). *Labiatae*. HORSE-BALM. HORSE-WEED. STONE-ROOT. Native perennial herbs.

Plants of small importance horticulturally, with large, odorous, ovate, serrate, mostly long-stalked lvs., thick roots, and simple or panicked, naked, terminal racemes of yellow or whitish fls.—Three species in E. N. Amer., one of which is sometimes offered by dealers in native plants, but is not especially ornamental. They are of simple cult.

*canadensis*, Linn. CITRONELLA. Height 2-4 ft.: lvs. 4-9 in. long, broadly ovate to oblong; racemes panicked; calyx in fl. 1 line, in fr. 4 or 5 lines long; corolla light yellow, lemon-scented,  $\frac{1}{2}$  in. long. Rich woods, Canada to Wis., Kans., and south to Fla.

L. H. B.

**COLLÒMIA** (Greek for *glue*, alluding to the mucilaginous character of the wetted seeds). *Polemoniaceæ*. In Asa Gray's late treatment, *Collomia* is included with *Gilia*, although at first kept distinct by him (Proc. Amer. Acad. Arts. & Sci. XVII, 223), and this disposition is followed here, particularly since none of the species seems to be known in the trade as *Collomia*. Engler & Prantl keep the genus distinct, however, ascribing to it eighteen species from western North America and Chile. Such as are cultivated will be found in this Cyclopedia under *Gilia*. The *Collomias* are annual, biennial and perennial.

**COLOCÀSIA** (old Greek substantive name). *Araceæ*. Perennial herbs with cordate-peltate leaves, which are often handsomely colored in cultivation; grown under glass, and one of the forms much used for planting out when large-leaved tropical effects are desired; also grown for the edible tubers.

Plants tuberous or with an erect caudex: lf.-blades peltate, ovate or sagittate-cordate, basal lobes rounded; blade of spathe 2-5 times longer than tube; spadix shorter than spathe, terminating in a club-shaped or subulate appendage destitute of stamens. Differs from *Alocasia* and *Caladium* in floral characters—Species 5. Tropics.

*Colocasias* include the plants known as *Caladium esculentum*, which are much grown for subtropical bedding. *C. odorata* (which is an *Alocasia*) has very large,





The generic character of flower-colors is comprehended in the hues just named, although such names are of little consequence so long as identification is without question. Unfortunately scientists and artists have not yet established a standard nomenclature of color, and as a consequence the name of a

WITH BLACK	WITH WHITE	CLEAR COLOR
OLD GOLD	SULPHUR	YELLOW
OCHRE	STRAWY.	GOLD Y.
BURNT ORANGE	SALMON	ORANGE.
TERRA COTTA	SHRIMP P.	SCARLET
CARDINAL	PINK	RED
MAROON	C. PINK	CRIMSON
PLUM	P. LILAC	MAGENTA
DARK B. PLUM	LILAC	PURPLE
LOGWOOD VIOLET	B. LILAC	VIOLET
INDIGO	V. BLUE	ULTRAM <sup>RE</sup>

1036. Color phases in flowers.

505, violet at 430, ultramarine at 455, and blue at 480. These numbers indicate the wave-lengths of the respective hues, with the micron (one-millionth part of an inch) as the unit. This identification of color, however satisfactory from a scientific point of view, is both intangible and impracticable in every other respect. The flower-petal or the artist's pigment matched with the spectrum is the only proper medium through which to convey an adequate knowledge of a given hue to the layman, and it must be remembered that everyone is hypothetically the layman who is not directly associated with the particular science or art under consideration. The colors of certain flower-petals as matched with the spectrum lines are as follows:

Yellow (580).—*Oenothera biennis*, *Brassica nigra*, *Ranunculus acris*, *Helianthus decapetalus*, a single dandelion ray.

Gold-yellow (590).—*Rudbeckia hirta*, golden calendula.

Gold-yellow (585).—*Kerria japonica*.

Gold-orange (600).—Golden eschscholtzia.

Gold-orange (615).—*Crocus susianus*.

Orange (635).—*Tropæolum majus* (deepest orange hue), the common type.

Scarlet (645).—Mme. Crozy canna, scarlet geranium and *tropæolum*, berry of *Cornus canadensis*.

Red (680).—Red azalea, red carnation, tube of *Rhododendron nudiflorum*.

Red (690).—Red gladiolus.

Crimson.—Crimson peony, American Beauty rose (dilute).

Magenta.—Magenta cineraria, *Polygala sanguinea*.

Purple.—Purple cineraria, *Mimulus ringens*.

Violet (425).—*Viola cuculata* and *Campanula rotundifolia* (light).

Violet (430).—*Verbena erinoides*.

Ultramarine violet (440).—*Centaurea Cyanus*, the bluest phase (light).

Ultramarine blue (455).—*Scilla sibirica* (light).

Ultramarine blue (435).—*Gentiana Andrewsii*, (bluest tip of petal).

Blue (475).—*Myosotis palustris*, bluest phase (pale).

particular hue is largely determined by a consensus of public opinion, which, very naturally, is not always correct.

#### Classification of colors.

It is essential, therefore, to accept both popular and scientific estimates of color if the subject is to be considered in its relation to flowers. The scientific determination of simple colors is expressed by certain arbitrary numbered lines in the spectrum. Thus, yellow is at line 580, gold-yellow at 605, orange at 630, scarlet at 655, red at 680, green at 530, peacock-blue at

Such a list is manifestly imperfect; to state the case accurately, few flowers are "on the line;" three of the colors have no numbered lines, and many of the plant species or varieties are not and can not be explicitly cited. For example, the red carnation must be a red and not a scarlet-red variety, and its coloring should match that of the *Rhododendron nudiflorum* tube; the same rule applies to the red gladiolus. It is equally the case that many flowers show only a modification or a dilution of the hue they are chosen to represent; the blue of the forget-me-not at best is extremely dilute.

A list of artists' pigments is more to the point. It has the great advantage of nomenclatorial fixity and it does not include hues subject to change. The representative colors are:

Lemon, zinc, ultramarine, pale cadmium, and light malori yellow.

Medium cadmium and malori gold-yellows.

Cadmium orange and deep malori orange-yellow.

Orange mineral.

Scarlet-vermilion.

Carmine or alizarin lake (no single pigment is exactly normal red), these incline to scarlet.

Crimson lake.

Magenta: a mixture of crimson and mauve lakes in nearly equal parts.

Mauve lake: a true purple.

Violet ultramarine.

Guimet's French ultramarine.

Cobalt blue.

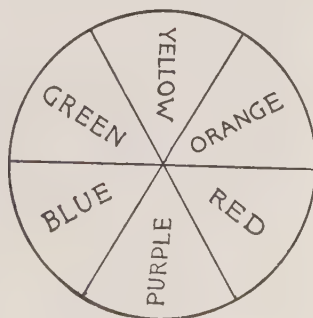
Emerald-green.

#### The color harmonies.

If the simple colors, yellow, orange, red, purple, blue, and green, are arranged in a circle (Fig. 1037), those lying opposite each other harmonize by reason of absolute contrast. Blue and orange, for example, are complementary colors and theoretically they balance each other. It by no means follows, however, that a mass of orange nasturtiums and blue forget-me-nots must therefore look well together; the very massing of such hues would make that impossible in spite of the fact that the misty grayish character of a clump of blue forget-me-nots is the reverse of aggressive. But the orange of the nasturtium is obtrusive to the last degree, and its environment should be as colorless as possible—even to the point of dull gray or white.

If these six simple colors in the circle are again separated by intermediate hues (Fig. 1035), so about three of the latter lie between the six original colors, the result will be a circle of twenty-four divisions, having the effect of a rainbow. This will perfectly illustrate the principle of color harmony and color discord. Besides the opposing colors which harmonize by contrast, there are neighboring colors which harmonize by analogy.

For example, any four or five colors lying side by side in the circle are bound together harmoniously by reason of their near relationship. Therefore, all these four or five colors may be combined—and nature does combine them—with esthetic results. But skip over four of the colors and attempt a combination of the first and sixth, and the result will prove to be a discord, the bond of relationship is broken, and the eye is disturbed by the aggressiveness of two colors between which there is evidently no bond of sympathy. It



1037. Harmony by contrast.

would be safe to say, therefore, that the circle demonstrates the fact that its colors situated at right angles with each other are discordant, and those lying nearly parallel with each other are harmonious.

This is the theoretical side of color harmony. The practical side is scarcely different; it simply modifies the theory. Brilliant blue and orange, which are theoretically harmonious, are scarcely as agreeable in each other's company as the rule would imply. The trouble, however, lies with the brilliancy. The golden calendula and the deep purple aster in association are violent and aggressive. Remove the one and the other and substitute pale-tinted flowers of these hues and the result will be harmonious.

Flower families are very likely to sustain harmonies of analogy. Hyacinths, sweet peas, and nasturtiums

with each other. It will be found quickly that white is a peacemaker, and green is an invaluable mediator. With these colors at command, the chances of discord are reduced to a minimum. Everything also depends upon simplicity in color-combinations. It is questionable whether a combination of more than two colors can be ever esthetically a success. The adjustment of many colors needs the hand of an expert.

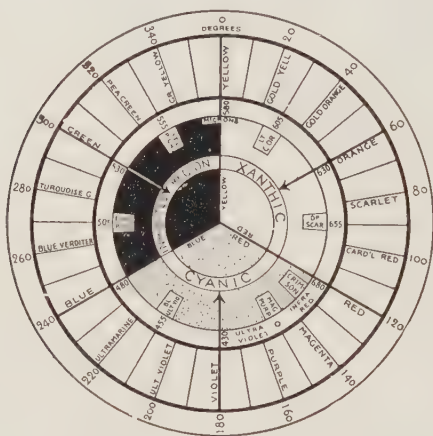
#### *The restriction of color in flowers.*

The very strict limitation of range in flower-colors demands careful study if it would be thoroughly understood. Augustin Pyramus de Candolle divided flower-colors into two classes, which he named xanthic (red, scarlet, orange, gold-orange, yellow, and green-yellow), and cyanic (green-blue, blue, ultramarine-violet, violet, purple, and red). Further, he explained, flowers of the yellow (xanthic) series could pass into red or white but never into blue, and those of the blue (cyanic) series could pass into red or white but never into yellow. The theory is correct but it requires both modification and revision. Gold-orange must evidently displace yellow, and ultramarine-violet displace blue as series names; furthermore, the passage into red should not exceed scarlet-red in the xanthic series, or crimson-red in the cyanic series. Pure red logically should be the zero point between the two divisions, and not be included in either unless connected by analogous hues.

Gold-orange and ultramarine-violet are respectively the type-colors of the two series because each occupies a median position with equal influence on either hand. Red, occupying the median position between the two series, should and does exercise an equal influence on both; a casual glance at the chromatic scale demonstrates the fact. Neither the xanthic nor the cyanic series can exclusively claim the respective yellow and blue in absolute purity, for the cogent reason that among flowers yellow is associated with both these divisions, and a true blue scarcely appears at all. Further, if pure red is the zero point between the two series, then the consistent red of the xanthic order is scarlet-red, and that of the cyanic order is crimson-red; a pure red or pure yellow flower, therefore, consistently belongs to either order according to its xanthic or cyanic congeners.

The best proofs of the above statements are to be found among the flowers themselves. Asters belong to the cyanic group, but there is no blue aster. Tropæolums belong to the xanthic group, but there is no pure yellow nasturtium; there are, however, ultramarine-violet asters and gold-yellow nasturtiums. There is a pure yellow, a golden orange, but no white marigold (*Tagetes*); the species is xanthic. The family *Cruciferae* is cyanic; it includes pure yellow, deeper yellow, and magenta flowers. The genus *Hyacinthus* is cyanic; it includes no blue flower, but many which are purple, violet, cyanic red, and modified yellow. *Viola tricolor* is cyanic; it includes a strong yellow along with intense purple and violet-ultramarine flowers. The genus *Zinnia* is xanthic; it includes no true yellow flower but many which range through all reds into cyanic crimson. The genus *Rosa* is cyanic; its flowers range from pure red to magenta-crimson, develop a strong, modified yellow, fuse yellow with crimson, but never approach the xanthic gold-orange. The genus *Chrysanthemum* is xanthic; its flowers include all yellows, skip pure orange and scarlet, and range from scarlet-red to cyanic red-crimson.

Species belonging to the cyanic group invariably produce white flowers which have an albino origin. Species of the xanthic order produce white flowers which are not albinos but which invariably displace flowers of some strong, pure xanthic hue. For example, geraniums are white, red, scarlet, and pink, but never gold-orange or golden yellow. Carnations are white, red, and cardinal-red, but never scarlet, or orange. Chrysanthem-



1038. The circle of 360° in colors.

represent groups with very nearly related hues or tints. There is a predominating influence of crimson-pink among sweet peas, of lilac among hyacinths, and of orange among nasturtiums, yet the influence at times (in a particular variety) is wholly wanting and is replaced by an analogous tint or hue. It would be a rather nice bit of color adjustment which would result in a harmony superior to that of a careless grouping together of flowers gathered at random from any one of these three genera.

But the theory that analogous colors harmonize is correct only when not carried to excess. Attempts to force deep-hued flowers into harmony often lead to contrary results. A range of color from crimson to ultramarine depends for its harmony upon the careful grading of intermediate hues. Such colors, in full force, might do violence to each other. It is tempting the hardness of a diamond to pound it with a hammer. It is taxing crimson too heavily to expect it to show its beauty in the presence of strong violet! The effort should rather be to merge the individualities of the crimson and the purple flowers into a group and effect a play of color between the two.

The theory that colors at right angles on the wheel are discordant is also subject to some modification. Relatively the right-angled colors must be crude and strong to affect the eye objectionably. Yellow and red in the rose is an agreeable color-combination. Yellow and red dahlias crowded together are certainly harsh and unneighborly.

A country bouquet of asters, marigolds, fuchsias and dahlias is bad, because the country garden is not a part of it. Atmosphere, space, and a stretch of green foliage make a world of difference.

It is wisest to try the effect of one color upon another before allowing two or three strong hues to wage war





XXIX. Cranberry-picking in a New Jersey bog.





mums are yellow, white, and pink, but never orange or scarlet. Dahlias are scarlet, red, crimson-red, and even pure yellow, but never pure gold-orange, or orange.

It is perfectly evident from the foregoing examples that the range in a given genus, or species, is limited to what may be termed the swing of a pendulum upon the chromatic scale (Fig. 1038). The swing may extend over a quarter of the dial, rarely it does more. If it happens that two colors are developed, like violet and yellow, it will still be found that there is but one pendulum-swing and not two. Violet will be associated with contiguous hues, but yellow will be developed quite alone.

This, it is reasonable to believe, is direct evidence of a dual or treble origin of color in a flower group. Yellow cannot be evolved from violet, or vice versa. Necessarily, if white appears in a xanthic group, it must have evolved alone and independent of any color-range in that group. Undoubtedly the range of contiguous colors itself has evolved from a median hue which has spread out, fanlike, in graded variations within strict limits. Naturally, such statements conflict with the old theory that all flowers were originally yellow, but they are not inimical to the idea that the earlier ones might have been yellow, and later ones magenta, violent ultramarine, scarlet, and gold-orange. It is important to keep in mind the fact that a steamboat is not evolved from a locomotive.

It is further evident that yellow belongs quite as little to the xanthic as it does to the cyanic series, or, to put it more strongly, it belongs to neither. Its origin, independent of any "range," was undoubtedly the elimination of blue from chlorophyll. Hence, it is not surprising to find it in some modified form associated with both series, and in the cyanic series isolated. The flora of the northeastern United States is essentially cyanic. Twenty-one per cent is yellow, 21 per cent magenta and 22 per cent white; the remainder is 8 per cent xanthic and 28 per cent cyanic—the last mostly pink and light violet. The record is significant and points directly either to an arrested color development, or to a depauperate color condition in an inclement region; the former seems the more likely. An aggregation of cyanic-flowered plants are found in the north temperate zone, and of xanthic-flowered plants in the torrid zone.

#### Color activity.

Color results from a play of light upon a surface which rejects or absorbs certain rays. It is a significant fact that the red end of the spectrum comprehends those hues which are produced by the caloric rays of the sun, and the violet end those hues which are produced by the actinic rays. It is not surprising therefore that the coloring of vegetation is intense, and that xanthic flowers predominate under the equator. A separation of cyanic and xanthic flowers follows almost identically the thermal lines which band the great continents of the northern hemisphere, cyanic color prevailing north, and xanthic color south of the line marking 80° F. In a word, xanthic flowers belong to a very warm, and cyanic flowers to a temperate or cold climate. That they should become mixed in a narrow zone between the extremes is only natural; the rule, therefore, is in no way compromised thereby. That yellow, too, should appear in both cyanic and xanthic groups is not at all surprising. In the spectrum it holds a median position between the red and the violet ends; it is neither a hot nor a cold color, and has consequently evolved from its primitive condition as a constituent of the green in chlorophyll under any and all temperatures. That is the only way to account for its isolation when connected with cyanic groups.

It would appear, then, that magenta, violet, and ultramarines, together with gold-orange, orange, and red, are primitive colors quite as well as yellow and

white. In what order they appeared upon the earth in the petals of flowers, it would be difficult to determine, but it is reasonable to think they appeared as original colors, in weak, perhaps, but absolute purity. Otherwise, the remarkable limitation of color-range must be accounted for by a less logical theory. Upset this limitation, and attempts to produce a blue rose, yellow aster, white nasturtium, or green carnation, should prove successful. Recognize the limitation, and the futility of such attempts becomes at once apparent, and the possibility of improving existing "strains" of color is illimitable. At some time or other in the distant past the law of limitations fixed the range of flower-colors; no new law of elasticity has since developed to remove the boundaries and thus aid the floriculturist in his ambition to produce what would prove to be a mere novelty. See *Standards of Color*.

F. SCHUYLER MATHEWS.

**COLTSFOOT:** *Tussilago Farfara*. Sweet coltsfoot is *Petasites*, formerly called *Nardosmia*.

**COLUMBINE:** *Aquilegia*.

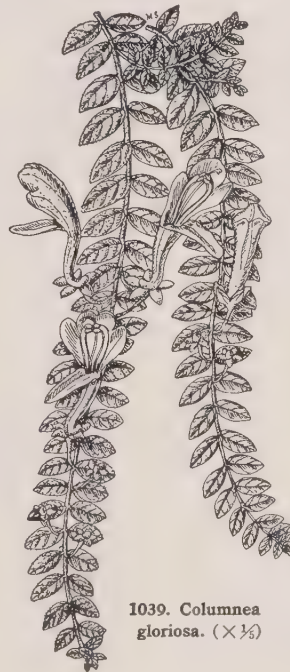
**COLQUHOUNIA** (after Sir Robert Colquhoun). *Labiata*. Tender plants with dense whorls of gaping fls. an inch long or more, colored scarlet and yellow.

Erect or twining shrubs, woolly in all parts when young: lvs. large, crenate: whorls few-fl'd., axillary or crowded into a terminal spike or raceme; corolla-tube incurved, the throat inflated.—Two Asian species. Prop. by cuttings of growing tips, in sandy soil, under glass in summer.

**coccinea**, Wall. Tall climber, with very long branches, 8–10 ft.: lvs. stalked, ovate-acuminate, 3–5 in. long, crenate, dark green above, roughish, typically with scarcely any wooliness except when young: corolla twice as long as the calyx. B.M. 4514.—*C. tomentosa*, Houll., is probably identical. The dense wooliness is perhaps temporary. R.H. 1873:130 shows a handsome terminal spike in addition to axillary clusters, containing about 20 fls.—Apparently not advertised, but probably as worthy as the next.

**vestita**, Wall. Very similar to *C. coccinea*, except that it is a low-growing, erect plant, and more densely and permanently woolly on the st., calyx and under side of lvs., which are elliptic or elliptic-ovate and cordate.—Cult. outdoors at Santa Barbara, Calif., where it may be used for the wild garden as it is perfectly hardy. Not of much horticultural value.

N. TAYLOR.†



1039. *Columnea gloriosa*. (× ½)

**COLUMNEA** (after Columna or Colonna, Italian writer on plants, sixteenth century). *Gesneraceae*. Tropical American shrubs and climbers, sometimes grown under glass in choice collections.

Flowers widely gaping, showy, often 2 in. long: lvs. opposite, nearly equal or widely unlike: fls. solitary or numerous, axillary, stalked or not, without bracts or with bracts in an involucre; corollas scarlet, carmine or yellowish.—A group of 100

species of which half a dozen mostly red- or orange-fl., are cult. abroad and may be known to a few fanciers at home, but are not advertised by the dealers. They are warmhouse evergreens requiring the treatment of *Trichosporum* (*Æschynanthus*).

**Schiedeana**, Schlecht. The best known species. It has handsome scarlet fls. 2 in. long, sometimes variegated with yellow. It is an herbaceous climber from Mex. B.M. 4045. P.M. 9:31.

**gloriösa**, Sprague. Fig. 1039. An epiphytic perennial herb: lvs. ovate or ovate-oblong: fls. axillary, solitary, scarlet and yellow. Costa Rica. B. M. 8378.

*C. glabra*, Oerst, var. *major*. Fls. scarlet; stamens white. Costa Rica.—*C. magnifica*, Klotzsch & Hanst. Corolla bright scarlet; tube inflated about the middle. Costa Rica. G.C. III. 43:66.—*C. Oerstediana*, Klotzsch. Epiphytic undershrub or herb: fls. scarlet. Costa Rica. B.M. 8344. N. TAYLOR.†

**COLÛTEA** (*Koloutea*, ancient Greek name). *Leguminosæ*. **BLADDER SENNA**. Shrubs grown chiefly for their attractive yellow or brownish red flowers and the ornamental bladder-like pods.

Deciduous, with alternate, odd-pinnate lvs.: lfts. many, rather small; stipules small: fls. papilionaceous, in axillary, few-fl., long-peduncled racemes, yellow to brownish red; calyx campanulate, 5-toothed; standard suborbicular with 2 swellings above the claw; 9 stamens connate, 1 free: pod inflated, bladder-like, many-seeded.—About 15 species in the Medit. region to Abyssinia and Himalayas. Ornamental free-flowering plants of rapid growth, with pale green or glaucous foliage and yellow or brownish red fls. during summer, followed by large, usually reddish-colored and decorative pods. They grow in almost any soil, but prefer a tolerably dry and sunny position; not quite hardy N., the hardest being *C. arborescens*.—Prop. by seeds sown in spring or by cuttings of mature wood inserted in fall in sandy soil; rarer species and varieties are sometimes grafted on *C. arborescens* in spring under glass.

A. Fls. yellow: pod closed at the apex.

**arborescens**, Linn. Fig. 1040. Shrub, to 15 ft.: lfts. 9-13, elliptic, dull green, mucronulate, usually slightly pubescent beneath,  $\frac{1}{2}$ -1 in. long: fls. 3-8, about  $\frac{3}{4}$  in. long; wings nearly as long as the keel, flat. June-Sept. S. Eu., N. Afr., N. B.M. 81.—Lvs. have cathartic properties. Var. *crispâ*, Kirchn. Dwarf, with crisped lvs. Var. *bullata*, Rehd. (*C. bullata*, Hort.). Dwarf and compact: lfts. 5-7, obovate or nearly orbicular and somewhat bullate.

**cilicica**, Boiss. (*C. longialata*, Koehne. *C. melanocalyx*, Hort., not Boiss.). Shrub: lfts. bluish green, usually 11, oval or broadly ovate, rounded or truncate and mucronulate at the apex,  $\frac{1}{2}$ - $\frac{3}{4}$  in. long: fls. bright yellow, 3-6, about  $\frac{3}{4}$  in. long; wings longer than the keel. June-Aug. Asia Minor. G.C. III. 16:155.

AA. Fls. orange-yellow or brownish red; wings shorter than the keel.

**média**, Willd. Shrub, to 10 ft.: lfts. 7-13, obovate, grayish green or glaucous,  $\frac{1}{3}$ - $\frac{2}{3}$  in. long, nearly gla-

brous: fls. 3-6, orange or reddish yellow, the standard with brownish markings: pod closed at the apex. June-Sept.—Probably hybrid of garden origin between *C. arborescens* and the following, often cult. under the names of the following species.

**orientalis**, Mill. (*C. cruenta*, Ait.). Shrub, to 6 ft.: lfts. 7-11, obovate, glaucous, thickish,  $\frac{1}{3}$ - $\frac{1}{2}$  in. long, nearly glabrous: fls. 3-5, reddish yellow or brownish red: pod open at the apex. June-Sept. S. E. Eu., Orient.—Often cult. under the name of *C. halepica* or *C. istria*.

*C. brevialata*, Lange. Shrub, to 4 ft.: lfts. usually 11, oval,  $\frac{1}{2}$ - $\frac{3}{4}$  in. long: fls. 2-6, yellow; wings much shorter than keel. S. France.—*C. gracilis*, Freyn & Sitenis. Lfts. usually 11, obovate,  $\frac{1}{4}$ - $\frac{1}{2}$  in. long: fls. 2-5, yellow, with the wings almost as long as the keel. Turkestan.—*C. istria*, Mill. (*C. halepica*, Lam. C. Pocockii, Ait.). To 4 ft.: lfts. glaucous, small and numerous: fls. yellow, nearly 1 in. long; wing longer than the keel.—*C. nepalensis*, Hook. Similar to *C. arborescens*: racemes drooping. B.M. 2622. B.R. 1727. Tender.

ALFRED REHDER.

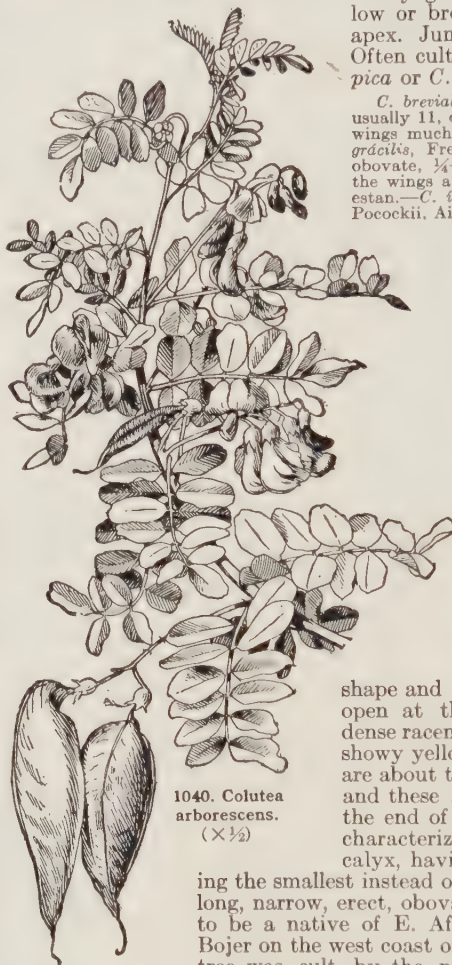
**COLVILLEA** (after Sir Charles Colville, governor of Mauritius). *Leguminosæ*. Showy-flowered tropical tree, a worthy rival of the royal poinciana, which is closely allied, but easily distinguished, especially by its round and full, not flat, legume.

Colvillea has drooping racemes,  $1\frac{1}{2}$  ft. long, densely crowded with perhaps 200 fls. of curious shape and of a splendid scarlet; the fls. open at the st. end of the pendent dense raceme, and display masses of long showy yellow stamens; the unopened fls. are about the size and shape of a filbert, and these are gradually smaller towards the end of the raceme.—Only 1 species, characterized by its large, oblique, colored calyx, having 4 segms., the standard being the smallest instead of the largest part; wings very long, narrow, erect, obovate: pod 2-valved.—Supposed to be a native of E. Afr., but discovered in 1824 by Bojer on the west coast of Madagascar, where a single tree was cult. by the natives. It flowered there in April or May. Its cult. is similar to that of *cesalpinia*. Prop. in the S. only by seeds. Not common in cult. outside of botanic gardens and fanciers' collections.

**racemosa**, Bojer. Tree, 40-50 ft. high, with the general aspect of *Poinciana regia* but with a thicker trunk and ampler foliage; branches very long and spreading: lvs. about 3 ft. long, alternate, remote, twice pinnate, with 20-30 pairs of pinnae which are opposite, 4 in. long, and have 20-28 pairs of lfts., each  $\frac{1}{2}$  in. long: keel very small, almost covered by the wings; free stamens 10, 3 inserted below the standard, 2 under the wings, 1 under the keel, and 4 under the ovary. B.M. 3325-6.

WILHELM MILLER.

**COMÁNDRA** (name alludes to the hairs in the fl.). *Santalacææ*. Perhaps a half-dozen leafy herbs or subshrubs, one in Eu., and the others in N. Amer., more or less parasitically attached to the roots of other plants, one or two of which may be of interest to horticulturists. Lvs. alternate, almost sessile: fls. whitish or greenish, small, perfect, in terminal cymes or umbellate panicles; calyx 4-5-cleft, lined or constricted



1040. *Colutea arborescens*. ( $\times \frac{1}{2}$ )



above the ovary, and the tube sometimes conspicuously continued to a neck or top on the fr.; petals wanting; stamens of same number as calyx-lobes, the anthers connected by hairs to the calyx-lobes: fr. nut-like or drupe-like. *C. umbellata*, Nutt. (Fig. 1041), 6-18 in.

high, in dry mostly open ground in the eastern states, is an attractive plant when allowed to spread naturally in patches in waste places: rootstock not showing above ground (*C. Richardiana*, Fern., has a superficial rootstock): lvs. thin, oblong, pale beneath: fls. whivish.

L. H. B.

**COMARÉLLA:** *Potentilla*.

**COMAROSTAPHYLIS:** *Arctostaphylos*.

**COMARUM** (an old Greek name). *Rosaceæ*. One species allied to *Potentilla*, and often referred to that genus but differing in the lateral style unknown in *Potentilla*. *C. palustre*, Linn. (*Potentilla palustris*, Scop.), the marsh cinquefoil, is a decumbent herb growing in swales in the northern states (also in the Old World), with pinnate, 5-7-foliolate lvs. (lfts. dentate), and solitary or cymose purple fls.  $\frac{1}{2}$  in. across: petals shorter than the calyx-lobes, acute; stamens numerous. An odd and interesting but not showy plant, sometimes planted in bogs. Mn. 3:97.—The fr. somewhat resembles a strawberry, but is spongy instead of juicy. In some parts of Scotland, it is said to be called cowberry and is rubbed on the inside of milk-pails to thicken the milk. *C. Salesovii*, Bunge (*Potentilla Salesoviana* Steph.), of the Himalayan region and Thibet, 11,000-14,000 ft. altitude, is a suffruticose silky-hairy plant worthy of cult., but little known in gardens: lvs. pinnate; lfts. 7-9, oblong, obtuse, crenate-serrate: fls. white, in an ample paniculate cyme. Probably better placed in *Potentilla*. B.M. 7258.

N. TAYLOR.†

**COMBRÈTUM** (old Latin name). *Combretææ*. Tropical shrubs and trees, many of which are climbers by means of the persistent leaf-stalks.

Leaves mostly opposite, in some species verticillate in 3's or 4's, entire: fls. in spikes or racemes, polygamous; calyx bell-shaped; petals usually 4; stamens usually 8: fr. winged and indehiscent, 1-seeded.—A genus of 250 species from Asia, Afr. and Amer., particularly S. Afr. The combretums are warmhouse plants, little known in this country. Prop. by cuttings of firm wood. One climbing species is in the American trade: *C. coccineum*, Lam. (*C. purpureum*, Vahl. *Poivreia coccinea*, DC.), from Madagascar. Lvs

oblong-lanceolate, acuminate, evergreen: fls. small, brilliant red, the long-exserted stamens forming the chief feature of beauty; the handsome loose spikes often in panicles; parts of the fl. in 10's. B.M. 2102. L.B.C. 6:563.—Handsome. *C. butyrosom* yields a butter-like substance, used by the Afirs as food. *C. sundaicum* in recent years has attained some prominence as a reputed anti-opium remedy.

N. TAYLOR.†

**COMFREY:** *Symphytum*.

**COMMELINA** (bears the name of early Dutch botanists). Also written *Commelyna*. *Commelinææ*. DAY-FLOWER. Perennial or annual herbs, of which a very few are cultivated in the open or under glass for their interesting flowers.

Upright, spreading or procumbent, usually more or less succulent, often rooting at the joints: lvs. alternate, sessile or short-petioled, clasping the st., a lf. subtending the sessile fl.-cluster and forming a clasping folded spathe: fls. opening for a day, mostly blue (varying to white and rose), irregular; outer perianth parts (calyx) 3, colored, 2 of them somewhat united; inner parts (petals) 3, one of them small and 2 broad and with long claws; stamens usually 6, but only 3 of them fertile; filaments not hairy: fr. a 2-3-celled caps. on a recurved pedicel.—Nearly or quite 100 species, in warm regions around the globe, a few of them reaching cool-temperate climates. The cult. species are perennials. The hothouse species appear not to be offered in this country or to be much cult. Allied to *Tradescantia* and *Zebrina*.

Commelinas are mostly of easy culture, thriving well in any light rich soil. The evergreen stove and greenhouse species are readily propagated in March or April by cuttings inserted in an ordinary propagating-bed and kept close for a few days, while the tuberous-rooted half-hardy herbaceous species may be propagated either by division of the tubers or by seeds sown in a frame early in April and afterwards transplanting the seedlings in the herbaceous border. In the fall, they should be lifted and the tubers stored away in the same manner as dahlias. Of the tuberous-rooted species, *C. caelestis* is perhaps the best, its bright blue flowers being very effective, especially when planted in masses. (Edward J. Canning.)

A. Plant hardy in the open.

**nudiflora**, Linn. (*C. Sellowii*, Walp. *C. Sellowiana*, Schlecht.). Creeping, rooting at the joints, glabrous or practically so: lvs. lanceolate to ovate-lanceolate, acute or acuminate, the lf.-sheaths often ciliate: spathe-lf. acute or acuminate, broad at base, petioled: fls. few in each cluster,  $\frac{1}{2}$  in. or less across, blue: caps. 3-celled and 5-seeded. N. J. southward and widely dispersed in other parts of the world.—Sometimes offered as an outdoor plant. A rose-colored form is reported.

**communis**, Linn. Much like the last and often confused with it: more erect and less rooting at joints: fls. larger: caps. 2-celled and 4-seeded. N. Y. southward, and widely distributed; perhaps an intro. from Asia.

1042.  
*Commelina*  
*caelestis*.  
( $\times \frac{1}{2}$ )



1041. *Comandra umbellata*. ( $\times \frac{1}{2}$ )



AA. *Plant tender or only half-hardy.*

**tuberosa**, Linn. Diffuse and branching, from a tuberous root: lvs. narrow-lanceolate, 2-3 in. long: spathe-lf. cordate-ovate to lanceolate, conduplicate, more or less hairy; sheaths pubescent: fls. rich blue. Mts. of Mex.—The plant sold under this name is recommended as a free-flowering border plant in England, the tubers to be lifted in autumn and stored in dry sand for the winter.

**cœlestis**, Willd. Fig. 1042. Erect, root more or less tuberous, 10-18 in. high, branching, with clasping, long, broad-lanceolate pointed lvs. and blue fls. (2-10 together) on elongating axillary pubescent peduncles: spathe-lf. ovate, folded; sheaths ciliate. Mts. of Mex.—Runs into several forms. Var. **alba**, Hort., has white fls. Var. **variegata**, Hort., has fls. blue and white. *C. cœlestis* is a half-hardy plant, in the N. requiring protection of a greenhouse, although it may be planted out. Prop. by seed, cuttings and tubers.

L. H. B.

**COMPARÉTTIA** (Andreas Comparetti, 1746-1811, Italian botanist). *Orchidaceæ*. A small group of graceful epiphytes.

Pseudobulbs, 1-3-lyd.: racemes simple or branched; fls. small, lateral sepals united in a single piece, lengthened at the base into a conspicuous horn; lateral petals converging; labellum large, produced into a double spur, which is hidden in the horn made by the sepals; column free, semi-terete, erect; pollinia 2.—Four species, Mex. to Brazil. Grown on blocks or in baskets in a light intermediate or warmhouse.

**coccinea**, Lindl. Pseudobulbs small, bearing lanceolate, coriaceous lvs., purple beneath: racemes several-fld.; fls. 1 in. across; petals and sepals light yellow, margined orange-red, labellum large, broader than long, crimson. Brazil. B.R. 24:68. I.H. 13:472.

**falcata**, Poepp. et Endl. (*C. rosea*, Lindl.). Similar in habit to *C. coccinea*: fls. 1 in. across, deep crimson; labellum broad; racemes pendent. Peru. B.M. 4980. A.F. 6:609. Lind. 4:163. F.S. 2:109.

**macropiëtron**, Reichb. f. Fls. 10 or more, 2 in. across, dorsal sepal whitish, often spotted with purple; midlobe of labellum cleft, suborbicular, magenta-rose, dotted at the angled base; spurs conspicuous. Colombia. B.M. 6679. Var. **punctatissima**, Hort., has the fls. copiously rose-spotted. C.O. 1. GEORGE V. NASH.†

COMPASS PLANT: *Silphium*.

**COMPOST**. Mixed and rotted vegetable matter, particularly manure and litter, used as a fertilizer and amendment.

The mixture of bulky fertilizing materials known as compost, while of little importance to the general farmer, plays an important part in garden practices. Many of the garden crops must be made in a very short time, or are of delicate feeding habits. Their food, therefore, must be easily assimilable. It is good practice to pile all coarse manures, sods, weeds, or any rubbish available for the purpose, in big flat heaps (Fig. 1043), to ferment and rot before being applied to the garden soil. If desired, chemical manures, especially superphosphate (dissolved bone or South Carolina rock) and potash (muriate or kainit), may be added to make the compost the richer. By spading or forking the heaps over a few times at reasonable intervals, a homogeneous mass is easily obtained, which can be applied in greatest liberality without fear, or more sparingly, in accordance with the needs of the particular crop. Of equal, if not still greater importance, is the compost heap which gives soil for greenhouse benches, flats, hotbeds and coldframes. This compost is principally made of sods shaved off a rich pasture or meadow and piled in alternate layers with stable manure, more of the latter being used for forcing succulent crops, and

less in growing plants which should be short and stocky, like cabbage or tomato plants. Garden litter may be added to the pile, as leaves and trimmings. All compost heaps, during dry weather, need frequent and thorough moistening with water, or, better, with liquid manure. Turn several times during the year, to ensure thorough rotting of the materials. T. GREINER.

**COMPTÈRIS**. The only published reference to this generic name and species is in G.C. III. 29: May 21, 1901, suppl. 2, where its introduction to cultivation by L. Linden is noted. The name *Compteris* may be a corruption, or the plant may have been a young form of some known form. The description below is quoted from *The Gardeners' Chronicle*.

**C. Brazzaiana**, Hort. Intro. in Eu. about 1900, as a remarkably distinct large fern with long bipinnate fronds narrow at base and broad across the middle and tapering to a narrow point; barren pinnae oval or oblong and simple; fertile pinnae distinctly lobed.

R. C. BENEDICT.

**COMPTÔNIA** (Henry Compton, Bishop of London, patron of horticulture, died 1713). *Myricaceæ*. A small native shrub, useful for covering banks and to grow on sterile sandy and stony soil.



1043. A compost heap.

The genus is allied to *Myrica*, and by some not regarded as sufficiently different in botanical characters to justify separate generic rank: branching brown-twigged bush, dioecious or monoecious, with globular fertile catkins, the 1-celled ovary surrounded by 8 linear persistent scales or bractlets: lvs. long-oblong, pinnatifid: fr. a bur-like axillary head of few small nuts. The only species is *C. asplenifolia*, Gærtn. (*C. peregrina*, Coulter. *Myrica asplenifolia*, Linn.) SWEET FERN. In dry, sterile soil in the E. and N. U. S.; also in the trade. It is an attractive undershrub (1-3 ft.) with fern-like, scented foliage and brownish heads of imperfect fls.: roots long and cord-like: staminate catkins 1 in. or less long, slender, in clusters at the ends of the branchlets.

L. H. B.

**CONÁNDRON** (cone-shaped anther). *Gesneriaceæ*. Almost stemless herb with radical glabrous rugose lvs. Differs from *Streptocarpus*, its nearest horticultural relative, in having a straight, not twisted pod. For cult. see *Streptocarpus*. It should be grown in shade and is hardy only south of N. C.

**C. ramondoides**, Sieb. & Zucc., of Japanese mountains, is the only species. It is an interesting little tuberous-rooted herb, with oblong, rugose, irregularly toothed root-lvs. and scapes bearing 6-12 white or purple, dodecatheon-like fls.: cymes nodding or drooping pubescent; corolla 1 in. diam.: seeds very minute



B.M. 6484.—This is one of several groups of rare and widely scattered herbs, of which *Ramondia*, *Haberlea*, *Wulfenia*, *Didymocarpus*, *Shortia* and *Schizocodon* are examples. Conandron is adapted to growing in shady rockeries. Scapes less than 1 ft. high. Little known in cult., but is in the trade.

N. TAYLOR.†

**CONE-FLOWER:** *Rudbeckia*. **Purple Cone-Flower:** *Echinacea*.

**CONGÈA** (from an East Indian vernacular name). *Verbenacæ*. A few species of climbing shrubs in Burma and the Malayan peninsula: lvs. opposite and entire: fls. in peduncled capitate cymes which are combined in large terminal panicles, the bracts at the base of the cyme-peduncles large and often showy; calyx funnel-form, 5-toothed; corolla-tube slender, seldom much exceeding the calyx, usually hairy in the throat, 2-lipped, the upper lip of 2 narrow upright lobes and the lower of 3 shorter broader lobes; stamens 4, exserted; ovary incompletely 2-celled: fr. a small roundish nearly dry drupe. *C. tomentosa*, Roxbg., is grown in India and is said to be suitable for growing in a stove or warm conservatory in Britain: a strong climber, conspicuous for the pink and changing tints of the large elliptic persistent bracts in the loose woody terminal panicles: lvs. 3 in. long, ovate-acute, soft-hairy beneath: corolla white; calyx hairy. Burma. G.C. III. 54:399.—Evergreen: infl. retained for several weeks. Allied to *Petræa volubilis*.

**CONIFERS:** *Arboriculture*.

**CONIOGRÁMME** (Greek, *dust-line*). Formerly *Dictyogramma*. *Polypodiææ*. A few Japanese and Pacific island ferns, with naked sori, which follow the course of the free or reticulated veins. The species are sometimes referred to *Gymnogramma*. Strong-growing indoor-ferns, useful for specimen plants.

**japónica**, Diels. Lvs. simply pinnate or bipinnate at the base, 1½–2 ft. high, the pinnæ 6–12 in. long and an inch wide; sori extending from the midrib to the edge. Japan and Formosa.—Also known as *Gymnogramma japonica*. An interesting fern of rather strong growth, and very distinct in appearance. Grows best in a moderate temperature—for example, 55–60°—and requires an open and well-drained soil of peaty character.

R. C. BENEDICT.†

**CONIUM** (Greek name). *Umbelliferæ*. Two weedy biennial plants, widely distributed. *C. maculatum*, Linn., is the poison hemlock, “by which,” as Gray writes, “criminals and philosophers were put to death at Athens.” It is a rank, much-branched European herb which has run wild in E. N. Amer., and which has been offered in the trade as a border plant. It is biennial, rank-smelling, and poisonous, and is scarcely worth cult. although the finely cut dark foliage is highly ornamental. It grows from 2–4 ft. high, and has large umbels of small white fls. See *Poisonous Plants*.

In North America the word hemlock is used for the hemlock spruce, *Tsuga*.

**CONOCÉPHALUS** (Greek, *cone head*). One of the liverworts (*Marchantiacæ*), with broad flat forking evergreen thallus, growing on moist banks, like a moss. *C. cónicus*, Dumort., is sometimes offered by collectors as a cover for rockeries, but can scarcely be said to be a cultivated plant.

**CONOCLINIUM:** *Eupatorium*.

**CONOPHÁLLUS** (name refers to the cone-shaped inflorescence). *Aracææ*. A name proposed by Schott for certain aroids, but now made a section of *Amorphophallus*. *C. Kónjac*, Koch., is *Amorphophallus Rivieri* var. *Konjac*, Engler. The great tuber is much grown in Japan for the making of flour (see Georgeson, A.G.13:79). *Amorphophallus Rivieri* is figured on p.

276, Vol. I.; also in R.H. 1871, p. 573; and in B.M. 6195 (as *Proteinophallus Rivieri*). Konjak is offered by importers of Japanese plants.

**CONSERVATORY.** Primarily a glasshouse in which plants that have been brought to perfection—usually in other greenhouses—are to be placed for display or to be kept in condition.

The conservatory should be as near the residence as possible; if not an architectural unit of the house, it may be connected by a corridor or pergola. The size of a conservatory depends of course upon the requirements or taste of the family; some are as small as 6 by 10 feet, while others are as large as 35 by 75. The aspect or side of the dwelling best suited to a conservatory is on the east, and preferably against a gable, so that sliding snow from the roof of the dwelling will not give trouble. If this is not convenient, the glass roof of the conservatory must be protected with snow-guards. A lean-to house is subject to great fluctuations if placed against the south side.

Since much attention has been given to the building of conservatories within the past few years, they can now be made attractive in architectural design, and at the same time supply the best possible conditions for the well-being of the plants. A curvilinear roof is usually more attractive and is better for the plants than a flat roof, but abundant ventilation must be provided. The roof glass should be ground or frosted, as plants remain in flower much longer under a subdued light than when exposed to direct sunlight. Even ground glass is not sufficient in summer, some shading being required; roller shades are hard to adjust and not altogether practicable: whitewash applied to the glass outside is unsightly and damages the painted wooden strips in which the glass is laid. The following has been found to be an excellent shading mixture: Sixteen ounces white lead, thirty-eight ounces turpentine, two ounces linseed oil; apply to the glass outside with an ordinary paint-brush. The advantages of this mixture are that it is not unsightly, is easily applied, and wears off as winter comes on.

The heating of a conservatory is an important matter, since even night temperatures must be maintained as in other greenhouses. This can easily be arranged if the dwelling is heated by hot water, which is the best for any conservatory; but with steam or hot air it is more difficult; if possible when these methods of heating the dwelling are used, a separate small hot-water system should be installed for the conservatory. The temperature at which conservatories are to be kept depends upon the plants grown in them. Palms, ferns, orchids and ornamental-leaved plants generally require a night temperature of about 60°. Flowering plants, such as chrysanthemums, azaleas, primulas and bulbs, do better in a temperature of 45° to 50° at night with a rise of 15° to 20° for both classes of plants by day before opening the ventilators, and these, in winter especially, must be opened with caution, admitting the outside air very sparingly.

The floor of a conservatory may be of tiles and the interior may be arranged with rugs and easy chairs in the center with the plants arranged on tables around the outside or over the heating-pipes. The catalogues of the principal greenhouse builders show some very artistic arrangements, both inside and outside.

A conservatory is often a part of a commercial greenhouse establishment, being in effect the display house or room into which interesting and perfected plants are brought for inspection; and in large cities conservatories are often attached to florists' stores, not only as a display house but because plants will keep in much better health and condition for a much longer time than in the ordinary conditions of the florist's store; but commonly the word is used as above to designate an adjunct to a home.

EDWARD J. CANNING.

**CONVALLARIA** (old name *Lilium convallium*, derived from *convallis*, a valley). *Liliaceæ*. **LILY-OF-THE-VALLEY**. A dainty herb, much prized for its erect racemes of white delicately-scented flowers; perennial.

Leaves radical, from a horizontal rootstock, producing upright parts or pips (Fig. 1044): fls. white (sometimes pink-tinged), small and short-bell-shaped, with short blunt recurved lobes, nodding, in a short, radical, raceme (Fig. 1045), the stamens 6 included, style 1 (Fig. 1046): fr. a globular small few-seeded red berry. —Commonly considered to be only one species, native in Asia, Eu., and in the higher mts., Va. to S. C.; of several similar races or types.

Lily-of-the-valley is much prized for its delicate, sweet-scented flowers. The rhizome and roots are sold in drug-stores: they are poisonous in large doses; in small doses used as a heart tonic. The plant is popularly supposed to be the one referred to in the Sermon

on the Mount, but this is not to be determined. It is essentially a shade-loving plant. The species is *C. majalis*, Linn. Lvs. oblong or oval, thick and persisting till autumn, forming a dense sod, plane, with more or less bloom: racemes 5–10 in. high: berry  $\frac{1}{4}$  in. diam. R.H. 1886: 84. Gn. 47, p. 179; 52:182 and p. 319 (the latter in fruit). A.F. 13:402. Gng. 5:56–7. F.R. 2:4. G.C. III. 23:149 (var. *grandiflora*). Lowe, 42 (var. *variegata*).

The plant is hardy, and is easily grown in partially shaded places and moderately rich ground. Old beds are liable to run out. The roots and runners become crowded, and few good flower-stems are produced. It is best to replant the beds every few years with vigorous fresh clumps, which have been grown for the purpose in some out-of-the-way place. Five or six strong pips, with their side growths, planted close together, will form a good clump in two years if not allowed to spread too much. The mats of clean foliage make attractive carpets under trees and in other shady places. If the bed is made rich and top-dressed every fall, it may give good results for four or five years; and plants in such beds thrive in full sunshine. One form has prettily striped foliage, very ornamental in the early part of the season. Lilies-of-the-valley bloom early in spring. They run wild in many old yards, in cemeteries, and along shady road-sides. There are double-flowered forms; also one (var. *prolificans*) with racemes 2 feet long. (J. B. Keller.)

For culture as a florist's flower, see *Lily-of-the-valley*.

Recent studies of this genus by E. L. Greene, have distinguished 3 other species: *C. japonica*, Greene, representing the Japanese form of the plant: rootstock very short and stout: lvs. 2 only, sub-equal, elliptic, cuspidately acute, bright green with no trace of bloom on either surface; peduncle short, about equaling the bases of the lvs.: raceme few-fl'd., the bracts small, ovate-lanceolate; perianth widely opening, broadly bell-shaped or almost saucer-shaped; stamens large, very short, the very obtuse anthers longer than the filaments. —*C. globosa*, Greene. Herbage light green, without trace of bloom: lvs. with a more fibrous and less fleshy anatomy than those of *C. majalis*, and of shorter duration, disappearing by the end of summer: perianth urn-shaped (not bell-shaped); stamens inserted about the middle of the perianth, extending horizontally (rather than vertically, as in *C. majalis*). Probably N. C., but described from plants growing in a wild garden in Washington, D. C.; later-blooming than *C. majalis*. —*C. majuscula*, Greene. Differs from *C. majalis* in its very large light green lvs., which have no trace of bloom and an excessively fibrous

anatomy which makes the growing lf. to look plicate; more than twice larger than *C. majalis*, later-blooming: perianth broadly bell-shaped; filaments very short, nearly hypogynous, erect; anthers large, oblong, obtuse, cordate at base. S.E. Pa., and southward. L. H. B.

**CONVOLVULUS** (Latin, *convolvere*, to entwine). *Convolvulaceæ*. Includes *Calystegia*. **BINDWEED**. Annual and perennial herbs, grown mostly in the open; some are twiners.

Sometimes suffrutescent, twining, trailing, erect or ascending, with filiform, creeping rootstocks: lvs. petiolate, entire, toothed or lobed, generally cordate or sagittate: fls. axillary, solitary or loosely cymose, mostly opening only in early morning; corolla campanulate or funneliform, the limb plaited, 5-angled, 5-lobed or entire. —A genus of about 175 species, widely distributed in temperate and tropical regions. *Convolvulus* and *Calystegia* are no longer kept separate. As *Convolvulus Sepium* is the type of both genera, they are therefore synonymous. When the fls. of *C. occidentalis* are borne singly, the calyx bracts are broad and *Calystegia*-like; when borne in clusters the bracts are greatly reduced.

The species thrive in a variety of soils without especial care. The greenhouse species do best in a soil with considerable fiber. The hardy perennials are usually propagated by dividing the roots, otherwise by cuttings or seeds, the tender species preferably by cuttings. *C. tricolor* is the most important of the hardy annuals. It may also be started in the greenhouse, and makes an excellent plant for the hanging-basket. All are vigorous growers, and may become troublesome weeds in some places if not kept within bounds. *C. japonicus* and *C. Sepium* should be used with caution. This is the chief reason why the hardy perennials are not often found in well-kept gardens, except along wire fences or lattice screens, where the turf is laid up close so as to allow only a narrow border for the roots. The double-flowered form of *C. japonicus* is seen to best advantage in half-wild places, or on rocky banks, where shrubs make but a stunted growth. Here it will grow luxuriantly, forming graceful festoons from branch to branch, and covering the ground with a pretty mantle of green. (J. B. Keller.)

*C. purpureus*, the common morning-glory, and many related species are to be found under *Ipomœa*.

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1044. Lily-of-the-valley pip.



1045. Raceme of Lily-of-the-valley. (Natural size)



1046. Section of flower of lily-of-the-valley, laid open to show the parts. (×2)



A. Calyx with 2 membranaceous bracts at the base: peduncles usually 1-fld. (*Calystegia*.)

B. St. prostrate, 8 in. to 2 ft. high: peduncle usually shorter than the lvs.

1. *californicus*, Choisy (*C. villosus*, Gray. *Calystegia villosa*, Kellogg). Plant densely white-villose throughout: st. prostrate, scarcely twining: lvs. slender-



1047.  
*Convolvulus japonicus*.  
( $\times \frac{1}{2}$ )

petioled, reniform-hastate to sagittate, the upper acuminate, 1 in. or less long, the basal lobes often coarsely toothed: bracts oval or ovate, completely inclosing the calyx: fls. cream-yellow, 1 in. long. Calif.—Perennial.

2. *malacophyllus*, Greene. Similar to the preceding but foliage velvety or plushy pubescent. Calif.—Perennial. Other closely related Californian species are *C. saxicola*, Eastw., *C. deltoideus*, Greene, *C. Berryi*, Eastw. and *C. atriplicifolius*, House.

BB. St. twining or trailing, 3–10 ft. high: peduncle exceeding the lvs.

3. *japonicus*, Thunb. (*Calystegia pubescens*, Lindl.). CALIFORNIA ROSE. Fig. 1047. Hardy perennial herbaceous twiner: growth very vigorous, often 20 ft.: whole plant more or less densely and minutely pubescent: lvs. hastate, lanceolate, obtuse or broadly acute, with angular or rounded lobes at the base, variable, occasionally without lobes, rarely sharp lanceolate: fls. bright pink, 1–2 in. broad, produced freely during the summer months and remaining expanded for several days. Japan and E. Asia. The double form is now naturalized from S. E. N. Y. to D. C. and Mo. P.M. 13:243. F.S. 2:172. B.R. 32:42.—The double form is completely sterile, with narrow wavy petals, irregularly arranged, the outer somewhat lacerate. A valuable decorative plant for covering stumps and walls. In rich soil the roots spread rapidly, and will smother out all other plants unless confined in tubs. The *Calystegia pubescens* of Lindley has been wrongly referred to *Ipomæa hederacea*, but the two plants are very different, the former being perennial and the latter annual. See Journ. Hort. Soc. 1:70 (1846). The plant is commonly confounded with *C. Sepium*.

4. *occidentalis*, Gray. Hardy perennial, herbaceous or with suffrutescent base: st. twining, several feet high, glabrous or minutely pubescent: lvs. from angulate-cordate, with a deep and narrow sinus, to lanceolate-hastate, the posterior lobes often 1–2-toothed: peduncle 1-fld. or proliferously 2–3-fld., bracts ovate or lanceolate, usually completely inclosing the calyx, variable; corolla white or pinkish, 1–2 in. long; stigmas linear. Dry hills, Calif.—Listed as early as 1881.

An admirable plant for rockeries. Several related species are native also to Calif.: *C. cyclostegius*, House, *C. Binghamiæ*, Greene, *C. polymorphus*, Greene, *C. Greenei*, House, *C. aridus*, Greene, *C. purpuratus*, Greene, *C. illecebratus*, House, *C. gracilentus*, Greene, and *C. longipes*, Wats.

5. *Sepium*, Linn. (*Calystegia Sepium*, R. Br.). RUTLAND BEAUTY. Fig. 1048. Perennial trailer, 3–10 ft. long, glabrous or minutely pubescent: lvs. round-cordate to deltoid-hastate, the basal lobes divaricate, entire or angulate: fls. white, rose or pink, with white stripes. F.S. 8:826. B.M. 732. A.G. 12:638. Gn. 50:514.—A very variable species. Cosmopolitan in temperate regions. An insidious weed in moist soil. The native forms have been called *C. interior*, House, Rocky Mt. region; and *C. americanus*, Greene, in the eastern states, but are difficult to distinguish. Var. *repens*, Gray (*C. repens*, Linn.). Pubescent: sts. trailing or sprawling: the basal lobes of the lvs. obtuse or rounded. Coastal region from Que. to Fla.

AA. Calyx without bracts: peduncle 1–6-fld. (*Euconvolvulus*.)

B. St. prostrate, trailing, glabrous or minutely pubescent.

6. *mauritanicus*, Boiss. Strong perennial roots: st. herbaceous, slender, prostrate, rarely branched, minutely villose: lvs. alternate, round-ovate, obtuse, short-petioled: fls. blue to violet-purple, with a lighter throat, 1–2 in. across, very handsome. Afr. B.M. 5243. F.S. 21:2183. Gn. 39:52.—A free bloomer through the summer. On dry banks each plant forms a dense tuft which throws up many graceful shoots. Not hardy north of Philadelphia.

7. *Scammônia*, Linn. Hardy perennial trailer, deciduous: st. angular, glabrous: lvs. cordate-sagittate, gray-green, the lobes entire or dentate: sepals glabrous, ovate, obtuse; corolla white, creamy or light pink. Asia Minor.—The large tap-roots supply the resinous cathartic drug scammony.

BB. St. erect or ascending, silky.

8. *Cneorum*, Linn. St. shrubby, half-hardy, 1–4 ft. high: lvs. persistent, lanceolate or spatulate, silky gray: infl. a loose panicle, 1–6-fld.; fls. white or tinged with pink, borne freely during the summer. S. Eu.—Valuable as a pot-plant for greenhouse or window decoration, or trained to a warm wall. Confused with *C. oleæfolius*.

9. *oleæfolius*, Desr. Tender perennial: lvs. linear-lanceolate, acute, slightly villose: fls. bright pink, borne freely in loose, umbellate panicles in the summer. Greece. B.M. 289 (as *C. linearis*).—Many plants now passing as *C. oleæfolius* are *C. Cneorum*. The latter may be distinguished by its broader, blunter, silvery-villose lvs., lighter-colored blossoms and taller growth.

10. *tricolor*, Linn. (*C. minor*, Hort.). Fig. 1049. Hardy annual: st. trailing, ascending 6–12 in., angulate, densely covered with long brown-



1048. *Convolvulus Sepium*. ( $\times \frac{1}{2}$ )

ish hairs: lvs. linear-oblong or subspatulate, obtuse or rounded at the apex, usually pubescent but sometimes glabrous, the margin ciliate towards the base: peduncle 3-fld., exceeding the lvs.; sepals ovate, lanceolate, villous, acute; limb of the corolla azure-blue, throat yellow, margined with white. S. Eu. B.M. 27.—One of the best annuals for the home border. Each plant covers a ground space of 2 ft., and blooms continuously throughout the summer. Fls. remain open all day during pleasant weather. There are many variously striped and spotted forms of this popular annual, none of which surpasses the type in beauty. A variety with pure white fls. is attractive. Other well-marked horticultural forms are: Var. *vittatus*, prettily striped with blue and white. F.S. 3:298. R.H. 1848:121. Var. *compactus*, dwarf, and valuable for pot culture. Gt. 47, p. 635. A 5-petaled form is also recorded. F.S. 8, p. 116, desc.

11. *aureus superbus*, Hort. A tender perennial, but may be treated as an annual, since it flowers the first season from seed: st. trailing or twining, 4-5 ft. long: fls. golden.—Valuable as a greenhouse climber and for hanging-baskets. Not sufficiently described for identification.

*C. althæoides*, Linn. (*C. italicus*, Roem. & Schult.). St. prostrate, twining or climbing, if it finds support: upper lvs. pedatifid.; lower ovate-cordate, crenate, silvery: fls. pink. May-Aug. Medit. region. B.M. 359. F.S. 10:1021 (as var. *argyreus*). R.H. 1864:111.—*C. ambigens*, House, native from Mont. to New Mex. and S. Calif., is a close relative to *C. arvensis*.—*C. arvensis*, Linn. Slender perennial trailer, 1-3 ft. long, glabrous or nearly so: lvs. ovate-sagittate or hastate, variable: fls. white or pink. Eu. and E. Asia. Naturalized in old fields through the Atlantic states and Calif. A troublesome weed in cult. grounds.—*C. canariensis*, Linn. Greenhouse evergreen: lvs. oblong-cordate, acute, villous: fls. violet-purple; peduncle 1-6-fld. Canary Isls. B.M. 1228.—*C. dahuricus*, Herb. (*Calystegia dahuricus*, Fisch.). Hardy deciduous twiner, 3-6 ft.: lvs. oblong-cordate, shortly acute: fls. pink or rose-violet. June, July. N. Eu. B.M. 2609. F.S. 10:1075.—*C. erubescens*, Sims (*C. acaulis*, Choisy). Tender biennial: lvs. oblong, hastate, the basal lobes toothed: fls. small, 5-lobed, rose-pink. Austral. B.M. 1067.—*C. macrostegius*, Greene. The plants in the trade under this name may be referred to *C. occidentalis*.—*C. major*, Hort., not Gilib. = *Ipomoea purpurea*.—*C. ocellatus*, Hook. Stove evergreen: limb of corolla white, 5-angled; throat reddish purple: lvs. sessile, linear, acute, 1-veined, villous. S. Afr. B.M. 4065.—*C. scoparius*, Linn.—*C. Soldanella*, Linn. Sts. prostrate: lvs. reniform: fls. pink or rose-colored. Sandy shores, Wash. to Calif.; also in Eu. and Asia.

S. W. FLETCHER.  
H. D. HOUSE.†

COÖKIA: *Claucaena*.

COONTIE: *Zamia integrifolia*.

COOPÈRIA (after Joseph Cooper, English gardener). *Amaryllidaceæ*. Tender bulbous plants with the habit of *Zephyranthes* but night-blooming.

Flowers fragrant, solitary, 2 in. or more across, waxy-white, tinged red outside, and more or less green within; the perianth subtended by a bract-like spathe, somewhat as in *Iris*; anthers erect in distinction to versatile in *Zephyranthes*: lvs. appearing with the fls. in summer, long, narrow, flat and twisted.—Only 2 or 3 species from Texas to New Mex. and Mex., usually growing in dry places. The bulbs should be taken up in autumn and stored during the winter in dry soil. Cult. easy and like *zephyranthes*.

A. Neck of bulb short: perianth-tube  $3\frac{1}{2}$  in. long or more.

*Drummondii*, Herb. EVENING STAR. Bulb roundish, 1 in. thick, with a short neck: lvs. narrowly linear, erect, 1 ft. long: peduncle slender, fragile, hollow,  $\frac{1}{2}$ -1 ft. long; spathe  $1\frac{1}{2}$ -2 in. long, 2-valved at the tip; perianth tube 3-5 in. long; limb  $\frac{3}{4}$ -1 in. long, white, tinged with red outside; segms. oblong, cuspidate. Prairies, of wide range. Var. *chlorosolen*, Baker, has a perianth-tube stouter and tinged with green: limb



1049. *Convolvulus tricolor*. ( $\times \frac{1}{2}$ )

longer and less wheel-shaped: lvs. a little broader. B.M. 3482.

AA. Neck of bulb long: perianth-tube less than  $2\frac{1}{2}$  in. long.

*pedunculata*, Herb. GIANT PRAIRIE LILY. More robust than *C. Drummondii*: bulb with a longer neck, 2-3 in. long: lvs. about 6, 1 ft. long,  $\frac{1}{4}$  in. broad: peduncle about 1 ft. long; spathe 1-2-valved at the tip; perianth-tube shorter,  $1\frac{1}{2}$  in. long; limb nearly as long as the tube, tinged red outside. B.M. 3727. R.H. 1853:401.—The best species. Fls. larger, of purer color, and remaining open a day or two longer.

N. TAYLOR.†

COPAÍFERA (from *copaiba*, Brazilian name of the balsam derived from some of these trees). Syn. *Copaiba*. *Leguminosæ*. Sixteen or more spineless trees of Trop. Amer., and Afr., with abruptly pinnate lvs., small mostly white, not papilionaceous fls. in panicles, interesting because several of them produce an oleo-resin known as *copaiba*. They are not in cult., except now and then in collections of economic plants.

COPERNÍCIA (from *Copernicus*). *Palmææ*, tribe *Coryphææ*. Tall fan-palms with their trunks frequently thickened above the base.

Leaves flabellate, the petiole often with small spines; the small young lvs. usually undivided, the older much cut palmately: spadix very much branched, the fls. single upon it or in small clusters; calyx tubular, more or less deeply 3-toothed: fr. globose or ovoid, 1-seeded.—Species about 8, all confined to Trop. Amer. *C. cerifera* is a valuable economic plant, the wood being among the hardest known, and the lvs. being the source of a valuable wax. For cult., see *Corypha*. G.C. II. 24:362. Beccari, *Le Palme Americane*, tribe *Coryphææ*, 1907.

*cerifera*, Mart. CARNAUBA PALM. St. 30-35 ft., with a small swelling near the base: lvs. 3-4 ft. wide, nearly round; rachis none; petiole convex below, concave above, the margins with rather thick spines: spadix erect or spreading, 5-6 ft. long and thrice branched; fls. in clusters on the spathe. Trop. S. Amer.—Not well known in the trade; see *Livistona*.

*C. australis*, Becc., a recently described species, said to be more hardy than *C. cerifera*, has been cult. at Riverside, Calif. Taller, 60-80 ft.; infl. densely woolly tomentose.

N. TAYLOR.

COPRA: material from the coconut, which see (p. 811).

COPRÓSMIA (Greek name referring to the fetid odor of the plants). *Rubiaceæ*. Shrubs or small trees, often trailing, of New Zealand, Australia and Polynesia, sometimes planted for the pretty fruit or variegated leaves.

Leaves opposite, mostly small, stalked or almost sessile: fls. small, solitary or fascicled, white or greenish, dioecious; corolla-limb 4-5-lobed, the lobes revolute; stamens 4-5: fr. an ovoid or globose usually 2-celled drupe.—About 60 species mostly in New Zeal., extending to Borneo, Hawaii and Juan Fernandez.

Coprosmas are greenhouse plants in the North, but they are rarely cultivated. Propagated by hardened cuttings. The soil which is found among *kalmia* roots, mixed with good loam and sand, if necessary, will suit these plants. Cuttings should be rooted in moderate heat in spring, before growth begins. If placed under a handlight or propagating-frame, care must be taken to prevent damping, to which the cuttings are liable. (G. W. Oliver.)



**Baëri**, Endl. (*C. Baueriana*, Hook. f.) Shrub or small tree, in exposed and rocky places in its native habitat sometimes not more than 1-3 ft. high and with branches nearly prostrate, in better conditions often a round-topped tree 20-25 ft. high: lvs. thick, shining green, 1-3 in. long, wide-ovate or oblong, obtuse or notched at the apex, the margins usually revolute: male fls. in dense heads on short axillary peduncles; females 3-6, the heads with shorter peduncles; calyx very small; corolla of female fls. tubular, 4-lobed. New Zeal.—In cult. there are two forms, both with variegated lvs.; one has lvs. broadly blotched creamy yellow, at times the green disappearing altogether (var. *variegata* or *picturata*); the other (*C. Stöckii*, Hort.) has lvs. blotched yellow-green on a deeper ground. *C. Baueri* is a favorite in S. Calif., and probably the only one grown there; thrives near the sea.

**acerōsa**, A. Cunn. Low and spreading, much branched, with minute lvs., small white fls., and pretty sky-blue drupes or berries. New Zeal.—Once catalogued in Calif.

**Pétriei**, Cheesem. Prostrate and creeping, forming mats, the branches to 1½ ft. long: lvs. ¼ in. or less long, linear-oblong or -obovate, rigid and thickish: fls. solitary, on the ends of short erect branchlets, the males 4-toothed and without calyx, the females smaller, irregularly toothed and calyculate: drupe ½-¾ in. diam., mostly purplish. New Zeal.—Mentioned abroad for cultivation.

L. H. B.

**CÓPTIS** (Greek, *to cut*, from the cut leaves). *Ranunculaceæ*. Hardy perennial herbs of the cooler parts of the northern hemisphere, sometimes planted in bogs and moist places.

Low, stemless plants, with slender rootstocks: lvs. radical, compound or divided, lasting over winter: fls. white or yellow, scapose; sepals 5-7, petal-like; petals 5-6, small, linear, hood-like; stamens numerous: carpels stalked, few, becoming an umbel of follicles.—Eight species, only one of which is used in American gardens.

The bitter roots yield the tonic medicine known as "gold thread;" also a yellow dye. The plants should have peaty soil, with a little sand, and prefer shade, in damp situations. They are rather hardy. The roots withstand severe winters, being native of the cooler parts of the northern hemisphere. If the plants are given some protection in winter, as in a cold pit or by a dressing of litter, the leaves remain green and fresh. The plants are valuable in hardy borders because of the leaves and also the flowers.

The plants are very easily propagated in either early spring or late fall, the former being preferred. Seeds may be sown when ripe, before they become old, and will grow readily in moist but well-drained soil. They should be only slightly covered with soil but the surface should be kept moist by a close covering with leaves or paper, and partial shade is preferred. The seedlings may be transplanted at any time after the leaves are large, by keeping plenty of soil about the roots.

**trifolia**, Salisb. No st.: rootstock yellow: lvs. compound, long-petioled; lfts. broadly obovate, cuneate, obtuse, the teeth mucronate: fl.-st. slender; sepals white, with yellow base; petals small, club-shaped: follicles 3-7, spreading, equaled by their stalk; seeds black. May-July. Adirondacks and westward. L.B.C. 2:173.—Neat and pretty, with shining lvs.

K. C. DAVIS.

**CORAL BERRY**: *Symphoricarpos vulgaris*.

**CORAL DROPS**: *Bessera elegans*.

**CORALLORHIZA** (Greek for *coral-root*). *Orchidaceæ*. **CORAL-ROOT**. Low orchids, growing in woods and parasitic on roots, destitute of green foliage, the plant usually brownish or yellowish and inconspicuous.

Flowers small, somewhat 2-lipped, usually obscurely spurred at the base; sepals and petals nearly alike; lip small, slightly adherent to the base of the column; pollinia 4.—Species few, in N. Amer., Eu. and Asia. The coral-roots have little merit as garden plants, although very interesting to the student. They may be grown in rich, shady borders. Two species have been offered by dealers in native plants. *C. multiflora*, Nutt. (Fig. 1050), is purplish, 1½ ft. or less high, 10-30-fld., lip deeply 3-lobed; grows in dry woods in northern states; *C. Mertensiana*, Bong., scape many-fld., 8-15 in. high, the lip entire and broadly oblong; occurs in Brit. Col. and north to Alaska. *C. odontorrhiza*, Nutt., provides what is known as *crawley-root*, said to be used for its diaphoretic and febrifuge properties: it is a slender plant, in woods S., but extending north as far as Canada, light brown or purplish, 6-7 in. tall: lip nearly or quite entire, white spotted with crimson.

L. H. B.

**CORAL-PLANT**: *Jatropha*.

**CORAL-ROOT**: *Corallorhiza*.

**CORAL-TREE**: *Erythrina*.

**CÓRCHORUS** (name refers to some reputed virtue, as an eye remedy, of one of the species). *Tiliaceæ*. Shrubs or herbs of the tropics, two of which supply jute.

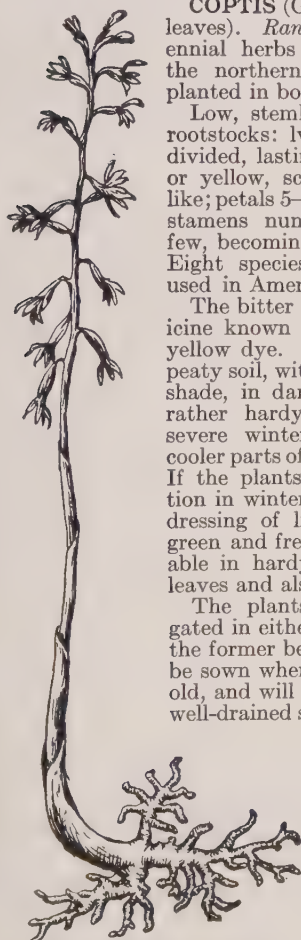
The jute plants are *C. capsularis* Linn. and *C. olitorius*, Linn. The latter differs from the *C. capsularis* in having an elongated, not semi-globose, pod. B.M. 2810. They are annual plants, natives of Asia but cult. throughout the tropics, growing 10-12 ft. high, with a straight st. as thick as the little finger and branched only at the top. Fls. small, yellow, with 4-5 glandless petals and a slender caps., or sometimes the caps. is globose. The young shoots of both are used as pot herbs. *C. olitorius* is much grown for this purpose in Egypt, and is known as Jews' mallow. Jute is made from the fibrous bark of these and other species of Corchorus. It is released from the sts. by retting in stagnant pools. See Cyclo. Amer. Agric., Vol. II, pp. 282, 507.

*C. Baldacii*, Fedde, has very recently been mentioned in foreign horticultural literature. It is described as a perennial, woody at the base: lvs. linear-elliptic, pilose above and white-tomentose beneath: fls. solitary, axillary and minute. Italian Somaliland.

The corchorus of trade lists is likely to be *Kerria*.

**CÓRDIA** (an early German botanist, Valerius Cordus, born 1515). *Boraginaceæ*. Warm-climate trees, shrubs or almost herbaceous, sometimes planted.

Leaves mostly alternate, reticled, entire or dentate: fls. in dense heads or clusters or scirpioid cymes, perfect or polygamous, the corolla usually white or orange; calyx tubular or campanulate, toothed or lobed; corolla tubular, funnellform or salverform, lobed, the parts and the stamens 4 or more; style 4-lobed: fr. a drupe which is 4-lobuled and usually 4-seeded.—Species about 230 in tropical and subtropical regions, mostly



1050. *Corallorhiza multiflora*.  
(× ½)

in the western hemisphere. Some of them are vines; some are herbaceous above the base. Species confused.

The cordias are greenhouse plants with showy flowers of easy culture. Grown in the open in the extreme South. Propagated by cuttings of firm wood and by seeds.



1051. *Cordia Greggii* var. *Palmeri*. ( $\times \frac{3}{8}$ )

**Sebestëna**, Linn. (*C. speciosa*, Willd.). **GEIGER TREE**. Tall evergreen shrub or small tree, hairy, with rough, ovate, entire or undulate stalked lvs.: fls. 1-2 in. long, orange or scarlet, stalked, in large open terminal clusters, the crumpled corolla-lobes and stamens 5-12; drupe inclosed in the hazel-like husk formed by the persistent calyx. Keys of Fla. and south. B.M. 794.

**Gréggii**, Torr. Much-branched shrub, to 8 ft.: lvs. less than 1 in. long, pale, obovate, obtuse, dentate, rugose, long-cuneate at the base: fls. more than 1 in. across, white, in few-fl. contracted capitate clusters but becoming looser as flowering proceeds; corolla-lobes obtuse; stamens 5 or 6, scarcely half the length of the corolla. Mex. Var. **Palmeri**, Wats. (Fig. 1051, adapted from G.F. 2:233) has more broadly funnel-form corolla, the limb  $1\frac{1}{4}$  in. broad: lvs. somewhat larger, ovate-oblong and abruptly cuneate at the base, acute or obtuse at the apex. Mex.—Deserving of planting in the southwest country, if hardy.

Other cordias are likely to come into cult. in the southern country. Some of them yield drugs, many of them produce useful timber, and some have edible frs. There are numbers of species in Porto Rico and others of the W. Indies.—*C. Francisci*, Tenore. Tall: lvs. dark green: fls. white. S. Amer.—*C. Myxa*, Linn., from Trop. Asia and Austral., is one of the best woods for kindling fire by friction, and is useful in many other ways.

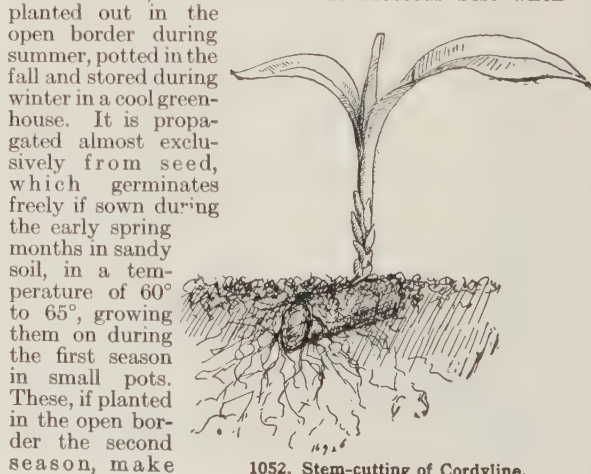
L. H. B.

**CORDYLÏNE** (*club-like*, referring to the fleshy roots). *Liliacæ*. **DRACENA**. **DRACENA PALM**. Greenhouse plants closely related to *Dracæna*; planted in the open in California and similar climates.

Stems tall, often woody and palm-like, bearing large crowded lvs., to the striking variegation of which the group owes its value: fls. panicked; stamens 6; pedicels articulated; perianth 6-parted; ovary 3-celled: fr. a berry.—Cult. for the ornamental foliage. The horticultural

forms and names have become very numerous. The various species are in the trade under *Dracæna*, which see for a key to the species of both genera combined. From *Dracæna*, *Cordylina* differs in the ovary containing several ovules in each cell, and the solitary pedicels being provided with a 3-bracted involucre. In the following paragraphs, the initial *D.* indicates that the plant in question is known in the trade as a *Dracæna*, and *C.* that it is known as a *Cordylina* (see *Dracæna*). For a monograph, see Baker, Journ. Linn. Soc. 14:538 (1875).

Of cordylines or dracenas, propagation is usually effected by cutting the ripened stems or trunks, from which all leaves have been removed, into pieces from 2 to 4 inches long. These are laid either in very light soil or in sand in the propagating-bed, where they receive a bottom heat of about 80°, being barely covered with sand or moss (Fig. 1052). The eyes soon start into growth, and, as soon as they have developed about six leaves, these shoots are cut off with a small heel and again placed in the propagating-bed until rooted, after which they are potted off into small pots in light soil, kept close until they become established. They are then shifted on into larger pots as soon as well rooted. They delight in a mixture of three parts good turfy loam and one part well-decayed cow-manure, with a liberal sprinkling of sharp sand. A warm, moist atmosphere suits them best while growing, but towards fall the finished plants must be gradually exposed to full sunshine and a dry atmosphere, which develops their high colors. The kinds enumerated below are such as are mainly grown in large quantities for decorative purposes, and are sold principally during the winter months, especially during the holiday season, when plants with bright-colored foliage are always in strong demand: *C. amabilis*.—A strong-growing form with broad green foliage, which is prettily variegated with white and deep rose. One of the hardiest varieties, either for decorations in winter or for outdoor work, vases, and the like in summer. *D. fragrans*.—An African species with broad, massive, deep green foliage which makes noble decorative plants, being frequently grown into specimens from 6 to 8 feet high. Its foliage is of heavy texture, making it a useful plant for the dry atmosphere of a living-room. Two handsomely variegated forms of the above are *D. Lindenii* and *D. Massangeana*, both very desirable varieties. *C. terminalis*.—This is the most popular species, and is grown in immense quantities. The foliage on well-matured plants is of an intense rich crimson marked with lighter shadings. *C. australis* (commonly called *C. indivisa*).—Used principally as an outdoor decorative plant in summer, being extensively used for furnishing vases, window-boxes, and the like. It succeeds best when



1052. Stem-cutting of *Cordylina*.



fine plants for 6- or 7-inch pots. There are a number of varieties of *C. australis*, among them several handsomely variegated bronze-colored forms, which, however, are but little distributed yet. Among the principal varieties and species besides the above which are grown in a commercial way are: *Baptistii*, *Shepherdii*, *stricta grandis*, *Youngii*, *Goldieana*, *Lord Wolseley*, *Desmetiana*, *Sanderiana*, *Godseffiana*, and *Mandæana*. (J. D. Eisele.)

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<i>cannæfolia</i> , 6.	<i>jardiniere</i> , 6.	<i>Youngii</i> , 6.
<i>Cantrellii</i> , 6.	<i>lineata</i> , 3.	

A. *Foliage of sessile, thick, sword-shaped lvs.*B. *Lvs. glaucous beneath, broad.*

1. *indivisa*, Kunth. Arborescent, 10-20 ft. high: lvs. dark green, densely crowded, 2-6 ft. long, 4-6 in. broad at the middle,  $1\frac{1}{2}$ -2 in. at the base, rigid, very coriaceous; midrib stout, colored red and white, veins on each side of it 40-50; panicle nodding; bracteoles lanceolate, 3-4 lines long, membranous; perianth 3-4 lines long, white; tube very short, campanulate; segms. equal, sharply recurved; berries  $\frac{1}{4}$  in. diam., blue; ovules 5-6 in each cell. New Zeal. Gn. 49, p. 86. Lowe, 52.—Coolhouse; valuable for vases. Rare in cult. See *C. australis*, No. 4.

BB. *Lvs. green on both sides, narrower.*

2. *stricta*, Endl. (*D. congesta*, Hort.). Slender, 6-12 ft. high: lvs. less crowded than in the next, acuminate, 1-2 ft. long, 9-15 lines wide, base 3-6 lines wide, scarcely costate; veins scarcely oblique, margins obscurely dentate; panicle terminal and lateral, erect or cernuous; pedicels  $\frac{1}{2}$ -1 line long; lower bracteoles lanceolate; perianth lilac, 3-4 lines long, campanulate, interior segms. longer than the outer; ovules 6-10 in each cell. Austral. B.M. 2575. G.C. III. 17:207.—Coolhouse, vases, and the like. Var. *grândis*, Hort. Large, highly colored. Var. *discolor*, Hort. Like var. *grândis*, but with foliage dark bronzy purple.

3. *austrâlis*, Hook. (*D. indivisa*, Hort. *D. calocoma*, Wend.) Fig. 1053; 359, Vol. I. Arborescent, 15-40 ft. high: lvs. densely rosulate,  $1\frac{1}{2}$ -3 ft. long,  $1\frac{1}{2}$ -2½ in. wide; base 6-12 lines wide, acuminate, green; midrib firm, indistinct, nerves on each side of it 12-20, scarcely oblique; panicle drooping or erect, terminal, ample; pedicels very short; bracteoles deltoid,  $\frac{1}{2}$  line long; perianth white, 3-4 lines long; tube short, campanulate, segms. nearly equal, recurved; berry white or bluish-white; mature seeds often solitary. New Zeal. B.M. 5636. G.C. III. 23:153. Gn. 47, p. 312; 48, p. 197. I.H. 35:40 (as var. *Doucetiana*); 37:114 (as var. *Dalseriana*); 40:190 (as *C. lineata* var. *purpurascens*). S.H. 1, p. 487.—Coolhouse, vases. Var. *aurea-striata*, Hort. Variegated with a number of longitudinal yellow stripes. Var. *atropurpurea*, Hort. Base of lf. and under side of midrib purple. Var. *lineata*, Hort. Lvs. broader, the sheathing base stained with purple. Var. *Veitchii*, Hort. (*D. Veitchii*, Hort.). Base of lf. and under side of midrib bright crimson. *C. Hookeri*, Hort., was a garden form of this species.—Much of the *C. indivisa* of the American trade has been, in the past, *C. australis*. Known as "cabbage tree" to residents of New Zealand.

AA. *Foliage of petioled lvs.*B. *Lvs. oblanceolate; petioles broad.*

4. *rubra*, Hugel. Slender, 10-15 ft. high: lvs. contiguous, ascending, 12-15 in. long, 18-21 lines wide above the middle, thick, dull green both sides, distinctly costate; veins oblique; petiole broad, deeply grooved, 4-6 in. long; panicle lateral, nodding; pedicels very short; bracteoles small, deltoid; perianth lilac,  $4\frac{1}{2}$ -5 lines long, inner segms. longer than the outer; ovules 6-8. Country unknown.—Cool-house, vases. *D. Bruantii*, Hort., was a garden form of this species. R.H. 1897, pp. 514, 515. G.C. III. 22:285. G.W. 12, p. 230.

BB. *Lvs. lanceolate; petioles narrow, nearly terete.*

5. *Haageana*, Koch (*C. Murchisoniæ*, F. Muell.). Slender and small: lvs. contiguous, ascending, oblong-falcate, 4-8 in. long, 2-2½ in. wide at the middle, acute, base rounded or deltoid, thick, dull green

1053. *Cordyline australis*—*C. indivisa* of the trade.

throughout, distinctly costate; veins slender, oblique; petiole 3-4 in. long, deeply channelled; panicle lateral; pedicels  $1\frac{1}{2}$ -2 lines long; perianth 4-4½ lines long, tinged with lilac; ovules 6-8 in each cell. Austral.

6. *terminalis*, Kunth. Low and slender, 3-8 ft. high: lvs. contiguous, ascending, green or rarely colored, 12-30 in. long, 2-5 in. wide, elliptical or elliptic-lanceolate, acute, thickish, distinctly costate; veins frequently unequal, strongly oblique; petiole 4-6 in. long, deeply channelled; pedicels very short or none; bracteoles deltoid, membranous; perianth 5-6 lines long, white, lilac, or reddish, segms. short; ovules 6-10 in each cell; berry large, red. E. Indies. A.G. 16:361. B.R. 1749. Var. *cannæfolia*, Baker (*D. and C. cannæfolia*, Hort.). Lvs. oblanceolate, 12-15 in. by 2-2½ in.; perianth 2 lines long; segms. twice the length of tube. Var. *ferrea*, Baker (*D. and C. ferrea*, Hort.). Lvs. narrow, oblanceolate, 2-2½ in. broad, dull purple or variegated; petiole short: fls. much as in the typical form, but redder and often smaller. B.M. 2053.—*C. Guilfoylei* is a form with lvs. tapering both ways, recurved, striped with red, pink or white; white on lower part of lf. and margin of petiole. I.H. 19, p. 249. Var. *Ti*, Baker (*D. braziliensis*, Schult. *C. Eschscholziæna*, Mart.). Robust: lvs. large, mostly oblong, 4-6 in. wide; panicle large, lower branches compound; perianth 6 lines long, lilac; segms. as long as the tube.—*D. imperialis*, Hort., is a form with lvs. arching or erect, thick, deep metallic green, rayed all over with bright crimson or pink, handsome. *D. reginæ*, Hort.

belongs here. The varieties of this species in cult. are almost innumerable. Names that have been used for those in the American trade, usually considered as horticultural species, though many of these names are now no longer used, are as follows: *C. amabilis*. Lvs. broad, shining deep green, in age becoming spotted and suffused with rose and white. *C. amboyensis*. Lvs. oblong-lanceolate, recurved, deep bronze-green, edged with rose-carmine below; petioles tinged with purple. *C. anerliensis*. Lvs. very broad, deep bronze-red, with some white. *C. Baptistii*. Fig. 1054. Lvs. broad, recurved, deep green, with some pink and yellow stripes; sts. also variegated. I.H. 26:334. *C. Baùsei*. Lvs. broad, dark green, with some white. *C. bella*. Lvs. small, purplish, marked with red. *C. Cántrellii*. Lvs. dark metallic crimson, young ones bright carmine. *C. Coöperi*. Lvs. deep wine-red, gracefully recurved; common in cult. *C. Fräseri*. Lvs. somewhat erect, broad, oblong, abruptly acute, blackish purple with bloom, margin below with a deep rosy lake stripe extending down the petiole. *C. Gládstonei*. Lvs. broad, brilliant crimson. *C. híbrida*. Lvs. broad, variegated, deep green margined with rose, in age deep rose, creamy white in young lvs. *C. jardinière* (*C. terminalis alba* × *C. Guilfoylei*). Lvs. very small and compact, narrow, green broadly margined with white. *C. metálica*. Lvs. erect-arching, oblong, when young uniform rich coppery purple, in age dark purple-bronze; petioles same. F.M. 1872:24. *C. nigro-rubra*. Lvs. narrow, linear-lanceolate, dark brown with rosy crimson centers, young often entirely rose. *C. norwoodiënsis*. Lvs. striped with yellow, green and crimson, last color principally confined to the margin; petioles brilliant. *C. Robinsoniana*. Lvs. long lanceolate-acuminate, arched, light green, striped with bronze-green and brownish crimson. I.H. 26:342. *C. Schúldii*. Lvs. broad, variegated. F.E. 7:961. *C. Scóttii*. Lvs. broad, arching, deep green, crimson edged; said to be a hybrid. *C. Yóungii*. Lvs. broad, spreading, when young bright green streaked with deep red and tinged with rose, in age bright bronze. *C. Yóungii* var. *rösea*, Hort. Green, tinged with pink, white or carmine. *C. Yóungii* var. *álba*, Hort. Variegated with white instead of red. Crosses with *C. Scottii* are known as *C. stricta*, *C. albo-lineata*, Mrs. George Pullman, Mrs. Terry; with *C. norwoodiënsis*, as Little Gem.

*C. angústa*, Hort. (*C. terminalis* var.). Lvs. narrow, arching, dull dark green above, purplish beneath. A slender form.—*C. angustifolia*, Kunth= *C. stricta*.—*C. aurantiaca*, Hort.= (?).—*C. Balmoréna*, Hort. Lvs. bronzy with white and pinkish stripes.—*C. Bánskii*, Hook. Lvs. very long, linear-lanceolate, 3-5 ft. long, 2-3 in. wide, petioled, green, glaucous beneath; veins conspicuous. G.C. III. 13:613.—*C. Berhéleyi*, Hort.= (?).—*C. Cassanova*, Hort.= (?).—*C. Chélsónii*, Hort. (form of *C. terminalis*). Lvs. large, glossy dark green, almost black, becoming suffused and edged with crimson. I.H. 19, p. 90.—*C. compácta*, Hort. (*C. terminalis* form). Lvs. recurved, broad, dull green, with bronze and rose stripes in age.—*C. Dénissonii*, Hort. (*C. terminalis* form). Dwarf: lvs. broad, bronzy purple.—*C. Elizabethæ*, Hort.= (?).—*C. excélsa*, Hort. (*C. terminalis* form). Lvs. broad, arching, bronzy, margined with crimson.—*C. Frederica*, Hort.= (?).—*C. frutescens*, (?).—*C. gloriösa* Hort. (*C. terminalis* form). Lvs. very large and broad, green, with a peculiar bronze-orange hue.—*C. helychioides*, F. Muell.= *C. terminalis*.—*C. heliconiæfolia*, Otto & Diet.= *C. terminalis*.—*C. Hénderonii*, Hort.= (?).—*C. magnífica*, Hort. (*C. terminalis* form). Lvs. large and broad, bronzy pink, becoming darker.—*C. Mánners-Süttoniæ*, F. Muell.= *C. terminalis*.—*C. Mays*, Hort. Lvs. green, margined with red; young lvs. wholly red.—*C. porphyrophýlla*, Hort. (*C. terminalis* form). Lvs. deep bronzy purple, glaucous beneath.—*C. Réx*, Hort. (*C. terminalis* form). Lvs. medium width, bronzy green, flushed purple and streaked with carmine.—*C. rosacea*, Hort. (*C. terminalis* form). Lvs. recurved, broad, dark bronzy green margined with pink.—*C. Rümphii*=D. Hookeriana.—*C. Salmónæa*= (?).—*C. sepáriæ*, Seem.= *C. terminalis*.—*C. Sièberi*, Kunth= *C. terminalis*.—*C. splendens*, Hort. (*C. terminalis* form). Lvs. dense, short, ovate-acute, bronzy green, shaded with rose-carmine.—*C. zeelándica*, Hort.= *C. rubra*.

K. M. WIEGAND.

**CORÈMA** (Greek, a broom, in allusion to its bushy habit). *Empetrææ*. BROOM CROWBERRY. Two species of low heath-like shrubs from E. N. Amer. and S. W. Eu. and the Atlantic Isls., of which the American spe-

cies is rarely cult. in botanical collections. Closely allied to *Empetrum* and differing chiefly in the apetalous fls. arranged in terminal heads, and in their upright bushy habit. Cult. and prop. like *Empetrum*. *C. Cónradii*, Torr., is a much-branched shrub, to 2 ft. high, with crowded linear lvs. about 1/2 in. long; fls. inconspicuous, in terminal heads, the staminate with long exserted purple stamens; fr. a small berry-like drupe, usually with

3 nutlets. H.I. 6:531. Hardy N.—*C. álbum*, D. Don, has obtuse lvs. with revolute edges and resinous dots: fls. pink; fr. white to purple. S. W. Eu., Azores. ALFRED REHDER.



1054. *Cordyline terminalis* var. *Baptistii*.

**COREÓPSIS** (Greek, signifying *bug-like*, from the fruit). Including *Calliopsis*. *Compósitæ*. TICKSEED. Annual or perennial herbs, flowering in summer or autumn, nearly all natives of eastern North America, some of them popular as flower-garden subjects.

Leaves opposite or rarely alternate: heads pedunculate and radiate; the broad involucre with bracts of 2 distinct series, the outer narrower or shorter and more herbaceous, the inner broad triangular-ovate or oblong, thin, yellowish green or purplish, and striate; receptacle chaffy; rays very showy, yellow, particled or rarely rose, neutral; disk-fls. yellow, dark or brown; pappus of 2 weak bristles or scales, or a low crown or none: achenes often winged.—The genus differs from *Bidens* only in the reduced or obsolete, not stiff-awned pappus, and lf.-segms. not serrate. Many of the species are in the trade under the name *Calliopsis*. Other genera with this peculiar involucre are *Hidalgoa*, *Dahlia*, *Thelesperma*, *Cosmos*, and *Leptosyne*. All the kinds are of easiest cult. The perennials are hardy border plants. The annuals are raised in any garden soil, and bloom freely with little care. They are all showy plants, of 50-70 species.

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A. *Rays cuneate, lobed.*

B. *Disk yellow; rays rose-purple.*

1. *rosea*, Nutt. Perennial: diffusely branched from slender, creeping rootstocks, 1-2 ft. high, smooth: lvs. all narrowly linear, entire or with a few linear teeth or lobes: heads small, about 1 in. broad or less, short-peduncled; rays narrowly wedge-shaped, lobed at the apex: achene narrowly oblong, wingless; pappus an obscure border. Mass. to Ga.

BB. *Disk and involucre dark purple; rays yellow or parti-colored, wedge-shaped and lobed.*

c. *Outer involuclral bracts very short, lanceolate or triangular.*

D. *Lvs. entire: achenes with lacerate wings and setiform pappus.*

2. *angustifolia*, Ait. (*C. dichotoma*, Michx. *C. linifolia*, Nutt.). Perennial: strict and tall, 1-3 ft. high, glabrous, sparsely branched at the summit: lvs. entire, thickish; basal oblanceolate to narrowly spatulate, long-petioled; lower cauline elliptical on long petioles; upper narrowly spatulate or linear, sessile or reduced to bracts: heads 1-1½ in. broad; rays entirely yellow. S. U. S.

DD. *Lvs. divided: achenes and pappus not as above.*

3. *cardaminefolia*, Torr. & Gray. Annual: low and diffusely much branched from the base, 6-24 in. high, glabrous: numerous basal and lower cauline lvs. petioled, pinnatifid, divisions several pairs, short, oval, elliptical, rarely linear, often again divided; upper cauline nearly sessile with narrower and fewer divisions: heads as in No. 5, but smaller, and often entirely dark: achenes broader, winged; pappus minute or none. S. U. S. Gn. 29, p. 498; 37, p. 203.

4. *Atkinsoniana*, Douglas. Perennial or annual: st. tall, 2-4 ft. high: lvs. pinnatifid, the divisions linear: heads as in the next: achenes with narrow wing or scarious margin; pappus composed of 2 short, subulate teeth. Autumn-flowering. S. W. U. S. B.R. 1376.



1055. *Coreopsis tinctoria*—*Calliopsis elegans* of gardens. ( $\times \frac{1}{2}$ )

5. *tinctoria*, Nutt. (*C. bicolor*, Reichb. *C. elegans*, Hort. *Calliopsis marmorata*, Hort.). Fig. 1055. Annual: st. tall, strict, 1-3 ft. high, branched, glabrous: basal lvs. few or wanting; cauline petioled, the upper sessile, pinnatifid, divisions from narrowly elliptical to often again divided and narrowly linear: heads ¾-1½, rarely 2, in. broad; rays with dark purple base: achenes oblong, wingless; pappus none. Cent. U. S. B.M. 2512 B.R. 846. Mn. 1, p. 85.—A common garden annual; showy and good. Var. *nana*, Hort. Dwarf, low and compact. Gn. 29, p. 499. Tom Thumb varieties. Var. *atropurpurea*, Hook. (*C. nigra*, Hort.). Rays almost entirely dark. B.M. 3511.

cc. *Outer involuclral bracts narrowly linear, about equaling the inner.*

6. *Drummondii*, Torr. & Gray (*C. diversifolia*, Hook. *C. picta*, Hort.). GOLDEN WAVE. Annual: st. branched above, 10-24 in. high: lvs. petioled below, sessile above, pinnatifid, divisions few, short, broadly elliptical, those of the upper lvs. linear: heads 1-2 in. broad, large; rays usually dark at the base: achene oval, wingless, margin cartilaginous incurved; pappus none. Texas. B.M. 3474. S.B.F.G. II. 4:315. Gn. 26, p. 461; 29, p. 498; 37, p. 203; 43, p. 397. G.M. 54:13. G. 16:58.

BBB. *Disk yellow or brown; rays entirely yellow (except No. 7); peduncles long.*

c. *Style-branches acute or obtusish, not acuminate: dark lines at base of rays.*

7. *coronata*, Hook. Annual: low and often weak, 12-24 in. high, much branched from the base, sparsely hirsute: lvs. thick; the basal usually numerous, petioled, pinnatifid or entire, divisions elliptic, rather obtuse, lateral divisions smaller; the cauline lvs. few, spatulate, often entire: heads 1½-2 in. broad; rays with a few dark lines above the orange base; outer involucre a third to a half shorter than the inner: achene orbicular, broadly winged, often echinate, with a thickened callus at base and apex on inner face; pappus very minute. Texas. B.M. 3460. S.H. 1:270. Gn. 26, p. 461; 29, p. 499.

cc. *Style-branches cuspidate-acuminate: rays entirely yellow.*

8. *pubescens*, Ell. (*C. auriculata*, Schkuhr & Hort., not Linn.). Perennial: tall, 1-4 ft. high, branched above, pubescent or nearly glabrous, leafy throughout: lvs. thickish, oval to lanceolate, very acute, petioled or nearly sessile, entire or with small, acute, lateral lobes; basal few: heads 1½-2½ in. broad; outer involucre nearly as long as the inner: achenes and pappus similar to those of the next species. S. U. S. Gn. 37, p. 202.

9. *lanceolata*, Linn. Fig. 1056. Perennial: low, 1-2 ft. high, sparingly branched, glabrous or nearly so, leafy toward base: lvs. few, large, oblong-spatulate to linear, petioled, barely acute, upper entire, lower usually pinnatifid, divisions very distant: heads 1½-



1056. *Coreopsis lanceolata*. ( $\times \frac{1}{2}$ )

2½ in. broad; peduncles very long; outer involucre equaling the inner or one-half shorter: achenes orbicular, papillose, broadly winged; pappus of minute scales or obsolete. E. U. S. Gn. 25, p. 165; 33, p. 7; 37, p. 203. G.W. 10, p. 22. V. 18:102.—Used extensively for cut-fls.

Var. *glabélla*, Michx. (var. *angustifolia*, Torr. & Gray). Low: sts. scapiform: lvs. narrow and crowded at base of st., 2–4 lines wide.

Var. *villósa*, Michx. (*C. oblongifolia*, Nutt.). Lvs. spatulate-obovate to oblong, villous, as is also the st., with jointed hairs.



1057. *Coriaria japonica*. (×½)

10. *grandiflora*, Nutt. (*C. longipes*, Hook. *C. Boykiniana*, Nutt.). Perennial; simple or branched, glabrous, 1–2 ft. high, leafy throughout: basal lvs. few, lower lvs. spatulate or lanceolate, entire, upper divided into several linear entire divisions: heads 1–2½ in. broad: achene orbicular, papillose, broadly winged; pappus of 2 small scales. S. U. S. B.M. 3586. Gn. 47:7; 62, p. 338. Mn. 5:201. G. 29:461. J.H. III 57: 479. Gn. W. 23:349; 26:113.

AA. Rays elliptical, entire or toothed at apex.

B. Color of rays pale yellow: lvs. petioled.

11. *tripteris*, Linn. Perennial; very large and stout, 4–8 ft. high, branched above, glabrous: lvs. petioled, 8 in. or less long, trifoliate, or rarely irregularly 5–7-foliate, divisions lanceolate: heads medium, rays pale, disk-fls. yellow or dark purple: achene oblong, narrowly winged; pappus a fimbriate border. Cent. U. S.

BB. Color of rays deep yellow: lvs. sessile.

C. Lvs. 3-cleft to below middle; base entire, 3-ribbed.

12. *palmaßa*, Nutt. (*C. præcox*, Fresen.). Perennial; tall and stout, 1½–3 ft. high, sparingly branched at the summit: lvs. thick, cuneate, 2½ in. long, divisions broadly linear, often irregularly again divided: heads 1½–2½ in. broad: achenes oblong, narrowly winged; pappus minute or obsolete. Cent. U. S. R.H. 1845:265.

CC. Lvs. divided to the base.

D. The lvs. 3-divided, divisions entire, ½–1 in. broad.

13. *major*, Walt. (*C. senifolia*, Michx.). Perennial; tall and stout, 2–3 ft. high, pubescent, much branched

above: basal lvs. wanting, lower cauline small, upper 2–3 in. long, palmately 3-divided, divisions equal, lanceolate, acute: heads 1¼–2 in. broad; rays deep yellow; disk-fls. yellow: achenes obovate-elliptical, winged, summit 2-toothed. S. E. U. S.

Var. *Öemleri*, Brit. Smooth: lf-divisions more attenuate at the base. B.M. 3484 (as *C. senifolia*).

Var. *linearis*, Small. Smooth: lf-divisions narrow, 2–4 lines wide.

DD. The lvs. dissected, divisions ⅓–3 lines wide.

14. *delphinifolia*, Lam. Perennial; glabrous, branched above, 1–3 ft. high: lvs. sessile, 2–3 in. long, basal wanting, ternately divided, divisions dissected into linear-filiform segms., which are 1–3 lines wide: head 1–2½ in. broad; disk dark: achene oblong-obovate, narrowly winged; pappus-teeth short. S. E. U. S.

15. *verticillata*, Linn. (*C. tenuifolia*, Ehrh.). Perennial; sparingly branched, 1–3 ft. high: basal lvs. wanting; cauline, sessile, similar to the last but segms. only ⅓–½ lines wide: heads 1–2 in. broad; disk yellow: achenes oblong-obovate, narrowly winged; pappus nearly obsolete. E. U. S.

*C. aristosa*, Michx., *C. aurea*, Ait., and *C. trichosperma*, Michx., are now placed under *Cidens* (which see).—*C. atropurpurea*, Hort. = *Thelesperma* sp.—*C. auriculata*, Linn. (*C. diversifolia*, DC.). Perennial: low, stoloniferous, hirsute: lvs. petioled, short, oval, mostly entire: heads large, very long-peduncled: probably not in the trade. S. U. S.—*C. billa*, Hutchins. Undershrub about 3 ft. high. British E. Afr.—A very handsome species.—*C. Granti*, Oliv. A compact bushy plant about 2 ft. high. Fls. in the winter. Trop. Afr. B.M. 8110. G.C. III. 39:162. Gn. 69, p. 161.—*C. Léavenworthii*, Torr. & Gray. Annual: lf-divisions linear-spatulate: rays cuneate, lobed, yellow: awns 2, slender: achene winged. Fla.—*C. nudata*, Nutt. Perennial, rush-like: lvs. mostly basal, long, filiform: rays rose-colored: wing of achene pectinate. S. U. S.—*C. radiata*, Hort. Plant very dwarf: fl.-heads with ray-florets rolled up. Of garden origin.

K. M. WIEGAND.

**CORIANDER** is the seed-like fruit of *Coriandrum sativum*, Linn., an umbelliferous annual of southern Europe. The plant grows 1 to 3 feet high, glabrous, strong-smelling, with leaves divided into almost thread-like divisions, and small white flowers. The plant is easily grown in garden soil. It occasionally becomes spontaneous about old yards. The seeds (fruits) are used as seasoning and flavoring in pastries, confections and liquors, although they are less known in this country than caraway. The plant is sometimes grown in American gardens with sweet herbs and other things.

**CORIANDRUM:** *Coriander*.

**CORIARIA** (*corium*, skin, leather; a shrub used for tanning leather was described as *frutex coriarius*, by Pliny). *Coriariaceæ*. Shrubs or perennial herbs grown chiefly for their ornamental fruits.

Leaves deciduous, entire, 3–9-nerved, opposite and distichous: fls. polygamous-monœcious in slender racemes, small; petals and sepals 5; stamens 10: fr. berry-like, consisting of 5 1-seeded nutlets inclosed by the enlarged and colored petals.—About 8 species in Himalayas and E. Asia, Medit. region, N. Zeal. and S. Amer. Ornamental shrubs or herbs, with slender arching branches imitating pinnate lvs., and with very showy yellow, red or black fr. The lvs. of some species are used for tanning leather; the frs. are poisonous in some species, edible in others. *C. japonica* has proved hardy with slight protection in Mass., and *C. terminalis* seems to be of the same hardiness; the other species are more tender. They grow in almost any good garden soil, and prefer sunny position. Prop. readily by seeds and greenwood cuttings in summer under glass; also by suckers and layers.

*japonica*, Gray. Fig. 1057. Shrub, 2–3, sometimes to 10 ft.: branches quadrangular: lvs. nearly sessile, ovate or ovate-lanceolate, 3-nerved, smooth, 2–4 in. long: fls. in axillary racemes from the branches of last year: fr. becoming bright red in summer, changing to violet-



black when ripe. Japan. B.M. 7509. G.F. 10:343 (adapted in Fig. 1057). S.I.F. 2:58. R.H. 1913, p. 79.

*terminalis*, Hemsl. Herbaceous or suffruticose, 2-3 ft.: branches quadrangular; lvs. nearly sessile, broad-ovate to ovate-lanceolate, 5-9-nerved, scabrous on the veins beneath, 1-3 in.: fls. in terminal racemes on shoots of the current year: fr. black. Sikkim, W. China. Var. *xanthocarpa*, Rehd. & Wilson. Fr. yellow. Sikkim. B.M. 8525. R.H. 1907:160. G.C. III. 34:282. J.H. III. 49:443. F.S.R. 3:106. M.D. 1897:1.—A very ornamental plant, keeping its yellow fr. from July until late in fall; being herbaceous, it is easier to protect from frost than the former. Originally intro. into cult. as *C. nepalensis*.

*C. himalayensis*, Hort. Said to have persistent lvs. and edible frs. Possibly not different from *C. nepalensis*.—*C. myrtifolia*, Linn. Shrub, 4-10 ft.: lvs. 3-nerved, glabrous; fls. greenish, from the old wood: fr. black, poisonous. Medit. region. Yields a black dye.—*C. nepalensis*, Wall. Shrub, 8-10 ft.: lvs. 3-5-nerved, glabrous; fls. brownish: fr. black. Himalayas.—*C. sarmentosa*, Forst. Suffruticose, procumbent: racemes axillary, on young branches. B.M. 2470.—The wineberry shrub of the natives. The berries yield a pleasant drink, but the seeds are poisonous. Source of the New Zeal. toot-poison, which is very destructive to human and animal life.—*C. sinica*, Maxim. Allied to *C. japonica*. Shrub to 18 ft.: lvs. oval or broadly elliptic, abruptly short-pointed,  $1\frac{1}{2}$ -3 in. long: fr. black. Cent. China.

ALFRED REHDER.

**CÔRIS** (ancient name, transferred). *Primulacææ*. Two low thyme-like herbs of S. Eu., sometimes planted in rock-gardens, but apparently not in the trade. Lvs. small, alternate, linear, spreading or recurved, the margin revolute: fls. lilac or rose-purple, in terminal densely-fld. racemes. *C. monspeliensis*, Linn., of the Medit. region, is 6 in. high, much branching and spreading, the sts. thickly covered with the little narrow lvs.

**CORK-TREE:** *Quercus*.

**CÓRMUS:** *Sorbus*.

**CORN, MAIZE (SWEET and POP).** A tender annual cultivated for its grain, which is used both for human and live-stock food, and for the herbage which is used as forage. As a horticultural crop, it is grown primarily for the unripe grain or for pop-corn.

The word maize, Spanish *maiz*, is derived from the name Mahiz, which Columbus adopted for this cereal from the Haytians. Maize has not yet been found truly wild. Its close relationship to a native Mexican grass called teosinte, *Euchlaena mexicana*, is indicated by the known fertile hybrids between this species and maize as pointed out by Harshberger. Teosinte and the only other species which show close botanical relationship to maize are indigenous to Mexico. In fact the evidence all shows that maize is of American origin, although its original form has not yet been discovered, nor has its evolution from other types been completely traced. DeCandolle concludes that maize is not a native of the Old World but is of American origin, and that it was introduced into the Old World shortly after the discovery of the New, and then was rapidly disseminated.

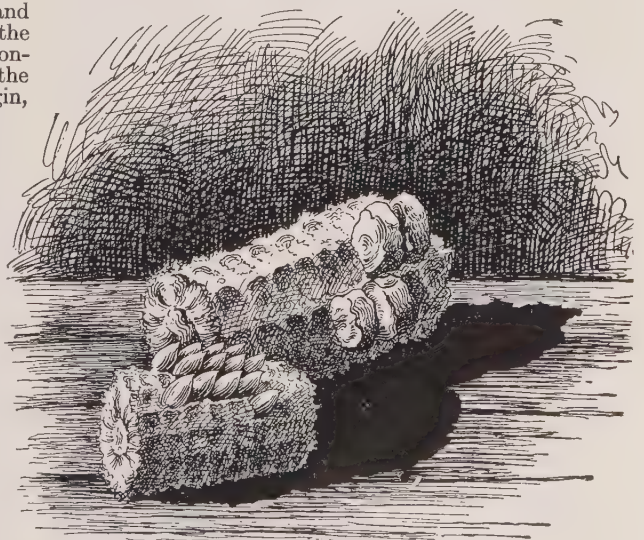
Very early in the exploration and settlement of the New World, the whites learned from the natives the use of maize as food. Several of the Indian names for preparations of food from this cereal were adopted or adapted by the settlers and passed into the English language,—as for example hominy, samp, and succotash. In the English-speaking colonies, maize was grown as a field crop under the name Indian corn, but later the tendency was to drop the word Indian so that this cereal is now known in American agriculture and commerce by the simple word corn. The word corn has thus come to have a specific meaning on this continent which does not attach to it in the British Isles.

Corn now holds first rank among the agricultural products of the United States, both in the area

devoted to its cultivation and in the value of the annual crop. The types known in garden culture in this country are the sweet corns and the pop-corns; the other types, which are more strictly agricultural, may be designated as field corns. Sweet corn and pop-corn are also grown as field crops in comparatively limited areas, the sweet corn either as a truck crop or for canning, and the pop-corn to supply the demand for this product in our domestic markets. Only the types of sweet corn and pop-corn will receive attention in this article.

#### Botanical classification.

*Zea* almost uniformly has been considered by botanists as a monotypic genus, its one species being *Zea Mays*. But *Z. Mays* is an extremely variable species, including groups which are separated by definite characteristics. As a working classification, that proposed by Sturtevant is the best which has yet appeared. He describes seven "agricultural species." These are *Zea tunicata*, the pod corns; *Z. everta*, the pop-corns (Fig. 1058); *Z. indurata*, the flint corns; *Z. indentata*, the dent corns; *Z. amylacea*, the soft corns; *Z. saccharata*, the sweet or sugar corns (Figs. 1058, 1059, 1060); *Z. amylaea-saccharata*, the starchy sweet corns. *Z. canina*, Wats., is a hybrid form, as shown by Harshberger. *Z. Mays*, Linn., belongs to the natural order of grasses or Gramineæ. Culms 1 or more, solid, erect,  $1\frac{1}{2}$ -15 ft. tall, or more, terminated by a panicle of staminate fls. (the tassel): internodes grooved on one side; branches ear-bearing or obsolete: lvs. long, broad, channeled, tapering to the pendulous tips, with short hyaline ligules and open embracing sheaths: fls. monocious, awnless, usually proterandrous; staminate fls. in clusters of 2-4, often overlapping; 1 fl. usually pedicelled, the other sessile or all sessile; glumes herbaceous; palea membranaceous; anthers 3, linear. The ear contains the pistillate fls. on a hard, thickened, cylindrical spike or spadix (cob), which is inclosed in many spathaceous bracts (husks); spikelets closely sessile, in longitudinal rows, paired in alveoli with hard, corneous margin; fls. 2 on a spikelet, the lower abortive; glumes membranaceous; style single, filiform, very long (silk); ovary usually sessile: ear variable in length and size, often distichous; grain variable in shape and size. The color ranges from white through light and dark shades of yellow, red and purple to nearly black.



1058. Kernels of corn on the cob—sweet corn behind, pop-corn in front. ( $\times\frac{1}{2}$ )

**Sweet corn** (*Zea saccharata*, Sturt.). Figs. 1058-1060. This is a well-defined species-group, characterized by horny, more or less crinkled, wrinkled or shriveled kernels, having a semi-transparent or translucent appearance. Sturtevant, in 1899, lists sixty-one distinct varieties. He gives the first variety of sweet corn recorded in American cultivation as being introduced into the region about Plymouth, Massachusetts, from the Indians of the Susquehanna in 1779. Schenck, in 1854, knew two varieties. It appears, therefore, that the distribution of sweet corn into cultivation made little progress prior to the last half of the nineteenth century, green field corn having largely occupied its place prior to that period.

Sweet corn is preëminently a garden vegetable, although the large kinds are sometimes grown for silage or stover. As a garden vegetable, it is used when it has reached the "roasting ear" stage, the kernel then being well filled and plump but soft, and "in the milk." The kernel is the only part used for human food. When sweet corn is used as a fresh vegetable, it is often cooked and served on the cob. Dried sweet corn, though never an important article of commerce, was formerly much used, especially by the rural population. It is gradually being generally abandoned for canned corn, for other cereal preparations or for other vegetables, but recently desiccated corn has been put upon the market and is finding sale in certain districts, particularly in the South and in mining and lumber camps. It is practically unknown outside North America.

In the last quarter of the last century, canned sweet corn came to be an important article of domestic commerce in the United States and Canada. The total pack for the United States and Canada for the year 1898 was 4,398,563 cases, each containing two dozen two-pound tins. The following statement shows the number of cases packed for the United States for the five-year period from 1907 to 1911:

1907.....	6,653,744
1908.....	6,779,000
1909.....	5,787,000
1910.....	10,063,000
1911.....	14,301,000

Comparatively little of this corn was sent abroad, most of it being consumed in the States, Canada, and Alaska. In 1911 Iowa took first rank in the output of canned corn with a pack of 2,774,000 cases, which was nearly 20 per cent of the total output of the United States for that year. Illinois, New York, Maryland, Maine, Ohio, and Indiana followed in the order named. These seven states packed about 88 per cent of the total output of this country in 1911. These figures are the best obtainable and give a general idea of the progress and distribution of the corn-canning industry. Maine produces as good canned corn as is put on the market and grows the crop largely in localities having too short a season to mature the seed.

Sweet corn is commonly grown for canneries under contract, the canning company supplying the seed and guaranteeing it to be good and true to name, while the farmer agrees to grow a certain specified acreage and deliver the whole crop to the cannery at a stipulated price. In Iowa the price now paid the grower is about \$7 per ton of good ears. A yield of three to four tons to the acre is considered good. The ears are snapped from the stalks with the husks on and hauled in deep wagon-boxes to the canneries. The stalks, when preserved either as ensilage or as stover, make excellent fodder. The overripe and inferior ears, being unmarketable, are left on the stalks and thereby materially increase their value as a stock food. The stover keeps best in loose shocks, as it is liable to mold when closely packed in large stacks or bays.

As a field crop, sweet corn is grown most extensively

on medium heavy loams that are well supplied with humus or organic matter. It luxuriates in rich warm soils. The crop rotation should be planned so as to use the coarse manures with the corn, which is a gross feeder. On the more fertile lands of the central corn-belt, nitrogenous manures may not always be used to advantage with corn, but in the eastern and southern states, where the soil has lost more of its original fertility, stable manure may often be used profitably with this crop at the rate of 8 or 10 cords to the acre, or possibly more.

In the northern part of the corn-belt in the central and western states, that is to say north of the Ohio and Missouri rivers, deep fall plowing of corn land is generally favored, but in experiments at the Illinois and Indiana experiment stations, the depth of plowing has had little influence on the crop. In sections of the eastern states, shallow plowing late in spring is favored, especially if the land be in sod. In warmer, drier regions, as in parts of Nebraska and Kansas, listing has been much practised on stubble ground. The listing plow, having a double mold-board, throws the soil into alternate furrows and ridges, the furrows being 8 or 9



1059. Early Marbledhead sweet corn.

inches deeper than the tops of the ridges. The corn is planted in the bottom of the furrow, either by means of a one-horse corn-drill or by a corn-drill attachment to the lister plow, consisting of a subsoil plow through the hollow leg of which the corn is dropped.

Great care should be used to secure seed-corn having high vitality as a precaution against the rotting or weak germination of the seed in the soil, should the season be cold and wet after planting. Select the seed-ears early before any hard frosts have come. At this time the large, early, and well-matured ears can be distinguished from the rest of the crop, as the husks about the early-maturing ears will have started to turn brown. Early maturity is a vital point to consider in selecting seed-ears and this quality should never be sacrificed for the size of late unmaturing ears. In selecting seed for a field crop, seek systematically for stalks having little or no growth of stools and bearing single, large, and early-maturing ears. For garden use, seed from more productive stalks is desirable, even though the ears be smaller. The seed-ears should be dried at once by artificial heat so that the seed may better withstand unfavorable conditions of temperature or moisture. In many localities so-called kiln-dried seed is much in favor.

In the North, sweet corn should be planted as early as can be done without involving great risk of loss from frosts or from rotting of seed in the soil. In New York, field-planting is generally done from May 10 to May 20; in central Minnesota from May 10 to May 30. The ground having been plowed and prepared so as to make a seed-bed of fine, loose soil 3 inches deep, the seed should be planted to a depth of 1 to 3 inches. The drier and looser the soil, the greater should be the depth of planting. In planting small fields, the ground may be marked in check-rows so that the hills planted



at the intersection of the rows will stand about 3 feet 4 inches to 3 feet 6 inches apart each way, and the corn planted by a hand-planter, which each time it is thrust into the ground drops from four to five kernels, which is usually the number desired. Three feet apart is too close to allow the cultivators to work easily. For large fields, the check-row type of planter should be used. These planters drop and cover the seed in hills at uniform distances apart, planting two rows at one trip across the field. Two types of furrow-openers are now used on corn-planters; these are the runner furrow-openers and the disc furrow-openers. The former are less satisfactory on sod land or in fields covered with trash, as the runners will often ride out and leave the seed uncovered. It is better to use the disc furrow-opener on such land; besides opening the furrow better, it also pulverizes the soil about the seed. Field corn is often planted in drills by planters adapted to this purpose, but sweet corn should be in hills so that the surface of the ground may be kept loose and entirely free from weeds.

Till for the purpose of retaining soil-moisture as well as to kill weeds. This requires frequent shallow cultivation, pulverizing the surface of the soil so that it will act as a mulch to retard the evaporation of soil-moisture. Tillage should begin as soon as the planting is done, using the slanting-tooth harrow and the weeder types of implements until the corn is nearly 6 inches high, providing that the weeds are small and the ground is in friable condition. After this time the spring-tooth cultivators or the two-horse cultivators, having preferably three or four shovels on a side, are generally used, depending somewhat upon the kind of soil to be cultivated. This type of two-horse cultivator is preferable to the double-shovel type which was formerly much used. The two-horse revolving disc cultivator is sometimes used in damp, weedy ground. One great objection to this type is that too much earth is thrown toward the corn and the middles between the rows are usually left either untouched or bare of the loose soil which is needed for a mulch. For the later cultivations the two-horse surface cultivator is coming more and more into general use.

Till at intervals of seven to ten days. At first the cultivator may run from 2 inches deep near the plant to 4 inches deep midway between the rows. Each successive cultivation should gradually increase in depth towards the middle between the rows; throw  $\frac{1}{2}$  inch or more of earth towards the corn and cover the weeds. At the last cultivation the cultivator may be kept a little farther from the corn. It should leave the soil pulverized to a depth of 2 to 3 inches over the entire field. The earlier cultivation may be deepened, if necessary, to kill weeds, even though some corn roots are severed, but cutting the roots by deep cultivation near the plants late in the season is to be especially avoided. Till the soil until the corn gets so large as to prevent the use of a two-horse cultivator. Occasionally a later cultivation, with a one-horse cultivator, may be necessary if heavy rains leave the surface soil hard and start the weeds. Often catch-crops for late pasturage, cover-crops or crops of winter wheat or rye are sown in the cornfield and cultivated in with the last cultivation. The seed is covered deeply by cultivating it in because the weather is apt to be dry at this period. The lower part of the furrow-slice is thus left compact, furnishing a compact seed-bed, in which small grains delight.

The cultivation of sweet corn in the garden should follow the general lines indicated for field culture, but stable manure and commercial fertilizers may be used more liberally. Except on very fertile soils, it is well to put a small amount of a complete commercial fertilizer in each hill and mix it well with the soil before planting the corn. A fertilizer which has a large amount of nitrogen in quickly available form should be chosen

for this purpose. Dwarf early-maturing varieties may be planted, for early use, as soon as the ground is sufficiently dry and warm. A little later, when the ground is warmer, the second-early main crop and late varieties may be planted. Later successional plantings insure a supply of green corn till frost kills the plants.

Corn is not grown commercially as a forcing crop. Attempts to force it in winter have not given encouraging results, but it may be successfully forced in spring, following any of the crops of vegetables which are grown under glass, providing the houses are piped so as to maintain the minimum night temperature at 65° F. Provide good drainage. Give a liberal application of stable manure and thoroughly mix it with the soil. In the latitude of New York the planting may be made as early as the first of March. As soon as the first leaf has unfolded, the temperature may be allowed to run high in the sun, if the air is kept moist by wetting the floors and walls. The glass need not be shaded. Keep night temperature close to 65° F., not lower and not much higher. After the silk appears, jar the stalks every two or three days, when the atmosphere is dry, and thus insure abundant pollination. Early maturing varieties, like Cory, give edible corn in about sixty days when thus treated. Corn may be forced in the same house with tomatoes, eggplant, and other vegetables which require similar range of temperature.

#### *Varieties of sweet corn.*

Some of the desirable varieties for the garden, the market, and for canning are listed below. These varieties are named to show the range of variation and to indicate the leading groups or types, rather than to recommend these particular kinds. New varieties are continually supplanting the old.

For the home garden.—Extra-early: Golden Bantam, an extra-early sort, has recently become very popular, on account of its productiveness, good flavor, and desirable size for table use, and because the kernels separate very easily from the cob; many plant it in succession so as to cover the entire season with this variety alone. Peep o' Day and Minnesota are other good extra-early varieties. Second-early: Early Crosby; Early Evergreen. Medium or standard season: Hickox Improved, Stowell Evergreen, White Evergreen. Late: Black Mexican, Country Gentleman.

For market.—Extra-early: Cory (red cob), White Cob Cory, and Extra-Early Adams, which, though not a sweet corn, is largely grown for early use. This last-named variety is recommended in the South because of its comparative freedom from the attacks of the ear worm. Second-early: Shaker, Crosby, Early Champion; Early Adams also is extensively grown for market, though not a true sugar corn. Midseason and Late: Stowell Evergreen, Country Gentleman, Late Mammoth, Egyptian.

For canning.—Stowell Evergreen is the standard variety for canning factories everywhere. Country Gentleman is also grown to a considerable extent for fancy canned corn. Other varieties that are used for canning include Early Evergreen, White Evergreen, Egyptian, Potter Excelsior, and Hickox Improved.

#### *Diseases and pests of sweet corn.*

The most widespread and destructive disease of corn in the United States is the smut produced by the parasitic smut-fungus, *Ustilago Zeæ*. The sorghum-head smut, *Ustilago Reiliana*, also attacks maize. Smut causes most injury when it attacks the ears. The grains are transformed into a mass of dark-colored smut spores, and become exceedingly swollen and distorted out of all semblance to their normal outlines. Infection may take place at any growing point of the plant from early till late in the season, hence treatment of seed corn by fungicides is of no value as a

remedy for corn smut. The destruction of smutted parts of the plants, and taking especial care that the smut does not become mixed with manure which is used for the corn crop, are measures which may be expected to lessen the prevalence of the disease. No remedy is known.

Another disease of sweet corn in the United States is the bacterial blight caused by *Pseudomonas Stewartii*. It has been found in New York, New Jersey, and Michi-



1060. Golden Bantam sweet corn.

gan, but thus far has been seriously destructive only on Long Island on early dwarf varieties of sweet corn. It is characterized by wilting and complete drying of the whole plant, as if affected by drought, except that the leaves do not roll up. The fibro-vascular bundles become distinctly yellow, and are very noticeable when the stalk is cut open. The disease attacks the plant at any period of growth, but is most destructive about the time the silk appears. No remedy is known.

These two diseases are of the most economic importance in the United States. Two others of somewhat minor importance which deserve mention are rust and leaf blight. The leaf-blight fungus causes round, brownish, dead spots on the foliage. The maize rust, *Puccinia sorghi*, is found principally where rainfall is abundant. It is rather common throughout the corn-belt. The fungus is similar in nature to that which causes the rust of small grains. It cannot be controlled economically.

Over 200 species of insects are known to be injurious to corn, either to some part of the growing plant or to the stored product. The corn-ear worm, known South as the cotton-boll worm, is especially injurious to sweet corn. It burrows in tender green corn, ruining the ear for either canning or market purposes. It is known to do serious damage as far north as western New York and central Iowa. Recent experiments in dust-spraying promise well. Spraying is done weekly, beginning when silks appear, using equal weight powdered lead arsenate and lime. Shallow fall plowing to kill pupæ is a partial remedy. Wire-worms, northern corn-root worms, white grubs, and certain other grass insects attack corn plants. One of the best preventive measures is to plan the rotation so that corn does not immediately follow any cereal or grass crop.

**Pop-corn** (*Zea everta*, Sturt.). Fig. 1058. Pop-corn is characterized by the excessive proportion of the corneous endosperm and the small size of the kernel and ear. The kernel split laterally shows the chit and corneous matter enveloping, and in some cases a fine, starchy line. The small size of the kernel and the property of popping makes identification certain. This species-group extends throughout North and South America and has claims for prehistoric culture.

The preparation of the ground recommended for sweet corn holds for pop-corn. Tillage should be started early in the spring to conserve as much of the soil-moisture as possible, thus protecting the crop against possible injury from drought later in the season.

On good clean ground the pop-corn is very often drilled, dropping the kernels 6 to 8 inches apart in the row. More often, however, it is check-rowed with the rows 3 feet 4 inches apart and from four to six kernels in the hill. The ordinary corn-planters are

used with special plates for pop-corn planting. For dwarf varieties of pop-corn such as the Tom Thumb, when planted in home gardens and tilled by hand, the hills may be as near together as  $2\frac{1}{2}$  feet.

Pop-corn is much slower in germinating than field corn and the plant is not so vigorous a grower. Shallow cultivation is recommended just as for other corns, especially for the later cultivations, since deep cultivating cuts too many roots.

Pop-corn is planted earlier than field corn. It should be planted deep enough to reach the moist soil, usually  $1\frac{1}{2}$  to 2 inches, but in a dry season it may need to go 3 inches deep.

The White Rice, which is grown more extensively for market than any other variety, mixes with field corns readily. The resulting hybrid types have larger ears and larger, smoother kernels and give heavier yields than do the pure pop-corns. These hybrid types

were for a time quite in favor with the commercial growers because of their greater yield. Now they are being discriminated against by the buyers because of their inferior popping qualities, and the tendency among the growers is to get back to the pure types, even though they give smaller yields.

Pop-corn matures earlier than field corn. For this reason in many sections of the country it is regarded as a surer crop. In the region about Odebolt, Iowa, where pop-corn is grown more extensively than in any other district in the world, harvesting sometimes begins as early as the middle of September, but more often it is delayed till the first of October or later to let the corn dry on the stalk. There are two methods of harvesting. One is to snap the corn and pile it in the crib, then shuck it during the winter. However, this is not generally practised because it makes more work and takes more crib room. The other and common method is to pick and shuck the ears from the standing stalks directly into the wagon, the same as with field corn.

On account of the heavy expense of hand-picking, some are now using the harvesting apparatus called the corn-picker and husker. Opinions differ as to the economy of using this picker. The rows should be long and the corn should stand up well to justify its use. For hand-picking the price per bushel usually ranges from 10 to 12 cents. A good hand can pick about forty bushels in a ten-hour day if the corn is good.

It is very important that the pop-corn be thoroughly dried. After it is picked it is placed in the crib which usually has ventilators through the center. These extend along the middle of the floor, are slatted to admit air, and are about  $1\frac{1}{2}$  feet wide by  $2\frac{1}{2}$  feet high. The corn is usually left in the crib through the winter season. Sometimes it is marketed on the cob. Formerly it was a common practice to ship it on the cob in sacks, but now it is generally held over winter in the crib, shelled the next spring, and shipped in two-bushel sacks. It is usually marketed from June to September.

It is ready to use for popping just as soon as it is dry enough. It can be popped immediately after it is gathered if the season is dry and the corn is allowed to dry sufficiently in the field. Usually it is left on the stalk till it is so dry that it shells some when thrown into the wagon.

Various companies make a practice of contracting for a certain number of acres of pop-corn at a certain price in the spring of the year, so that the farmer may know just what price he will get for his corn in the fall or at some stated time at which it is to be delivered. The contracting firm does not as a rule supply the seed but does specify the grade of the corn and objects to the coarse hybrid types.

The prices for corn in the ear are ruling from 1 cent to 2 cents a pound; for shelled corn from  $1\frac{1}{2}$  cents



to 3 cents a pound. Pop-corn is considered a very profitable crop and less likely to fail than field corn because it matures earlier. A good return to the acre would be twenty to twenty-five bushels of ear corn, worth from \$20 to \$50, averaging about \$30. Field corn in the same region averages about fifty-five bushels, worth usually from \$20 to \$25 an acre.

#### Varieties.

In 1899, Sturtevant described twenty-five varieties of pop-corn. Tracy, in his "American Varieties of Vegetables for the Years 1901 and 1902," enumerated fifty-four varieties. The rice pop-corns are generally used for commercial plantings. White Rice is now the leading commercial variety of pop-corn, since it gives the greatest yield and also brings the highest price on the market. In the noted region about Odebolt, Iowa, this variety is grown almost exclusively. The following list includes the leading varieties:

**White Rice.**—Ear 4 to 8 inches long. This vigorous, late variety is widely cultivated. With other rice corns, it is characterized by deep, tapering, beaked kernels.

**White Pearl.**—Ear 4 to 8 inches long. Matures somewhat earlier than Rice and later than Dwarf Golden. Kernels round and silvery white.

**Dwarf Golden.**—Ear 1 to 3 inches long. An early-maturing sort, with broad, golden yellow kernels. A favorite garden variety.

**Golden Tom Thumb.**—Ear 2 to 2½ inches long. An ornamental variety for home gardens. The stalks only grow to a height of about 20 inches. The kernels are bright and golden yellow.

Other kinds of pop-corn worthy of mention are Golden Queen, Silver Lace, and California Yellow.

S. A. BEACH.

**CORN COCKLE:** *Lychnis Githago*.

**CORNEL, CORNELIAN CHERRY:** *Cornus mas*.

**CORNFLOWER:** *Centaurea Cyanus*.

**CORN POPPY** of Europe is the weed of the grain fields from which some of the garden poppies have been raised, *Papaver Rhæas*.

**CORN-SALAD** (*Valerianella olitoria*, Poll.). *Valerianaceæ*. A spring and summer salad and pot-herb plant.

Annual: mature plant 4-6 in. tall, forking; radical lvs. tufted (the parts used), oblong and obtuse, narrowed at the base, entire or few-toothed; st.-lvs. narrow, often clasping; fls. very small, in small terminal cymes, whitish; fr. (seed) nearly globular, gray, not crested. S. Eu. *V. eriocarpa*, Desv., of S. Eu. and N. Afr., is sometimes cult. as salad; lvs. longer and lighter-colored; fr. (seed) flattened, pale brown, crested. Known also as lamb's lettuce, fetticus, and vetticost.

Sow the seed of corn-salad in early spring, at the time of the first sowing of lettuce, and make successional plantings as often as desired. For very early salads the seeds are planted in September, and the young plants are covered with a light mulch and wintered exactly as spinach is often managed. Sow in drills a foot or 18 inches apart and cover lightly. Work the ground thoroughly, and give an abundance of water. The leaves may be blanched, but are usually eaten green. It matures in sixty to sixty-five days during good spring weather. Only one variety is offered by most American seedsmen, but several sorts are known to European gardeners. It is sometimes used for a pot-herb, being served like spinach, but is chiefly valuable for salads. It is rather tasteless, and is not so popular as cress or lettuce on that account, but persons who prefer a very mild salad, or who would rather taste the salad dressing, will doubtless fancy corn-salad.

It is best served in mixture with other herbs, as lettuce, water-cress or white mustard. It is easy to grow. There are no special enemies.

F. A. WAUGH.

**CÓRNUS** (ancient Latin name of *Cornus mas*). *Cornaceæ*. Dogwood. Woody plants (one or two infrequently cultivated herbs), grown for their attractive flowers and fruits; some species also for the winter effect of their brightly colored branches.

Shrubs or trees, rarely herbs: lvs. opposite, rarely alternate or whorled, deciduous, entire; fls. small, 4-merous, usually white, in terminal cymes (Fig. 1061) or heads; calyx-teeth minute; petals valvate; style simple, filiform or cylindric; ovary inferior, 2-celled: fr. a drupe with a 2-celled stone.—About 40 species in the temperate regions of the northern hemisphere and one in Peru. Monograph by Wangerin in Engler, Pflanzenreich, hft. 41, pp. 43-92, quoted below as Wang.

The dogwoods are hardy ornamental shrubs with handsome foliage, often assuming a brilliant fall coloring, and with attractive flowers and fruits. Nearly all are very desirable for planting in shrubberies. They grow nearly as well in shady places under large trees as in sunny exposed situations, and thrive in almost any soil. One of the most beautiful in bloom is *C. florida*, with extremely showy flowers in spring. *C. racemosa* is one of the best for shrubberies, blooming profusely in June. The red-branched species, as *C. alba*, *C. Amomum*, *C. Baileyi*, *C. sanguinea* are very attractive in winter. Propagated by seeds, which usually do not germinate until the second year. The species with willow-like soft wood, as *C. alba* and its allies, grow readily from cuttings of mature wood, while the others are sometimes increased by layers. They are often grown in this country from nearly ripened cuttings



1061. *Cornus* winter shoots, showing the opposite buds and terminal flower-clusters.—*Cornus Baileyi*.

1062. Cutting of *Cornus*.

(Fig. 1062), handled in frames in summer. Horticultural varieties of other species are mostly budded in summer on seedlings of the type, or grafted in early spring in the propagating-house.

Various species of *Cornus* have many interesting uses. Our native *C. florida*, which in flower is the showiest



1063. *Cornus alternifolia*.

member of the genus, furnishes a useful substitute for quinine. The bark of all parts contains the same substances found in cinchona, but in different proportions. It is inferior in effectiveness and more difficult to secure in large quantities. It is sometimes possible to ward off fevers by merely chewing the twigs. The powdered bark makes a good tooth-powder, and the fresh twigs can be used for the same purpose. The bark mixed with sulfate of iron makes a good black ink. The bark of the roots yields a scarlet dye. The wood, being hard, heavy, and close-grained, is good for tool handles. The cornelian cherry has pulpy fruits resembling cornelian in color and about the size and shape of olives, for which they can be substituted. The ripe fruits are soft and rather sweet. The name dogwood comes from the fact that a decoction of the bark of *C. sanguinea* was used in England to wash mangy dogs. The small red berries of *C. suecica* (not in the trade) are eaten by the Esquimaux.

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#### A. Plants, shrubs or trees.

#### B. Fls. in cymes or panicles without involucre. (*Svida*.)

#### C. Foliage alternate: fls. in umbel-like cymes, cream-colored.

1. *alternifolia*, Linn. (*Svida alternifolia*, Small). Fig. 1063. Shrub or small tree, to 25 ft.: lvs. slender-

petioled, elliptic or ovate, usually cuneate, acuminate, nearly glabrous above, pale or whitish beneath and appressed pubescent, 3-5 in. long: cymes  $1\frac{1}{2}$ - $2\frac{1}{2}$  in. wide: fr. dark blue, globular,  $\frac{1}{2}$  in. across, on red peduncles. May, June. New Bruns. to Ga. and Ala., west to Minn. S.S. 5:216. Em. 463. Wang. 51.—Of very distinct habit, the branches being arranged in irregular whorls, forming flat, horizontally spreading tiers, as in the picture. A variety which shows this habit more distinctly than the common form is var. *umbraculifera*, Dieck. Var. *argentea*, Temple & Beard, is a form with white-marked foliage. Var. *ochroleuca*, Rehd., has yellowish frs.

2. *controversa*, Hemsl. (*C. brachypoda*, Koch, not C. A. Mey. *C. macrophylla*, Koehne, not Wall.). Tree, to 60 ft.: lvs. slender-petioled, broadly ovate or elliptic-ovate, usually rounded at the base, abruptly acuminate, whitish and slightly hairy beneath, 3-5 in. long: cymes 3-4 in. wide: fr. bluish black. June. Himalayas to Japan. B.M. 8261. S.I.F. 1:77. R.B. 30:63.—With the habit of the former, but of more vigorous growth: not hardy N. Var. *variegata*, Rehd. (*C. macrophylla variegata*, Barbier). Lvs. edged white. Gng. 3:67; 16:291. J.H. III. 28:129; 47:147.

cc. Foliage opposite.

d. Fr. white or blue.

e. The fls. in umbel-like flat cymes.

f. Color of fr. white or bluish white.

g. Under side of lvs. with appressed hairs, glaucous.

3. *stolonifera*, Michx. (*C. alba*, Wang.). RED-OSIER Dogwood. Fig. 1064. Shrub, to 8 ft., usually with dark blood-red branches and prostrate st., stoloniferous: lvs. obtuse at the base, ovate or oblong-lanceolate, acuminate, 2-5 in. long: cymes dense, 1-2 in. wide; disk usually red: fr. white, globose, with the stone broader than high. May, June. From Brit. N. Amer. to Ill. and Calif. G.C. II. 8:679.—Habit bush-like, as in Fig. 1064. Var. *flaviramea*, Spaeth. Branches yellow. There are also varieties with variegated lvs. Var. *nitida*, Schneid. (*C. alba* var. *nitida*, Koehne). Branches green: lvs. glossy above. Var. *coloradensis*, Schneid. (*C. alba* var. *C. coloradensis*, Koehne). Branches brownish red, strongly recurved: fr. bluish white. Colo. Var. *pendula*, Ell. Low shrub with pendulous branches.

4. *alba*, Linn. (*C. tatarica*, Mill.). Shrub, to 10 ft., with usually erect st. and bright blood-red branches, mostly with glaucous bloom when young: lvs. obtuse at the base, ovate or elliptic, somewhat bullate or rugose above, acute,  $1\frac{1}{2}$ - $3\frac{1}{2}$  in. long: cymes dense, small; disk



1064. *Cornus stolonifera*.



yellow: fr. ovoid, bluish white, sometimes whitish; stone usually higher than broad, flat. Siberia, N. China. Var. *argenteo-marginata*, Rehd. (*C. alba* var. *elephantissima variegata*, Hort.). Lvs. edged white. Var. *Spaethii*, Spaeth. Lvs. broadly edged yellow. Gn. 64, p. 378; 69, p. 343. Var. *Gouchaultii*, Rehd. (*C. sibirica Gouchaultii*, Carr.). Lvs. variegated with yellowish white and pink. Var. *sibirica*, Lodd. Branches bright coral-red. C.L.A. 21, No. 4:29. G.M. 54:249. Var. *Kesselringii*, Rehd. (*C. sibirica* var. *Kesselringii*, Wolf). Branches very dark purple, nearly purplish black. There are also some other varieties with variegated lvs.

GG. Under side of lvs. with woolly hairs.

5. *Baileyi*, Coult. & Evans. Fig. 1065. Erect shrub, with reddish branches: lvs. ovate to lanceolate, acute or acuminate, white beneath, with woolly and with appressed hairs, 2-5 in. long; fls. in small rather compact woolly cymes: stone of the white fr. much broader than high, compressed and flat-topped. Pa. to Minn. and Wyo. G.F. 3:465 (adapted in Fig. 1065).—A very handsome species of upright growth, with dark red branches, blooming nearly all summer, and of a distinct grayish hue due to the slightly upward curled lvs. The fall color of foliage and winter color of twigs are unequaled. Well adapted for sandy soil. Early observed on dunes, S. Haven, Mich., but brought to the attention of systematists from specimens collected in extreme N. E. Minn. in 1886.

6. *asperifolia*, Michx. Shrub, 8-15 ft.: branches reddish brown: lvs. slender-petioled, elliptic to ovate, acuminate, rough above, pale and woolly-pubescent beneath, 1-4 in. long; cymes rather loose, rough-pubescent: fr. globose, white; stone nearly globose, slightly furrowed. Ont. to Fla., west to Texas. G.F. 10:105.

FF. Color of fr. blue or bluish, sometimes partly white or greenish white.

G. Lvs. densely woolly-pubescent beneath.

7. *rugosa*, Lam. (*C. circinata*, L'Her.). Shrub, 3-10 ft.: the young branches green, blotched purple, older ones purplish: lvs. orbicular or broadly ovate, acute or short-acuminate, slightly pubescent above, pale and densely pubescent beneath, 2-6 in. long; cymes rather dense: fr. light blue or greenish white. May, June. Em. 464. Wang. 61.—Bark has medicinal properties.

GG. Lvs. pubescent only on the veins or nearly glabrous beneath.

8. *Amomum*, Mill. (*C. sericea*, Linn. *C. cœrulea*, Lam.). Shrub, 3-10 ft., with purple branches: lvs. usually rounded at the base, elliptic-ovate or elliptic, dark green and nearly glabrous above, pale green beneath, usually with brownish hairs on the veins, 2-4 in. long; cyme compact: fr. blue or sometimes partly white. June, July. Mass. to Ga., west to N. Y. and Tenn. Em. 466.—Bark has medicinal properties. Var. *variegata*, Hort. Lvs. variegated with yellowish white.

9. *obliqua*, Raf. (*C. Purpusii*, Koehne). Shrub, similar to the preceding, usually broader and more loosely branched: branches purple to yellowish red: lvs. usually narrowed at the base, elliptic-ovate to oblong, dark green and glabrous above, glaucous beneath, on the veins usually with whitish or brownish hairs, 2-3½ in. long; cyme compact: fr. blue or partly white. May, June in the S., July in the N. Que. to Minn. and Kans. south to Pa., Ill. and Mo. S.T.S. 1:39. R.H. 1888:444 (as *C. stolonifera*).

EE. The fls. in broad panicles: fr. white or pale blue.

10. *racemosa*, Lam. (*C. candidissima*, Marsh., not Mill. *C. paniculata*, L'Her. *C. oblongata*, Hort.). Shrub 6-15 ft., with gray branches: lvs. cuneate, ovate-lanceolate or lanceolate, acuminate, appressed-pubes-

cent or nearly smooth, whitish beneath, 1½-4 in. long: petals white, lanceolate: fr. white. May, June. Maine to N. C., west to Minn., and Neb. Wang. 58 (as *C. femina*).—Free-flowering; very handsome when in bloom, and with its white frs. on red peduncles in fall.

11. *femina*, Mill. (*C. stricta*, Lam. *C. fastigiata*, Michx.). Shrub, to 15 ft., with purplish branches: lvs. ovate or ovate-lanceolate, sparingly and minutely appressed-pubescent, green on both sides, 1½-3 in. long: petals white, ovate-lanceolate: fr. pale blue. April, May. Va. to Ga. and Fla.—Tender N. Closely allied to the former, and perhaps only variety.

DD. Fr. black (green in a var. of No. 16).

E. Fls. in broad panicles.

12. *brachypoda*, C. A. Mey. (*C. ignorata*, Shiras. *C. macrophylla*, Hemsl., not Wall. *C. Thelycanis*, Lebas. *C. Thelyana*, Hort.). Shrub or small tree: branches yellowish or reddish brown: lvs. slender-petioled, elliptic-ovate to elliptic-oblong, abruptly acuminate, rounded or broadly cuneate at the base, dark green



1065. *Cornus Baileyi*. (Spray  $\times \frac{1}{4}$ )

above and nearly glabrous, glaucous beneath and sparingly appressed hairy, with 6-8 pairs of veins, 2½-6 in. long; panicle rather loose, 3-6 in. across; style below the stigma abruptly enlarged into a disk: fr. bluish black. Aug. Japan, Cent. China. S.T.S. 1:41. S.I.F. 1:77. R.H. 1875, p. 395. F. 1876, p. 123.—One of the handsomest dogwoods on account of its large lvs. and large panicles of white fls.; not quite hardy N.

13. *Wilsoniana*, Wang. Tree, to 40 ft.: branches brownish: lvs. elliptic, narrowed at the base, acuminate, above sparingly, beneath more densely appressed-pubescent, green or glaucous beneath, with 3-4 pairs of veins, 2-4 in. long; panicle 2½-4 in. across; style cylindric, scarcely enlarged below the stigma: fr. bluish black. Cent. China. Wang. 66.—Very handsome, similar to the preceding, but harder. Page 3567.

EE. Fls. in umbel-like cymes: lvs. green beneath.

F. Lvs. with appressed hairs beneath.

14. *paucinervis*, Hance (*C. quinquenervis*, Franch.). Shrub 4-6 ft.: young branches quadrangular, usually reddish brown: lvs. short-petioled, of firm texture, oblong-obovate to elliptic-lanceolate, acute, cuneate at the base, dark green above, paler beneath with appressed hairs, with 3-4 pairs of veins, 1½-3½ in. long; cymes long peduncled; style thickened below the apex:

fr. black. June. Cent. China. G.C. III. 50:95. G.M. 54:593. Gt. 1896, p. 285. Wang. 72.—Handsome shrub nearly half-evergreen, but not hardy N. P. 3567.

15. *pumila*, Koehne (*C. más* var. *nana*, Dipp.). Dense shrub, to 6 ft.: branchlets terete, glabrous: lvs. crowded, broadly ovate to oblong-ovate, short-acuminate, abruptly contracted at the base, dark green and nearly glabrous above, paler and appressed-hairy beneath,  $1\frac{1}{2}$ – $3\frac{1}{2}$  in. long: cymes long-peduncled, 2–6 in. broad; style thickened below the apex: fr. black. July. Origin unknown.—Handsome with its dense dark green foliage, particularly when dotted with the white fl.-clusters; has proved hardy at the Arnold Arboretum.

FF. Lvs. with woolly hairs beneath: branches purple.

16. *sanguinea*, Linn. Shrub, to 12 ft., with purple or dark blood-red branches: lvs. broad-elliptic or ovate, rounded or narrowed at the base, usually pubescent on both sides, pale green beneath,  $1\frac{1}{2}$ – $3\frac{1}{2}$  in. long: fls. greenish white, in dense cymes: fr. black. May, June. Eu., Orient. Var. *variegata*, Dipp. Lvs. variegated with yellowish white. G.W. 9, p. 247. Var. *viridissima*, Dieck. With green branches and green fr.

BB. Fls. in dense heads or umbels, with an involucre.

c. Color of fls. yellow; involucre yellowish, not exceeding the fls. (*Macrocarpum*.)

17. *más*, Linn. (*C. mascula*, Hort.). CORNELIAN CHERRY. Fig. 1066. Shrub or small tree, to 20 ft.: lvs. ovate or elliptic, acute, appressed-pubescent, and green on both sides,  $1\frac{1}{2}$ –4 in. long: fls. in sessile opposite umbels, before the lvs.; pedicels not exceeding the involucre: fr. oblong, scarlet,  $\frac{3}{4}$  in. long, edible. March, April. S. Eu., Orient. Mn. 5:192. G.C. II. 9:399. H.W. 3, p. 61.—Handsome shrub of dense growth with glossy foliage, very attractive in early spring with its yellow fls., and again in fall with its shining scarlet frs. Var. *macrocarpa*, Dipp. Fr. larger. Var. *albicarpa*, Schneid. (var. *luteo-carpa*, Wang.). Fr. yellowish. Var. *aurea*, Schelle. Lvs. yellow. Var. *aureo-elegantissima*, Schelle. Lvs. variegated with pink or yellow. F. 1877: 109. G.Z. 21:169. Var. *argenteo-marginata*, Hort. Lvs. bordered white. Var. *nana*, Simon-Louis. Dwarf form. It has been confused with *C. pumila* (No. 15) which has lenticillate branchlets and usually 4 pairs of veins.

18. *officinalis*, Sieb. & Zucc. Shrub or small tree, to 15 ft.: lvs. elliptic, acuminate, pale green beneath and with large tufts of dark brown hairs in the axils of the veins: fls. like those of the former; pedicels longer than the involucre: fr. scarlet, oblong. Japan, China. S.Z. 50.—Very similar to the last.

cc. Color of fls. greenish yellow, sessile, with a showy white involucre, much exceeding the fls.

D. Frs. in dense clusters, but individually distinct. (*Benthamedia*, *Cynoxylon*.)

19. *florida*, Linn. (*Cynoxylon floridum*, Raf.). FLOWERING DOGWOOD. Fig. 1067. Shrub or small tree with spreading branches, 10–15 ft., rarely to 40 ft.: lvs. oval or ovate, acute, dark green and glabrous above, glaucous or whitish beneath, usually only pubescent on the veins, 3–6 in. long: involucre white or pinkish, 3–4 in. wide; bracts 4, obovate, emarginate: fr.  $\frac{1}{2}$  in. long, scarlet. May. Mass. to Fla., west to Ont. and Texas, also E. and S. Mex. S.S. 5:112–13. Em. 468. G.F. 3:431. B.M. 526. Gn. 33, p. 441; 43, p. 153; 52, p. 177; 53, p. 222. J.H.

III. 28:453.; 55:331. F.E. 23:511. G. 34:531. Gn. M. 5:138. M.D.G. 1898:405. V. 5:230; 20:51.—One of the most beautiful American flowering trees; hardy N. Var. *pendula*, Dipp. With pendulous branches. F.E. 17, p. 68. V. 13:333. Var. *rubra*, André. With pink involucre. R.H. 1894:500. A.G. 18:441. F.E. 9:572. B.M. 8315. G. 28:689. Neither variety as hardy as the type.

20. *Nuttallii*, Audubon. Tree, to 80 ft.: lvs. ovate or obovate, usually pubescent beneath, 4–5 in. long: involucre white or tinged with pink, 4–6 in. across; bracts 4–6, oblong or obovate, sometimes roundish, mostly acute: fr. bright red or orange, crowned with the broad, persistent calyx. Brit. Col. to S. Calif. S.S. 5:214–15. Gng. 6:274. B.M. 8311. G. 27:366.—This species surpasses the former in beauty, but is more tender, particularly while the plants are young, and has rarely been successfully cult. outside of its native country.

DD. Frs. connate into a globular fleshy head. (*Benthamedia*.)

21. *Kousa*, Buerg. (*Benthamedia japonica*, Sieb. & Zucc. *C. japonica*, Koehne, not Thunb.). Fig. 1068. Shrub or small tree, to 20 ft.: lvs. cuneate, elliptic-ovate, acuminate, dark green above, glaucous and appressed-pubescent beneath, 2–4 in. long: involucre creamy white,  $2\frac{1}{2}$ –3 in. wide; bracts ovate, acute: frs. forming a globular head. June. Japan, China. S.Z. 16. S.I.F. 2:59.



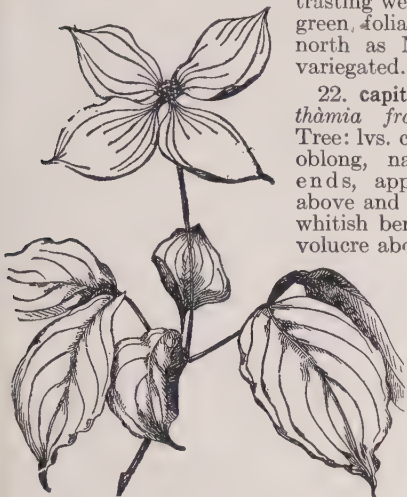
1066. *Cornus mas*. (Sprays  $\times \frac{1}{2}$ )



1067. *Cornus florida*. ( $\times \frac{1}{2}$ )



Gn. 43:152; 60, p. 165. G.C. III. 19:783. A.G. 9:329 (adapted in Fig. 1068); 13:674. Gng. 3:149. J.H. III. 35:9; 63:187. M.D.G. 1899:328-9. R.B. 30:64. G. 27:367. Gn.W. 8:741. G.M. 35, suppl. Oct. 8.—Fls. very showy, appearing after the lvs. in June and contrasting well with the bright green foliage; hardy as far north as Mass. Sometimes variegated.



1068. *Cornus Kousa*. ( $\times \frac{1}{2}$ )

22. *capitata*, Wall. (*Benthàmia fragifera*, Lindl.). Tree: lvs. coriaceous, elliptic-oblong, narrowed at both ends, appressed-pubescent above and more densely and whitish beneath, 2-4 in.: involucre about  $2\frac{1}{2}$ -3 in. wide; creamy white; bracts ovate, acute: fr.-head over 1 in. across, scarlet. June. Himalayas. B. R. 19:1579. Gn. 54, p. 310; 60, p. 165; 64, p. 135; 70, p. 123; 73, p. 411. G.C. III. 16:501; 45:83; 48:447. J. H.

III. 30:213. M.D.G. 1898:568.—Evergreen tree, with showy fls. and frs.; hardy only S.

AA. Plants low herbs: fls. in dense heads, with a white (or pinkish) involucre. (*Arctocrania*, *Chamaepericlymenum*.)

23. *canadensis*, Linn. Herb,  $\frac{1}{2}$ - $\frac{2}{3}$  ft. high, with creeping rootstock: lvs. whorled, sessile, elliptic or obovate, glabrous or nearly so, 1-3 in. long: head greenish, long-peduncled; involucre white, 1- $1\frac{1}{2}$  in. wide: fr. bright red, globose. May-July. N. Amer., south to Ind., Colo., and Calif. B.M. 880. G.C. III. 47:363.—Handsome plant for half-shady places.

*C. Arnoldiana*, Rehd. (*C. obliqua*  $\times$  *C. racemosa*). Intermediate between the parents: last year's branches purple, older gray or grayish brown: fls. as profusely as in *C. racemosa*, but the white or bluish white fr. appears rather sparingly. Originated at the Arnold Arboretum. S.T.S. 1:40.—*C. australis*, C. A. Mey. Closely allied and very similar to *C. sanguinea*, but lvs. beneath with appressed hairs and branches less brightly colored. Asia Minor, Caucasus.—*C. Bretschneideri*, Henry (*C. aspera*, Wang.) Shrub, to 12 ft.: branches green or purplish: lvs. ovate to elliptic-ovate, usually rounded at the base, rough-pubescent on both sides, 2-4 in. long: cyme dense: fr. bluish black. N. China. Hardy.—*C. corynostylis*, Koehne—*C. macrophylla*,—*C. glabrata*, Benth. Shrub, to 10 ft.: branches gray: lvs. small, nearly glabrous, green and shining on both sides: fr. white. Ore. to Calif.—*C. Hessei*, Koehne. Allied to *C. alba*. Dwarf, dense shrub: lvs. crowded, small, very dark green: fr. bluish white. Probably from E. Asia.—*C. Koenigii*, Schneid. (*C. australis* var. *Koenigii*, Wang.) Allied to *C. sanguinea*. Lvs. larger, 3-5½ in. long, sparingly appressed-pubescent beneath. Transcaucasia.—*C. macrophylla*, Wall. (*C. corynostylis*, Koehne). Allied to *C. brachypoda*. Tree, to 30 ft.: lvs. broadly ovate to elliptic-ovate, acuminate: inf. cymose; style club-shaped at the apex. Himalayas. B.M. 8261. J.H.S. 27, p. 860. Gt. 1896, p. 285.—*C. oblonga*, Wall. Shrub or tree, to 30 ft.: lvs. narrow-oblong, nearly glabrous, glaucous beneath, coriaceous: fls. white, fragrant, in cymose panicles. Himalayas.—*C. poliochylla*, Schneid. & Wang. Shrub, to 12 ft.: branches brown: lvs. subcoriaceous, elliptic or elliptic-ovate, slightly villous above, beneath more densely so and grayish white,  $2\frac{1}{2}$ -4½ in. long: cymes long-peduncled: fr. black. Cent. China.—*C. pubescens*, Nutt. Shrub, to 15 ft., with purple branches: lvs. nearly glabrous above, glaucous and woolly-pubescent beneath: fr. white. Brit. Col. to Calif.—*C. Stuebelii*, Rehd. (*C. rugosa*  $\times$  *C. stolonifera*). Intermediate between the parents: branches purple: lvs. more or less woolly beneath: fr. bluish, rarely white. Originated at Rochester, N. Y.—*C. suecica*, Linn. (*Chamaepericlymenum suecicum*, Aschers. & Graebn.) Allied to *C. canadensis*: lvs. all opposite: fl.-head purple, the white involucre 1 in. or less wide. Arctic Amer., N. Eu., N. Asia. Gn. 55, p. 239. S.E.B. 4:634.

ALFRED REHDER.

**CORÒKIA** (from the native name). *Cornàceæ*. Evergreen shrubs, adapted to outdoor planting in the S. Upright, with tortuous or straight branches and black

bark: lvs. alternate or fascicled, stalked, entire: fls. perfect, small, yellow, in axillary or terminal clusters; calyx-tube top-shaped, the limb 5-lobed; petals 5, each with a scale at base; stamens 5: fr. an ovoid or oblong 1-2-celled drupe. Three or four species in New Zeal. *C. Cotonéaster*, Raoul, is offered abroad as a bush of curious growth, very attractive when covered with its very small yellow star-like fls.: rigid, densely branched, 4-8 ft., the branches crooked and interlaced, tomentose: lvs. 1 in. or less long, the blade orbicular to obovate or oblong-ovate, obtuse or emarginate, shining above, flat, stalked. B.M. 8425. I.T. 2:73.

L. H. B.

**CORONÍLLA** (Latin, a little crown: from the arrangement of the flowers). *Leguminosæ*. CROWN VETCH. Shrubs and herbs, some grown in the hardy garden and some in greenhouses, for their yellow or purple bloom.

Annuals or perennials, often woody, smooth or rarely silky-hairy, with odd-pinnate lvs., entire lfts., and purple or yellow fls. in peduncled heads or umbels; calyx 5-toothed; corolla papilionaceous, the standard orbicular and the keel incurved, wings obovate or oblong; stamens 9 and 1: pod jointed, terete or 4-angled; seeds oblong.—Species about 20, Medit. region and Canary Isls., W. Asia. The shrubby *C. Emerus* and *C. glauca* are useful in S. Calif. and the southern states. The species are occasionally grown in borders. *C. glauca* is sometimes grown under glass for spring bloom, after the manner of *Cytisus*. All are of easy cult.

A. Fls. yellow.

B. Plant herbaceous.

*cappadocica*, Willd. (*C. ibérica*, Bieb.). Low perennial herb, about 1 ft. high: lfts. 9-11, obcordate, ciliate: umbels 7-8-fld.; fls. yellow, large, July, Aug.: stipules membranaceous, rounded, ciliate-toothed. Asia Minor. L.B.C. 8:789. B.M. 2646.—A good trailer for rock-gardens and the margins of borders.

BB. Plant shrubby, at least at base.

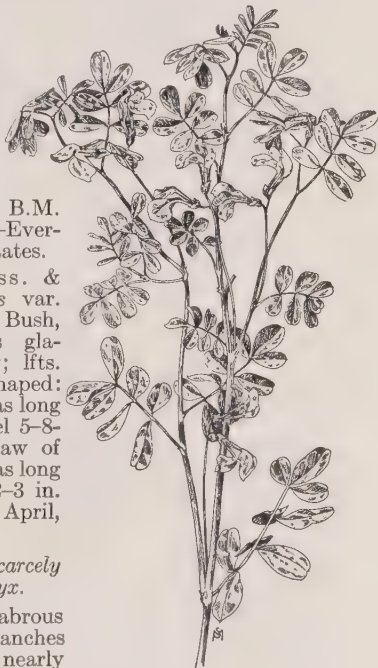
c. Claw of the petals much longer than the calyx.

*Émerus*, Linn. (*Émerus major*, Mill.). SCORPION SENNA. Fig. 1069. Dense, symmetrical shrub, 3-5 ft. high, the branches green and striate: lvs. deep glossy green; lfts. 5-7, obovate; stipules small: peduncles 3-fld.; fls. large, yellow, tipped with red. Blooms freely, May-July. Showy, half-hardy. S. Eu. B.M. 445. Gng. 5:36.—Evergreen in southern states.

*emeroides*, Boiss. & Sprun. (*C. Émerus* var. *emeroides*, Wöhlfl.). Bush, 3-6 ft.: branches glabrous or soft-hairy; lfts. 2-3 pairs, heart-shaped: peduncle 2-3 times as long as the lf., the umbel 5-8-fld.; fls. yellow; claw of petals about twice as long as the calyx: pod 2-3 in. long, very narrow. April, May. S. Eu.

cc. Claw of petals scarcely exceeding the calyx.

*júncea*, Linn. Glabrous gray-green shrub: branches rush-like, terete, nearly naked: lfts. 3-7, linear-



1069. *Coronilla Emerus*.

oblong, obtuse, somewhat fleshy, scattered: fls. golden yellow, in 5-7-fl. umbels: pod hanging, lance-linear. S. France. B.R. 820. L.B.C. 3:235.

*minima*, Linn. Glabrous, diffuse, soft gray-green sub-shrub, 3 or 4 in. high, procumbent: lfts. 7-13, ovate, obtuse or retuse, scattered or at base of plant: fls. golden yellow in 7-8-fl. umbels, sweet-scented. In dry sands. Eu. B.M. 2179.

*glauca*, Linn. Glabrous shrub 2-4 ft. high: stipules small, lanceolate: lfts. 5-7, obovate, very blunt, glaucous: fls. 7-8 in each umbel, yellow, heavy-scented. S. Eu. B.M. 13.—One of the common garden shrubs of S. Calif., flowering all the year. There is a variegated form.

AA. Fls. white and pink.

*viminàlis*, Salisb. Trailing shrub: stipules soon deciduous, ovate, membranaceous: lfts. 13-21, obovate, notched, glaucous: umbels 6-10-fl.; fls. pale red or white with a red stripe on the banner. Algeria.—Promising as a florists' plant for cut-fls. Fls. all the year in S. Calif.

*varia*, Linn. CROWN VETCH. Fig. 1070. Straggling or ascending smooth herb, 1-2 ft. high: lvs. sessile; lfts. 11-25, oblong or obovate, blunt and mucronate,  $\frac{1}{2}$ - $\frac{3}{4}$  in. long: peduncles longer than lvs.; fls. in dense umbels,  $\frac{1}{2}$  in. long, pinkish white. June-Oct. Eu. B.M. 258. Gng. 5:337.—Trailing plant for hardy herbaceous border.

JARED G. SMITH.  
L. H. B.†

**CORRÊA** (after Jose Francesco Correa de Serra, Portuguese author, 1750-1823). *Rutacæ*. Tender Australian shrubs, rarely cultivated under glass.



1070.  
*Coronilla varia*.  
( $\times \frac{1}{2}$ )

Shrubs, usually with dense, minute, stellate hairs: lvs. opposite, stalked, entire, and with transparent dots: fls. rather large, showy, red, white, yellow or green, usually pendulous, solitary or 2 or 3 together; petals and sepals each 4; stamens 8: carpels 4, nearly distinct.—Seven species. *C. speciosa* is probably the

best and most variable species. It is a native of barren sandy plains, and belongs to the large and much-neglected class of Australian shrubs.

*speciosa*, Ait. (*C. cardinalis*, F. Muell.). Tender shrub, 2-3 ft. high: branches slender, brown, opposite, covered with minute rusty hairs: lvs. opposite, about 1 in. long, elliptic, about a fourth as wide as long, wrinkled, dark green above, whitish below, margin entire, recurved: peduncles opposite, axillary, longer than the lvs., 1-fl., with a pair of leafy bracts; fls.  $1\frac{1}{2}$  in. long, pendulous, tubular, bright scarlet, with a very short limb of 4 spreading, greenish yellow segms.; calyx small, cup-shaped, with 4 almost obsolete teeth; stamens 8, exserted, about  $\frac{1}{4}$  in. B.M. 4912.—There are several varieties.

*alba*, Andr. Fig. 1071. A compact and much-branched shrub, 3-4 ft., the branches rusty-tomentose: lvs. variable, orbicular to obovate or elliptic, very blunt,  $\frac{1}{2}$ -1 in. long: fls. white or pink, 2 or 3 together, not over  $\frac{1}{2}$  in. long, and not so showy as preceding. B.R. 515.—Offered in S. Calif.

WILHELM MILLER.  
N. TAYLOR.†

**CORTADERIA** (from *Cortadero*, the native name in Argentina). *Graminææ*. PAMPAS-GRASS. Large reed-like perennials with numerous long, narrow blades and a large striking plume-like inflorescence. Species six, South America. See *Gynèrium*.

*argentea*, Stapf (*Gynèrium argenteum*, Nees). PAMPAS-GRASS. Culms numerous, in large thick tussocks, 3-10 ft. high, excluding the panicle: lvs. mostly basal, the upper sheaths gradually elongated; blades firm, long and slender, very scabrous on the margins,  $\frac{1}{8}$ - $\frac{1}{4}$  in. wide, tapering to a slender point: panicle large, compact, 1-3 ft., silvery white or in cult. varieties tinged with purple, diocious; spikelets 2-3-fl., the pistillate silky with long hairs, the staminate naked; glumes white and papery, long and slender; lemmas bearing a long slender awn. A.G. 14:323. G. 1:412. G.C. III. 40:295; 43:195. Gn. 62, p. 346; 66, p. 375. G.W. 3:415. Gn.W. 5:85; 23:20. J.H. III. 35:483; 49:27. R.H. 1862, p. 150. V. 3:369, 391. S. Brazil and Argentina. *C. Lambleyi foliis variegatis*, Hort. G.C. III. 25:335, appears to be a form of *C. argentea*.

*Quila*, Stapf (*Gynèrium Quila*, Nees. *G. jubatum*, Lem. *G. arcuato-nebulosum*, Hort.). Differs from pampas-grass in the rather laxer, more graceful plume, with longer, more flexuous, nodding branches, somewhat smaller spikelets, and more delicate glumes, and in the longer, very slender staminodes of the pistillate fls.: plume lavender-colored, 1-2 ft. long, the spikelets 3-5-fl. B.M. 7607. G.C. III. 26:102. Gn. 15, p. 179; 55, p. 93. R.H. 1885, p. 200; 1899:52, 53.—Grows in a dense tuft; perennial, but with biennial culms; the plant has been killed by a temperature of 3° F. Intro. by Lemoine, of



1071. *Correa alba*.  
( $\times \frac{1}{2}$ )



Nancy, France. Probable synonyms are *Gynerium roseum Rendlateri* and *G. argenteum carminatum Rendlateri*. F.S. 20:2075. Not so well known as *C. argentea*.

A. S. ИТЧСКОК.

**CORTUSA** (named by the herbalist Matthioli after his friend Cortus, professor of botany at Padua). *Primulaceae*. Scapose, perennial, pubescent herbs with long-stalked, cordate-ovate lvs. and purple umbellate fls. *C. Matthioli*, Linn., from the Swiss Alps, has long been a choice and delicate but not very popular plant, suited for shady parts of the rockery. It was long considered the only species of the genus. It is an herbaceous perennial, about 6 in. high, pubescent, rhizomatous, with a few long-stalked, cordate, 7-9-lobed, dentate lvs., and a slender scape bearing an umbel of about 7 small, rosy purple, drooping fls., which appear in early spring. B.M. 987. L.B.C. 10:956. It has some resemblance to *Primula cortusoides*. The genus has possibly 4 species, and is distinguished from *Primula* and *Androsace* by its stamens attached to the base of the corolla, and its long-acuminate anthers. Its culture is similar to that of the hardy primulas, but it needs winter protection in the northern states. Prop. by division of the roots.

**CORYANTHES** (Greek, *korys*, helmet, and *anthos*, flower, referring to the shape of the lip). *Orchidaceae*. Epiphytic orchids requiring warmhouse conditions.

Pseudbulbous: lvs. plicate, lanceolate: fls. in racemes; sepals spreading, dilated, flexuose, conduplicate, lateral ones largest, distinct at the base; petals small, erect; lip large, tridentate, basal portion forming a hood, continued into the column; distal portion bucket- or pouch-like; column pointing downward, elongated, terete, bicornute at the base, apex recurved; pollinia 2, compressed, caudicle linear, arcuate. The bucket part of the lip is provided with a spout-like structure, by means of which the bucket overflows when about half full of a secretion which drops from a pair of glands near the base of the column. The fls. of the species known are not lasting, the sepals being of such delicate texture that although at first they fully expand, they soon collapse and become unsightly. Although much interest attaches to the species of *Coryanthes*, the genus is not generally cult., since the fls. last too short a time and are not particularly brilliant. This complex genus, which is closely related to *Stanhopea*, is represented by several interesting species inhabiting Trop. Amer. For cult. see *Stanhopea*.

**macrantha**, Hook. Fls. few, in drooping racemes; ground-color rich yellow dotted with red; hood and part of bucket brownish red. Caracas. P.M. 5:31. B.B. 1841. B.M. 7692. G.C. III. 28:355. O.R. 3:41.

**maculata**, Hook. Fls. in a drooping raceme; sepals and petals dull, pale yellow, bucket blotched on the inside with dull red. B.M. 3102; 3747. B.R. 1793. F.S. 8:755 (as *C. Albertinae*). A.F. 30:325. C.O. 1. Var. **punctata**, Hort., has the petals and sepals bright yellow, speckled with red, the hood yellow, blotched with reddish orange, the pouch pale, speckled and spotted with red. Demerara. *C. Cobbii* is an unspotted form of this.

*C. Balfouriana*, Hort. Similar in habit to a *stanhopea*, with a long pendulous scape bearing 2 or 3 large and curiously shaped fls. Peru.—*C. leucocorys*, Rolfe. Sepals yellowish green, marked with brownish purple, the petals white, marked with light purple, the lip white with the bucket marbled with light rosy purple. Peru. Lind. 7:293.—*C. Mastersiana*, Lehm. Raceme erect; fls. 2 or 3, yellowish, tinged and spotted with copper-red. Colombia. G.C. III. 29:19.—*C. Sanderi*, Hort. A very large-fl. plant allied to *C. macrantha*.—*C. speciosa*, Hook. Raceme of 2 or 3 fls.; sepals and petals pale yellow; lip brown-red, the stalk brownish yellow. Brazil. G.C. III. 36:106. B.M. 2755 (as *Gongora*). C.O. 2.

GEORGE V. NASH.†

**CORÝDALIS** (Greek, *lark*, the spur of the flower resembling a lark's spur). *Fumariaceae*. Hardy plants allied to the Dutchman's breeches.

Erect or prostrate herbs, usually perennially rooted,

but often annuals: lvs. lobed and finely dissected in nearly all the species: fls. racemose, often yellow, less frequently blue, purple or rose; petals 4, spurred as in the Dutchman's breeches; stamens 6, in 2 groups.—Ninety species, natives of the north temperate regions. They are all of easy cult. They prefer full sunlight but will grow in half-shade. Prop. by division or seed.

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A. Fls. chiefly purple or rose, sometimes tipped yellow.

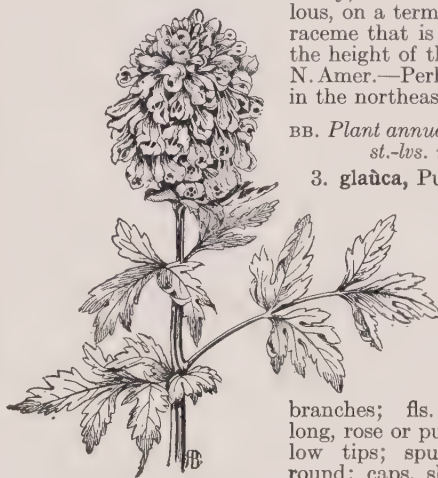
B. Plant perennial: root tuberous: st.-lvs. few.

1. **bulbosa**, DC. (*C. solida*, Swartz). Erect, 6 in. high: lvs. 3-4, stalked, biternately cut, segms. wedge-shaped or oblong: root solid: fls. large, purplish. Spring. Eu.

2. **Allenii**, Fedde. A perennial caulescent herb, with glaucescent foliage: lvs. usually alternate with finely divided segms., the whole lf. not over 10 in. long: fls. showy, rose-colored, pendulous, on a terminal dense-fl. raceme that is usually about the height of the lvs. N. W. N. Amer.—Perhaps not hardy in the northeastern states.

BB. Plant annual: root fibrous: st.-lvs. many.

3. **glauca**, Pursh. Annual, 1-2 ft. high, very glaucous: lobes of the lvs. mostly spatulate: racemes short, panicked at the naked summit of the



1072. *Corydalis nobilis*.

branches; fls. barely  $\frac{1}{2}$  in. long, rose or purple with yellow tips; spur short and round: caps. slender, linear; seeds with minute, transverse wrinkles. Summer. Rocky or sterile ground, Nova Scotia to Rocky Mts., and even Arctic coast, south to Texas. B.M. 179 (as *Fumaria*).—Not advertised for sale, but probably worth cult.

AA. Fls. chiefly yellow.

B. Foliage not tomentose.

C. Plant perennial: root tuberous or woody: st.-lvs. few or none.

D. The fls. at least 1 in. long.

4. **nobilis**, Pers. Fig. 1072. Perennial, erect: lvs. bipinnately cut; segms. wedge-shaped and lobed at the apex: fls. white, tipped with yellow, and a dark purple spot; spur 1 in. long. Spring. Siberia. B.M. 1953 (as *Fumaria nobilis*). G.C. II. 19:725.

5. **thalictrifolia**, Franch., not Jameson. Rhizome woody, elongated: lvs. large, long-petiolate, rigid, but spreading, the pinnæ of the finely dissected lvs. petiolulate: fls. yellow, in large spreading racemes, which are opposite the lvs.; sepals persistent, ovate.—A very showy species from China, the foliage strongly resembling *Thalictrum*.

6. **Wilsonii**, N. E. Br. A glabrous, often glaucescent perennial, with a rosette of radical much-dissected lvs. about 5 in. long: fls. in an erect raceme 7 in. high, which is usually leafless; corolla deep canary-yellow, about 1 in. long, the blunt spur about  $\frac{1}{2}$  in. long. G.C. III.

35:306.—Useful for the Alpine garden and more profuse bloomer than *C. tomentosa*, its nearest relative. China.

DD. The fls. not over  $\frac{1}{2}$  in. long.

7. *cheilanthisfolia*, Hemsl. A small low perennial with radical, fern-like, much-dissected, erect lvs. about 8 in. long: scape usually taller than the lvs., bearing numerous fls. not over  $\frac{1}{2}$  in. long, yellow. China. May.—Suitable for moist places in the alpine garden. Probably unknown in U. S. as it is a rare plant in nature.

CC. Plant annual or biennial: root fibrous: st.-lvs. numerous.

D. Height of plants 2 ft. or more.

8. *ophiocarpa*, Hook. f. & Thoms. Root fibrous, the st. 2-3 ft. and branched: lvs. pinnatisect, 4-8 in. long, and glaucous beneath: fls. yellow, in many-fl., lax racemes which are opposite the lvs.; sepals orbicular, finely toothed and fimbriate. Moist valleys of the Himalayas.

DD. Height of plants usually less than 1 ft.

E. Raceme spike-like; fls. almost sessile.

9. *curvisiliqua*, Engelm. Probably a perennial: commonly more robust than *C. aurea*, ascending or erect, 1 ft. high or less: fls. golden yellow, over  $\frac{1}{2}$  in. long, in a spike-like raceme; spur as long as the body, commonly ascending: caps. quadrangular,  $1\frac{1}{2}$  in. long; seeds turgid to lens-shaped, with acute margins densely and minutely netted. Woods in Texas.

EE. Raceme not spike-like; fls. pedicellate.

10. *aurea*, Willd. Annual, 6 in. high, commonly low and spreading: fls. golden yellow, about  $\frac{1}{2}$  in. long, on rather slender pedicels in a short raceme; spur barely half the length of the body, somewhat decurved: caps. spreading or pendulous, about 1 in. long; seeds 10-12, turgid, obtuse at margin, the shining surface obscurely netted. Rocky banks of Lower Canada and N. New England, northwest to latitude  $64^\circ$ , west to Brit. Col. and Ore., south to Texas, Ariz. and Mex.; not Japan.—The western forms have the spur almost as long as the body of the corolla and pass into

Var. *occidentalis*, Engelm. More erect and tufted, from a stouter and sometimes more enduring root: fls. larger; spur commonly ascending: caps. thicker; seeds less turgid, acutish at margins. Colo., New Mex., W. Texas, Ariz.

11. *lutea*, DC. Erect or spreading, 6-8 in. high, annual, or forming a tufted stock of several years' duration: lvs. delicate, pale green, much divided; segms. ovate or wedge-shaped, and 2-3-lobed: fls. pale yellow, about  $\frac{1}{2}$  in. long, in short racemes; spur short: pod  $\frac{1}{4}$  or  $\frac{1}{2}$  in. long. Stony places of S. Eu., and runs wild in Eu.

BB. Foliage tomentose.

12. *tomentosa*, N. E. Br. A low rock-loving perennial, with a rosette of radical lvs. 4-7 in. long, oblong in outline and tomentose, the tomentum whitish pink, pinnæ finely dissected: racemes erect, 5-7 in. tall; corolla about  $\frac{3}{4}$  in. long, light canary-yellow, the spur very blunt and about  $\frac{1}{4}$  in. long. China.—A good plant for the rock-garden.

*C. angustifolia*, DC., is a little-known perennial with bi-ternately divided lvs. and flesh-colored fls.—*Fumaria angustifolia*, Bieb. G. C. III. 35:307.—*C. cava*, Schweigg. & Kort. (probably a form of *C. tuberosa*, DC.) is somewhat larger than *C. bulbosa*, with pretty fls. varying into purplish and white. Eu.—*C. ochroleuca*, Koch. One ft. high, blooming June-Sept.: fls. yellow-white, the spur yellow: caps. linear; petiole winged. Italy.—*C. Scouleri*, Hook., grows 3 ft., and is cult. in some European gardens. W. Amer.

N. TAYLOR.†

**CORYLOPSIS** (*Corylus* and *opsis*, likeness; in foliage resembling the hazel). *Hamamelidaceæ*. Woody plants, grown chiefly for their yellow fragrant flowers appearing in early spring and for the handsome foliage.

Deciduous shrubs, rarely trees: lvs. alternate, strongly veined, dentate: fls. in nodding racemes with large bracts at the base, appearing before the lvs., yellow; calyx-lobes short; petals clawed, 5; stamens 5, alternating with entire or 2-3-parted short staminodes; styles 2; ovary half-superior, rarely entirely superior: fr. a 2-celled, dehiscent, 2-beaked caps., with 2 shining black seeds.—About 12 species in E. Asia and Himalayas.

These are low ornamental shrubs, with slender branches and pale bluish green distinct foliage; all are very attractive in early spring, when covered with numerous nodding spikes of yellow, fragrant flowers. Not hardy north of New York, except in sheltered positions. They grow best in peaty and sandy soil. Propagated by seeds sown in spring, best with slight bottom heat, and by cuttings of half-ripened wood in summer under glass; also by layers, rooting readily in moderately moist, peaty soil.

A. Fls. in many-fl. racemes.

B. Petals obovate to oblong-obovate.

C. Young branchlets and lvs. beneath pubescent, at least on the veins.

*spicata*, Sieb. & Zucc. Shrub, to 4 ft.: lvs. oblique and rounded or cordate at the base, roundish ovate or obovate, sinuate-dentate, glaucous beneath and pubescent, 2-3 in. long: racemes 7-10-fl., 1-2 in. long, their bracts ovate; fls. bright yellow; stamens slightly longer than the obovate petals; calyx hairy. Japan. S.Z. 19. B.M. 5458. F.S. 20:2135. R.H. 1869, p. 230; 1878, p. 198; 1907, p. 403. G.C. II. 15:510; III. 25:210. Gn. 33, p. 441. S.I.F. 2:26.—This species has larger and handsomer foliage and fls. of a deeper yellow, in longer racemes, but *C. pauciflora* flowers more profusely and is somewhat harder.

*sinensis*, Hemsl. Shrub, 6-15 ft.: lvs. obovate to oblong-obovate, abruptly acuminate, obliquely subcordate or cordate at the base, sinuate-denticulate, pubescent at least on the veins and grayish green beneath, 2-4 in. long: racemes about 2 in. long, their bracts nearly orbicular; petals orbicular-obovate, slightly longer than style and stamens; calyx hairy. Cent. China. G.C. III. 39:18. Var. *glandulifera*, Rehd. & Wilson (*C. glandulifera*, Hemsl.). Young branchlets and petioles with scattered glandular bristles: calyx glabrous. H.I. 29:2819.

CC. Young branchlets glabrous; lvs. glabrous or only with a few silky hairs on the veins beneath when young.

*Veitchiana*, Bean. Shrub, 3-6 ft.: lvs. short-petioled, elliptic, abruptly acuminate, subcordate at the base, sinuate-denticulate, glaucous beneath, 3-4 in. long: racemes 1-2 in. long; petals obovate, slightly shorter than the stamens; calyx hairy; nectaries 2-parted. Cent. China. B.M. 8349. Gn. 76, p. 184.

BB. Petals with the blade as broad as or broader than long.

*Willmottiae*, Rehd. & Wilson. Shrub, to 12 ft.: lvs. oval to obovate, cordate or truncate at the base, sinuate-denticulate, glaucous beneath, 1-3½ in. long: racemes 2-3 in. long; petals suborbicular; calyx glabrous; nectaries 2-parted, slightly shorter than the sepals. Cent. China. G.M. 55:191 (as *C. multiflora*).

*platypetala*, Rehd. & Wilson. Shrub, 3-8 ft.: young branchlets with scattered glandular bristles: lvs. on glandular petioles, ovate or broadly ovate, cordate or subcordate at base, sinuate-denticulate, on both sides sparingly silky-hairy when young, soon glabrous 2-4 in. long: racemes 1-2 in. long; petals hatchet-shaped,  $\frac{1}{2}$  in. broad; nectaries emarginate at the apex; stamens and styles much shorter than petals; calyx glabrous. Cent. China. Var. *lævis*, Rehd. & Wilson. Branchlets and petioles without any glands. W. China.—Less showy than most other species.



## AA. Fls. in 2-3-fld. racemes.

**pauciflora**, Sieb. & Zucc. Low, much-branched shrub, 2-3 ft.: lvs. obliquely cordate, ovate, sinuate-dentate, ciliate, pubescent and glaucous beneath, 1-2 in. long; racemes 2-3-fld.,  $\frac{1}{2}$ - $\frac{3}{4}$  in. long; fls. light yellow; petals obovate, about as long as stamens and style. Japan. S.Z. 20. G.F. 5:342. Gt. 48:1467. B.M. 7736. G.W. 15, p. 101. J.H. III. 48:381. S.I.F. 2:26.

*C. Griffithii*, Hemsl. (*C. himalayana*, Hook., not Griff.). Shrub or small tree, to 20 ft.: young branchlets and lvs. beneath densely pubescent; lvs. subcordate; racemes 1-2½ in. long; stamens and styles much shorter than the obovate petals. Himalayas. B.M. 6779.

ALFRED REHDER.

**CÓRYLUS** (ancient Greek name). *Betulaceæ*. HAZEL. FILBERT. COBNU. Woody plants grown for their handsome rather large foliage and some species for their edible nuts.

Deciduous shrubs, rarely trees: lvs. alternate, stipulate, petioled, serrate and usually more or less pubescent; fls. monœcious, appearing before the lvs.; staminate in long, pendulous catkins, formed the previous year, and remaining naked during the winter (Fig. 1073), each bract bearing 4 divided stamens; pistillate included in a small, scaly bud with only the red styles protruding (Fig. 1074): fr. a nut, included or surrounded by a leafy involucre, usually in clusters at the end of short branches.—Fifteen species in N. Amer., Eu. and Asia, all mentioned below. Monograph by Winkler in Engler, Pflanzenreich, hft. 19, pp. 44-56 (1904), quoted below as Winkl.

Numerous varieties are cultivated in Europe for their edible nuts. They are also valuable for planting shrubberies, and thrive in almost any soil. The foliage of some species turns bright yellow or red in autumn. Propagated by seeds sown in fall, or stratified and sown in spring; the varieties usually by suckers, or by layers, put down in fall or spring; they will be rooted the following fall. Budding in summer is sometimes practiced for growing standard trees, and grafting in spring in the greenhouse for scarce varieties. They may also be increased by cuttings of mature wood taken off in fall, kept during the winter in sand or moss in a cellar and planted in spring in a warm and sandy soil. Illustrated monograph of the cultivated varieties by Franz Goeschke, Die Haselnuss (1887). See, also, bulletin on Nut-

1073. Winter catkins of filbert.

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A. Husk or involucre consisting of 2 distinct bracts (sometimes partly connate).

B. Involucre densely spiny: lvs. nearly glabrous.

1. **ferox**, Wall. Tree, to 30 ft.: young branchlets silky-hairy: lvs. oblong to obovate-oblong, usually rounded at the base, acuminate, doubly serrate, glabrous except on the veins beneath, with 12-14 pairs of veins, 3-5 in. long; involucre tomentose, forming a spiny bur about  $\frac{1}{2}$  in. across, longer than the small nuts. Himalayas. Winkl. 45. Var. **thibetica**, Franch.

(*C. thibetica*, Batal.). Lvs. broadly ovate to obovate: involucre glabrescent. Cent. and W. China. R.H. 1910:204.

BB. Involucre not spiny.

c. Bracts of the involucre deeply divided into linear lobes, much longer than the nut: tree.

2. **Colurna**, Linn. Tree, to 70 ft.: petioles  $\frac{3}{4}$ -2 in. long, usually glabrescent: lvs. deeply cordate, roundish ovate to obovate, slightly lobed and doubly crenate-serrate, at length nearly glabrous above, pubescent beneath, 3-5 in. long; frs. 3-10, clustered: involucre open at the apex, usually densely beset with glandular hairs: nut roundish ovate,  $\frac{3}{4}$  in. long. From S. Eu. to Transcaspia. G.C. III. 40:256. Gn. 31, pp. 260-1. H.W. 2, p. 29. G.W. 14, p. 642. Gng. 16:163.—Ornamental tree, with regular pyramidal head, not quite aardy N. Rarely cult. for the fr. under name of filbert or of Constantinople or Constantinoople nut. Var. **glandulifera**, DC. Petioles and peduncles glandular-setose: lobes of the involucre less acute and more dentate.

3. **chinensis**, Franch. (*C. Colurna* var. *chinensis*, Burk.). Tree, to 120 ft.: petioles  $\frac{1}{2}$ -1 in. long, pubescent and setulose: lvs. ovate to ovate-oblong, cordate and very oblique at the base, glabrous above, pubescent on the veins beneath, doubly serrate, 4-7 in. long; fr. 4-6, clustered; involucre constricted above the nuts, with recurved and more or less forked lobes, finely pubescent, not glandular. W. China. Winkl. 49 and 50.

cc. Bracts of the involucre divided into lanceolate or triangular lobes: shrubs.

d. The involucre not or only slightly longer than the nut, open or spreading at the apex.

E. Lobes of bracts serrate or dentate.

4. **Avellana**, Linn. Shrub, to 15 ft.: lvs. slightly cordate, roundish oval or broadly obovate, doubly serrate and often slightly lobed, at length nearly glabrous above, pubescent on the veins beneath: involucre shorter than the nut, deeply and irregularly incised: nut roundish ovate,  $\frac{1}{2}$ - $\frac{3}{4}$  in. high. Eu., N. Afr., W. Asia. H.W. 2:16, p. 28. Var. **atropurpurea**, Kirchn. (var. *fusco-rubra*, Goeschke). Lvs. purple. Var. **aurea**, Kirchn. Lvs. yellow. Var. **laciniata**, Kirchn. (var. *heterophylla*, Loud.). Lvs. laciniately incised or lobed. Var. **pendula**, Goeschke. With pendulous branches. G.W. 2, p. 13. There are also many varieties cult. for their fr.

5. **pontica**, Koch. Shrub: lvs. cordate, roundish ovate or broad-oval, doubly serrate, pubescent beneath: involucre finely pubescent, with few glandular hairs at the base, campanulate, somewhat longer than the nut, with large spreading lobes: nut large, broad-ovate. W. Asia. F.S. 21:2223-4 (as *C. Colurna*).—From this species the cobnuts seem to have originated; also the Spanish nuts are probably mostly cross-breeds between this species and *C. Avellana* or *C. maxima*, or between the two latter species.

EE. Lobes of the bracts entire or sparingly dentate, triangular.

6. **heterophylla**, Fisch. Shrub, to 12 ft.: petioles about  $\frac{3}{4}$  in. long: lvs. orbicular-obovate, cordate at the base, nearly truncate at the apex and with a very short point, incisely serrate, pubescent on the veins beneath, 2-4 in. long; involucre somewhat longer than the nuts, striate, glandular-setose near the base. Japan to W. China. S.I.F. 1:20.—Several varieties apparently not yet in cult. occur in China: var. *Crista-Galli*, Burkill, var. *setchuenensis*, Franch., and var. *yunnanensis*, Franch.



1074. Pistillate flowers of *Corylus rostrata*. (Natural size)

DD. *The involucre about twice as long as the nut, usually tightly inclosing the nut.*

7. *americana*, Walt. Shrub, 3-8 ft.: young branchlets pubescent and glandular bristly: lvs. slightly cordate or rounded at the base, broadly ovate or oval, irregularly serrate, sparingly pubescent above, finely tomentose beneath, 3-6 in. long: involucre compressed, exceeding the nut, the 2 bracts sometimes more or less connate, with rather short, irregular, toothed lobes: nut roundish ovate, about  $\frac{1}{2}$  in. high. From Canada to Fla. west to Ont. and Dak. Var. *calyculata*, Winkl. (*C. calyculata*, Dipp.). Involucre with 2 very large bracts at the base.

AA. *Husk or involucre tubular, narrowed above the nut and forming an elongated beak.*

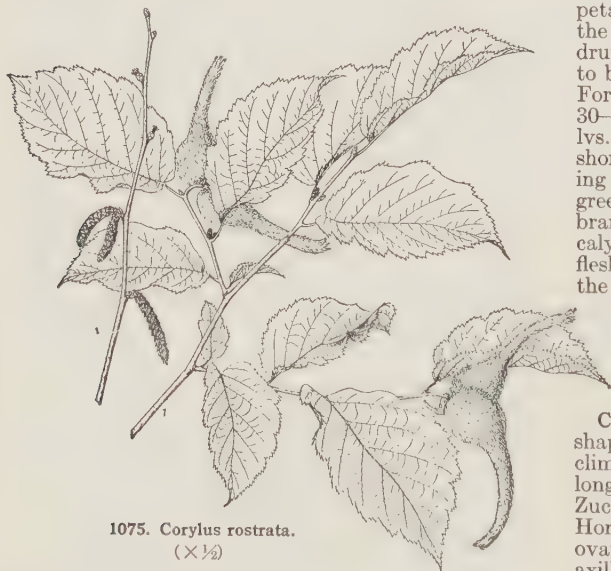
B. *Involucre finely pubescent outside with rather wide gradually narrowed beak.*

8. *máxima*, Mill. (*C. tubulosa*, Willd.). Shrub, sometimes small tree, to 30 ft.: lvs. cordate, roundish-ovate, slightly lobed and doubly serrate, 3-6 in. long: involucre finely pubescent outside: nut oblong, large; kernel with thin red or white skin. S. Eu. H.W. 2, p. 30. Winkl. 49. Var. *purpurea*, Rehd. (*C. Avellana purpurea*, Loud. *C. máxima* var. *atropurpurea*, Dochnahl). Lvs. deep purplish red darker than in *C. Avellana atropurpurea*. F.E. 21:325.—Many varieties, with large nuts, known as filberts or Lambert's filberts. The cult. forms are partly hybrids with *C. Avellana*.

BB. *Involucre densely beset with bristly hairs, and usually rather abruptly constricted into a narrow beak.*

c. *Petioles usually longer than  $\frac{1}{2}$  in.*

9. *mandshurica*, Maxim. (*C. rostrata* var. *mandshurica*, Regel). Shrub, to 15 ft.: young branchlets pubescent: lvs. suborbicular to elliptic or obovate,



1075. *Corylus rostrata*.  
( $\times \frac{1}{2}$ )

doubly serrate and slightly sinuately lobed, pubescent beneath, 3-5 in. long: involucre thickly beset with brown spreading bristles, about 2 in. long, about 3 times as long as the nut, divided at the apex into narrow entire segms. Manchuria, Korea. Winkl. 49.

10. *Sieboldiana*, Blume (*C. rostrata* var. *Sieboldiana*, Maxim.). Shrub, to 15 ft.: lvs. elliptic to oblong or obovate, usually rounded at the base, doubly serrate and slightly lobed, 2-4 in.; the young lvs. often with a purple blotch in the middle: involucre with less stiff bristles, about  $\frac{1}{2}$  in. long, 2 or sometimes 3 times as

long as the nut, narrowed toward the apex. Japan. S.I.F. 1:20.

cc. *Petioles shorter than  $\frac{1}{2}$  in.*

11. *rostrata*, Ait. Fig. 1075. Shrub, 2-6 ft.: branchlets pubescent or glabrous, not bristly: lvs. rounded or slightly cordate at the base, oval or obovate, densely serrate and sometimes slightly lobed, nearly glabrous at length, except sparingly pubescent on the veins beneath,  $2\frac{1}{2}$ -4 in. long: involucre densely beset with bristly hairs, beak long and narrow: nut ovoid,  $\frac{1}{2}$  in. long. E. N. Amer., west to Minn. and Colo. G.F. 8:345 (adapted in Fig. 1075).

12. *californica*, Rose (*C. rostrata* var. *californica*, DC.). Allied to *C. rostrata*. Shrub, to 20 ft.: lvs. more villous beneath: involucre with a short beak, which is often flaring and sometimes torn. Calif. to Wash.

*C. colchica*, Alboff. Low shrub, to 3 ft.: lvs. ovate or obovate, densely doubly serrate, sparingly pilose: involucre connate, with a short lacerated beak, pubescent. Caucasus. Winkl. 53. Not in cult.—*C. colurnoides*, Schneid. (*C. intermedia*, Lodd., not Fingerh., *C. Colurna* X *C. Avellana*). Similar to *C. Colurna*: small tree or large shrub. bark darker: involucre shorter, scarcely glandular. Garden origin.—*C. Fargesii*, Schneid. (*C. mandshurica* var. *Fargesii*, Burkill). Tree to 45 ft.: lvs. narrow-obovate to oblong: involucre soft-pubescent, sometimes only slightly so. W. China.—*C. Jacquemontii*, Deene. (*C. Colurna* var. *lacera*, DC.). Allied to *C. chinensis*. Tree: lvs. ovate, lobed toward the apex, less pubescent, 5-8 in. long: involucre pubescent, not constricted, lobes not or rarely forked, often dentate. Himalayas.

ALFRED REHDER.

**CORYNOCÁRPUS** (Greek, *club-fruit*, alluding to the shape). *Anacardiaceae*; by Engler made the sole representative of *Corynocarpaceae*. A very few New Zeal. and Polynesian evergreen trees, one of which is intro. in Calif. Glabrous: lvs. large, alternate, simple and entire, without stipules: fls. perfect, small, whitish green, inodorous, in terminal or subterminal panicles; calyx-lobes petal-like, unequal, 2 exterior smaller; petals much like the calyx-lobes; stamens 5, opposite the petals and shorter; staminodia 5, petal-like: fr. drupaceous, narrowly ovoid, 1-seeded, the pulp said to be edible; seed very bitter, poisonous. *C. laevigata*, Forst. NEW ZEALAND LAUREL. Attractive leafy tree, 30-40 ft., the trunk sometimes more than 2 ft. diam.: lvs. to 8 in. long, elliptic-oblong or oblong-ovate, with a short stout petiole, margins slightly recurved, suggesting those of *Magnolia grandiflora*: fls. very small, greenish or whitish, short-pedicelled, in a terminal branched panicle; petals concave, little exceeding the calyx-lobes: drupe  $1\frac{1}{2}$  in. or less long, orange-colored, fleshy, plum-like. N. Zeal., in lowlands not far from the sea. B.M. 4379.—*C. similis*, Hemsl., and *C. dissimilis*, Hemsl., from New Hebrides and New Caledonia respectively, are not listed among cult. plants.

L. H. B.

**CORYNOPHÁLLUS**: *Hydrocyme*.

**CORYNÓSTYLIS** (Greek, describing the club-shaped style). *Violaceae*. A monotypic genus of woody climbers, with alternate lvs. and terminal racemes of long-stalked violet-like fls. *C. Hybanthus*, Mart. & Zucc. (*Calyptrion Aubletii*, Ging. *Corynostylis Aubletii*, Hort.), is native of Trop. Amer. The lvs. are 2-5 in. long, ovate, or orbicular, bright green, serrate: fls. white, in axillary showy racemes which are contiguous along the st., long-spurred, 2 or 3 times as large as a violet, the spur half-twisted. F.S. 21:2213. B.M. 5960.—A handsome, vigorous warmhouse climber, and cult. in the open in S. Calif. Prop. by cuttings and seeds.

**CÓRYPHA** (Greek for *summit* or *top*,—where the leaves grow). *Palmaceae*, tribe *Corypheae*. Tall fan-leaved palms with a spineless stout trunk.

Leaves terminal, large, orbicular, flabellately divided to the middle into numerous linear-lanceolate segms.; segms. induplicate in the bud; rachis none; ligule small; petiole long, stout, concave above, spiny on the







XXX. Chrysanthemum.—Two of the florist's types.



margins; sheaths split; spadix solitary, erect, paniculately much branched; spathes many, tubular, sheathing the peduncle and branches; fls. green, the plant dying after once flowering and fruiting: frs. as large as a cherry, with a fleshy pericarp.—Species 6, Trop. Asia and Malay Archipelago. G.C. II. 24:362. These fan-palms are cult. the same as *Chamærops* and *Livistona*. They are warmhouse plants, prop. by seeds. Large fans, umbrellas and tents are made of the talipot palm by the natives of Ceylon. *Coryphas* are but little grown commercially, the growth of young plants being slow. Good loam well enriched with stable manure, a night temperature of 65° and abundant moisture, are the chief requisites in their cult., with a moderately shaded house during the summer.

*elata*, Roxbg. (*C. Gebanga*, Blume). Fig. 1076. Trunk straight, 60–70 ft. high, 2 ft. diam., spirally ridged: lvs. lunate, 8–10 ft. diam.; segms. 80–100, separated nearly to the middle, ensiform, obtuse or bifid; petioles 6–12 ft., with black margins and curved spines; spadix about one-fourth the length of the trunk, but narrow. Bengal and Burma.

*umbraculifera*, Linn. TALIPOT PALM. Trunk ringed, 60–80 ft.: lvs. sub-lunate, 6 ft. long by 13 ft. wide, palmately pinnatifid, folded lengthwise above the middle; segms. obtusely bifid; petiole 7 ft., the spines along its margins often in pairs: spadix sometimes 20 ft. long, with spreading branches. Malabar coast and Ceylon. A.F. 12:313. Gng. 5: 213.—Lvs. used as a substitute for paper.

*C. australis*, R. Br.=*Livistona*.—*C. macrophylla*, Hort.= (?).—*C. minor*, Jacq.=*Sabal*.—*C. Woganii*, Hort., is a dwarf round-lvd. plant. A.G. 15:307.

N. TAYLOR.†

**CORYSANTHES** (*helmet-flower*, Greek). *Orchidaceæ*. Not to be confounded with *Coryanthes*. Fifteen or more terrestrial orchids of Austral., New Zeal. and Malaysia, little cult. Dwarf, delicate, tuberous-rooted or fleshy-rooted herbs, bearing a solitary broad lf. and a large solitary fl.: upper sepal large, helmet-shaped; lateral sepals free, linear or filiform; petals (sometimes wanting) smaller than lateral sepals and similar to them; lip large, tubular at base, the margins inclosing the column, the upper part extended into a broad reflexed limb; pollinia 4. *C. picta*, Lindl., Malaya, is 3–4 in. high: upper part of fl. deep purple and yellow, and lower part with four long awl-like segms. and a bract at base of ovary. *C. limbata*, Hook. f., Java, is mostly even lower, with fl. purple and white, the ovate-cordate lf. with reticulating white veins. B.M. 5357.

**CORYTHOLOMA** (referring to the helmet-shape). *Gesneriaceæ*. By some referred to *Gesneria*: a half-hundred or more leafy-stemmed tuberous herbs of Trop. S. Amer., with mostly red or speckled tubular fls. in terminal umbels or racemes, or solitary or few in the axils: lip of corolla erect, concave; disk 5-glandular; stamens didynamous. It is doubtful whether any of the species are in the trade. *C. macropodium*, Sprague, recently mentioned, is a glandular-hirsute herb, 6–9 in. high, from a subglobose tuber: lvs. 3–5 in. across, suborbicular: fls. in solitary axillary cymes, 5–7-fld., cinnabar-red, the corolla-tube about 1 in. long and nearly cylindric, the limb only slightly 2-lipped, the 3 lower lobes blotched purple. S. Brazil. B.M. 8228.—A handsome little plant. These plants are probably to be handled after the manner of gloxinias and similar things.

**COSMANTHUS**: *Phacelia*.

**CÓSMEA**: *Cosmos*.

**COSMÍDIUM**: *Thelesperma*.

**COSMOPHYLLUM**: *Podachænum*

**CÓSμος** (from the Greek word with a root idea of orderliness; hence an ornament or beautiful thing). Syn., *Cósmea*. *Compositæ*. Annual or perennial herbs, now popular as flower-garden subjects.

Often tall, usually glabrous: lvs. opposite, pinnately cut in the garden kinds fls. typically shades of rose, crimson and purple, with one yellow species, and white horticultural varieties, long peduncled, solitary or in a loose corymbose panicle: achenes glabrous: chaff of the receptacle

in *C. bipinnatus* with a long and slender apex, in other species with a blunt and short apex.—Perhaps 20 species, all Trop. American, mostly Mexican. The genus is distinguished from *Bidens* chiefly by the seeds, which are beaked in *Cosmos* but not distinctly so in *Bidens*, and by the color of the rays, which in *Cosmos* is typically some form of crimson, while in *Bidens* the rays are yellow or white.

The "black cosmos" (*C. diversifolius*) is, perhaps, better known to the trade as a *Bidens* or *Dahlia*. It has the dwarf habit and dark red early flowers of some dahlias, but the achenes are very puzzling. They resemble those of *Bidens* in being four-angled, and not distinctly beaked. They are unlike *Bidens*, and like *Cosmos*, in being not distinctly compressed on the back. They resemble both genera in having two rigid persistent awns, but, unlike these genera, the awns have no retrorse barbs or prickles. The achenes are linear, as in *Cosmos* and all our native tropical species of *Bidens*; but, although narrowed at the apex, they are not distinctly beaked, as in most species of the genus *Cosmos*. The plant is, perhaps, nearest to *Bidens*.

Until 1895 there were in the two leading species only three strongly marked colors: white, pink and crimson. These and the less clearly defined intermediate shades have come from *C. bipinnatus*; and the yellow forms have come from *C. sulphureus*, which was introduced in 1896. At first cosmos flowers were only an inch or two across. The best varieties now average 3 inches, and sometimes reach 4 or 5 without thinning or disbudding. Pure white flowers of cosmos are rarely if ever found wild, but some of the cultivated varieties are clear white. The group is lacking in bright deep reds. There are no full double forms of cosmos as yet, and, as regards strongly marked types of doubling, the cosmos may be decades behind the China asters. In the single forms, flat, incurved, or cupping, and reflexed flowers are to be looked for. Stellate forms are now offered; and also dwarfs, and other variants.

It is a mistake to grow cosmos in too rich soil, as one gets too vigorous growth and too few flowers, which are also late. A sandy soil is to be preferred as being earlier, and not too rich. It is well to pinch out the leading shoots of young plants in order to make them bushy and symmetrical, instead of tall and straggling. In the East, for best results it is still neces-

sary to sow seed indoors in April and transplant outdoors as soon as danger of frost is past. Seed sown in the open ground often fails to produce flowers in some northern localities before frost. The early frost kills the typical species, but some of the new strains are said to resist a degree or two of frost.



1076. *Corypha elata*, having spent itself in blooming.

*A. Rays white, pink or crimson: disk yellow.*

*bipinnatus*, Cav. Fig. 1077. Glabrous annual, 7-10 ft. high: lvs. bipinnately cut, lobes linear, remote, entire: involucrel scales ovate-lanceolate, acuminate: fls. white, pink or crimson: seeds smooth, with an abrupt beak much shorter than the body. Mex. B.M. 1535. Gn. 41:10. R.H. 1892:372.—The older and commoner species. *C. hybridus*, Hort., is presumably a trade name for mixed varieties of *C. bipinnatus*, but see G.F. 1:474 for note.

*AA. Rays yellow: disk yellow.*

*sulphureus*, Cav. Fig. 1078. Pubescent, 4-7 ft. high, much branched: lvs. often 1 ft. or more long, 2- or 3-pinnately cut, lobes lanceolate, mucronate, with rachis and midrib ciliate or hispid; pinnae alternate, entire or 2-3-toothed: peduncles 7-10 in. long, naked: outer involucrel bracts 8, linear, acuminate, green, 2 lines long; inner ones 8, oblong, obtuse, scarious, 5 lines long; fls. 2-3 in. across, pale, pure or golden yellow; rays 8, broadly obovate, strongly 3-toothed at the apex, ribbed beneath; anthers of the disk exerted, black, with orange tips: seeds linear, 1 in. long, including the slender beak. Mex. G.F. 8:485 (adapted in Fig. 1078).—Intro. 1896; parent of the yellow forms.

*AAA. Rays dark red: disk red.*

*diversifolius*, Otto (*Bidens atrosanguinea*, Ortg. *B. dahlioides*, Wats. *Dahlia Zimapani*, Roezl). BLACK COSMOS. Tender annual, 12-16 in. high, with tubers more slender, and requiring more care in winter than those of common dahlias: lvs. pinnately parted; lfts. 5-7, entire or slightly serrate, the terminal lfts. largest: peduncles each bearing 1 head 6 in. or more above foliage; rays dark velvety red, sometimes tinged dark purple. Mex. B.M. 5227. Gt. 1861:347. F.C. 2:47. J.H. III. 33:403. Var. *superba*, Hort., is sold.—Prop. almost exclusively by seeds. WILHELM MILLER. †

**COSSÍGNIA** (Jos. Fr. Charpentier de Cossigny, 1730-1789, French naturalist). *Sapindaceæ*. Shrubs or little trees of about 3 species, sometimes mentioned for cult. in warmhouses. *C. pinnata*, Comm., of Mauri-

tius, has white fls. in terminal panicle corymbs, and odd-pinnate lvs., with 3-5 oblong and entire lfts.

**COST-ACCOUNTING.** The keeping of profit-and-loss records, and the drawing of conclusions from them for the improvement of the business.

In recent years, the application of cost-accounting and efficiency methods to farming operations has opened practically a new approach to the discussion of agricultural problems and is forcing a reorganization in practices and in the sub-divisions of the business. Careful and extended studies have not yet been made of the efficiency principles in most horticultural occupations; but the suggestions drawn from orchard records may show the nature and scope of the work.

#### *Annual inventory.*

There is no single account that is more important than the annual inventory. This inventory should list the land and each important building separately. The total value of these items should equal the value of the farm. It should list each cow, horse and important piece of machinery separately. All the cash, notes, mortgages and accounts due the farmer should be recorded with his property. A separate list should be made of all notes, mortgages or accounts due to others. The difference between these and the value of property owned gives the net worth of the farmer. A comparison of the net worth at the beginning and end of the year shows the gain or loss for the year unless money or property has been added to the business from some other sources or taken from it.

#### *Cost-accounts.*

But an inventory does not show on which enterprises gains or losses have occurred. Usually a business is made up of both profitable and unprofitable enterprises, or of enterprises that are unequally profitable. In order to know how to develop the business to the best advantage, it is important to know which enterprises pay best for the use of land and labor. Cost accounts also have very many uses aside from determining the relative profitableness of different enterprises. If all the time spent, labor costs, and other costs, and the receipts are known, it is often possible to see ways of changing the management of a crop so as to increase profits.

In order to keep a complete cost-account with any crop, it is necessary to know all the labor of men, teams and machinery for the crop; to know all receipts and expenses caused by the cropping, and to keep track of any outlays contributed to the crop from the farm or other enterprises, also whatever this crop contributes to other enterprises.

A work-report of the time of man and horse should be kept in an ordinary account-book. At the end of the year, the total time is charged to each crop-account in the ledger. The ledger should have wide pages, so that there may be room for full descriptions. The left-hand page is used for charges, and the right-hand page for credits.

Each evening one should record any cash spent during the day under the proper crop or enterprise. The number of hours that have been spent on each enterprise for both man and horse labor are also recorded in the form shown on the next page. For convenience, the horse time is reduced to terms of one horse. A three-horse team working 10 hours is put down as 30 hours. If one desires, he may keep an account with only one enterprise. It is better to keep accounts with all the enterprises on the farm, so that one may study each part of his business and the business as a whole.

The best method of discussing the subject is to show an account as kept by a farmer. The following account with a 3-acre apple orchard was kept by a New York farmer in 1912:—



1077. *Cosmos bipinnatus*.



## WORK REPORT FOR APPLE ORCHARD.—THREE ACRES

1912		Man		Horse	
		Hrs.	Min.	Hrs.	Min.
April 1.	Manured.....	9	45	18	
May 8.	".....	2	30	5	
15.	Pruned.....	3			
25.	Brush hauled and burned.....	1	30	3	
27.	Sprayed.....	16	30	13	
28.	".....	4	30	5	
31.	".....	10	15	10	
June 1.	".....	13	45	3	45
3.	".....	16	30	9	
4.	".....	9	30	5	
5.	".....	14		7	
7.	Cleaned and put up sprayer.....	1	15		
July 31.	Removed borers.....	7	15		
Aug. 19.	Thinned.....	11	30		
20.	".....	4			
Sept. 7.	Manured.....	8	30	17	
Oct. 11.	Picked.....	4	15		
12.	Hauled barrels.....	8		16	
14.	Picked and packed.....	34	30	2	30
15.	" " " ".....	7		2	
	" " " ".....	11	30	5	
	Hauled to station.....	2	30	5	
17.	Picked and packed.....	15	45	4	30
18.	" " " ".....	12	30		
19.	" " " ".....	28	30	2	
21.	" " " ".....	22	15		
25.	" " " ".....	19	30	1	
28.	" " " ".....	25	30	1	
28.	" " " ".....	36			
30.	" " " ".....	34	30		
	Hauled to station.....	5	30	11	
Nov. 4.	Picked and packed.....	21	30	1	30
6.	Selling.....	2			
	Packed.....	7	30		
8.	Picked up drops.....	17		3	
12.	Hauled to station.....	10	15	8	
13.	Got ready for shipping.....	7	30		
14.	Hauled to station.....	4	30	9	
15.	" " " ".....	9		10	
Dec. 10.	" " " ".....	9	30	14	
	Hauled manure.....	2		4	
	Total hrs. and mins. ....	492	45	196	15

1078. *Cosmos sulphureus*. ( $\times \frac{1}{4}$ )

## LEFT-HAND PAGE.

1912		
Jan. 1.	Inventory—barrels on hand.....	\$12 00
Mar. 25.	100 lbs. arsenate of lead.....	8 10
April 5.	Freight on arsenate of lead.....	3 24
	1 bbl. lime-sulfur, \$8; freight 28 cts.....	8 38
June 10.	3 loads manure.....	1 50
Sept. 5.	6½ loads manure.....	3 25
Oct. 11.	Freight on barrels.....	6 00
18.	150 barrels.....	75 00
31.	Barrel liners, 60 cts.; freight, 25 cts.....	85
Nov. 8.	Postage.....	20
Dec. 2.	Post-cards for advertising.....	3 52
	Adv., "Apples for sale".....	37
	Telephone.....	25
31.	Use of land.....	40 00
	493 hrs. man-labor @ 18.3 cts.....	90 22
	196 hrs. horse-labor @ 13.3 cts.....	26 07
	196 hrs. equipment-labor @ 5.1 cts.....	10 00
	Interest on costs.....	3 00
	Total.....	\$288 95
	Gain.....	51 47
		\$340 42

## RIGHT-HAND PAGE.

Aug. 11.	4 empty barrels sold.....	\$1 58
12.	1 bus. King, \$1; 1 bus. Snow, 75 cts.....	1 75
17.	12 bus. drop apples.....	3 00
	2 empty barrels.....	1 10
21.	2 bus. Spy, 1 bus. Baldwin.....	2 25
22.	25 bus. drops.....	6 25
Oct. 25.	Mrs. Franklin, 7 bbls. Baldwin, 2 bbls. King, 2 bbls. Greening, 4 bbls. Spy, 1 bbl. Spitz.....	35 25
	Archdeacon & Co., 6 bbls. Snow, net.....	9 39
Nov. 4.	1 bbl. King, \$2.25; 1 bbl. Baldwin, \$1.85; 1 bbl. Spy, \$2.75.....	6 85
11.	2 bbls. Baldwin.....	3 95
	15 bus. Baldwin culls.....	75
20.	12 bbls. Baldwin, \$26.50; 4 bbls. Greening, \$8.25; 1 bbl. Spy, \$2.25; 1 bbl. Wagener, \$1.75.....	38 75
21.	3 bus. culls.....	1 00
	111 bbls. (1 bbl. Spitzenberg, 1 bbl. King, 6 bbls. Wagener, 1 bbl. Fall Pippin, 9 bbls. Hubbardston, 69 bbls. Baldwin, 24 bbls. Greening).....	188 70
22.	2 bbls. Baldwin.....	
23.	5 bbls. (1 bbl. King, 2 bbls. Baldwin, 1 bbl. Greening, 1 bbl. Spy).....	12 75
26.	5 bbls. Baldwin.....	7 85
	3 bus. Hubbardston, 6 bus. King.....	5 25
	Kept for home use; 3 bus. Snow, 20 bus. Baldwin.....	11 50
	25 bus. drops to chickens.....	2 50
	Total.....	\$340 42

This mere keeping of cost-accounts is not the end. The accounts must be studied. The following are a few of the facts that the farmer used in the preceding records and the suggestions derived from them:

Total crop:	Bus.	Total crop:	Bus.
Baldwin.....	421	Brought forward.....	611
Greening.....	93	Wagener.....	21
Hubbardston.....	30	Spitzenberg.....	6
Spy.....	23	Fall Pippin.....	3
King.....	22		
Snow.....	22		641
		Drops and culls.....	105
Carried forward.....	611		

From the foregoing records he was able to determine the yields per tree or different varieties.

Yields per acre good apples, 214 bushels.

Yield per acre culls and drops, 33 bushels.

Per cent of culls and drops, 14.

Total receipts, good apples, less cost of barrels, \$233.07.

Average price per bushel, good apples, without barrels, 36 cents

Hours of man-labor, per acre, 164.

Hours of horse-labor, per acre, 65.

Profit, per acre, \$17.

Profit, per hour, of man-labor, 10 cts.

Cost, per bushel, good apples, without barrels, 28 cents.

Profit, per bushel, 8 cents.

It will be seen that the cost of barrels was very high owing to buying late in the season. Ten cents a barrel extra cost is more than equal to the profit on a bushel of apples, or one-third the entire profit. Usually the profit on an enterprise can be greatly changed by small changes in cost.

The profit per acre is in addition to pay for use of land. If all the profit is expressed in terms of land, the orchard paid \$27 per acre rent, or gave a profit of \$14 per acre.

If the profit is all expressed in terms of labor, the orchard paid 28 cents per hour for time spent on it, or gave a profit of 10 cents per hour.

Records similar to those given above may be kept with each crop or enterprise on the farm. If this is done, an account is kept with horses from which the cost of an hour of horse-labor is determined. At the end of the year, the labor on each crop for the year is charged at this rate. Similarly, the cost of man-labor is found and charged. The cost of machinery-labor is charged in proportion to the hours that horses worked for the enterprise. This is how the costs per hour given above were determined. But if a complete set of accounts is not kept, the charge for labor of men and horses is placed at the usual rate of pay for such work in the region, including the cost of board. References: "Farm Management," G. F. Warren, pp. 428-93 (1913). Minnesota Bulletins, Nos. 97, 117, and 124. "Farm Accounts," J. A. Vye. G. F. WARREN.

**COSTMARY:** The rayless form of *Chrysanthemum Balsamita*, known as var. *tanacetoides*.

**CÓSTUS** (old classical name). *Zingiberaceæ*. **SPIRAL FLAG.** Perennial thick-rooted tropical herbs, cultivated under glass for their flowing-limbed showy flowers, which are in terminal bracteate spikes.

Stems short or tall and leafy (plant rarely acaulescent), roots often tuberous; fls. golden yellow, red, saffron-colored or white; corolla tubular, cleft, not showy; 1 staminodium, enlarged and bell-shaped, usually with a crispy limb, and forming the showy part of the fl. (called the lip), cleft down the back; ovary 3-loculed; filaments petaloid. — About 100 species, widely distributed in the tropics. More or less fleshy plants, prized in warm-houses, and grown in the open in S. Fla. and other warm regions. Monogr. by Schumann in Engler's *Pflanzenreich* hft. 20 (1904).

This interesting genus of tropical herbs thrives in any rich moist soil, but luxuriates in that of a gravelly or sandy character, when under partial shade. The plants are readily propagated by cutting the canes, or stalks, into short pieces of an inch or two in length, and planting in sifted peat, or fine moss and sand, covering but lightly. The roots may also be divided, but this is a slow means of propagation. Specimen plants require rather high temperature to bring out the rich colors of the leaves, which in some species are prettily marked with a purplish

tint, and are usually arranged spirally on the ascending stem. This gives rise to the name "spiral flag." (E. N. Reasoner.)

**speciosus**, Smith. Somewhat woody at base, 4-10 ft., stout, erect; lvs. oblong or oblanceolate, acuminate, nearly 1 ft. long, silky beneath; bracts red; fl. large, with a flowing white limb and yellowish center, 3-4 in. across, not lasting. E. Indies. I.H. 43:56. Gn. 47:166.

**igneus**, N. E. Br. One to 2 ft.: lvs. oblong or elliptic-lanceolate, 4-6 in. long; bracts not colored nor conspicuous; fls. clustered, orange-red. Brazil. I.H. 31:511. B.M. 6821. J.H. III. 28:11.

Few species of *Costus* are offered in this country, but others may occur in special collections. — *C. Friedrichsenii*, Petersen. 6 ft. or more: lvs. sessile, lanceolate, acuminate,  $1\frac{1}{2}$  ft. or less long; fls. very large, bright yellow in thick terminal spikes. Gt. 52:15-21. Cent. Amer. (?) — *C. micranthus*, Gagnep. 5-6 ft.: lvs. spirally placed, lanceolate; fls. very small with red tube and orange-red yellow-tipped lobes, the lip tubular and purple, in cone-like spikes 3 in. long. Martinique. — *C. muscarius*, Hort. Lvs. obliquely lanceolate, 4-5 in. long, dark green, marked and tessellated with silvery gray. W. Afr. — *C. zebrinus* is very likely the same as last. L. H. B.

**CÓTINUS** (ancient Greek name of a tree with red wood). *Anacardiaceæ*. **SMOKE-TREE.** **CHITTAM-WOOD.** Woody plants, grown chiefly for the attractive feathery fruiting panicles and for the handsome foliage turning brilliant colors in autumn.

Deciduous shrubs or trees with a strong-smelling juice; lvs. slender-petioled, entire, without stipules; fls. dioecious or polygamous, small, greenish or yellowish, in large and loose terminal panicles; the pedicels of the numerous sterile fls. lengthen after the fls. have dropped and become clothed with spreading hairs; petals 5, twice as long as the pointed calyx-lobes, the 5 stamens shorter than the petals, inserted between the lobes of the disk; ovary superior with 3 short styles; fr. a small compressed oblique-obovate dry drupelet with the style on one side. — Two species, one in N. Amer. and one in S. Eu. to Cent. Asia. Formerly usually included under *Rhus*, which differs chiefly in its usually compound and more or less serrate lvs., the globose fr. with terminal style, the absence of plumose pedicels and in the milky juice. Often planted, particularly the European species, for its loose feathery panicles which give almost the effect of a dense cloud of smoke, from which the shrub derives its name. The panicles of the American species are much less showy, but the autumnal coloring is more brilliant. Both species hardy as far north as Mass., the American being somewhat more tender. They prefer a sunny, and in the N., a somewhat sheltered position and well-drained soil, and are adapted for planting in dry and rocky ground. Prop. by seeds; also by root-cuttings and layers.

**Coggýgia**, Scop. (*C. Cótinus*, Sarg. *C. Coccýgea*, Koch. *Rhus Cótinus*, Linn.) **SMOKE-TREE.** Fig. 1079. Spreading, rather dense shrub, to 15 ft.: lvs. slender-petioled, oval or ob-



1079. *Cotinus*  
*Coggýgia*.  
( $\times \frac{1}{5}$ )



ovate, abruptly narrowed at the base, rounded at the apex, glabrous,  $1\frac{1}{2}$ – $3\frac{1}{2}$  in. long: panicles to 8 in. long, densely plumose, usually purplish: frs. few, about  $\frac{1}{8}$  in. long. June, July: fr. Aug., Sept. S. Eu. to Cent. China and Himalayas. Gn. 34, p. 162; 54, p. 505; 71, p. 552. Gng. 5:118. M.D.G. 1902:217. G.C. III. 29:92. H.W. 3, p. 32. Var. *atropurpurea*, Dipp. Panicles with dark purple hairs. Var. *péndula*, Dipp.



1080. *Cotoneaster horizontalis*.

Branches pendulous. Var. *pubescens*, Engler. Lvs., at least beneath, and often also the young branches, pubescent.

*americanus*, Nutt. (*C. cotinoides*, Brit. *Rhus cotinoides*, Nutt.). Upright shrub or small tree, to 35 ft.: lvs. gradually narrowed at the base, obovate to elliptic-obovate, rounded at the apex, silky beneath when young, at maturity glabrous or nearly so, 4–6 in. long: panicles 5–6 in. long, with short and rather inconspicuous pale purple or brownish hairs. June, July. Ala. to W. Texas and E. Tenn. S.S. 3:98, 99.—The autumnal tints orange and scarlet, as in the preceding species, but more brilliant.

ALFRED REHDER.

**COTONEÁSTER** (*cotoneum*, quince, and *aster*, similar: the leaves of some species resemble those of the quince). *Rosaceæ*, subfamily *Poméæ*. Shrubs, rarely small trees, chiefly grown for their ornamental red or black fruits and some species also for their foliage which turns brilliant colors in autumn.

Leaves alternate, deciduous or persistent, short-petioled, entire, stipulate: fls. solitary or in cymes, terminal, on short lateral branchlets, white or pinkish; petals 5; stamens about 20: fr. a black or red pomaceous drupe, with 2–5 stones.—About 40 species, in the temperate regions of Eu. and Asia, also in N. Afr., but none in Japan.

Cotoneasters are ornamental shrubs, many of them with decorative fruits remaining usually through the whole winter, while only a few, like the hardy *C. hupehensis* and *C. multiflora* and the tender *C. frigida*, and also *C. racemiflora* and *C. salicifolia*, are conspicuous with abundant white flowers. Of the species with decorative red fruits, *C. tomentosa*, *C. racemiflora* and *C. integerrima* are quite hardy, and *C. Simonsii*, *C. acuminata*, *C. rotundifolia*, *C. microphylla* and others are hardy at least as far north as New York, while *C. frigida* and its allies are the most tender. The foliage of some of the species assumes brilliant colors in autumn; dark crimson in *C. Simonsii*, *C. horizontalis*, *C. divaricata* and *C. Dielsiana*; scarlet and orange in *C. foveolata*, bright yellow in *C. Zabelii*. The half-evergreen *C. horizontalis* and *C. adpressa*, and the evergreen *C. Dammeri* and *C. microphylla*, with its allied species, are well adapted for rockeries on account of their low, spreading or prostrate habit. Cotoneasters thrive in any good, well-drained garden soil, but dislike very moist and shady positions. Propagation is effected by seeds, sown in fall or stratified; the evergreen species grow readily from cuttings of half-ripened wood in August under glass; increased also by layers, put down in fall, or by grafting on *C. vulgaris*, hawthorn, mountain ash or quince.

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A. Petals upright, small, usually pinkish; cymes usually few-fl'd. or nodding, if many-fl'd. (*Orthopetalum*.)

B. Fr. red.

C. Under side of lvs. glabrous or only pubescent.

D. Habit prostrate.

1. *adpressa*, Bois (*C. horizontalis* var. *adpressa*, Schneid.). Prostrate shrub, with creeping and often rooting sts. irregularly branched: lvs. oval, acutish, wavy at the margin, nearly glabrous,  $\frac{1}{8}$ – $\frac{1}{2}$  in. long: fls. 1–2, pinkish: fr. subglobose, usually with 2 stones. June: fr. Aug., Sept. W. China. V.F. 116.—Hardy at the Arnold Arboretum.

2. *horizontalis*, Decne. Fig. 1080. Low shrub: branches almost horizontal and densely distichously branched: lvs. round-oval, acute at both ends, glabrous above, sparingly setosely hairy beneath,  $\frac{1}{8}$ – $\frac{2}{3}$  in. long: fls. erect, 1–2, pink: fr. ovoid, bright red, usually with 3 stones, smaller than in the preceding species. June; fr. Sept., Oct. China. R.H. 1885, p. 136; 1889:348, fig. 1. G.C. III. 32:91. Gn. 66, p. 407. Var. *perpusilla*, Schneid. Lvs. less than  $\frac{1}{2}$  in. long: fr.  $\frac{1}{4}$  in. across.—Like the preceding species, one of the most effective fruiting shrubs for rockeries.

DD. Habit upright.

E. Lvs. small, not exceeding 1 in., nearly glabrous beneath.

3. *Simonsii*, Baker (*C. acuminata* var. *Simonsii*, Decne.). Shrub, with spreading branches, to 4 ft. lvs. roundish oval, acute, glabrous above,  $\frac{1}{2}$ –1 in. long, semi-persistent: cymes 2–5-fl'd.; fls. white, slightly pinkish; calyx appressed-pubescent: fr. bright red, usually with 3–4 stones. June, July. Himalayas. Refug. Bot. 1:55. B.M. 8010 (excl. fls.; as *C. rotundifolia*). One of the best red-fruited species, often under the name *C. Simonsii* or *C. Symonsi*.

4. *divaricata*, Rehd. & Wilson. Upright shrub, to 6 ft.: lvs. deciduous, oval or broadly oval, acute or obtusish, broadly cuneate at the base, lustrous above,  $\frac{1}{8}$ – $\frac{3}{4}$  in. long: fls. usually 3, pink; calyx appressed-pubescent: fr. ovoid, nearly sessile, bright red,  $\frac{1}{2}$  in. long, usually with 2 stones. June; fr. Sept. Cent. and W. China.—Very handsome when studded with its bright red frs.; hardy at the Arnold Arboretum.

EE. Lvs. larger,  $1\frac{1}{2}$ –3 in. long, deciduous.

5. *acuminata*, Lindl. Erect shrub, to 6 ft.: lvs. oblong to ovate-oblong, acute or acuminate, appressed-hairy on both sides, dull above to light green beneath: cymes 2–5-fl'd., nodding; fls. white or slightly pinkish; calyx pubescent: fr. deep scarlet, turbinate, with 2–3 stones. June; fr. Sept., Oct. Himalayas. L.B.C. 10:919 (as *Mespilus*). R.H. 1889:348, fig. 5 (as *C. nepalensis*).

6. *bullata*, Bois. Spreading shrub, to 6 ft.: lvs. ovate, acuminate, rounded or broadly cuneate at the base, rugose and finally nearly glabrous above, reticulate, pale grayish green and pubescent beneath: fls. pinkish, few; calyx glabrous: fr. red, subglobose, with 4–5

stones. May, June; fr. Sept., Oct. W. China. V.F. 119. Var. *floribunda*, Rehd. & Wilson (*C. moupinensis floribunda*, Stapf). Cymes many-fl.; calyx slightly pubescent. B.M. 8284. Var. *macrophylla*, Rehd. & Wilson. Lvs. elliptic to lanceolate-oblong, narrowed at the base, often nearly glabrous, 2-6 in. long; cymes many-fl.—The varieties are much handsomer than the type.

cc. Under side of lvs. whitish or grayish tomentose: young branchlets densely pubescent.

d. Lvs.  $\frac{3}{4}$ –2½ in. long, rounded at base.

7. *integerrima*, Medikus (*C. vulgaris*, Lindl.). Shrub, to 4 ft.: lvs. ovate or oval, acute or obtuse and mucronulate, glabrous and dark green above, whitish and at length greenish tomentose beneath,  $\frac{3}{4}$ –2 in. long; cymes nodding, 2-4-fl.; fls. pale pinkish; calyx glabrous outside: fr. globular, bright red. May, June; fr. Aug. Eu., W. Asia, Siberia. H.W. 3, p. 73, figs. a-i.

8. *tomentosa*, Lindl. Shrub, to 6 ft.: lvs. broadly oval, obtuse, dull green above and pubescent when young, whitish tomentose beneath, 1-2½ in. long; fls. 3-12, white, calyx tomentose outside: fr. bright brick-red. June; fr. Sept., Oct. Eu., W. Asia. H.W. 3, p. 73, figs. k-o. G.O.H. 105.—Sometimes cult. as *C. speciosa*, Hort.

DD. Lvs. about 1 in. or less long, slightly pubescent above.

E. Apex of lvs. mostly obtuse, base rounded.

9. *Zabelii*, Schneid. Shrub, to 6 ft. with slender spreading branches: lvs. oval to ovate, dull green and loosely pubescent above, grayish or yellowish tomentose below, on young plants sometimes more glabrescent and acutish,  $\frac{3}{4}$ –1¼ in. long; fls. 5-9 in loose corymbs, pinkish; calyx villous outside, with obtuse teeth: fr. ovoid, red, about ½ in. long, with 2 stones. May; fr. in Sept., Oct. Cent. China.

EE. Apex of lvs. mostly acute, base often cuneate.

10. *Dielsiana*, Pritz. (*C. applanata*, Duthie). Shrub, to 6 ft. with slender spreading and arching branches: lvs. deciduous, firm, ovate or elliptic, acutish, rounded or broadly cuneate at base, yellowish gray tomentose beneath, ½–1 in. long; fls. few, short-stalked; calyx pubescent: fr. 1-3, subglobose, ¼ in. across, red, with 3-4 stones. June; fr. Sept., Oct. Cent. China. Var. *major*, Rehd. & Wilson. Lvs. larger and broader: fr. larger. Var. *elegans*, Rehd. & Wilson. Lvs. smaller, sub-persistent, finally nearly glabrous and somewhat shining above: fr. pendulous, coral-red. W. China.

11. *Franchetii*, Bois. Upright densely branched shrub with spreading branches: lvs. thickish, elliptic or ovate, acute or acuminate, usually cuneate at base,

yellowish white tomentose beneath,  $\frac{3}{4}$ –1½ in. long; fls. 6-15, in short and dense corymbs, pinkish, small; calyx pubescent outside, with acute teeth: fr. orange-red, ovoid, over ½ in. long, with usually 3 stones. June; fr. Sept., Oct. W. China. R.H. 1902, p. 379; 1907:256. V.F. 118.

BB. Fr. black or nearly black.

c. Lvs. acute or acuminate, pubescent or nearly glabrous beneath.

d. Upper surface of lvs. glabrous and somewhat lustrous: calyx slightly pubescent or glabrous.

12. *lucida*, Schlecht. (*C. acutifolia*, Lindl. *C. sinensis*, Hort.). Upright, rather dense shrub, to 12 ft.: lvs. elliptic or elliptic-ovate, acute, usually cuneate at the base, slightly pubescent beneath, 1-1½ in. long; fls. 3-6, in nodding corymbs: fr. purplish black, subglobose, with 3-4 stones. May, June; fr. Sept. Altai Mts. G.W. 5, p. 247 (as *C. acutifolia*).—Foliage dark green, remaining green until very late in autumn.

DD. Upper surface of lvs. pubescent, at least when young, dull green: calyx pubescent.

13. *acutifolia*, Turcz. (*C. pekinensis*, Zabel. *C. acutifolia* var. *pekinensis*, Koehne). Shrub, to 12 ft., with spreading slender branches: lvs. elliptic-ovate to oblong-ovate, acute or acuminate, usually rounded at base, slightly appressed-pilose beneath, becoming nearly glabrous, 1½–2 in. long; fls. 2-5, nodding: fr. ovoid, black, to ½ in. long, with usually 2 stones. May, June; fr. Sept., Oct. N. China. Var. *villösula*, Rehd. & Wilson. Lvs. more densely villous beneath, somewhat larger: calyx densely villous: fr. thinly pubescent. Cent. and W. China.

14. *foveolata*, Rehd. & Wilson. Shrub, to 10 ft. with spreading branches: lvs. elliptic to elliptic-ovate, rarely ovate-oblong, acute or acuminate, soon glabrous above, pubescent beneath, chiefly on the veins, finally nearly glabrous, 2-3 in. long; fls. 3-6, pinkish; calyx pubescent: fr. black, subglobose, ½ in. across, with 3-4 stones. June; fr. Sept. Cent. China.—The foliage turns bright scarlet and orange in autumn.

cc. Lvs. obtuse or acutish, tomentose beneath.

15. *melanocarpa*, Lodd. (*C. nigra*, Wahlb.). Shrub with spreading branches, to 6 ft.: lvs. oval or ovate, usually rounded at base, dark green and sparingly pubescent above, grayish white tomentose beneath, 1-3 in. long; fls. 3-8; calyx glabrous: fr. black, globose, with 2-3 stones. May, June; fr. Aug. N. and E. Eu. to Siberia. L.B.C. 16:1531. Var. *laxiflora*, Koehne (*C. laxiflora*, Jacq.). Corymbs 12- to many-fl., elongated, pendulous. B.R. 14:1305. Var. *commixta*, Schneid. (*C. laxiflora*, Hook.). Lvs. acutish, 2 in. long; corymbs 8-15-fl. B.M. 3519.

AA. Petals spreading, white, roundish: fr. red. (*Chaenopetalum*.)

B. Fls. in many-fl. corymbs: upright shrubs.

c. Lvs. broadly ovate or oval, obtuse or acute, ½–1½ in. long, deciduous.

d. The lvs. glabrous beneath at maturity.

16. *multiflora*, Bunge (*C. reflexa*, Carr.). Shrub, to 6 ft., with usually slender, arching branches: lvs. broad-ovate, usually acute, slightly tomentose at first beneath, soon becoming glabrous: cymes very numerous, 6-20-fl.; calyx and peduncles glabrous: fr. red, ½ in. across. May. Spain, W. Asia to Himalayas



1081. *Cotoneaster hupehensis*. (× ½)



and China. R.H. 1892, p. 327; 1893, p. 29. G.W. 6, p. 62. M.D.G. 1914: 7.—Very decorative in bloom, and hardy, but less free fruiting. Var. *calocarpa*, Rehd. & Wilson. Lvs. larger and narrower, slightly hairy below; fr. larger, nearly  $\frac{1}{2}$  in. across, freely produced. W. China.

DD. *The lvs. tomentose beneath.*

17. *hupehensis*, Rehd. & Wilson. Fig. 1081. Shrub, to 5 ft., with slender spreading branches, villous while young; lvs. ovate to elliptic, obtuse or acutish; mucronulate, rarely emarginate, above finally glabrous, thinly grayish tomentose beneath,  $\frac{1}{2}$ –1 in. long; corymbs very numerous, with 6–12 or more white fls.; peduncle and calyx villous; anthers yellow; fr. red, subglobose, about  $\frac{1}{2}$  in. across, with 2 stones. May. Cent. and W. China. M.D.G. 1914: 6 (as *C. acutifolia* var.).—One of the handsomest species in bloom; hardy as far north as Mass.

18. *racemiflora*, Koch (*C. nummularia*, Fisch. & Mey. *C. Fontanèsii*, Spach). Shrub, to 4 ft., with erect or spreading branches, rarely prostrate; lvs. roundish or broad-ovate, obtuse or acute, whitish or grayish tomentose beneath, glabrous above; cymes very short-peduncled, 3–12-fl.; peduncle and calyx tomentose; fr. red. May, June. From N. Afr. and W. Asia to Himalayas and Turkestan. R.H. 1867: 31.—Very decorative and hardy. Var. *soongarica*, Schneid. Lvs. oval, usually obtusish, less pubescent. Var. *microcarpa*, Rehd. & Wilson. Similar to the preceding, but fr. ovoid, smaller. Var. *orbicularis*, Wenz. (*C. Wheeleri*, Hort.). Low and divaricate; lvs. roundish or obovate,  $\frac{1}{2}$ – $\frac{3}{4}$  in. long; cymes 3–6-flid.

CC. *Lvs. elliptic to oblong, acute at both ends, subcoriaceous.*

D. *Length of lvs.  $\frac{1}{2}$ –1½ in.: corymbs 1 in. across or less.*

19. *pannosa*, Franch. Half-evergreen shrub, to 6 ft.: lvs. elliptic to ovate-oblong, mucronate at the apex, glabrous above, densely grayish white-tomentose beneath; calyx tomentose; fr. red, globose-ovoid,  $\frac{1}{2}$  in. long with 2 stones. S. W. China. R.H. 1907: 256. G. 25: 408. Gn. 67, p. 118. J. 12: 120.—Very handsome, but tender.

DD. *Length of lvs. 1½–4 in.: corymbs 1–2 in. across.*

20. *salicifolia*, Franch. Half-evergreen shrub, to 15 ft.: young branchlets floccose-tomentose; lvs. elliptic-oblong to ovate-lanceolate, acute or acuminate, rugose and glabrous above, floccose-tomentose beneath, 1½–3 in. long; fls. white in dense corymbs 1–2 in. across; fr. subglobose, bright red,  $\frac{1}{2}$  in. across, with 2–3 stones. June; fr. Oct., Nov. W. China. Var. *rugosa*, Rehd. & Wilson (*C. rugosa*, Pritz.). Lvs. broader and shorter, elliptic-oblong, dull green above, more woolly-tomentose beneath; fr. larger, usually with 2 stones. Cent. China. Var. *floccosa*, Rehd. & Wilson. Lvs. oblong to oblong-lanceolate, floccose-tomentose beneath while young, later becoming partly glabrous and glaucous, bright green and lustrous above; fr. larger, usually with 3 stones. W. China.—This species is very handsome, particularly in autumn when studded with its clusters of bright red berries. The var. *floccosa* which has been advertised as var. *glaciola* (misspelled for *floccosa*) seems to be the hardiest and most desirable.

21. *frigida*, Wall. Large half-evergreen shrub, to 20 ft.: lvs. oblong, acute at both ends, glabrous above, tomentose beneath when young, 2–4 in. long; cymes long-peduncled, very many-flid., pubescent; fr. scarlet. April, May. Himalayas. B.R. 15: 1229. L.B.C. 16: 1512.—One of the most beautiful in fl. and fr., but not hardy N.

BB. *Fls. 1–3: low prostrate or trailing shrubs: lvs. persistent.*

C. *Lvs. green beneath.*

22. *Dammeri*, Schneid. (*C. humifusa*, Duthie). Prostrate shrub with trailing often rooting branches; lvs. elliptic, usually cuneate at the base, obtusish and

usually mucronulate, glabrous or nearly so, about 1 in. long; fls. usually solitary; calyx sparingly pubescent or nearly glabrous; fr. bright red. May, June; fr. Oct., Nov. Cent. China. Var. *radicans*, Schneid. Lvs. often obovate, slender-petioled; fls. 1–2, on peduncles about  $\frac{1}{2}$  in. long.

CC. *Lvs. glaucous or whitish tomentose beneath.*

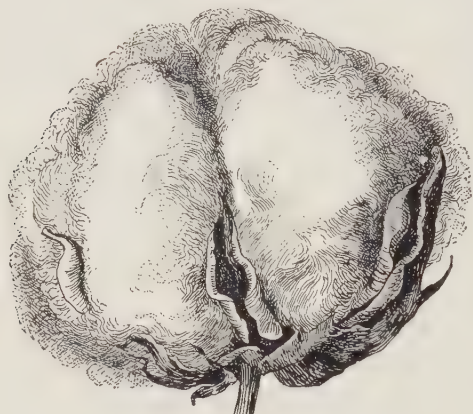
23. *rotundifolia*, Wall. (*C. microphylla* *Üva-ürsi*, Lindl. *C. prostrata*, Baker). Low or prostrate shrub; lvs. nearly orbicular or broadly oval, dark green above and somewhat pubescent, loosely pubescent beneath or glabrescent and glaucous,  $\frac{1}{3}$ – $\frac{1}{2}$  in. long; fls. 1–3, about  $\frac{1}{2}$  in. across; fr. bright red, subglobose, more than  $\frac{1}{2}$  in. across. Himalayas. May, June; fr. Sept. B.R. 14: 1187. Var. *lanata*, Schneid. (*C. buxifolia*, Baker, not Wall. *C. Wheeleri*, Hort.). Lvs. elliptic to elliptic-oblong, tomentose beneath; fr.  $\frac{1}{2}$  in. across. Refug. Bot. 1: 52 (fls. in bud). Gn. 55: 186. R.H. 1889, 348, fig. 4.

24. *microphylla*, Wall. Low, prostrate shrub, densely branched; lvs. cuneate-oblong or obovate, acute, shining above, densely pubescent beneath,  $\frac{1}{4}$  in. long; fls. usually solitary; calyx pubescent; fr. bright red. May, June. Himalayas. B.R. 13: 1114. L.B.C. 14: 1374. R.H. 1889: 348, fig. 3. G.C. II. 12: 333; 18: 681. Gn. 4, p. 165. Var. *thymifolia*, Koehne (*C. thymifolia*, Baker). Very dwarf; lvs. linear-oblong, smaller; fls. and fr. smaller. R.H. 1889: 348, fig. 2. G.C. II. 12: 333; 18: 681. Refug. Bot. 1: 50. Var. *glacialis*, Hook. (*C. congesta*, Baker). Lvs. glabrous beneath, oval; fls. smaller, often pinkish. Refug. Bot. 1: 51.

*C. affinis*, Lindl. Allied to *C. frigida*. Lvs. broad-elliptic; fr. dark brown, globose. Himalayas. L.B.C. 16: 1522.—*C. ambigua*, Rehd. & Wilson. Related to *C. acutifolia*. Shrub, to 6 ft.: lvs. elliptic-ovate to rhombic-ovate, villous beneath; fls. 5–10; calyx slightly pubescent or nearly glabrous; fr. ovoid, black. W. China.—*C. amana*, Wilson. Related to *C. Franchetii*. Dense shrub, to 5 ft.: lvs. ovate or elliptic, usually  $\frac{1}{2}$  in. long; corymbs 6–10-flid.; sepals acuminate; fr. globose, orange-red. Yunnan. G.C. III. 51: 2.—*C. angustifolia*, Franch.—*Pyracantha angustifolia*.—*C. apiculata*, Rehd. & Wilson. Related to *C. Simonsii*. Shrub, to 6 ft.: lvs. orbicular to roundish ovate, apiculate, bright green and lustrous, nearly glabrous,  $\frac{1}{4}$ – $\frac{1}{2}$  in. long; fr. nearly sessile, globose, bright red. W. China.—*C. arborescens*, Zabel=*C. Lindleyi*.—*C. bacillaris*, Wall. Related to *C. frigida*. Lvs. smaller, usually glabrous beneath at length; fr. dark brown. Himalayas.—*C. buxifolia*, Wall. Related to *C. rotundifolia*. Lvs. elliptic, slightly pubescent above at first, grayish tomentose beneath; fls. 2–4,  $\frac{1}{2}$  in. across; fr. red. India. Wight, Icon. 3: 992. Tender.—*C. disticha*, Lange. Related to *C. Simonsii*. Half-evergreen, upright shrub, to 4 ft.: lvs. suborbicular to broadly obovate, apiculate, sparingly pubescent above, nearly glabrous beneath,  $\frac{1}{2}$  in. or less long; fls. 1–2; calyx glabrous or nearly so; fr. scarlet. Himalayas.—*C. Harrisoniana*, Wilson. Related to *C. salicifolia*. Shrub, to 6 ft.: lvs. elliptic-oblong, sometimes oval, 1–2 in. long, densely villous beneath; corymbs  $\frac{1}{2}$  in. across. S. W. China.—*C. Henryana*, Rehd. & Wilson (*C. rugosa* var. *Henryana*, Schneid.). Related to *C. salicifolia*. Shrub, to 12 ft.: lvs. thinner, elliptic-oblong to oblong-lanceolate, 2–3½ in. long, and about 1 in. broad, pubescent and only slightly pubescent above, densely grayish pubescent beneath; corymbs many-flid., about 2 in. across; calyx pubescent; fr. red, ovoid,  $\frac{1}{4}$  in. across, with 2–3 stones. Cent. China. G. C. III. 46: 339 (not good). M.D.G. 1914: 15.—*C. ignava*, Wolf. Related to *C. melanocarpa*. Shrub, to 5 ft.: lvs. ovate or oval, greenish white beneath, pubescent, 1–2 in. long; fls. 8–13, pinkish; calyx pubescent at the base; fr. dark reddish brown, nearly black. E. Turkestan. Yearb. For. Inst., Petersburg, 15: 240.—*C. Lindleyi*, Steud. (*C. arborescens*, Zabel). Similar to *C. racemiflora* but fr. black. Himalayas.—*C. mowpinensis*, Franch. Related to *C. foveolata*. Shrub, to 15 ft.: lvs. elliptic to ovate-oblong, thicker, rugose above, pubescent beneath, at least on the veins, 2–5 in. long; corymbs many-flid.; fls. white or pinkish; calyx sparingly pubescent; fr. black, with 4–5 stones. W. China.—*C. nitens*, Rehd. & Wilson. Related to *C. divaricata*. Lvs. broadly oval or roundish ovate, glabrous and lustrous above,  $\frac{1}{2}$ – $\frac{1}{2}$  in. long; fr. ovoid, purplish black, stalked, pendulous. W. China.—*C. obscura*, Rehd. & Wilson. Related to *C. acuminata*. Shrub, to 10 ft.: lvs. elliptic-ovate, finally glabrous above, yellowish gray-tomentose beneath, 1–2 in. long; fr. dull brownish red, ovoid,  $\frac{1}{2}$  in. long, usually with 3 stones. W. China.—*C. Pyracantha*, Spach=*Pyracantha coccinea*.—*C. rosea*, Edgew. Related to *C. integririma*. Shrub, with slender upright branches; lvs. elliptic to ovate-oblong, nearly glabrous, grayish green beneath, 1–1½ in. long; fls. 4–9, pinkish with slightly spreading petals; fr. subglobose, dull red. Himalayas.—*C. Silvestrii*, Pampanini. Allied to *C. integririma*. Lvs. elliptic-ovate, densely hairy and cream-colored beneath, 1–2 in. long; calyx pubescent outside; fr. orange-colored. Cent. China.—*C. uniflora*, Bunge. Allied to *P. vulgaris*. Lvs. oval to oval-oblong, glabrous when older; fls. solitary; fr. red. Altai Mts.

ALFRED REHDER.

**COTTON** belongs to the genus *Gossypium* (name used by Pliny), of the *Malvaceæ*. The species are now much confused, but it is generally agreed that the sea island cotton is of the species *G. barbadense*, Linn. The upland cotton is probably derived chiefly or wholly from *G. hirsutum*, Linn. The former is native in the West Indies. The nativity of the latter is in dispute, but it is probably Asian. The cotton flower is mallow-like, with a subtending involucre of three large heart-shaped bracts. The carpels or cells of the pod are three to five. These carpels break open, and the cotton covering of the seeds makes a globular mass,—the cotton boll (Fig. 1082). Cotton is not a horticultural



1082. A cotton boll.

crop, and is therefore not considered in this work. The reader will find "The Cotton Plant" (published by the Dept. of Agric., Bull. 33), a useful monograph. Consult Cyclo. Amer. Agric., Vol. II, p. 247.

**COTTONWOOD:** species of *Populus*.

**CÓTULA** (Greek, *small cup*, the bases of the clasping leaves forming a hollow or basin). *Compósitæ*. Small diffuse or much-branched strong-smelling annual or perennial yellow-flowered herbs, a few of the perennials sometimes used as carpeters in rock-gardens.

Leaves alternate, toothed, lobed or pinnatisect: heads pedunculate, hemispherical or bell-shaped, many-fl. and discoid; outer or marginal florets nearly or quite apetalous, usually pistillate and fertile; disk-florets 4-toothed, fertile or male; torus naked; pappus not evident; achene glabrous, compressed.—About 50 or 60 species, largely in the southern hemisphere.

**dioica**, Hook. f. (*Leptinella dioica*, Hook. f.). Sts. glabrous or slightly hairy, 1 ft. or less long, creeping: lvs. solitary or tufted, not thick or stiff, stalked, 2 in. or less long, linear-obovate to spatulate, obtuse, serrate to pinnatifid or even pinnate: heads on axillary naked peduncles that are longer or shorter than the lvs., unisexual, the males  $\frac{1}{2}$  in. or less diam., and the females a little larger: achene obovoid, curved. New Zeal.—Very variable. A compact dwarf carpeter.

**Muëlleri**, Kirk. (*C. potentilliana*, Hort.? *Leptinella potentillina*, Muell.). Sts. long and rather stout, creeping and rooting, the branches ascending and somewhat villous towards the tips: lvs. 2–5 in. long, stalk and all, linear-obovate, deeply pinnatifid, glandular-dotted: heads on peduncles that usually are shorter than the lvs., bisexual, about  $\frac{1}{2}$  in. diam.: achene club-shaped and 4-angled. New Zeal.

**C. lanata**, Hook. f. (*Leptinella lanata*, Hook. f.). Stout and woolly: lvs. rather fleshy, pinnate or pinnatifid: florets glandular. New Zeal.—**C. lobata**, Linn.—*Lidbeckia*.—**C. plumosa**, Hook. f. (*Leptinella plumosa*, Hook. f.). Stout, soft-woolly: lvs. 3–4 times pinnatisect: florets not glandular. New Zeal.—**C. squalida**, Hook. f. (*Leptinella squalida*, Hook. f.). Allied to *C. dioica*, with lvs. deeply pinnatifid and segms. incised. New Zeal.

L. H. B.

**COTYLÉDON** (a name used by Pliny, meaning a cavity, having reference to the concaved or cup-like leaves of some kinds). *Crassulaceæ*. Succulent herbs or shrubs, rarely annual, grown mostly for their oddity, but some of them making good winter bloomers in pots and some used for summer bedding because of the stiff thick foliage; some are half-hardy North.

Habit very various, rosulate or erect, sometimes of a scandent tendency: branches and lvs. thick and fleshy: lvs. opposite or alternate, petiolate or sessile: calyx 5-parted, as long as or shorter than the corolla-tube; corolla tubular, cylindrical or urn-shaped, sometimes 5-angled, the parts or petals 5, erect or spreading, connate to the middle, longer than the usually 10 stamens; ovary of 5 free carpels, each with a narrow scale at base; fls. erect or pendent, sometimes showy, in terminal racemes or cymes. Differs from *Sedum* in the connate petals.—Species about 100, in Calif. to Texas, and Mex., Afr., Asia and Eu. See I.H. 10:76 for an account of many of the species. Some of the species make dense rosettes of stiff lvs. on the ground and send up a small bracted scape; they remind one of the house-leek (*Sempervivum tectorum* and related species).

As above defined, Cotyledon comprises the broad group habitually known under that name. Recently, however, Britton and Rose have revised the group, excluding Cotyledon from America, reinstating *Echeveria* and *Pachyphytum* for some of the American species and making new genera for others, as *Dudleya*, *Oliveranthus*, *Urbinia*, *Stylophyllum*. For the convenience of the gardener, the cult. species are here brought together under Cotyledon, and they are also listed at other places under their new generic names.

Cotyledons are little known in this country except among fanciers and for carpet-bedding. Culturally, there are two groups,—the greenhouse kinds and the bedding kinds. The greenhouse kinds are well represented by *C. gibbiflora*. It is attractive both in foliage and flower. It may be expected to begin bloom in January or February. Its period of bloom is short, after which it may be propagated. The top of the main shoot (or of strong side shoots) may be cut off with 2 or 3 inches of stem, and stood in pots so that the cut end will rest on moss in the bottom and the leaves on the rim of the pot, using no earth; fine roots will soon form and the young plant may then be repotted into dryish soil. The old stems of this and similar tall kinds may be placed rather close together in shallow boxes, when it is desired to propagate them, and kept in a warm dry place, where they will form small growths along the stems; these, when large enough, may be put into boxes of dry sand, and potted in thumb- or 3-inch pots when they have made a sufficient quantity of roots. This species should be kept in a warmhouse in winter, where it is rather dry and not exposed to drip. *C. fulgens* is a good greenhouse species, producing showy waxy red flowers in winter; also *C. coccinea*. For this purpose the large plants should be lifted from the beds and carefully potted, as they make a much finer growth in the open ground than when grown in pots.—When it is desired to increase the low-growing carpet-bedding kinds on a larger scale, the plants should be lifted before the ground gets too wet and cold. They may either be boxed in dry soil and kept in a cool dry house, or placed thickly together in a frame, taking care that no drip is allowed on the plants, and giving no water. The most convenient time for propagation by leaves is during the months of November and December, when the fall work of rooting soft-wooded plants is over. Leaves rooted at this time will make plants large enough for planting out the following season. They will take from three to four weeks to root, according to the kind. The leaves must be taken from the plant as follows: Grasp each leaf between the thumb and forefinger, give a gentle twist first to one side then to the other until the leaf comes off, taking care that the dormant bud in the



axil of the leaf accompanies it, otherwise the leaf will root but a plant will not form from it. Make a depression about 2 inches deep in the center and 4 inches wide across the sand-bed, in this lay two rows of leaves with their bases touching each at the bottom of the depression; give no water until the small roots make their appearance, and only slightly afterwards. When the little plants are large enough they should be boxed, using sandy loam, and kept in a temperature of not less than 60° F. at night.—For summer bedding purposes the following have been employed very successfully, being lower growers: *C. atropurpurea*, *C. fulgens*, *C. coccinea*, *C. fascicularis*, *C. gibbiflora* var. *metallica*, *C. Pachyphytum*, *C. Peacockii*, *C. Purpusii*, *C. roseata*, *C. secunda*, *C. secunda* var. *glauca*, *C. mexicana*. (G. W. Oliver.)

Other species of *Cotyledon* occur in collections of succulent plants, but the following probably represent those of commerce in this country.

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A. *Plants of the Old World, of various habit: corolla-tube elongated, usually much longer than the calyx. (Cotyledon and Umbilicus.)*

B. *Lvs. crowded in a rosette (rosulate) at the base of the st.: plant low, more or less stemless; species of the houseleek or hen-and-chickens type, used in rock-gardens and for carpet-bedding.*

c. *Fls. yellow or milk-white.*

1. *Aizoon*, Schoenl. (*Umbilicus Aizoon*, Fenzl). Plant small, minutely pubescent, the st. very short: lvs. densely rosulate, lingulate, obtuse, ciliate, those on the st. oblong-obtuse: fls. golden yellow, on very short pedicels; calyx spreading; corolla-parts lanceolate-acuminate and keeled. Asia Minor.

cc. *Fls. red or greenish.*

2. *Bárbeyi*, Schweinf. Whole plant hoary-white, tall and branching: lvs. thick, fleshy, shovel-shaped: fls. olive-green and red, 1 in. long, in a close panicle. Blooms freely in spring and summer. Abyssinia. Gt. 45, p. 465.—An exquisite plant for carpet-bedding.

BB. *Lvs. variously scattered along the st., or sometimes in rosettes or clusters at the ends of the branches: mostly branching plants, grown in greenhouses, window-gardens, and sometimes used in summer bedding-out but not in carpet-bedding designs.*

c. *Fls. white or ochroleucus.*

3. *reticulata*, Thunb. Sts. much branched, fleshy: lvs. few at the ends of the branches cylindrical, acute, erect, fleshy, soft, smooth,  $\frac{1}{2}$  in. or less long: fls.  $\frac{1}{2}$  in. or less long, whitish, in an erect, dichotomous panicle. Cape. G.C. III. 21:282.—The wiry fl.-stalks remain on the plant and give it the appearance of being inclosed in a network. Odd.

4. *chrysántha*, Hort. (*Umbilicus chrysanthus*, Boiss.). Plant pubescent, glandular above, the st. short: lvs. rosulate, short, oblong-spatulate, obtuse, those on the st. elliptic and somewhat acute: fls. large, ochroleucous (milk-white or yellow-

ish), red-striped on the back of the oblong-lanceolate keeled lobes or parts of the corolla. Perennial. Asia Minor.

cc. *Fls. yellow or greenish.*

5. *Umbilicus*, Linn. (*Umbilicus pendulinus*, DC.). PENNYWORT. NAVELWORT. Perennial, 6–12 in. high in flower, simple or slightly branched, leafy at base: radical and lower lvs. fleshy, orbicular, crenate, more or less peltate: fls. yellowish green, pendulous, in a raceme; calyx very small; corolla cylindrical,  $\frac{1}{4}$  in. long but somewhat enlarging, with 5 short teeth.—On rocks and walls, W. Eu. Adaptable in rock-gardens.

ccc. *Fls. red or purple.*

6. *fasciculâris*, Soland. Smooth, 1–2 ft. high, thick-stemmed, branched: lvs. pale greenish white with a yellowish margin, glaucous, few, sessile, cuneate-obovate, thick, flattened, slightly concave, cuspidate: panicle branches long, scorpioid; fls. large, 1 in. long, pendent; calyx-lobes short, broadly ovate-acute; corolla-tube much longer than the calyx, with a greenish tube and reddish revolute limb. S. Afr. B.M. 5602. J.H. III. 29:443.

7. *Sempervivum*, Bieb. (*Umbilicus Sempervivum*, DC.). HOUSELEEK COTYLEDON. Plant green, glandular: radical lvs. spatulate, obtuse, attenuate-cuneate at base, the margin denticulate; st.-lvs. oblong: fls. purplish and papillose on the outside, on second branches in a corymbose panicle; corolla thrice longer than calyx, parted to the middle, the parts lanceolate-acuminate and somewhat recurved. Perennial.—Not to be confounded with *Sempervivum tectorum*.

8. *orbiculâta*, Linn. Erect, 2–4 ft. high: lvs. opposite, flat, obovate-spatulate, obtuse, mucronate, glaucous and mealy, with red margins: fls. large, reddish, panicked. Fls. June–Sept. S. Afr. B.M. 321. R.H. 1857, p. 347.—Grows well from cuttings. Variable, and has several named forms as var. *elata*, *oblonga*, *ramosa*, *rotundifolia*.

9. *hispánica*, Linn. (*Pistortinia hispánica*, DC.). Annual or biennial, branched, 6 in. high, erect: lvs. small, nearly cylindrical, oblong, few, sessile: fls. erect, in cymes, reddish; corolla trumpet-shaped, lobes spreading. Spain, Morocco. R.H. 1895, p. 472.

AA. *Plants of the New World: corolla-tube usually short, perhaps always shorter than the calyx.*

B. *Lvs. terete. (Stylophyllum.)*

10. *edulis*, Brewer (*Sedum edule*, Nutt. *Stylophyllum edule*, Brit. & Rose). Sts. cespitose, very short and thick: lvs. cylindrical, 3–4 in. long, erect, whitish or glaucous green, not mealy: fls. white, tinged with green, resembling those of *Sedum*,  $\frac{1}{2}$  in. diam., short-pedicelled, along the upper sides of the flexuous branches of the cymose panicle; scape 1 ft. high. San Diego, Calif.—Young lvs. eaten by Indians.

BB. *Lvs. linear or nearly so.*

11. *mexicana*, Hemsl. Plant glabrous, 3–4 in. high, erect, the branches woody: lvs. few, alternate,



1083. *Cotyledon secunda*. (Detail  $\times \frac{1}{2}$ )

crowded or sterile shoots, somewhat fleshy, linear or linear-spatulate, obtuse,  $\frac{1}{4}$ – $\frac{1}{2}$  in. long: fls. few short-pedicelled, cymose; sepals free, linear, obtuse; petals plane and strongly coherent, forming a tube,  $\frac{1}{2}$  in.; or less long, the lobes ovate, acute, erect. S. Mex.—One of the dozen known species of *Altamiranoa* (see p. 267, Vol. I), in that genus becoming *A. mexicana*, Rose.

BBB. Lvs. broader, flat, often very fleshy.

c. Calyx minute. (*Urbinia*.)

12. *agavoides*, Baker (*Echeveria agavoides*, Lem. *Urbinia agavoides*, Brit. & Rose). Small and compact: lvs. densely rosulate, stiff, acuminate and very sharp-pointed, pale gray-green on both sides, papillose: fls. 4–6, orange, on long pedicels; sepals several times shorter than the corolla. Mex.—Useful for carpet-beddings.

cc. Calyx evident or prominent.

d. Petals always appendaged at insertion of stamens. (*Pachyphytum*.)

13. *Pachyphytum*, Baker (*Pachyphytum bracteolum*, Klotzsch). SILVER-BRACT. Somewhat shrubby, very succulent, pale glaucous blue throughout: lvs. clothing upper part of st., more or less rosulate, large and thick, spreading, obovate, obtuse or obtuse-pointed, the scars from the fallen lvs. orbicular: fls. in spikes 4–6 in. long on lateral peduncles; corolla red, immersed in the large calyx which is about 1 in. long; stamens 5 large and 5 small. Mex. B.M. 4951.—A singular plant, blooming in summer. 1 ft.

DD. Petals not appendaged.

E. Corolla strongly 5-angled. (*Echeveria*.)

F. Color of plant (or of lvs.) dark purple.

14. *atropurpurea*, Baker (*Echeveria sanguinea*, Morr.). St. short and stout: lvs. in rosette at top of st., dark purple and glaucous, obovate-spatulate: fls. bright red, in a long raceme terminating the erect st.; corolla 5-angled, white toward base. Mex. See p. 1086.

FF. Color green, or ordinarily glaucous (except var. of No. 19).

G. St. wanting or nearly so (acaulescent species).

15. *Peacockii*, Baker (*Echeveria Peacockii*, Crouch.). Acaulescent: lvs. about 50 in a dense rosette 6 in. across and standing 4 in. high, obovate-spatulate, mucronate, reddish toward tip, glaucous: st. 12–24 in., with small lf.-like bracts: fls. bright red, in a scirpioid spike; calyx-lobes linear, unequal; corolla about  $\frac{1}{2}$  in. long, the parts lanceolate-acute. Mex.(?)—Interesting for its glaucous coloring and waxy coating of the lvs. Named for Mr. Peacock, of Hammersmith, England, in whose collection it flowered. See p. 1086.

16. *secunda*, Baker (*Echeveria secunda*, Booth). Fig. 1083. Stemless: lvs. in a rosette, crowded, cuneiform, mucronate, glaucous, curving upward: fls. in a 1-sided, recurved spike, reddish yellow; peduncle long, 6–12 in. high. June–Aug. Mex. B.R. 26:57.—Probably the most common species in gardens. Distinguished by its pale green red-tipped rosettes; several forms. Half-hardy. E. *glauca*, Baker (*E. secunda* var. *glauca*, Otto), has glaucous-green foliage. See pp. 1086–7.

GG. St. evident, often tall (caulescent species).

17. *Scheerii*, Baker (*Echeveria Scheerii*, Lindl.). Caulescent, branching: lvs. large, glaucous, oval, acute, narrowed into a long plane petiole-like part: fls. dingy red with yellow tips, broadest at base, in drooping racemes; sepals linear, acute, green, spreading, shorter than the corolla. Mex. B.R. 31:27. P. 1087.

18. *fulgens*, Baker (*Echeveria fulgens*, Lem.). St. 4–8 in. tall, but bearing long leafy fl.-branches: lvs. obovate-spatulate, pale glaucous green, clustered: fls. bright red with yellow base, in nodding racemes. Mex.

19. *gibbiflora*, Moc. & Sessé (*Echeveria gibbiflora*, DC.). Sts. 1–2 ft. high: lvs. flat, wedge-shaped, acutely mucronate, crowded at the ends of the branches: fls. short-petioled; panicle branches 1-sided, spreading; corolla gibbous at the base between the calyx-lobes, the tube white, the tips touched with crimson. Mex. B.R. 1247. Var. *metallica*, Baker (*Echeveria metallica*, Hort.). Lvs. large, obovate-spatulate, 6 in. wide by 7 in. long, a beautiful glaucous purple with metallic reflections: fls. yellowish with red tips. Mex.—An excellent plant for summer bedding. P. 1087.

20. *coccinea*, Cav. (*Echeveria coccinea*, DC.). Plant soft-pubescent, 1–2 ft.: lvs. lance-spatulate: fls. scarlet and yellow or paler within, in axillary long leafy, 15–25-fld., loose spikes. Mex. B.M. 2572. P. 1086.

EE. Corolla not strongly angled.

F. Fls. in a dense spike. (*Courantia*.)

21. *roseata*, Baker (*Echeveria rosea*, Lindl. *Courantia rosea*, Lem.). Sts. branching, 1 ft.: lvs. oval, erect, acute, mostly in terminal rosettes on the sterile shoots: fls. yellow, in dense rose-bracted spikes; sepals linear-acute, rose-colored; corolla bell-shaped, 5-parted. Mex. B.R. 28:22.

FF. Fls. in cymes or panicles. (*Dudleya*.)

22. *pulverulenta*, Baker (*Echeveria pulverulenta*, Nutt. *E. farinosa*, Hort. *Dudleya pulverulenta*, Brit. & Rose). Lvs. in a rosette, silvery green, very mealy, spatulate, acute, the tips reflexed, the cauline lvs. gradually diminishing into broadly cordate, clasping bracts: panicles dichotomously branched; pedicels slightly longer than the pale scarlet or coral fls. Plants 1 ft. diam. S. Calif. F.S. 19:1927–8.—A fine plant for carpet-bedding.

23. *Purpusii*, Nichols. (*Echeveria Purpusii*, Schum., not Brit. *Dudleya Purpusii*, Brit. & Rose). Cespitose, with powdered snow-white foliage: lvs. densely rosulate, broadly spatulate, acuminate: fls. in a branching upright cluster; corolla conico-tubular, much exceeding calyx; segms. scarlet with golden yellow tips. S. Calif. B.M. 7713. G.C. III. 20:698. Gt. 45, p. 609.



1084. *Couroupita guianensis*, the cannon-ball tree, showing the trunk and the hanging flowers and fruits.



24. *lanceolata*, Benth. & Hook. (*Echeveria lanceolata*, Nutt. *Dudleya lanceolata*, Brit. & Rose). Green or slightly glaucous, acaulescent: lvs. in a rosette, lanceolate, acuminate, slightly mealy; st.-lvs. or bracts small, cordate, clasping, distant: panicle narrow, dichotomous: fls. red and yellow; calyx-lobes broad-ovate,  $\frac{1}{2}$  in. long; corolla  $\frac{1}{2}$  in. or more long. S. Calif.

25. *californica*, Baker (D. *Cotyledon*, Brit. & Rose. *Sedum Cotyledon*, Jacq. *Echeveria californica*, Baker). Plant acaulescent, tinged red: lvs. in a rosette, concave, ligulate, lanceolate, acute, glaucous, mealy, slightly yellowish, 8 in. long: fls. pale yellow, on weak lateral flowering sts. 1-2 ft. long, with short, ovate, clasping lvs. or bracts and bi- or trifid racemes. Calif.

Many garden names occur in *Cotyledon*, some of which are unidentifiable and some of which probably represent hybrids. *C. devensis*, Hort. Hybrid between probably *C. glauca* and *C. gibbiflora*: fl.-sts. 5-7 ft. long. B.M. 8104. — *C. elegans*, N. E. Br. = *Oliverianthus*. — *C. eximia*, Hort. = (?). — *C. globosa*, Hort., see page 1087. — *C. globularifolia*, Baker. Rosulate, 8 in.: lvs. 30-40, obovate-spatulate,  $2\frac{1}{2}$  in. or less long: fls. white tinged red, 20-40 in a dense thyrselike cluster. Syria. — *C. imbricata*, Hort., described on p. 1087. — *C. insignis*, N. E. Br. About 2 ft., wholly glabrous, erect, light green: lvs. opposite, broad, to 5 in. long: fls. light red with lobes greenish yellow inside,  $1\frac{1}{2}$  in. long, in terminal and axillary cymes. Cent. Afr. B.M. 8036. — *C. mirabilis*, Hort., hybrid. — *C. mucronata*, Baker. = *Echeveria*, p. 1086. — *C. nana*, Marl. Very dwarf,  $1\frac{1}{2}$  in. or less high, densely branched and forming a tuft: lvs. yellowish green, not apiculate. S. Afr. — *C. Pestalozzei*, Mast. Lvs. distributed, the radical ones spatulate-obtuse and margins slightly denticulate, the cauline obovate-oblong: fls. pale rose, somewhat secund in a glandular-hairy panicle. Cilicia. — *C. pulvinata*, Hook. f. = *Echeveria*, p. 1086. — *C. sedoides*, DC. Annual, creeping, smooth: lvs. sedum-like, oblong and obtuse, convex: fls. few, pink, in summer. Pyrenees. Distinguished from *Sedum* by the gamopetalous corolla. — *C. spinosus*, Linn. Small and quaint, Apicra-like, with a rosette of flat spoon-shaped spine-tipped lvs., 12 in. or more tall: fls. yellow, in early summer. Siberia to China and Japan, but not hardy. — *C. superba*, Hort., is an annual with yellow fls. — *C. teretifolia*, Thunb. St. somewhat woody, 6-8 in. high, simple or branched: lvs. 4-5 in. long, opposite, nearly terete, acute or cuspidate, hirsute or subglabrous: fls. many, corymbed, the peduncle to 18 in., yellow; corolla-tube a little shorter than calyx. S. Afr.

L. H. B.†

COUCH GRASS: *Agropyron repens*.

COURÁNTIA (personal name). *Crassulaceæ*. Caulescent: lvs. alternate, closely set, broad: fls. in a dense bracteate spike; calyx-lobes nearly equal, linear, brightly colored; corolla not angled, yellow; stamens 10; filaments united into a tube for half their length. Only one species. First brought into cult. about 1842. For cult., see *Cotyledon*. *C. rosea*, Lem. (*Cotyledon roseata*, Baker). See No. 21, p. 870.

J. N. ROSE.

COUROUPÏTA (from a vernacular name in Guiana). *Lecythidaceæ*. Trees of Trop. Amer. (about 9 species) sometimes planted as oddities or for shade, particularly for the curiosity of the great ball-like frs. borne on the trunk. Lvs. alternate, oblong, reticulate, entire or crenate-serrate: fls. showy and odd, borne in racemes, often from the trunk and larger branches; calyx-tube top-shaped, the limb 6-lobed or -divided; petals 6, somewhat unequal, spreading and more or less incurved, borne on a disk; stamens many, in 2 sets,—one series forming a ring or cup in the center of the fl. and about the single 5-7-celled ovary, the other longer and rising from one side like a fringed palm or ladle over the pistil: fr. a large nearly or quite globular ball, coriaceous or woody, indehiscent, with many seeds imbedded in the pulp. *C. guianensis*, Aubl. CANNON-BALL TREE. Figs. 1034, 1085. Tall soft-wooded tree in Guiana, where it is native: lvs. oblong-obovate, elliptic or broad-lanceolate, acute, entire or very obscurely toothed: fls. with concave petals about 2 in. long, yellow- and red-tinged on the exterior and crimson-lilac within, very showy, in racemes 2-3 ft. long: fr. nearly or quite globular, 6-8 in. diam., reddish, hard on the exterior, pulpy inside, with very disagreeable odor when ripe. B.M. 3158-9.—Sometimes planted in the tropics, in botanic gardens and elsewhere. Shell of the fr. used for utensils, and the pulp said to be eaten by negroes and to be used for the making of beverages. L. H. B.

COUSSAPÔA (Caribbean name). *Moraceæ*. Fifteen to 20 milky-juiced trees or shrubs of Trop. S. Amer., 1 or 2 sometimes grown under glass, but apparently not in the American trade. They are sometimes scandent and epiphytic, like other *Ficus*-like things, sending down branches and completely enveloping the supporting tree and strangling it. Lvs. alternate, stalked, thick, penninerved or 3-nerved, entire: fls. dioecious, in globose heads, the peduncles solitary or in pairs and axillary, the male clusters few-fl. and often paniculate, the females on shorter peduncles: fr. oblong, becoming succulent and with the including thickened perianth forming a mulberry-like multiple fruiting body. *C. dealbata*, André (*Ficus dealbata*, Hort.), is described as a very beautiful greenhouse subject, with coriaceous elliptic lvs. 1 ft. long and half as broad, white-silky beneath and deep green above. I.H. 17:4.

L. H. B.

COVER-CROPS. Green temporary crops, grown for the purpose of improving the soil, either as protection or to be turned down as green manure; word used chiefly in speaking of fruit-growing operations.

The use of cover-crops has become an essential part of orchard management. The name is derived from the fact that the seed is sown in the fall or late summer, and sufficient growth results so that the ground is covered and protected during the winter. The crops are grown for their effect upon the orchard, not for the direct value of the crop. The term was first used in this connection by Bailey, Bulletin No. 61, of the New York Station at Cornell, p. 333, December, 1893.

Cover-crops make use of the available plant-food at a time when the trees are beginning to use it less and less. In this way, food that otherwise might be lost is stored up until it becomes available to the trees the following spring through the rotting of the cover-crops. The presence of the cover-crop, with its mat of roots, also prevents soil-washing and erosion with its accompanying loss of plant-food. The legumes, through the action of the bacteria found in their root-nodes, are able to add to the total amount of nitrogen present in the soil. This is the only way in which cover-crops increase the total supply of the plant-food elements, but the decay of the cover-crops increases the humus in the soil and, by the activities thus set up, the locked-up plant-food is released in a soluble form and thus the total available plant-food is increased. The ability of a soil to absorb and retain water is greatly increased in proportion to the humus that the soil contains. For this reason, soils rich in humus are less likely to be injured by erosion from the rapid run-off of the rainfall and less liable to suffer from drought. In soils plentifully supplied with moisture and plant-food, the trees are likely to continue growth so long that the wood does not mature and harden before winter, thus rendering them liable to injury during a severe winter. Such trees usually bear fruit that is poor in quality and in color. To produce mature, well-colored apples, it is essential that excessive growth after midsummer be prevented. The best means of doing this is to grow a crop in the orchard that will compete with the trees for the food and water. Soil protected by a cover-crop does not freeze so quickly or so deeply as when uncovered, and therefore the tree roots under a cover-crop are less likely to be injured by freezing and by heaving. Many



of our best fruit soils contain a large proportion of clay. When the humus-content of such soils becomes low, they are stiff and difficult to work and they dry out and bake quickly. Plowing under cover-crops restores the needed humus. This is important from the farm-management point of view. The period of time during which a clay field may successfully be plowed may frequently be doubled by thus increasing the humus supply. As the physical condition of the soil is bettered, the rootlets of the tree can more easily penetrate it in their search for food, and this larger feeding area means a greater supply of food. Orchards that are to be cultivated should be plowed as early as the land can be worked, in order to prevent excessive loss of moisture through evaporation and the demands of any growing cover-crop. This is especially true when rye, clover, or vetch are grown. Fall plowing is seldom advisable, as much of the benefit of the cover-crop is then lost. The time of seeding depends upon the needs of the fruit and the supply of moisture available. In seasons of plentiful rainfall the cover-crop should be put in early, but in a period of drought the trees need all the moisture there is in the soil and the seeding should be late. In the North Atlantic States, the cover-crops are planted from the latter part of July to the middle of August.

#### Kinds of cover-crops.

In general, cover-crops may be divided into the leguminous or nitrogen-gathering, and the non-leguminous crops.

1. Leguminous cover-crops.—Red and mammoth clover, Canada field peas, and winter vetch are used in the northern states; soybean, cowpea, crimson clover, and vetch in the central and southern states.

2. Non-leguminous cover-crops.—Rye, wheat, and barley; rape and turnips; buckwheat and nearly all weeds.

#### Average quantity of seed per acre.

Barley.....	2	to	2½ bushels.
Buckwheat.....			1 bushel.
Clover, red.....	10	to	15 pounds.
Clover, mammoth.....	10	to	15 pounds.
Clover, crimson.....	15	to	20 pounds.
Cowpea.....	1½	to	2 bushels.
Millet.....			1½ bushels.
Oats.....	2	to	3 bushels.
Peas.....	2	to	3 bushels.
Rape.....	2	to	5 pounds.
Rye.....	1½	to	2 bushels.
Soybean.....	1	to	1½ bushels.
Turnip.....			4 pounds.
Vetch.....	½	to	1 bushel.
Wheat.....	2	to	2½ bushels.

3. Combinations of cover-crops.—An ideal cover-crop should possess certain characters. It should make a vigorous vegetative growth by fall so as to furnish an abundance of humus and to hasten the maturity of the trees. The seed should be of such a nature that it will catch well when planted at a time of year when the soil is very dry. Preferably, the cover-crop should winter over. All these characters are seldom found in a single crop and, hence, combinations are desirable. Thus buckwheat, which makes a quick growth, does not live through the winter as does the slower-growing rye, so the two combine well. The following combinations are frequently used:

1.	{ Clover (red or mammoth).....	10	pounds.
	{ Winter vetch.....	15	pounds.
	{ Oats.....	½	bushel.
	{ Cowhorn turnips.....	½	pound.
2.	{ Buckwheat.....	½	bushel.
	{ Oats.....	1	bushel.
	{ Rye.....	1	bushel.

3.	{ Oats.....	1½	bushel.
	{ Clover.....	15	pounds.
4.	{ Buckwheat.....	¾	bushel.
	{ Oats.....	1	bushel.
5.	{ Oats.....	1½	bushel.
	{ Rye.....	1	bushel.

In the peach orchard, where large annual growth is not desirable, or in apple orchards making excessive growth, the leguminous crops should be used sparingly, if at all.

C. S. WILSON.

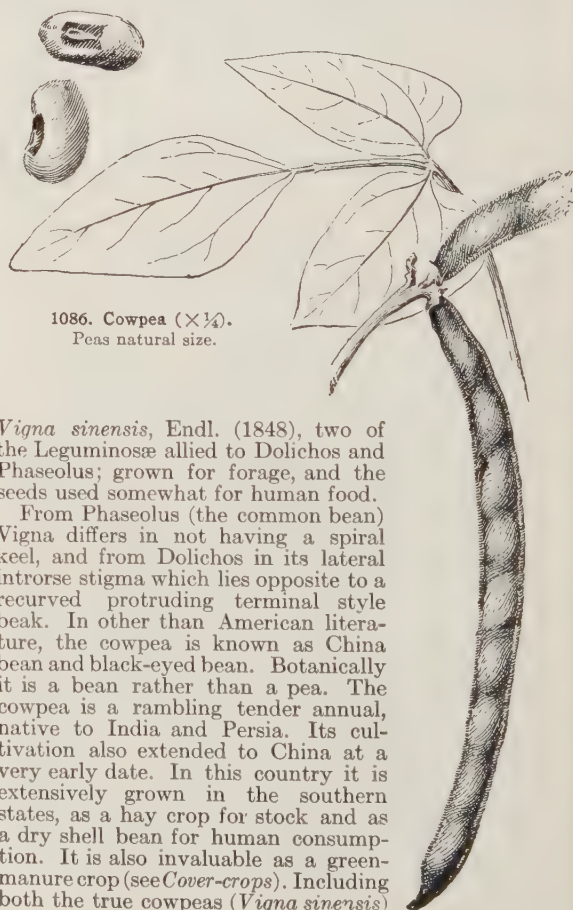
**COWANIA** (after James Cowan, an English merchant, who intro. many Peruvian and Mexican plants into England). *Rosaceæ*. Some 4 or 5 small shrubs from the S. W. U. S. and from Mex., with small crowded lvs. and handsome white or purple fls.; rarely cult. in botanical collections. Closely related to *Fallugia*, but differing in the absence of bracts at the base of the calyx. Cult. and prop. like *Fallugia*, but apparently more tender: like that plant well adapted for planting in rockeries. **C. mexicana**, Don (*C. Stansburiana*, Torr.), has small crowded cuneate 3-7-lobed lvs. and white fls. about 1 in. across. **C. plicata**, Don (*C. purpurea*, Zucc.), has incisely serrate lvs. and purple fls.

ALFRED REHDER.

**COWBERRY**: Usually means *Vaccinium Vitis-Idæa*. In parts of Scotland, *Comarum palustre*.

**COW-HERB**: *Saponaria Vaccaria*.

**COWPEA**. Fig. 1086. The American name for the cultivated forms of *Vigna catjang*, Walp. (1839), and



*Vigna sinensis*, Endl. (1848), two of the Leguminosæ allied to *Dolichos* and *Phaseolus*; grown for forage, and the seeds used somewhat for human food.

From *Phaseolus* (the common bean) *Vigna* differs in not having a spiral keel, and from *Dolichos* in its lateral introrse stigma which lies opposite to a recurved protruding terminal style beak. In other than American literature, the cowpea is known as China bean and black-eyed bean. Botanically it is a bean rather than a pea. The cowpea is a rambling tender annual, native to India and Persia. Its cultivation also extended to China at a very early date. In this country it is extensively grown in the southern states, as a hay crop for stock and as a dry shell bean for human consumption. It is also invaluable as a green-manure crop (see *Cover-crops*). Including both the true cowpeas (*Vigna sinensis*)



and the catjangs (*V. catjang*), Piper lists 270 varieties. As a class the catjangs may be distinguished from the true cowpeas by the smaller size of the seeds and pods and by the latter remaining upright throughout their growth period, never becoming strictly pendulous even after ripening. At the present time the true cowpeas are much more widely grown than the catjangs but the latter may yet come into more prominence on account of the resistance to the weevil of their small hard seeds. The cowpea is to the South what clover is to the North and alfalfa is to the West. It is sown broadcast after the manner of field peas. From three to five pecks of seed are used to the acre. See Cowpeas, Farmers' Bulletin No. 89, U. S. Dept. of Agric., by Jared G. Smith; Bulletin No. 102, pt. VI, and Bulletin No. 229 of the Bureau of Plant Industry, U. S. Dept. of Agric.; Cyclo. Amer. Agric., Vol. II, p. 260. For a botanical discussion of the cowpea and its taxonomic relatives, see *Vigna*.

GEO. F. FREEMAN.

**COWSLIP.** The true English cowslip is *Primula officinalis*. The plant wrongly called cowslip in America is the marsh marigold, *Caltha palustris*. The "American cowslip" is a popular name for *Dodecatheon Meadia*. The name "Virginian cowslip" is sometimes used for *Mertensia virginica*.

**CRAB'S-EYE VINE:** *Abrus*.

**CRAB-APPLE** in its widest sense means a small apple. The crab-apples of botanists are particularly fruits of *Pyrus baccata*. For more restricted uses of the word crab, see *Pyrus*.

**CRAB-GRASS:** One of several names for *Eleusine indica*; also for certain Panicums, as *P. sanguinale* (or *Digitaria sanguinalis*).

**CRÁMBE** (old Greek substantive). *Cruciferae*. Herbs or sub-shrubs, one grown in the vegetable-garden, and one or two in the hardy herbary.

Annuals, biennials or perennials, with thickened sts., and more or less fleshy lvs., glaucous: lvs. mostly large, more or less cut, lyrate or pinnatifid: fls. small, white, fragrant, in paniced racemes: fr. 2-jointed, indehiscent, the lower joint st.-like and seedless, the upper one globular and 1-seeded.—About 20 species in Eu., Asia, and 1 in Patagonia. Of easy cult.

**cordifolia**, Stev. Excellent foliage plant, withstanding the winters in the northern states: lvs. very large and heavy, cordate and ovate, toothed, glabrous or nearly so: fls. small but very numerous, in great branchy panicles 5–7 ft. high and nearly as broad, overtopping the mass of root-lvs. Caucasus. Gn. 50, p. 349. Gng. 4:291.—For the first 2 years from seed the plant makes only lvs.; but the third year it may be expected to bloom, after which the plant usually becomes weak and dies.

**maritima**, Linn. **SEA-KALE.** Perennial, smooth, stout, to 2 ft.: lvs. large, heavy and cut, more or less fringed or curled, glaucous green: fls. many, white, broad, honey-scented, in a tall panicle, in May. Coasts of Eu.—Grown as a garden vegetable. See *Sea-kale*.

**C. júncea**, Bieb. Biennial: small species with white fls. in an attractively slender-branched panicle. Iberia.—*C. Kotschyana*, Boiss. Perennial: lvs. somewhat hairy, the radical ones cordate-ovate with rounded dentate lobes, the st.-lvs. few, ovate-oblong, lobed. W. Asia.—*C. tatárca*, Jacq. Perennial, said to be grown in Hungary as "Tartarian bread." Glaucous, more or less rough-hairy: radical lvs. decomposed, with linear segms. Hungary, E. L. H. B.

**CRANBERRY.** A name applied to trailing species of the genus *Vaccinium* (*Ericaceae*); much grown in North America for the fruit. Plate XXIX.

Of the true cranberries, there are two species in North America, the small (*Vaccinium Oxycoccus*), and the large (*V. macrocarpon*). The large cranberry, *V. macrocarpon* (Fig. 1087), is now cultivated on thousands of acres in the United States and this cranberry culture is one of the most special and interesting of all

pomological pursuits. This cranberry grows wild only in North America, where it is native to acid swamps in the cooler parts of the United States and in Canada. Here it trails its slender stems and small oval evergreen leaves over the sphagnum and boggy turf, and the firm red berries which ripen during September and October often persist on the vines till the following spring or even longer. The curve of the slender pedicel in connection with the bud just before the blossom opens, with its resemblance to the head and neck of a crane, is said to have suggested the name craneberry which is now shortened to cranberry.

The low-bush cranberry, or wolfberry (*V. Vitis Idæa*), is much used in Nova Scotia and other parts, and is gathered and shipped in large quantities to Boston; but it is not cultivated. This berry is also common in Europe, where it is much prized. The quantities of this fruit imported into the United States from various sources is considerable.

The ideal bog for cranberry-culture should have the following qualifications: (1) Capability of being drained of all surface water, so that free water does not stand higher than 1 foot below the surface in the growing season. (2) Soil that retains moisture through the summer, for cranberries suffer greatly in drought. (3) Sufficient water-supply to enable it to be flooded. (4) A fairly level or even surface, so that the flooding will be of approximately uniform depth over the entire area. (5) Not over liability to frosts.

The water of the streams and pools in the acid swamps or bogs, which are the natural habitat of the cranberry, is usually, but not invariably, of a brownish or amber color, and some of the most common associate plants are the swamp huckleberry or blueberry (*Vaccinium corymbosum*), the cassandra or leather-leaf (*Chamaedaphne calyculata*), the red maple (*Acer rubrum*) and the swamp cedar (*Chamaecyparis thyoides*).

There are three centers for the production of cranberries in the United States: Massachusetts, where cranberry-culture began and from which come the most berries; New Jersey second; and Wisconsin third. While the culture is in most respects similar in these three centers, each has its own characteristic methods of preparation and care of the bogs. There is also an important and growing cranberry industry in Nova Scotia.

*The cranberry bog.* Figs. 1088–1090.

To insure success in cranberry-culture, a prime requisite is to locate the bog on soil on which wild cranberries or some of their common associate plants flourish. This is usually a black peaty formation from a few inches to 7 or 8 feet in depth, overlying sand which in turn is frequently underlaid by a "hardpan" that is nearly impervious to water and the presence of which had much to do with the formation of the peat. Another requisite is to make sure of an ample supply of water, preferably of the brownish color, for winter flooding and for protection from frost in spring and fall. Flooding at special times is also the safest and surest weapon against many kinds of insects



1087. *Vaccinium macrocarpon*, the common cranberry. ( $\times \frac{1}{2}$ )



Without an ample supply of water, cranberry-culture is so hazardous as hardly to be worth undertaking.

The building of the dams is the first step necessary for the improvement of a bog. A foundation for these should be made by digging a trench entirely through the peat, even if it should be 8 feet or more thick, to the clean sand, and this trench should be filled with sand free from all foreign material; above this foundation, embankments are built of clean sand and faced up with sods of live turf to prevent their being washed by the waves of the lake formed. The dams should be sufficiently high to flood the higher parts of the bog a foot deep, which will frequently make the water in the deeper parts 3 to 6 feet or more in depth. Gates or flumes must be constructed at the lowest point in these dams to provide for drawing the water off the bog and provision made for surface drainage. The latter is generally accomplished by opening the natural stream, if there should be one, or by digging an open ditch through the natural drainage center of the piece

ample supply of water permits reflooding when a later severe frost threatens. Reflooding about the first of June, provided the water has not been withdrawn earlier than May 5 to 10, will also furnish protection from a number of damaging insects and will not injure the crop, provided care is taken that the water does not stand on any part of the bog more than forty-eight hours. If a bog should become seriously infested with insects later in the season, it is occasionally profitable to sacrifice what remains of the year's crop and clear the bog of insects by flooding. This sometimes results in a greatly increased yield the following year. Damage from a light frost in the fall, before the berries are picked, may be prevented by raising the water in the ditches and about the roots of the vines. Protection from a heavy frost requires covering the plants with water, but this will cause immature berries to rot and should be done with great caution or the damage from water may be greater than it would have been from frost. During summer the irrigation of

the crop is accomplished by holding the water low or high in the ditches, as the varying season may demand.

#### *Preparation and tillage.*

Before cranberries are planted, the land must be cleared of all its natural growth, the stumps and roots removed and the ground leveled to a greater or less extent. The more nearly level a bog is made, so that proper drainage is provided for, the more economical it is in the use of water and the easier it is to provide the optimum amount of irrigation during the summer. The first cost of such perfect leveling, however, may be prohibitive or it may require the removal of all the good peaty soil over a considerable area,



1088. A Massachusetts cranberry bog.—Picking the fruit.

of land being improved. Side ditches should be dug leading into the stream, or main ditch, in sufficient number to drain off all surface water; they may be made from 1 to 3 feet deep, according to the character of the land to be drained. A reservoir built above the bog is very desirable in facilitating control of the water. In frosty Wisconsin it is considered almost necessary to have three times the area of the bog in reservoir to insure the crops. If a bog is situated on a stream subject to high water, provision must be made for keeping the flood water from the bog, as the crop would be destroyed if it were flooded during blooming time or seriously injured by flooding at any time during the active growing season. Winter flooding of cranberry bogs is to prevent heaving and winter-killing. The water is put on about the first of December or after the vines have become thoroughly reddened by cold weather.

Cranberry bogs, being always lower than the surrounding land, are peculiarly liable to damage by frost, serious loss frequently occurring when an ordinary farmer would not dream of danger, and a good supply of water is the only preventive that has been found efficient. The time of starting growth in the spring may be controlled by the time the water is drained off, and the earlier spring frosts may so be avoided while an

leaving nothing but pure sand in which the cranberries will not grow well. In many places, the removal of the natural growth may best be accomplished by cutting off the tops of the bushes and trees so that they will not extend above the surface of the water and flooding for two years, thus killing all vegetation. While this flooding entails loss of time, it is much easier and cheaper to clear away the dead roots and stumps than live ones, and when no sand is applied to the surface, as is the rule in New Jersey, it greatly lessens the expense of keeping the bog free from weeds for there are no live roots in the ground to send up suckers. In some places, as in most of Wisconsin, this method of drowning out is impracticable, because the surface soil, in which are the roots of all the living plants, will separate from the more perfectly decomposed peat below and rise to the surface of the water in floating islands making death to vegetation by drowning impossible. In such situations the ground must be turfed and all roots and stumps grubbed out. In either case the roots and stumps are best disposed of by piling in heaps and burning. In Massachusetts, it is the custom to cover the cleared and leveled bog with 3 to 5 inches of sand, which makes it still easier to keep the bogs free from weeds and acts as a moisture-retaining mulch for the



underlying peat. Where sanding is practised, it is the custom to apply a fresh coat of sand an inch or less in depth every two or three years; this keeps the vines short and close.

Cuttings for planting are secured by mowing vigorous vines from an old bog with a scythe. These cuttings, preferably not more than 8 or 10 inches long, are thrust diagonally into the surface of the bog from 12 to 14 inches apart. Not more than 3 or 4 inches of the top should be exposed, and if the bog is sanded, care should be taken that the cutting extends well into the muck below. As the vines grow they send out runners in all directions, netting the ground completely over. These sometimes grow as much as 6 feet in length and root in the soil at frequent intervals. From the runners grow upright stems which, in time, cover the bog with a solid mat of vegetation. The uprights are preferably not more than 6 inches high but under some soil conditions grow to a foot or more when the fruit is likely to be scanty. From the time of planting, three to five years must pass before the ground is matted over and a crop may be expected.

The character of the growth of cranberry vines precludes any cultivation in the ordinary sense of the word. The care of the bogs consists in keeping them free from other plants, which is accomplished almost entirely by hand-pulling; the regulation of the irrigation water, and preventive and curative measures for the many diseases and insect enemies to which they are subject.

Fertilizing of cranberries has met with considerable success in increased crops, various brands of commercial fertilizer having been employed. The subject is not well understood, however, and is attracting the attention of many thoughtful growers and their scientific helpers in the state experiment stations.

The pretty little pinkish white flowers of the cranberry open during June, when the bogs are not flooded, but the holding of the winter water till May throws the fullest bloom into the early part of July.

#### *Diseases and insects.*

Spraying with bordeaux mixture is very generally practised to prevent "scald," a fungous disease which has been especially injurious to the growers of New Jersey and which was so named because it was long thought to be caused by the scalding effect of the hot sun shining on berries wet with dew. As it is seldom possible to run heavy spraying machinery over the bogs, spraying involves the use of very long lines of hose or the laying of pipe lines, or both, the spraying of each

property being a separate engineering problem.

Insects of many kinds attack the roots, the leaves, the blossoms and the fruit of the cranberry. Knowledge of the life history of each of these is necessary for successful warfare against it, and detailed information is best secured from the various bulletins of the

United States Department of Agriculture and the agricultural experiment stations of New Jersey, Wisconsin and Massachusetts. More varieties of insects may be successfully combated with water than with any other one thing, as already explained. Arsenical poisons are expensive to apply, of indifferent success in destroying insects on the bogs, and they are suspected of being an actual poison to the vines.

#### *Varieties.*

There are now many varieties of cranberries in cultivation, all of them having been selected from wild vines or vines that appeared naturally in cultivated bogs. These varieties vary in shape, color, size, productiveness, time of ripening and adaptation to different soils. Some of the forms are shown in Figs. 1091-1093. The most generally cultivated are the Early Blacks and the Howes, both of which originated in the Cape Cod district and which together make

about 50 per cent of the berries marketed from all three of the cranberry states.

The Early Blacks are ready to harvest about the first of September both in Massachusetts and New Jersey, and the last of the Howes are seldom picked before the middle of October. As the pickers advance over a cranberry bog, they pick clean as they go and do not go back for successive relays of ripening berries as with most other small fruits.

#### *Picking and grading.*

In Massachusetts most of the picking is done by a scoop, by which the berries are raked from the vines. When the vines are short, the uprights not tangled, and the picker is experienced, berries can be harvested in this way very rapidly and with very little damage to either fruit or vines. The bogs are kept in good condition for "scooping" by pruning every three or four years with a rake the teeth of which are knives placed about 6 inches apart. The scoop (Fig. 1094) is also used to a considerable extent in New Jersey and Wisconsin but in these states a great many berries are still picked by hand.

Some of the berries, especially in Massachusetts, are cleaned and packed on the bog as they are picked, and sent directly to market, but this immediate packing tends to poor keeping. Most cranberries, after picking, are put in boxes which are packed in well-ventilated storehouses. Here they are kept from a few days to several months and the cleaning and packing for market is done immediately before they are shipped.

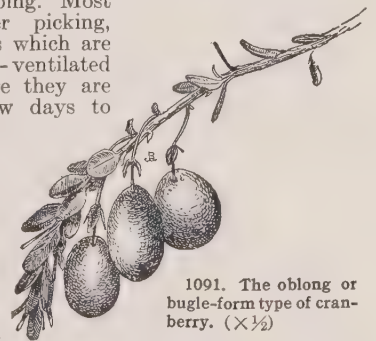
The machine which has been the standard for cleaning cranberries for many years is provided with a fan to blow away all grass, pieces of vine, dried-up berries or anything of like nature that may have gotten in the berries while being picked. The berries are then allowed to roll down a series of steps; those that are sound are elastic and will bounce like little rubber balls. There are bands of cloth stretched above the steps in such a way that when a berry bounces in the right direc-



1089. A cranberry bog flooded in winter.

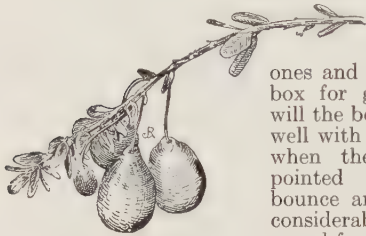


1090. The flume or outlet at the bottom of a cranberry bog.



1091. The oblong or bugle-form type of cranberry. ( $\times \frac{1}{2}$ )

tion it is received on the cloth and slides down into the box placed for the good berries without more bouncing. The rotten berries having lost their elasticity are not able to bounce over the cloth partition that separates the good from the bad. With berries that are nearly spherical and not too juicy this machine works very well, provided there are no frozen berries



1092. The obovoid or bell-shaped form of cranberry. ( $\times \frac{1}{2}$ )

to be taken out. Berries damaged by frost are even more elastic than sound

ones and will all go into the box for good fruit. Neither will the bounce machines work well with long or oval berries; when these strike on their pointed ends they fail to bounce and there is always a considerable percentage of sound fruit found in the refuse box. As there may be anywhere from ten to thirty or more steps, it is easily understood that berries going over these machines are not in the best possible condition for long keeping after they are put on the market. Some varieties of berries which are very juicy and tender can not be put through these machines at all as the steps get so sticky with the juice that the berries will not bounce.

In 1903, a machine was patented by Joseph J. White, which avoids the defects of the bounce machines. This has since been put on the market and its use is spreading among the more careful packers of Massachusetts and New Jersey, but the more complicated machinery and greater cost have prevented its adoption by other growers. This machine is provided with a hopper into which the cranberries are emptied through a screen which removes the coarser grass and vines; from the hopper the berries are fed, single file, to screw conveyors on which they are held by trough-like guards. These guards do not quite touch the screw, leaving a crack through which the remaining bits of grass, vines and dried berries are dropped into a box placed below to receive them.

The screw conveyor passes the berries over a series of selecting plates made of some resilient material, the best found so far being the selected spruce wood prepared for piano sounding-boards. These plates are tapped by small hammers placed beneath, the strength of the blow being regulated by a thumb-screw. The sound berries respond to this gentle tapping by jumping off the screw conveyor and falling on an endless belt a few inches below, which delivers all the sound fruit at one end of the machine. The rotten berries do not respond to the tapping of the selecting plates and are carried to the ends of the screw conveyors where they drop in the same box under the machine that receives the fine grass and the like. Frozen berries are removed by this machine nearly as well as

rotten ones and the shape of the berries is of no importance, while the berries only drop twice, a few inches each time, and are in much better condition for long keeping than those that go over the bounce machines. After the berries have been cleaned by machine it is customary to place them on tables where women remove any defective berries that may have been missed by the machines.



1093. The globular or cherry-shaped cranberry. ( $\times \frac{1}{2}$ )

### Marketing; yield.

Most cranberries are marketed in barrels holding about 100 quarts; a few are marketed in crates three of which fill a barrel. Some dealers prefer to buy cranberries "in the chaff," that is, just as they come from the bogs without having been run through any machine. Berries sold in this way are always packed in crates and are cleaned by the dealer, a few crates at a time, as his trade calls for them; they keep better than those that have been cleaned before being shipped.

Evaporated cranberries have been on the market for a number of years and are excellent, there being less difference between the sauce made from them and from fresh fruit than is the case with most kinds of fruit.

From the cranberry centers, the fruit is shipped in carload lots to the large cities of the United States, and from these distributed to the surrounding towns. There is also a small but steadily growing export trade.

A bog in good bearing should yield fifty barrels to the acre, but as many as 200 barrels have been secured.

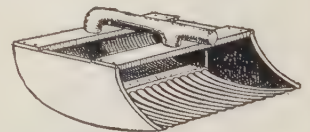
In 1895 coöperative selling of cranberries was inaugurated by some of the New Jersey growers, who organized the Growers' Cranberry Co., with Joseph J. White as president and Theodore Budd as vice-president. This company was joined by a number of large New England growers and, though handling only 25 per cent of the crop, prospered greatly. Later, A. U. Chaney organized another coöperative selling company. These two companies consolidated in 1910, forming the American Cranberry Exchange, with George W. Briggs, of Massachusetts, as president. The Exchange controls about 50 per cent of the crop of the country and has been remarkably successful in securing good prices for its members while keeping the retail price as low as during the years of fiercest competition.

### History.

Cranberry-culture began about a century ago in Massachusetts on the Cape Cod Peninsula. William Kenrick, writing in 1832 in the "Orchardist," says that "Capt. Henry Hall, of Barnstable, has cultivated the cranberry twenty years;" "Mr. F. A. Hayden, of Lincoln, Massachusetts, is stated to have gathered from his farm in 1830, 400 bushels of cranberries, which brought him in Boston market \$600." In the second and subsequent editions, Kenrick makes the figure \$400. It is not said whether Hayden's berries were wild or cultivated. At the present day, with all the

increase in production, prices are higher than those received by Hayden. In the third (1841) and subsequent editions, it is said that "an acre of cranberries in full bearing will produce over 200 bushels; and the fruit generally sells, in the markets of Boston, for \$1.50 per bushel, and much higher than in former years." It was as late as 1850, however, that cranberry-culture gained much prominence. It was in 1856 that the first treatise appeared: B. Eastwood's "Complete Manual for the Cultivation of the Cranberry." About 1845, cranberry-culture began to establish itself in New Jersey.

The culture of cranberries began in Nova Scotia about thirty years ago. The first attempt consisted in improving some of the patches of wild berries found growing around the central district of the Annapolis Valley. Gradually the idea was entertained of planting new areas, and as this proved successful the new industry was soon fairly established. Farmers in the vicinity of Auburn soon took up the industry, and in the fall of 1892 the first carload of cranberries was shipped to Montreal. Since then, Nova Scotia cranberries have met with a ready sale throughout Canada.



1094. Cranberry scoop, sometimes used in picking the berries.



PRODUCTION OF CRANBERRIES IN THE UNITED STATES  
IN 1899 AND 1909 (13th CENSUS)

State	1899	1909
New England—	Quarts	Quarts
Maine.....	100,192	49,728
New Hampshire.....	30,304	31,136
Vermont.....	1,120	
Massachusetts.....	22,714,496	19,164,992
Rhode Island.....	34,688	209,888
Connecticut.....	145,408	221,472
Middle Atlantic—		
New York.....	327,370	348,064
New Jersey.....	12,072,288	7,687,072
Pennsylvania.....	5,728	
East North Central—		
Ohio.....	4,256	
Indiana.....	7,552	139,520
Illinois.....	13,418	1,696
Michigan.....	125,536	124,288
Wisconsin.....	2,549,344	3,555,136
West North Central—		
Minnesota.....	22,112	35,840
Iowa.....		1,952
Missouri.....	6,944	
North Dakota.....	1,120	32
South Dakota.....	288	704
Nebraska.....		640
Kansas.....		1,152
South Atlantic—		
Virginia.....	18,112	
North Carolina.....	1,024	
East South Central—		
Alabama.....	96	
West South Central—		
Arkansas.....	288	
Mountain—		
Montana.....	32	
New Mexico.....	96	
Pacific—		
Washington.....	9,728	4,416
Oregon.....	40,864	22,784
California.....	10,656	
United States.....	38,243,060	31,600,512

#### Literature.

The standard books on the cultivation of cranberries are Webb's "Cape Cod Cranberries," and "Cranberry-Culture," by Joseph J. White; these are old books and in many respects out-of-date. The best literature on the subject is to be found in the various publications of the United States Department of Agriculture, the bulletins of the agricultural experiment stations of New Jersey, Wisconsin and Massachusetts, the proceedings of the American Cranberry Growers' Association which have been published biennially since 1880, the reports of the Cape Cod Cranberry Growers' Association, and the reports of the Wisconsin State Cranberry Growers' Association.

ELIZABETH C. WHITE.

**CRANBERRY TREE:** *High-bush cranberry, Viburnum Opulus.*

**CRANESBILL.** Loosely applied to the whole genus *Geranium*. In America it usually means *G. maculatum*.

**CRANIOIOLARIA** (from a fancied resemblance of the pod to a skull or cranium). *Martyniaceæ*. Coarse but interesting flower-garden annual.

Wide-spreading low viscid-hairy rank forking herb: lvs. large, opposite, long-petioled, broadly cordate, reniform or palmately lobed; fls. white, racemed; calyx 3-5-lobed, more or less inflated; corolla very long-tubed, the tube slender and cylindrical, campanulate at the throat, more or less 2-lipped, the 5 lobes rounded and somewhat undulate, the anterior largest; perfect stamens 4, didynamous, affixed at or near the throat; ovary 1-celled; fr. a 2-valved caps. with a long incurved beak, many-seeded.—Two species, Venezuela to Paraguay. Usually confused with *Martynia*, from which it is distinguished readily by having 4 rather than 2 fertile stamens and by the very long and slender corolla-

tube which widens at the throat; the closely related *Proboscidea* has a much broader tube widening nearly from the base.

**ánua**, Linn. (*Martynia Craniolària*, Glox.). Two feet high: lvs. palmately lobed, the margins dentate: calyx 2-bracted, cut down one side, about one-third the length of the slender straightish corolla-tube; lobes of corolla rounded and not much undulate; style 2-lobed, equaling or slightly exceeding the 2 pairs of stamens. N. S. Amer.—The thick fleshy root is preserved in sugar as a comfit; plant known as "Creole scorzonera" in S. Amer. There appears to be confusion in the seed sold as *Martynia Craniolària*; some of it may be *M. louisiana* or other species. L. H. B.

**CRÁSSULA** (Latin *thickish*; referring to the thick leaves and stems). *Crassulacæ*. Fleshy and leafy greenhouse shrubs or herbs, grown for the grotesque appearance of some of the kinds and also for the bloom.

Variable in habit and foliage, mostly erect; rarely annual: lvs. opposite, usually sessile and often connate, fleshy, very entire and the margins sometimes cartilaginous, glabrous or pubescent or scaly: fls. usually small, white, rose or rarely yellow, commonly in cymes but sometimes capitate, usually 5-merous; calyx 5-parted, the lobes erect or spreading; petals 5, free or joined at the base, erect or spreading; stamens 5, shorter than the petals; carpels 5, many-ovuled.—Species 150 or more, mostly in S. Afr., but a few in Abyssinia and Asia. Many species have been intro. to cult., but only a few are actually grown outside of fanciers' collections. The rocheas sometimes pass as crassulas. See *Rochea*.

The genus *Crassula* gives the name to the order *Crassulacæ*, which contains many cultivated succulent plants, and also others of widely different habit. The order is closely related to the *Saxifragacæ*, but differs in having the carpels of the ovary entirely free and equal in number to the petals, but the forms pass easily into the *Saxifragacæ* through *Francoa* and *Tetilla*, and back again through *Triactina*. The genera, as usually treated, are ill defined, and certain species of *Sedum* cross over the lines of *Crassula*, *Cotyledon* and *Sempervivum*, while between *Crassula* and *Tillæa* no very clear distinction can be made.

*Crassulas* are greenhouse plants requiring a dry atmosphere during the resting-period. While making growth, they may be treated like other greenhouse plants in the way of watering, placing them in the lightest and airiest part of the house. The pots must be drained so that any surplus moisture will easily pass through. The soil should consist of sand, loam, broken brick, and a very small quantity of leaf-soil or thoroughly rotted cow-manure. Propagation is usually from cuttings. Some of the species, such as *C. falcata*, do not give much material for this purpose, and they should, therefore, be headed over and the tops put in dry sand in the spring, allowing water only when they show signs of shriveling. The cut-over plants should



1095. *Crassula quadrifida*.  
( $\times \frac{1}{2}$ )

be encouraged to make side shoots, which may be rooted after they are large enough. (G. W. Oliver.)

A. *Floral parts in 4's.*

**quadrifida**, Baker. Fig. 1095. Perennial: lvs. oblong-spatulate, the upper ones rounder, decussate: fls. with their parts in 4's, paniced, white, tinged red. Cape.

AA. *Floral parts in 5's, which is considered to be normal in the genus.*

B. *Lvs. petioled.*

**cordata**, Soland. Plant slender and shrubby, 1-3 ft., erect or diffused and sometimes rooting at the joints: lvs. dotted, stalked, cordate-reniform, obtuse, entire, glabrous: cymes panicle-like; fls. reddish, sometimes pure white; petals free, lanceolate, spreading. Cape. Winter.—Closely allied to *C. spathulata*.

**spathulata**, Thunb. Somewhat shrubby, more slender and trailing than *C. cordata*, decumbent, branching: lvs. stalked, roundish, crenate, glabrous, shining above: corymbs panicle-like; fls. rosy or flesh-colored: petals acute. Cape. L.B.C. 4:359 as *C. cordata*.—Likely to be cult. as *C. cordata*.

BB. *Lvs. not petioled (or only tapering to base).*

c. *Foliage glaucous.*

**falcata**, Wendl. (*Röchea falcata*, DC.). Height 3-8 ft.: lvs. grown together at the base, thick, glaucous, oblong, falcate: fls. small, numerous (50 or more), in a crimson, rarely white, dense, terminal corymb; corolla-tube  $\frac{1}{2}$  in. long, as long as the limb or shorter. Cape. B.M. 2035.

cc. *Foliage not glaucous.*

**lacteæ**, Soland. Plant shrubby, branching, tortuous below, 1-2 ft.: lvs. narrow-obovate, acutish or acuminate, narrowed and grown together at the base, glabrous, spotted along the margin: cymes panicle-like, many-fl.; fls. white, small. Cape. Winter. B.M. 1771. L.B.C. 8:735.—A free-flowering window plant of easy cult. There is a form with variegated lvs. Differs from *C. arborescens* in the narrower acute lvs. that are more tapering at base, and in the color of the fls.

**arborescens**, Willd. Fleshy erect shrub, reaching 8-10 ft.: lvs. roundish-obovate and obtuse, tapering to base, fleshy, flat and glaucous, dotted above, the edges smooth: fls. rather large, rose-colored, in trichotomous paniced cymes. Cape. B.M. 384 (as *C. Cotyledon*).

*C. atrosanguinea*, Barbey. Erect, 12-20 in., rigid; st. reddish, branched at top: lvs. aloë-like, straight or recurved, glabrous, narrowed from base to apex, often 8 in. long, rosulate and on the st.: fls. dark red, in a dense terminal many-fl. cluster. Transvaal.—*C. coccinea*, Linn.—*Röchea coccinea*.—*C. congesta*, N. E. Br. Only  $3\frac{1}{2}$  in. high: lvs. thick and fleshy, ovate-lanceolate: fls. numerous, densely crowded in a sessile terminal head, the petals scarcely  $\frac{1}{2}$  in. long, white. S. Afr.—*C. conjuncta*, N. E. Br. Lvs. concave: fls. pure white in a compact narrow cluster. S. Afr.—*C. decipiens*, N. E. Br. Dwarf tufted perennial: lvs. densely covered with blunt papillæ or nipple-like projections, fleshy, oblong: fls. very small, white, in terminal 3-branched cymes. S. Afr. (?)—*C. jasmineæ*, Ker-Gawl.—*Röchea jasmineæ*.—*C. sedifolia*, N. E. Br. Only 1-2 in. high when in bloom: lvs. in small tufts at the base and 3 or 4 pairs on the fl.-sts., bright green, ciliate, with red-brown spots along the margin: fls. white, 3-9 together in terminal cymes. S. Afr.—*C. varidiblis*, N. E. Br. Plant 3-6 in. high, branched at base: lvs. in 4 rows, densely imbricated, ovate, small ( $\frac{1}{2}$  in. or less long), ciliate on margin: fls. white, or red outside, 5-7 in. small cymes disposed in a narrow terminal panicle. S. Afr. L. H. B.†

CRATÆ-MÉSPILUS: *Cratægus grandiflora*.

**CRATÆGO-MÉSPILUS**. This name has been bestowed on a graft hybrid between *Cratægus monogyna* and *Mespilus germanica*, discovered in 1894 in the garden of M. Dardar at Bronvaux near Metz, Germany. Like *Laburnum Adamii*, which is probably the best known of the graft hybrids, it produces at the same time branches intermediate in their characters between the parents and branches resembling more or less closely the parent plants. Two distinct forms pro-

duced on different branches of the parent tree have been prop. and distributed under the names *C. Dardari* and *C. Asnieresii*. The first form (*C. Dardari*, Simon-Louis), has the lvs. and the frs. very similar to those of the medlar, but the branches are spiny, the fls. appear in corymbs, are distinctly pedicelled and have 15-20 stamens and the frs. have only 1-3 stones, measure  $\frac{1}{2}$ - $\frac{3}{4}$  in. across, and are crowned by persistent upright connivent calyx-lobes. M.D.G. 1912:101. The second form, *C. Asnieresii*, Schneid. (*C. Jules d'Asnières*, Simon-Louis) resembles more *Cratægus monogyna*, but is pubescent; the lvs. on the flowering branchlets are usually oval to obovate and often entire, while those of the shoots are ovate or rhombic-ovate and usually with 1 to 3 rounded or rarely acute lobes on either side; the fls. are borne in pubescent, 6-12-fl. corymbs, have 20 stamens and 1-2 styles; the fr. is subglobose and less than  $\frac{1}{2}$  in. across. G.C. III. 50:183, 185. Gn. 75, p. 310. M.D.G. 1912:100.—While *C. Dardari* is botanically more interesting, *C. Asnieresii* is more ornamental and forms a handsome small tree with gracefully arching branches studded with numerous fl.-clusters. It is prop. by budding or grafting like the horticultural varieties of *Cratægus*.

ALFRED REHDER.

**CRATÆGUS** (ancient Greek name, derived from *kratos*, strength, on account of the hardness of the wood). *Rosaceæ*, subfam. *Pômææ*. CRATÆGUS. HAWTHORN. Woody plants grown for their handsome foliage, attractive flowers and decorative fruit which, in a few species, is edible, and also for their picturesque habit: very valuable for ornament.

Shrubs or small trees, usually spiny: lvs. alternate, deciduous, stipulate, serrate, often lobed or pinnatifid: fls. white, in some varieties red, in corymbs, rarely solitary; petals and calyx-lobes 5; stamens 5-25, usually 10 or 20; styles 1-5: fr. a drupe-like pome, with 1-5 1-seeded bony stones.—A large genus, widely distributed in the temperate regions of the northern hemisphere, most abundant in N. Amer., where between 800 and 900 species have been described, while from the Old World only about 60 species are known. There exists no recent monograph of the genus; a systematic enumeration of the arborescent American species will be found in Sargent, "Manual of the Trees of North America," pp. 363-504; of the species of the southern states in Small, "Flora of the Southeastern United States," pp. 532-569; and of the species of the north-eastern states in Gray's Manual, ed. 7, p. 460-79, and in Britton and Brown, Ill. Flor. (ed. 2) 2:294-321; for the species cult. in European gardens, see Lange, "Revisio Specierum Generis Cratægi" (1897), quoted below as Lange.

The hawthorns are hardy ornamental shrubs and trees, mostly of dense and low growth, with handsome foliage, turning, in most species, to a brilliant coloring in the fall. Almost all have attractive white flowers, pink or crimson in some varieties of *C. Oxyacantha* and *C. monogyna*. Most of the species have very decorative fruit which in *C. Phænopryum*, *C. nitida*, *C. viridis*, *C.*



1096. Thorns of *Cratægus*. They are modified branches, being in the axils of leaves; sometimes, as in the lower figure, some of the short branches bear leaves.



*fecunda*, *C. pruinosa*, *C. Carrierei*, *C. persistens*, *C. Oxyacantha*, *C. monogyna* and others persist on the trees until late into the winter, while some species, as *C. Arnoldiana*, ripen their large fruits, which soon drop, in August; also *C. dahurica*, *C. sanguinea* and the black-fruited *C. nigra* ripen about the same time, and *C. submollis* only a little later, but the earliest of all is the southern *C. æstivalis*, which ripens its fruits in May. This and the blue-fruited *C. brachyacantha* are among the most decorative hawthorns for the southern states. The fruit of *C. æstivalis*, and that of *C. mexicana* is made into preserves and jellies; also the fruits of the Molles group are suited for jelly-making, and in South Carolina an excellent jelly similar in quality and taste to Guava jelly is made from the fruits of some species of the Flavæ group. In Europe, *C. monogyna* and *C. Oxyacantha* are counted among the best hedge plants; also many American species like *C. Phænopyrum*, *C. Crus-galli* and possibly *C. macracantha*, *C. intricata*, *C. pastorum*, *C. rotundifolia*, may be used for hedges, but they are stronger growers and cannot be pruned so closely as the European species. The hawthorns grow well in exposed positions and as a rule do not like much shade; they are not particular as to the soil, but grow best in limestone soil, also in a rich, loamy, somewhat moist one, and even in strong clay. Propagated by seeds, sown in fall or stratified; before stratifying, most of the pulp may be removed by laying the fruits in shallow piles and allowing them to decay. Then they are mixed with sand or sifted soil and buried in the ground or kept in boxes in a cool cellar. The young plants should not be allowed to remain over one year in the seed-beds, as they form long tap-roots and are then difficult to transplant. Varieties and rarer kinds are easily budded or grafted on seedling stock of *C. Oxyacantha*, or other common strong-growing species.

The spines of crategus are modified branches (see Fig. 1096). The fruits are pomes (Fig. 1097), with structure similar to that of the apple.

ALFRED REHDER.

The American hawthorns are highly ornamental subjects for the planting of parks and private estates. The showy flowers in spring and early summer, the conspicuous red, crimson, and scarlet fruits of nearly all of them, which extend amongst the different species from August to early winter and midwinter,—and some of the species markedly retain their fruits without shrinkage of pulp or loss of color until early winter,—the absolute hardihood, and the bold rugged branching habits characteristic to most of them, make them very interesting objects when their leafless forms are outlined in a winter landscape. The landscape gardener cannot make any mistake in planting them in liberal quantities in private estates or public parks.

They are easily transplanted. They are much benefited by liberal pruning when transplanted from nursery rows or from the woodland. The side branches should be pruned in severely, and as the centers of good-sized plants are likely to be full of intricate and congested branches, these should be carefully thinned. In a young state they should be grown to one stem whether they are arborescent or shrubby species. Under this treatment they make beautiful garden plants.

The American hawthorns are almost invariably found growing in heavy limestone clay. They may occasionally overlap into sandy soil. In planting them in sandy soil, it should be liberally enriched with well-rotted manure, and they should be kept well mulched.

The seeds of all of the species of American hawthorns germinate slowly. None of the species germinates before the second year after sowing, and many of the seeds in the same "flat" will not germinate before the third year. In many instances, part of the seeds germinate the second year, and the remainder the third. The seeds of *Cratægus geneseensis* have been known to be

dormant for three years, and all come up thickly at the same time. In some of the groups the seeds of the species germinate more freely than in others. The species in the Molles, Flabellatæ and Tomentosæ groups germinate abundantly. The germination of the species in the Pruinosa group have a much lower per-



1097. Pomes of *Cratægus*, one of the large-fruited forms. (Half size.)

centage than in the former. The species in the Intricatæ group germinate badly.

The fruit can be sown broadcast in beds without any separation of the seeds, and heavily mulched until the spring of the second year, when the mulching should be removed. This method, however, is not considered good, and has been given up. The best way is to soak the fruits in water, and by maceration the seeds or nutlets are separated from the pulp, and the seeds will sink to the bottom of the tub or vessel. The seeds are then dried in the sun as they can then be handled easily. They are sown in "flats" of convenient size to handle, and piled up in the corner of the shade house and fitted tightly above each other to prevent mice getting at them. During this period of rest they must not be allowed to become dry. In the spring of the second year they are spread out to allow the seeds to germinate. Numbered zinc tags are nailed on the "flats" and the corresponding numbers with the names of the species are recorded.

The American hawthorns can be grafted readily on potted seedling stocks in the greenhouse in winter, any of the species in the Crus-galli group being good to use. They are grafted at the crown. This, however, is an unnecessary operation. All of the species of American hawthorns (and there are over 900 of them) come absolutely true from seed, and whilst they germinate slowly, they start to grow rapidly into plants of good stocky size from about two years after they germinate.

Some of the species of American hawthorns have highly colored foliage in the fall. The species in the Pruinosa, Medioximæ and Intricatæ groups have perhaps the most highly colored foliage. Notable examples are *Cratægus opulens*, *C. diffusa*, *C. maineana*, *C. discolor*, *C. cognata*, *C. conspecta*, *C. promissa*, *C. ezornata*, *C. perjucunda*, *C. fetida*, and *C. verecunda*.

The different species vary greatly in the time of ripening their fruits and in the period of duration. In many instances the fruit drops soon after ripening and in others hangs on for a long period. A selection

of twenty-six species that would give a good fruit display from August until early or mid-winter, would be as follows: *Cratægus matura*, *C. præcox*, *C. Arnoldiana*, *C. Dayana*, *C. Robesoniana*, *C. pedicellata*, *C. gloriosa*, *C. Ellwangeriana*, *C. lauta*, *C. submollis*, *C. champlainensis*, *C. arkansana*, *C. Dunbari*, *C. ferentaria*, *C. opulens*, *C. compta*, *C. gemmosa*, *C. lyoniana*, *C. geneseensis*, *C. persimilis*, *C. maineana*, *C. Barryana*, *C. coccinioides*, *C. leiophylla*, *C. durobriensis*, and *C. cordata*. (See pp. 887-889 for some of these.)

JOHN DUNBAR.

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## KEY TO THE SPECIES.

A. Veins of the lvs. extending to the points of the lobes or to the teeth only; lvs. usually slightly or not lobed; fr. not black or blue, except in No. 37.

B. Stones plain on the inner surfaces.

C. Petioles elongated, usually slender.

D. The petioles glandular at the apex or sparingly glandular throughout.

E. Corymbs many-fl.: petioles glandular only at the apex; lvs. broad at the base, truncate to broadly cuneate.

F. Lvs. tomentose or pubescent beneath, at least on the veins.

G. Stamens 20; anthers pale yellow; lvs. thick and leathery.

H. Fr. ripening in Aug. and Sept.: lvs. broadly ovate. . . . . 1. *mollis*

HH. Fr. ripening at the end of Oct.: lvs. oblong-ovate to oval. . . . . 2. *arkansana*

GG. Stamens 10; lvs. membranous at maturity.

H. Anthers yellow.

I. Fr. crimson, villous, ripening the middle of Aug.: lvs. dark green and smooth above. . . . . 3. *Arnoldiana*

II. Fr. orange-red, lustrous, puberulous at the base; lvs. dark yellowish green, scabrate above. . . . . 4. *submollis*

HH. Anthers rose-color: lvs. scabrate above.

I. Plant a tree: lvs. with short lobes; corymbs many-fl. . . . . 5. *Ellwangeriana*

II. Plant a shrub: lvs. rather deeply lobed; corymbs 4-6-fl. . . . . 6. *Robesoniana*

FF. Lvs. glabrous beneath or nearly so.

G. Fr. bloomy until nearly fully ripe.

H. Stamens 20; lvs. glabrous; fr. subglobose, often 5-angled. . . . . 7. *pruinosa*

HH. Stamens 10; lvs. scabrate above, while young; fr. obovoid. . . . . 8. *Barryana*

GG. Fr. not bloomy.

H. Stamens 20, anthers pink; lvs. truncate at the base.

I. The lvs. dull above, villous beneath when young; fr. with conspicuous calyx and with red flesh. . . . . 9. *coccinioides*

II. The lvs. lustrous above, quite glabrous; fr. with yellow flesh and small calyx. . . . . 10. *speciosa*

HH. Stamens 5-10; lvs. broadly cuneate.

I. Anthers pink or rose-purple; stamens usually 10.

J. Calyx-lobes coarsely glandular-serrate; stones usually 5; lvs. distinctly lobed. . . . . 11. *pedicellata*

JJ. Calyx-lobes entire or obscurely serrate; stones 2-3; lvs. slightly lobed. . . . . 12. *pastorum*

II. Anthers yellow; stamens 5-10; lvs. orbicular-ovate; fr. with 2-3 stones. . . . . 13. *rotundifolia*

EE. Corymbs usually few-fl.: petioles sparingly glandular throughout; lvs. cuneate at the base; stamens 10.

F. Calyx-lobes glandular-ciliate; corymbs slightly villous; anthers yellow. . . . . 14. *intricata*

FF. Calyx-lobes entire or glandular above the middle; corymbs glabrous.

G. Anthers purplish; calyx-lobes glandular above the middle. . . . . 15. *Buckleyi*

GG. Anthers yellow; calyx-lobes without glands. . . . . 16. *Boyntonii*

DD. The petioles glandless or with a few minute glands; lvs. cuneate at the base, ovate to lanceolate, not or very slightly lobed, lustrous above, glabrous at maturity; stamens 20.

E. Fr. subglobose,  $\frac{1}{4}$  in. across or less, bright scarlet or orange; lvs. oblong-obovate to ovate. . . . . 17. *viridis*

EE. Fr. ovoid, about  $\frac{1}{2}$  in. across, dull brick-red, bloomy; lvs. lanceolate to oblong-obovate. . . . . 18. *nitida*

CC. Petioles short; lvs. cuneate at the base, not or very slightly lobed.

D. The petioles glandless.

E. Corymbs many-fl.

F. Lvs. dark green and shining above.

G. Stamens 10; under side of lvs. glabrous or nearly so.



- H. Anthers rose-color or purple.
- I. Fr. glabrous: corymbs glabrous.
- J. Shape of lvs. cuneate-obovate to oblanceolate: fr. dull red; stones usually 2. .... 19. *Crus-galli*
- JJ. Shape of lvs. oblong to ovate: fr. crimson, lustrous; stones 3-5. .... 20. *Canbyi*
- II. Fr. villous until nearly fully grown: lvs. oblong-obovate to broadly ovate: corymbs slightly villous. .... 21. *fecunda*
- HH. Anthers yellow: lvs. obovate: fr. dull dark crimson. .... 22. *Arduennæ*
- GG. Stamens 20.
- H. Under side of lvs. villous: corymbs densely pubescent. .... 23. *Carrierei*
- HH. Under side of lvs. glabrous: corymbs slightly pubescent. .... 24. *persistens*
- FF. Lvs. dull above: stamens 20.
- G. Fr. juicy, edible: lvs. cuneate-oblong or elliptic-lanceolate, tomentose beneath. .... 25. *mexicana*
- GG. Fr. dry, mealy: lvs. obovate or oval.
- H. Length of lvs. 2-4 in., pubescent beneath: fr. ovoid,  $\frac{1}{2}$ -1 in. long, with large dots. .... 26. *punctata*
- HH. Length of lvs.  $1\frac{1}{2}$ -2 in., at maturity hairy only on the midrib beneath: fr. globose,  $\frac{1}{2}$ - $\frac{1}{2}$  in. across, with small dots. .... 27. *collina*
- EE. Corymbs few-fl.: lvs.  $\frac{1}{2}$ -2 in. long, pubescent beneath: stamens 20-25.
- F. Fls. with or before the lvs.: fr. ripening in May, juicy, bright red: lvs.  $1\frac{1}{2}$ -2 in. long. .... 28. *æstivalis*
- FF. Fls. after the lvs.: fr. ripening very late, dry, dull red or yellow: lvs. less than  $1\frac{1}{2}$  in. long.
- G. Lvs. obovate, mostly obtuse, crenately serrate: fls. usually solitary. .... 29. *uniflora*
- GG. Lvs. oval or ovate, acute, serrate and often lobed: fls. 2-6. .... 30. *Vailiæ*
- DD. The petioles, margin of lvs. and corymbs densely glandular: corymbs 3-7-fl.
- E. Stamens 20, anthers purple: fr. ovoid. .... 31. *flava*
- EE. Stamens 10.
- F. Fr. pyriform: anthers purplish. .... 31. *flava* var. [lobata]
- FF. Fr. globose: anthers yellow. .... 32. *aprica*
- BB. Stones with furrows or irregular cavities on the inner surfaces; fr. lustrous, soft at maturity.
- C. Lvs. not or only slightly lobed.
- D. Color of fr. scarlet or orange; stones 2-3: lvs. with impressed veins.
- E. Fr. small, ovoid or pear-shaped, upright, orange-red: lvs. thin, dull above, pubescent below. .... 33. *tomentosa*
- EE. Fr. subglobose, larger, nodding, scarlet: lvs. subcoriaceous, pubescent only on the veins beneath.
- F. Anthers rose-color; stamens usually 20. .... 34. *succulenta*
- FF. Anthers yellow; stamens 10.
- G. Foliage glabrous below: stones deeply grooved on the inner surface. .... 35. *macracantha*
- GG. Foliage usually pubescent on the veins below while young; stones slightly grooved. .... 36. *prunifolia*
- DD. Color of fr. black; nutlets 5: lvs. broadly elliptic to obovate, glabrous (see also No. 42 with blue frs.). .... 37. *Douglasii*
- CC. Lvs. more or less distinctly lobed.
- D. Length of lvs. more than 2 in.: lvs. pubescent: fr. nearly  $\frac{1}{2}$  in. across. .... 38. *sanguinea*
- DD. Length of lvs. less than 2 in.: lvs. quite glabrous: fr.  $\frac{1}{2}$  in. or less across. .... 39. *dahurica*
- AA. Veins of the lvs. extending to the points of the lobes and to the sinuses; lvs. usually distinctly lobed.
- B. Fr. very small,  $\frac{1}{2}$  in. long or less, red: calyx deciduous.
- C. Lvs. triangular-ovate, with shallow and broad lobes, often 3-lobed: fr. subglobose, lustrous; nutlets 3-5. .... 40. *Phænopyrum*
- CC. Lvs. ovate, deeply 5-7-lobed: fr. ovoid; nutlets 1-3. .... 41. *apiifolia*
- BB. Fr. larger: calyx-teeth persistent.
- C. Color of fr. black or blue.
- D. The fr. blue, bloomy: lvs. obovate to obovate-oblong, crenate-serrate, usually not lobed. .... 42. *brachy-*  
[cantha]
- DD. The fr. black; stones with cavities on the inner surfaces.
- E. Lvs. with about 5 pairs of lobes: fr. lustrous, subglobose, juicy. .... 43. *nigra*
- EE. Lvs. with 2-3 pairs of lobes: fr. ovoid, dull black or purplish black. .... 44. *pentagyna*
- CC. Color of fr. red or yellow.
- D. Stones with cavities on the inner surfaces, 1-2.
- E. Styles 2: lvs. 3-5-lobed with short and broad serrulate lobes. .... 45. *Oxyacantha*
- EE. Style 1: lvs. deeply 3-7-lobed, with acute, entire or sparingly toothed lobes. .... 46. *monogyna*
- DD. Stones plain on the inner surfaces, 2-5.
- E. Branchlets and lvs. pubescent.
- F. Lvs. with glandular toothed lobes, pubescent. .... 47. *tanacetifolia*
- FF. Lvs. not glandular-toothed, lobes often nearly entire.
- G. Upper surface of lvs. dull, pubescent, under surface villous. .... 48. *orientalis*
- GG. Upper surface of lvs. glabrescent, lustrous, under surface finely pubescent. .... 49. *Azarolus*
- EE. Branchlets glabrous: lvs. deeply lobed, glabrous. .... 50. *pinnatifida*

## 1. MOLLES.

1. *móllis*, Scheele (*C. tiliifolia*, Koch. *C. acerifolia*, Hort. *C. coccinea* var. *móllis*, Torr. & Gray). Tree, to 30 ft., with short, stout thorns: lvs. broadly ovate, sharply and doubly serrate and with 4-5 pairs of short acute lobes, densely pubescent beneath, 3-4 in. long: corymbs densely villous-pubescent; fls. with red disk: fr. about  $\frac{1}{2}$  in. across, usually pear-shaped, more or less pubescent, with thick mealy flesh and 4-5 stones. April, May: fr. end of Aug., Sept. Ohio to S. Dak. and Kans. S.S. 13:659. Em. 494 (as *C. tomentosa*). G.F. 5:221.—One of the most decorative species, with large, bright green foliage and showy fls. and frs., ripening in Sept., but dropping soon after maturity.

2. *arkansana*, Sarg. Tree, to 20 ft.: branches wide-spreading, forming an irregular open head, unarmed or

with straight spines  $\frac{1}{4}$ – $\frac{1}{2}$  in. long: lvs. oval or oblong-ovate, acute, truncate or broadly cuneate at the base, serrate and with 3–4 pairs of short lobes, pubescent on both sides at first, at maturity dull dark green and glabrous above, villous on the veins below, 2–3 in. long: corymbs villous; fls. nearly 1 in. across: fr. ovoid, bright crimson, slightly villous at the ends,  $\frac{3}{4}$ –1 in. long, with thick subacid flesh and usually 5 stones.



1098. *Cratægus Arnoldiana* ( $\times \frac{3}{4}$ ). No. 3.

May; fr. end of Oct., falling gradually. Ark. S.S. 13:660.—Very handsome in autumn with its abundant brilliant frs. persistent for some time; the lvs. turn clear yellow.

3. *Arnoldiana*, Sarg. Fig. 1098. Tree, to 20 ft., with stout ascending branches forming an open head with zigzag branchlets, armed with stout spines 2–3 in. long: lvs. broadly ovate to oval, acute, truncate to broadly cuneate at the base, doubly serrate and with many shallow broad lobes, at first hairy above and soft-pubescent below; later smooth, dark green and lustrous above, slightly villous on the veins below, 2–3 in. long: corymbs tomentose; fls.  $\frac{3}{4}$  in. across: fr. subglobose, bright crimson, villous toward the ends,  $\frac{3}{4}$  in. long, with thick subacid flesh and 3–4 stones. May; fr. middle of Aug., soon falling. Mass. S.S. 13:668.

4. *submollis*, Sarg. Tree, to 25 ft., with ascending or spreading branches forming a broad handsome head: spines numerous, thin, usually straight, 2–3 in. long: lvs. ovate, acute, broadly cuneate at the base, doubly serrate and with 3–4 pairs of acute short lobes, scabrous above, below at first soft-pubescent, later only puberulous on the veins, 2–3 in. long: corymbs tomentose; fls. 1 in. across: fr. pear-shaped or ovoid, bright orange-red and lustrous,  $\frac{3}{4}$  in. long with persistent erect calyx; flesh yellow, mealy; stones usually 5. May; fr. early in Sept., soon falling. Que. to Mass. and E. N. Y. S.S. 4:182 (as *C. mollis*).

5. *Ellwangeriana*, Sarg. Tree, sometimes to 20 ft., with stout ascending branches forming a broad symmetrical head, and with zigzag branchlets: lvs. oval, acute, rounded or broadly cuneate at the base, coarsely and often doubly serrate with many short acute lobes, at first hairy above and villous below on the veins, later scabrous and light green above, nearly glabrous below,  $2\frac{1}{2}$ – $3\frac{1}{2}$  in. long: corymbs densely villous; pedicels short; fls. 1 in. across: fr. ovoid, bright crimson, very lustrous, slightly villous at the ends, 1 in. long, with thin yellow acid flesh and 3–5 nutlets. May; fr. at the end of Sept., soon falling. N. Y. and Ont. to Mich., south to W. Pa. S.S. 13:671. G.C. III. 47:130. A.F. 24:325. F.E. 33:488.

6. *Robesoniana*, Sarg. (*C. spissiflora*, Sarg.) Shrub, with numerous erect sts., to 12 ft., or occasionally small tree, to 20 ft.: spines few, stout, 1– $1\frac{1}{2}$  in. long: lvs. oblong-ovate, acute, or acuminate, rounded or broadly cuneate at the base, sharply doubly serrate with many broad acute lobes, pubescent below on the veins while young, glabrous at maturity, scabrate above, 2–3 in. long: corymbs pubescent, 4–6-flid., compact; calyx villous, lobes glabrous outside: fr. ovoid, scarlet,  $\frac{3}{4}$  in. long, with small calyx; flesh thin, mealy; stones 4–5. May; fr. Sept., soon falling. N. Y. to S. Ont.—This species was formerly sold by Ellwanger & Barry under the name *C. coccinea*.

## 2. PRUINOSÆ.

7. *pruinosa*, Koch (*C. coccinea* var. *viridis*, Torr. & Gray). Shrub or tree, to 20 ft.: branches spreading with numerous stout straight spines: lvs. elliptic or ovate, acute, usually broadly cuneate at the base, irregularly and often doubly serrate, with 3–4 pairs of short acute lobes, red when unfolding, later dark bluish green above, paler below, glabrous, 1–2 in. long: corymbs rather few-flid.; fls. slender-pedicelled,  $\frac{3}{4}$ –1 in. across; stamens 20; anthers pinkish: fr. subglobose, apple-green and glaucous until nearly fully ripe, finely dark purple with yellow sweet flesh and 5 stones: calyx prominent with a well-developed tube. May; fr. Oct. Vt. to Va., and Ill. S.S. 13:648.

8. *Barryana*, Sarg. Shrub, to 15 ft.: branches spreading or ascending with slender spines: lvs. broadly ovate, rounded or abruptly cuneate at the base, sharply doubly serrate and slightly lobed, scabrate above, glabrous and glaucous below, 2–3 in. long: corymbs glabrous; calyx-lobes entire or sparingly dentate; fls.  $\frac{3}{4}$  in. across; stamens 7–10, with purple anthers: fr. obovoid, crimson with small pale dots, pruinose,  $\frac{3}{4}$  in. long, with usually 3 nutlets. May; fr. in Oct. W. N. Y.

## 3. DELTOIDES.

9. *coccinioides*, Ashe. Fig. 1099. Tree, sometimes 20 ft.: branches stout, spreading, forming a broad handsome head: spines thick,  $1\frac{1}{2}$ –2 in. long: lvs. broadly ovate, acute, rounded or truncate at the base, doubly serrate, with several pairs of broad acute lobes, at first yellowish green and lustrous above, villous on the veins beneath, later dull dark green above, paler and nearly glabrous beneath, 2–3 in. long: fls.  $\frac{3}{4}$  in. across, in compact 5–7-flid., sometimes slightly villous: corymbs: fr. subglobose, dark crimson and lustrous,  $\frac{3}{4}$  in. across, with thick subacid reddish flesh and 4–5 stones. May; fr. early in Oct. and falling gradually. Mo., Ind., and Kans. S.S. 13:674. M.D.G. 1901: 358, 359.—Very handsome small tree, the foliage tinged red when unfolding and turning scarlet and orange in autumn.

10. *speciosa*, Sarg. Shrub, to 15 ft., usually with many sts.: spines numerous, 1–2 in. long: lvs. ovate, acute or acuminate, rounded or subcordate at the base, doubly serrate and with 4–5 pairs of broad and short acute lobes, tinged red when unfolding and nearly glabrous, at maturity thick, dark green and lustrous



above, paler below and quite glabrous, 2-3 in. long: corymbs glabrous, 5-8-fld.; fls. 1. in. across: fr. depressed-globose, bright crimson and lustrous, nearly 1 in. broad, with thin yellow flesh and 5 stones. May; fr. the middle of Sept., soon falling. Mo. S.T.S. 1:33.—Very handsome with its lustrous lvs., large fls. and brilliant fr.

#### 4. COCCINEÆ.

11. *pedicellâta*, Sarg. Tree, to 20 ft., with rather slender spreading or ascending branches forming a symmetrical head: spines straight or slightly curved,  $1\frac{1}{2}$ -2 in. long: lvs. broadly ovate, broadly cuneate or truncate at the base, coarsely and often doubly serrate, above the middle with 4-5 pairs of short acute lobes, at maturity membranous, dark green and scabrous above, paler and nearly glabrous below, 2-4 in. long: fls.  $\frac{1}{2}$  in. across in loose slightly villous corymbs; calyx-lobes coarsely glandular-serrate: fr. pear-shaped or ovoid, bright scarlet, lustrous, with conspicuous persistent calyx; flesh thin, mealy; stones 4-5. May; fr. Sept. Pa. to Conn., N. Y., and Ont. S.S. 13:677.

#### 5. TENUIFOLIÆ.

12. *pastòrum*, Sarg. (*C. macrospërma* var. *pastòrum*, Eggleston). Glabrous shrub, sometimes to 15 ft., with many erect sts., armed with numerous stout or slender spines: lvs. ovate, acute, usually rounded at the base, doubly serrate, slightly lobed, at maturity thick, dark dull blue-green, glaucescent below,  $1\frac{1}{2}$ -2 in. long: fls.  $\frac{3}{4}$  in. across in many-fld. corymbs; calyx-lobes lanceolate, entire or obscurely serrate: fr. ovoid, bright scarlet, lustrous, about  $\frac{1}{2}$  in. long, with thick, yellow and mealy flesh and 2-3 stones. New England. May; fr. Sept. S.S. 4:180 (as *C. coccinea*).

#### 6. ROTUNDIFOLIÆ.

13. *rotundifolia*, Moench (*C. coccinea* var. *rotundifolia*, Sarg. *C. glandulosa*, Willd.) Shrub or bushy tree, sometimes to 20 ft., with slender, straight or curved spines: lvs. ovate-orbicular to oval, or obovate, acute, broadly cuneate at the base, rather coarsely serrate and usually with 3-4 pairs of short acute lobes, glabrous, 1-2 $\frac{1}{2}$  in. long: corymbs glabrous or slightly villous; fls.  $\frac{3}{4}$ -1 in. across; calyx-lobes and bractlets very glandular: fr. subglobose, about  $\frac{1}{2}$  in. long, red with yellow sweet flesh and 2-3 stones. May; fr. Sept. Nova Scotia to Sask., Ill. and Va. G.C. II. 14:557. Gn. 22, p. 145; 33, p. 464.—The most northern species. Var. *pùbera*, Sarg. (*C. coccinea*, Linn., in part). Branchlets, petioles and the lvs. on the veins more or less pubescent below while young.

#### 7. INTRICATÆ.

14. *intricatâ*, Lange. Shrub, to 10 ft.: branches upright or spreading, with rather long curved spines: lvs. elliptic-ovate, acute, cuneate at the base, doubly serrate with 3-4 pairs of short acute lobes, at first slightly pubescent, later scabrate above, bright green, slightly paler beneath and nearly glabrous, 1-2 $\frac{1}{2}$  in. long: corymbs slightly villous; fls. about 1 in. across; calyx-lobes serrate: fr. subglobose to ovoid, sparingly villous or glabrous, dull reddish brown, with usually 3-4 stones. May; fr. Oct., Nov. Mass. and Vt. to Pa. Lange 1.

15. *Bückleyi*, Beadle. Large shrub or tree, often to 25 ft., with stout spreading or ascending branches and stout straight spines  $\frac{1}{2}$  in. long: lvs. broadly ovate or oval, acute, usually rounded at the base, coarsely serrate and incisedly lobed with acuminate lobes, glabrous and thick and firm at maturity: corymbs 3-7-fld., compact, glabrous; fls.  $\frac{3}{4}$  in. across; sepals serrate toward the apex and stipitate-glandular: fr. subglobose, usually angled, about  $\frac{1}{2}$  in. across, yellowish green and flushed red or red, with 3-5 stones. May; fr. Sept. and Oct. Va. to N. C. and Tenn. S.M. 464.

16. *Boýntonii*, Beadle. Tree, occasionally to 20 ft., with stout ascending branches: spines straight, thin,  $1\frac{1}{2}$ -2 in. long: lvs. broadly ovate to oval, acute, sharply serrate with glandular teeth and often with 2-3 pairs of short acute lobes, bronzy red when unfolding and slightly viscid, at maturity yellowish green, thick and firm and glabrous, 1-2 $\frac{1}{2}$  in. long; petioles glandular: fls.  $\frac{3}{4}$  in. across, in 4-10-fld. glabrous corymbs; calyx-lobes entire or obscurely glandular-serrate above the middle: fr. depressed-globose, yellowish green flushed with red, about  $\frac{1}{2}$  in. across, with 3-5 stones. May; fr. Oct. Va. to Ky., Tenn. and Ala. S.S. 13:650.

#### 8. VIRIDES.

17. *viridis*, Linn. (*C. arborëscens*, Ell.). Tree, to 35 ft., with spreading branches forming a round, rather compact head: spines slender: lvs. oblong-ovate to oval, acute or acuminate, serrate above the cuneate base, dark green and lustrous above, paler below, finally glabrous, 1-3 in. long: corymbs glabrous; pedicels slender; calyx-lobes lanceolate, entire: fr. globose, bright red,  $\frac{1}{6}$ - $\frac{1}{4}$  in. across, with usually 5 stones. Md., Va. to Ill., Iowa, Texas and Fla. May; fr. Oct., persisting through the winter. S.S. 4:187.

18. *nítida*, Sarg. Tree, to 30 ft., with spreading branches unarmed or with thin straight spines: lvs. elliptic to oblong-obovate, acuminate, coarsely serrate except at the cuneate base, often slightly lobed, dark green and lustrous above, paler below, glabrous, 1-3 in. long: corymbs glabrous, calyx-lobes elongated, entire or sparingly glandular-serrate: fr. ovoid or subglobose, dark dull red, about  $\frac{1}{2}$  in. long with thick mealy flesh and 2-5 stones. May; fr. Oct., persistent through the winter. Ill., Kans. S.S. 13:703.—Like *C. viridis* very ornamental with its lustrous foliage and persistent frs.



1099. *Cratægus coccinioides* ( $\times \frac{2}{3}$ ). No. 9.

## 9. CRUS-GALLI.

19. *Crus-galli*, Linn. COCKSPUR THORN. Shrub or tree, to 40 ft.: branches wide-spreading, rigid, often pendulous, with numerous slender spines: lvs. obovate or oblanceolate, irregularly and sharply serrate, usually rounded at the apex, quite glabrous, 1-2½ in. long, often semi-persistent: corymbs glabrous; calyx-lobes entire or minutely serrate: fr. usually globose, red, with usually 2 stones; flesh thin and dry. May, June: fr. late in Oct. Que., south to N. C., west to Mich. S.S. 4:178. Em. 492. R.B. 1:116. G.F. 7:295. G.C. III. 28:244, suppl. Sept. 29.—A very decorative species of distinct habit, handsome in bloom and with showy, bright red fr., remaining on the branches often until spring; the lvs. assume a brilliant orange and scarlet color in fall. Often used for hedges. Var. *inermis*, Lange. Spineless form. Var. *linearis*, Ser. Lvs. linear-lanceolate. Var. *nana*, Nichols. Dwarf form. Var. *pyracanthifolia*, Ait. Lvs. elliptic or obovate, usually acute: fr. smaller, brighter red. W. N. Y. and Pa. to Fla. and Tenn. S.S. 13:637. Var. *salicifolia*, Ait. Lvs. oblanceolate or lanceolate, thinner. Var. *splendens*, Ait. (var. *lucida*, Hort.). Lvs. elliptic-oblanceolate, very shining. Var. *ovalifolia*, Lindl. (*C. pennsylvanica*, Hort., not Ashe). Lvs. elliptic or elliptic-obovate, less lustrous: fr. ovoid. B.R. 22:1860. Gn. 22, p. 146; 33, p. 468.—This is probably not a variety of *C. Crus-galli*, but a distinct species identical with one of the recently described species of this group.

20. *Cánbyi*, Sarg. Shrub or bushy tree, to 20 ft.: branches wide-spreading, with thick usually straight spines: lvs. oblong-obovate to elliptic, acute or obtuse, coarsely and often doubly serrate above the middle, glabrous, 1½-3 in. long: corymbs glabrous; calyx-lobes entire or sparingly serrate: fr. subglobose or ovoid, about ½ in. long, dark crimson, with juicy flesh and 3-5 stones. May; fr. Oct. E. Pa., Del., Md. S.S. 13:638.

21. *fecúnda*, Sarg. Small tree, to 25 ft.: branches wide-spreading, with slender spines: lvs. oblong-ovate to oval, usually acute, doubly serrate, with strongly marked veins, 1½-3 in. long: corymbs slightly villous; calyx-lobes glandular-serrate: fr. subglobose to ovoid, ½-¾ in. long, orange-red, with thick flesh and 2-3 stones. May; fr. Oct. Mo., Ill. S.S. 13:641.

22. *Arduénnae*, Sarg. Shrub or tree, to 20 ft.: branches spreading, forming a round-topped head: spines slender: lvs. oblong-obovate, acute, acuminate or rounded, crenulate-serrate from below the middle, with obscure veins, 1½-2½ in. long: corymbs glabrous, pedicels slender; calyx-lobes entire or slightly serrate:



1100. *Cratægus punctata*. No. 26.

fr. ovoid, dull dark crimson, about ½ in. long, with 1-2 stones. May; fr. the middle of Sept. Pa. to Ill., Mich. and Ont. S.M. 373.

23. *Carrièrei*, Vauv. Small tree, to 20 ft., with spreading branches and stout spines: lvs. elliptic or oblong-obovate, acute, pubescent below, glabrous above at

length and lustrous, irregularly serrate, 3-4 in. long: corymbs rather few-fl., pubescent; fls. large, with red disk; calyx-lobes linear, serrulate: fr. bright orange or brick-red, ovoid, about ½ in. long, with 1-3 stones. May. R.H. 1883:108. G.C. III. 21:118, 119.—Probably hybrid between *C. Crus-galli* and *C. mexicana*, originated in France. Possibly not different is *C. Lavallei*, Herincq, described with larger subglobose fr.

24. *persistens*, Sarg. Low tree, 12 ft. or more: branches wide-spreading, with numerous stout spines to 2 in. long: lvs. lanceolate to oblong-obovate, acuminate, cuneate at the base, coarsely serrate above the middle, at maturity glabrous, dark green and lustrous above, pale beneath, 2-3 in. long: corymbs slightly villous; fls. over ¾ in. across; calyx-lobes glandular-serrate above the middle or entire; stamens 20, anthers white; styles surrounded at the base by a broad ring of pale tomentum: fr. ovoid or slightly obovate, crimson, not lustrous, over ½ in. across; flesh thick and mealy, with 2-3 stones. May: fr. in Oct. S.T.S. 2:190.—Of unknown origin, possibly a hybrid of *C. Crus-galli*. Raised at the Arnold Arboretum. The lvs. remain on the branches unchanged until those of all the other hawthorns have fallen and the frs. persist until late into the winter. One of the most conspicuous of winter fruiting plants.

## 10. MEXICANÆ.

25. *mexicana*, Sess. & Moc. (*C. hypolasia*, Koch). Small tree, to 30 ft.: branchlets tomentose, unarmed or with short spines: lvs. cuneate-oblong or elliptic-lanceolate, obtuse or acute, crenate-serrate and often slightly lobed toward the apex, pubescent above, sometimes nearly glabrous, tomentose below, 1½-3½ in. long: corymbs white-tomentose; fls. ¾ in. wide; calyx-lobes entire or with a few teeth at the apex; stamens 20, with pink anthers: fr. ovoid to pyriform, orange or dull orange-red, ¾-1 in. thick, edible, with 3-5 nutlets. March; fr. Oct., Nov. Mex. B.R. 22:1910.

## 11. PUNCTATÆ.

26. *punctata*, Jacq. Fig. 1100. Tree, to 25 ft.: branches horizontally spreading, with short, stout spines or unarmed: lvs. obovate, obtuse or acute, narrowed at the base into a rather long margined petiole, irregularly serrate, on the shoots often slightly lobed, villous below, with impressed veins above, 2-4 in. long: corymbs villous; fls. large; calyx-lobes entire: fr. pyriform or subglobose, dull red, dotted, about ½ in. across, with 5 stones. May; fr. Oct., falling soon. From Que. to Ont., Ill. and Ga. S.S. 4:184. A.F. 28:805. Var. *aurea*, Ait. (var. *xanthocarpa*, Roem. *C. crocata*, Ashe). Fr. yellow.

27. *collina*, Chapm. Shrub or small tree, occasionally 25 ft.: branches wide-spreading, with stout spines, on the trunk with large branched spines: lvs. obovate or oval, acute, broadly cuneate at the base, irregularly, often doubly serrate, at maturity yellowish green above, paler below and glabrous except on the midrib: corymbs villous; calyx-lobes glandular-ciliate; anthers yellow: fr. subglobose, dull red, ½-¾ in. long, with yellow mealy flesh and usually 5 stones. May; fr. Oct. Va. to Tenn. and Ala. S.S. 13:654.

## 12. ÆSTIVALES.

28. *æstivalis*, Torr. & Gray. MAY HAW. APPLE HAW. Tree, to 30 ft., with a round compact head, unarmed or with stout straight spines 1-1½ in. long: lvs. elliptic to oblong-obovate, acute or rounded, gradually narrowed into the ¼-1 in. long petiole, sinuate-dentate or crenate-serrate, at maturity dark green and lustrous above, below, particularly on the veins, densely rusty-pubescent, 1½-2½ in. long: fls. with the lvs., 1 in. across, in 2-5-fl. glabrous corymbs; calyx-lobes entire or minutely glandular-serrate: fr. depressed-



globose, fragrant,  $\frac{1}{2}$ – $\frac{3}{4}$  in. across, bright red, crowned by the conspicuous calyx, with juicy subacid flesh and 3–5 stones. Feb., March; fr. May. Fla. to Ark. and Texas. S.S. 4:192.—The fr. is made into preserves and jellies.

### 13. UNIFLORÆ.

29. *uniflora*, Moench (*C. parvifolia*, Ait. *C. tomentosa*, Eggleston, not Linn. *C. florida*, Loud.). Dense, low shrub, with numerous slender spines, rarely spineless, 3–8 ft.: lvs. on short not glandular petioles, cuneate, obovate or oblong-obovate, irregularly or doubly crenate-serrate, pubescent on both sides, at length glabrous above,  $\frac{1}{2}$ – $1\frac{1}{2}$  in. long; fls.  $\frac{1}{2}$  in. across, 1–3-fl. corymbs; calyx pubescent, with large serrate lobes: fr. pyriform or globose, yellow,  $\frac{1}{2}$  in. across, with 3–5 stones. May, June. Ga. and Ala. to Fla. S.S. 4:191.

30. *Vailiæ*, Brit. Shrub, to 12 ft., with slender straight spines: lvs. oval or ovate, acute, cuneate at the base, crenate-serrate and often slightly lobed, at maturity glabrous and lustrous above, pubescent below,  $\frac{1}{2}$ – $1\frac{1}{2}$  in. long; fls.  $\frac{1}{2}$  in. across, in 2–6-fl., pubescent corymbs; calyx-lobes glandular-serrate: fr. globose,  $\frac{1}{2}$  in. across, dull red, with 3–5 stones. May; fr. Oct. Va. to Ga. and Ala.

### 14. FLAVÆ.

31. *flava*, Ait. Tree, to 20 ft.: branches wide-spreading, with thin nearly straight spines: lvs. broadly obovate or elliptic, acute or nearly rounded, cuneate at base, coarsely and doubly serrate, on vigorous shoots usually slightly lobed, the teeth tipped with red glands, at maturity puberulous only on the veins below, about 2 in. long; petioles glandular, short: corymbs few-fl., slightly villous; calyx-lobes glandular-serrate; fls.  $\frac{3}{4}$  in. across; stamens 20, with purple anthers: fr. ovoid, dark orange-brown,  $\frac{1}{2}$  in. long, with dry and mealy flesh and 5 stones. April; fr. in Oct. Ga. and Fla. S.S. 13:693.—The true *C. flava* is not in cult.; the plant now cult. as *C. flava* is quite different and is apparently not very closely related to this species; it has so far not been found growing wild in E. N. Amer., though it was apparently intro. from the southern states. As it has not yet been determined to which species it belongs, it may be enumerated here as var. *lobata*, Lindl. Shrub or small tree: lvs. ovate or obovate, cuneate at the base, acute, crenately serrate and often slightly lobed, at maturity pubescent on the veins beneath, 1–2 in. long; corymbs pubescent, few-fl.; stamens 10: fr. pyriform, green or reddish with hard flesh, and 3–5 stones. B.R. 23:1932, 1939. G.C. III. 27:404.—Tender.

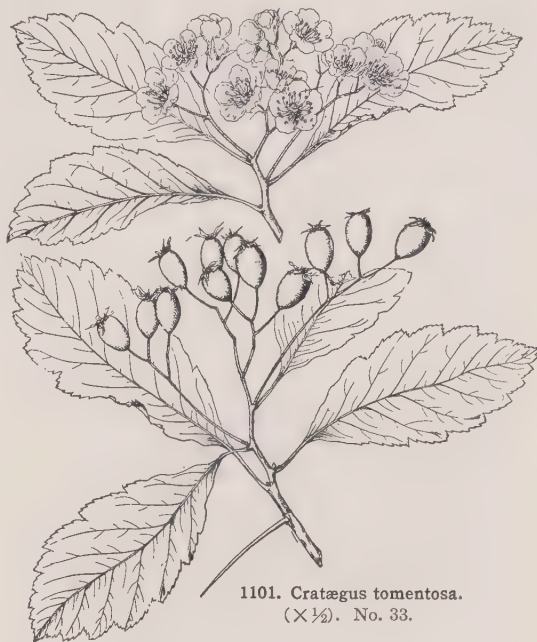
32. *ápica*, Beadle. A shrub or small tree, sometimes to 20 ft., with spreading branches and slender zigzag branchlets armed with thin straight spines 1– $1\frac{1}{2}$  in. long: lvs. broadly obovate or oval, acute or rounded at the apex, narrowed into the short petiole, serrate usually only above the middle and often slightly lobed, with gland-tipped teeth, pubescent on both sides while young, at maturity glabrous, dark yellow-green and thickish,  $\frac{3}{4}$ – $1\frac{1}{2}$  in. long; fls.  $\frac{3}{4}$  in. across, in 3–6-fl. compact pubescent corymbs; calyx-lobes glandular-serrate: fr. globose,  $\frac{1}{2}$  in. across, dull orange-red, with 3–5 stones. May; fr. Oct. Va. to Ga. and Tenn. S.S. 13:698.—This species has proved hardy at the Arnold Arboretum.

### 15. TOMENTOSÆ.

33. *tomentosa*, Linn. (*C. Calpodendron*, Medikus. *C. pyrifolia*, Ait. *C. leucophlæos*, Moench. *C. Chapmani*, Ashe). Fig. 1101. Shrub or small tree, to 20 ft., with spreading branches unarmed or with short spines: lvs. cuneate, obovate-oblong or elliptic, acute, serrate and often slightly lobed, dull green and usually finely glabrous above, below pubescent, 2–5 in. long; corymbs pubescent, compound and many-fl.; fls.  $\frac{1}{2}$  in. across; calyx-lobes serrate: fr. usually oval, dull yellow or

yellowish red,  $\frac{1}{4}$ – $\frac{1}{2}$  in. across, sweet and succulent, in upright corymbs; stones 2–3, with 2 furrows on the inner side. June; fr. Oct. Ont. to Minn., south to Tenn. and Mo. S.S. 4:183. G.F. 2:425 (adapted in Fig. 1101). Gn. 22, p. 145. B.R. 22:1877.

34. *succulenta*, Link. (*C. macracantha* var. *succulenta*, Rehd.). Tree, sometimes to 20 ft., with stout ascending branches, armed with numerous stout



1101. *Cratægus tomentosa*.  
( $\times \frac{1}{2}$ ). No. 33.

slightly curved spines: lvs. elliptic, acute or acuminate, gradually narrowed into the stout winged petiole, coarsely and usually doubly serrate and with many short acute lobes, at maturity dark green, thickish and somewhat lustrous above, pale green and usually puberulous on the veins below, 2–3 in. long; fls.  $\frac{2}{3}$  in. across, in many-fl. villous corymbs; stamens usually 20, sometimes 15: fr. globose, bright scarlet,  $\frac{1}{2}$ – $\frac{2}{3}$  in. across, with juicy sweet flesh and 2–3 stones. May; fr. Sept., Oct. Que. and Ont. to Mass. and Ill. S.S. 4:181 (as *C. coccinea* var. *macracantha*).

35. *macracantha*, Lodd. (*C. coccinea* var. *macracantha*, Dudley). Fig. 1102. Shrub or small tree, to 20 ft., of dense growth, with numerous long and slender spines: lvs. rather slender-petioled, broadly elliptic or ovate, doubly serrate, glabrous, at maturity thickish, shining and dark green above, almost glabrous beneath, 1– $2\frac{1}{2}$  in. long; corymbs slightly villous; fls.  $\frac{3}{4}$  in. across; stamens 10; calyx-teeth glandular-serrate: fr. subglobose,  $\frac{1}{2}$  in. diam., dark cherry-red, shining, with usually 2–3 stones. May, June. W. N. Y. and Vt. to Pa. S.S. 13:689. B.R. 22:1912. L.B.C. 11:1012 (as *C. glandulosa*). A.G. 11:509. M.D.G. 1906:561. G.W. 5:245.—Sometimes cult. under the name of *C. Douglasii*. See page 3567.

36. *prunifolia*, Pers. Shrub or tree, to 30 ft.: branches spreading or somewhat ascending, spiny: lvs. obovate, or roundish obovate, doubly serrate, glabrous or pubescent on the veins beneath when young, 2–3 in. long; corymbs pubescent; stamens 10; anthers pink: fr. red; stones with 2 furrows on the inner side, sometimes nearly plain. May, June.—Origin unknown; by some thought to be a hybrid between *C. Crus-galli* and *C. macracantha* or *C. succulenta*. B.R. 22:1868. G.W. 8:114. Var. *variegata*, Hort. Lvs. variegated with yellowish white. F.W. 1877:65.

## 16. DOUGLASIANÆ (page 3567).

37. *Doùglasii*, Lindl. (*C. sanguinea* var. *Doùglasii*, Torr. & Gray). Tree, to 40 ft., with slender, often pendulous branches, unarmed or with short spines: lvs. short-petioled, broadly ovate or oblong-ovate, acute, gradually narrowed at the base, serrate and slightly lobed, nearly glabrous, pubescent on the midrib above, chartaceous, 1-4 in. long: corymbs glabrous; fls.  $\frac{1}{3}$ - $\frac{1}{2}$  in. across; stamens 20; calyx-lobes triangular-ovate, usually glandular-serrate above the middle: fr. ovoid,  $\frac{1}{2}$  in. long, black and lustrous, with sweet, light yellow flesh and 3-5 nutlets. May; fr. Aug., Sept. Brit. Col. and N. Calif. to Wyo. S.S. 4:175. B.R. 21:1810.

## 17. SANGUINEÆ.

38. *sanguinea*, Pall. Shrub or small tree, to 20 ft., with upright, spreading branches and short spines: lvs. ovate or broadly ovate, narrowed into the petiole, irreg-

1102. *Cratægus macracantha* ( $\times \frac{1}{2}$ ). No. 35.

ularly serrate and slightly lobed, more deeply lobed on vigorous shoots, at first hairy above and often also below, at maturity glabrous or nearly glabrous,  $1\frac{1}{2}$ -3 in. long: corymbs pubescent or glabrous; fls. large; stamens 20, with purple anthers: fr.  $\frac{1}{2}$  in. diam. May; fr. in Aug., Sept. E. Siberia. Var. *chlorocarpa*, Schneid. (var. *xanthocarpa*, Regel). Fr. yellow, smaller: anthers whitish.

39. *dahùrica*, Koehne (*C. purpurea*, Bosc. *C. sanguinea* var. *altàica*, Loud.). Shrub or small tree: spines to  $1\frac{1}{2}$  in. long: lvs. ovate or broadly elliptic-ovate, acute, broadly cuneate at the base, sharply serrate, those of the flowering branches very slightly or scarcely lobed, those of the shoots distinctly and acutely lobed, glabrous,  $\frac{3}{4}$ -2 in. long: corymbs glabrous; fls.  $\frac{1}{2}$  in. across: fr. subglobose,  $\frac{1}{2}$  in. across, orange-red. April, May; fr. Aug. E. Siberia.—The earliest leafing species of all hawthorns; very graceful; hardy.

## 18. CORDATÆ.

40. *Phænopyrum*, Medikus (*C. cordata*, Ait. *C. acerifolia*, Moench. *C. populifolia*, Walt.). WASHINGTON THORN. Tree, to 30 ft., with slender spines: lvs.

slender, petioled, triangular or broadly ovate, usually truncate at the base, 3-5-lobed, sharply serrate,  $1\frac{1}{2}$ -2 $\frac{1}{2}$  in. long: corymbs many-fl., glabrous; styles 5: fr. depressed-globose,  $\frac{1}{4}$  in. across, shining, bright coral-red; calyx deciduous, leaving a circular scar; stones 3-5. May, June; fr. Sept., Oct. Va. to Ala. and Mo. S.S. 4:186. B.R. 14:1151. F.E. 28, p. 103 (habit).—A very desirable species, with beautiful fall-coloring and large clusters of bright red fr. remaining a long time on the branches. Formerly much used for hedges.

## 19. APIIFOLLÆ.

41. *apiifolia*, Michx. (*C. Marshallii*, Eggleston). Shrub or small tree, rarely 20 ft., with stout spines and the branchlets pubescent when young: lvs. slender-petioled, broadly ovate, pinnately 5-7-cleft, serrate, glabrous or pubescent,  $\frac{3}{4}$ -1 $\frac{1}{2}$  in. long: corymbs few-fl., villous; styles 1-3: fr. ovoid,  $\frac{1}{4}$  in. high, scarlet, with 1-3 stones; calyx often deciduous. April, May; fr. Oct. Va. to Fla., Ark. and Texas. S.S. 4:188.—A handsome species with graceful foliage and an abundance of white fls. in spring and small but brightly colored frs. in fall.

## 20. BRACHYACANTHÆ.

42. *brachyacantha*, Sarg. & Engelm. Tree, to 50 ft., with stout spreading branches, armed with numerous short usually curved spines,  $\frac{1}{3}$ - $\frac{1}{2}$  in. long: lvs. obovate-oblong, oblong-lanceolate or elliptic, acute or sometimes obtuse, cuneate at the base, crenulate-serrate, rarely slightly lobed, glabrous at maturity, lustrous above,  $\frac{3}{4}$ -2 in. long: corymbs many-fl., glabrous; fls.  $\frac{1}{3}$  in. across, turning orange in fading; stamens 15-20: fr. subglobose,  $\frac{1}{3}$ - $\frac{1}{2}$  in. across, bright blue and bloomy, with 3-5 stones. April, May; fr. Aug. La. and Texas. S.S. 4:177.—The only species with blue fr.; hardy only S.

## 21. PENTAGYNÆ.

43. *nigra*, Kit. (*C. carpathica*, Lodd.). Shrub or small tree: branches pubescent or tomentose, with short spines: lvs. short-petioled, ovate or ovate-elliptic, deeply pinnately 5-9-lobed with serrate lobes, slightly pubescent above, densely pubescent beneath, 2-3 in. long: corymbs dense, 10-15-fl., tomentose; pedicels short; fls. white, becoming slightly red; anthers yellowish: fr. subglobose,  $\frac{1}{2}$  in. across, black, lustrous, juicy, with 5 stones. May; fr. in Aug. S.E. Eu. L.B.C. 11:1021. L.I. 30.

44. *pentágyna*, Waldst. & Kit. (*C. melanocarpa*, Bieb.). Shrub or small tree, to 15 ft.: young branchlets pubescent, with short spines: lvs. ovate to obovate, irregularly and usually sparingly serrate, pinnately 3-7-lobed, hairy above while young, finally nearly glabrous above, pubescent below, 1-2 in. long: corymbs villous; fls.  $\frac{1}{2}$  in. across, anthers red: fr. ovoid or obovoid, purplish black,  $\frac{1}{2}$  in. long, with 4-5 stones. May; fr. Sept., Oct. S. E. Eu., Caucasus. B.R. 22:1874; 23:1933 (as *C. Oxyacantha Oliveriana*). R.H. 1901, p. 310.

## 22. OXYACANTHÆ.

45. *Oxyacantha*, Linn. HAWTHORN or MAY of English literature. Shrub or small tree, to 15 ft., with spreading glabrous branches and stout spines: lvs. short-petioled, cuneate or truncate at the base, roundish or broadly ovate, 3-5-lobed, with broad, serrulate lobes, 1-2 in. long: corymbs 5-10-fl., glabrous: fr. globular or roundish oval,  $\frac{1}{3}$ - $\frac{1}{2}$  in. high, scarlet; stones 2, with 2 furrows on the inner side. May. Eu., N. Afr. B.R. 13:1128 (as *C. oxyacanthoides*). Var. *bicolor*, Rehd. (*C. Oxyacantha* var. *Gumpperi bicolor*, Hort. *C. Oxyacantha rubra*, Schneid.). Fls. white in the center, edged red. F.S. 16:1651. Var. *Paùlii*, Rehd. (var. *coccinea*, Hort. Var. Paul's New Double Scarlet. *C. Oxyacantha* var. *spléndens*, Schneid.). Fig. 1103. With



double, bright scarlet fls.; one of the most showy. I.H. 14:536. F. 1867:117. Var. *aurea*, Loud. (*C. Oxyacantha* var. *xanthocarpa*, Lange). With yellow fr. Var. *quercifolia*, Loud. Lvs. with broad, rounded and crenate lobes.—Most of the garden forms usually listed as varieties of *C. Oxyacantha* belong to the following species. Even the varieties enumerated above are by some botanists not considered true *C. Oxyacantha*, but referred to *C. media*, Bechst., a hybrid between this and the following species; the existence of hybrid forms makes the distinction between the two species still more difficult.

46. *monogyna*, Jacq. (*C. Oxyacantha*, Hort.). Shrub or tree, to 20 ft., with stout spines: lvs. on rather slender petioles, ovate, 3-7-lobed, lobes with few teeth at the apex, 1-2 in. long; corymbs many-fl., with usually hairy pedicels: fr. oval, with usually 1 stone,  $\frac{1}{2}$ - $\frac{1}{2}$  in. high. May, June. Eu. and N. Afr. to Himalayas. Gn. 33, p. 465; 37, p. 467; 40, p. 500; 52, p. 266; 55, p. 452. R.H. 1900, p. 72 (all as *C. Oxyacantha*).—Many garden forms are cult.; some of the most distinct are the following: Var. *punicea*, Rehd. Fls. deep red, single. F.S. 15:1509, fig. 1. L.B.C. 14:1363. Var. *rosea*, Hort. Fls. pink, petals with white claw. Var. *albo-plena*, Schneid. With white double fls. F.S. 15:1509, fig. 2. Var. *rubro-plena*, Schneid. With double red fls. F.S. 15:1509, fig. 3. Varieties differing in lvs. and habit: Var. *laciniata*, Loud. Lvs. deeply pinnatifid with incised serrate lobes. Var. *pteridifolia*, Rehd. (*C. Oxyacantha* var. *pteridifolia*, Loud. Var. *flicifolia*, Hort.). Similar, but lvs. longer, with narrower and more incised lobes. F.S. 20:2076. Var. *ferox*, Schneid. (*C. Oxyacantha* var. *ferox* Carr. *C. Oxyacantha* var. *horrida*, Carr.) Branches with fascicles of numerous stout spines. F.S. 14:1468. G.C. III. 24:13. Var. *inermis*, Rehd. (*C. Oxyacantha* *inermis*, Dauthenay). A spineless form. R.H. 1900, p. 72, 73. Var. *pendula*, Loud. With pendulous branches. Gn. 68, p. 288. G.M. 44:827. M.D.G. 1902:25, 26. Var. *roseo-pendula*, Rehd. (*C. Oxyacantha* var. *pendula rosea*, Hort.). A pendulous form, with pink fls. Var. *stricta*, Loud. (var. *pyramidalis*, Hort.). Of fastigate, upright habit. G.C. III. 41:184. M.D.G. 1906:390. Var. *semperflorens*, Rehd. (var. *Briantii*, Carr.). Low, graceful shrub, flowering until fall. R.H. 1883, p. 140. Gn. 29, p. 431; 33, p. 465. There are also some varieties with variegated lvs.

## 23. ORIENTALES.

47. *tanacetifolia*, Pers. Shrub or small tree: branches with short spines or unarmed, branchlets tomentose: lvs. cuneate, obovate, pinnately 5-7-cleft, with the lobes glandular-serrate, villous-pubescent, 1-2 in. long; corymb dense, 5-7-fl.; calyx-lobes large, deeply glandular-serrate; fls. large: fr. pubescent, yellow, 1 in. or more across, with laciniate bracts at the base. May, June. Asia Minor. B.R. 22:1884. Gt. 43, p. 215.

48. *orientalis*, Pall. (*C. odoratissima*, Lindl. *C. apifolia*, Hort.). Shrub or small tree, with spreading, almost unarmed branches and tomentose branchlets: lvs. short-petioled, cuneate, obovate or oblong, pinnately 3-5-cleft, with the lobes incisely serrate at the apex, tomentose pubescent, 1-2 in. long; corymb dense, tomentose; calyx-lobes entire: fr. depressed globose, brick- or orange-red,  $\frac{3}{4}$ -1 in. across, with 4-5 stones. June. S. E. Eu., Asia Minor. B.M. 2314. B.R. 22:1885 (as *C. odoratissima*). Gn. 28:632 (as *C. tanacetifolia*), and p. 635. G.M. 40:824. Var. *sanguinea*, Rehd. (*C. sanguinea*, Schrad., not Pall. *C. Tournefortii*, Griseb.). Lvs. more glabrescent: fr. dark red, with 2-4 stones. B.R. 22:1852.

49. *Azàrolus*, Linn. (*C. Aronia*, Ser. *C. maïra*, Linn. f.). Shrub or tree, to 25 ft., with pubescent branchlets: lvs. short-petioled, cuneate-obovate, deeply 3-5-lobed, with the lobes nearly entire or incised at the apex,

grayish green, pubescent,  $1\frac{1}{2}$ -2 $\frac{1}{2}$  in. long; corymbs few-fl., densely tomentose: fr. orange-red or yellow, globular or ovoid,  $\frac{3}{4}$ -1 in. across. May. N. Afr., Asia Minor. B.R. 22:1897. (as *C. Aronia*). R.H. 1856:441. Var. *sinaica*, Boiss. Lvs. glabrous: fr. smaller, reddish yellow. B.R. 22:1855 (as *C. maroccana*). Gn. 22, p. 146; 28, p. 634.

## 24. PINNATIFIDÆ.

50. *pinnatifida*, Bunge. Fig. 1104. Shrub or small tree, to 20 ft.: lvs. slender-petioled, cuneate, elliptic-ovate, pinnately 5-9-cleft, incisely serrate: corymbs many-fl., usually pubescent: fr. globular or pyriform, dark red, punctate,  $\frac{1}{2}$ - $\frac{3}{4}$  in. high; stones 3-5. June. N. China, E. Siberia to Korea. R.H. 1901:308. Gt. 1862:366. Var. *major*, N. E. Br. (*C. Korolkowii*, Schneid., not Henry. *C. Bretschneideri*, Schneid. *C. californica*, Hort. *C. tatarica*, Hort.). Lvs. larger, less deeply lobed: fr. pyriform, 1 in. long. G.C. II. 26:620. R.H. 1901:308.

*C. altica*, Lange = *C. Wattiana*.—*C. ambigua*, C. A. Mey. Related to *C. monogyna*. Lvs. deeply 4-7-lobed, sparingly hairy on both sides, 1-2 in. long; corymbs slightly hairy: fr. ovoid, usually with 2 stones. S. Russia.—*C. Bætzleri*, Sarg.—*C. fœtida*.—*C. beata*, Sarg. Allied to *C. pruinosa*. Shrub, to 15 ft.: lvs. oblong-ovate, villous above while young; anthers dark maroon-color: fr.



1103. Paul's thorn—*Crataegus Oxyacantha* var. *Paulii*. (×  $\frac{1}{2}$ )

crimson, pruinose, ripens end of Sept. N. Y.—*C. Beckwithæ*, Sarg. Allied to *C. pastorum*. Shrub or tree, to 18 ft.: lvs. ovate, usually truncate at the base, at maturity thin; calyx-lobes glandular-serrate: fr. subglobose, crimson, with 5 stones. N. Y.—*C. bellula*, Sarg. Related to *C. pruinosa*. Shrub, to 12 ft.; glabrous: lvs. ovate, bluish green and lustrous above, 2-3 in. long; stamens 8-10: fr. dull crimson, bloomy,  $\frac{3}{4}$  in. across, with usually 4 stones. Mich. S.T.S. 1:56.—*C. berberifolia*, Torr. & Gray. Related to *C. Crugalli*. Lvs. obovate or obovate-oblong, obtuse, pubescent below, lustrous and nearly glabrous above,  $1\frac{1}{2}$ -2 in. long; corymbs pubescent; anthers yellow: fr. orange with red cheek. La. S.S. 4:179.—*C. Celsiana*, Bosc. Shrub: lvs. pinnately lobed, slightly pubescent beneath: corymbs many-fl.: fr. ovoid, red. Origin unknown, probably hybrid of *C. pentagyna*.—*C. champlainensis*, Sarg. Allied to *C. mollis*. Tree, to 20 ft., spiny: lvs. ovate, usually truncate at the base, lobed, glabrous above, pubescent on the veins below, 2-2 $\frac{1}{2}$  in. long; corymbs villous, usually 4-5-fl.; stamens 10: fr. obovoid or ovoid, scarlet,  $\frac{1}{2}$  in. long, in Sept. Que. and Ont. to Vt. and N. Y. S.S. 13:669.—*C. chlorosarca*, Maxim. Allied to *C. sanguinea*. Lvs. pinnately lobed, truncate at the base, with short lobes, glabrous at length: corymbs many-fl., nearly glabrous: fr. black, with green flesh. Japan.—*C. cognata*, Sarg. Closely related to *C. pruinosa*. Shrub, to 10 ft., spiny: lvs. ovate, acute or acuminate, slightly lobed, dull bluish green, glabrous: corymbs 5-7-fl.; anthers yellow: fr. ovoid or pyriform, pruinose, dull crimson at maturity, over  $\frac{1}{2}$  in. long, in Oct. Mass.—*C. compta*, Sarg. (*C. silvicola* var. *compta*, Eggleston). Allied to *C. pruinosa*. Shrub, spiny, glabrous: lvs. oblong-ovate, usually rounded at the base, slightly lobed, glabrous: corymbs many-fl.; stamens 7-10; anthers dark rose: fr. obovoid, light cherry-red,  $\frac{1}{2}$  in. long, in Oct. W. N. Y.—*C. conspecta*, Sarg. Allied to *C. pruinosa*. Tree, to 20 ft., spiny: lvs. broadly ovate, rounded or subcordate at the base, lobed, yellow-green, pubescent on the midrib below: corymbs 5-6-fl., slightly hairy, compact; anthers white: fr. subglobose, crimson, over  $\frac{1}{2}$  in. across, in Oct. Ont.—*C. crenulata*, Roxbg. = *Pyracantha crenulata*.—*C. cuneata*, Sieb. & Zucc. Belongs to group *Cuneata*. Shrub: young branchlets villous: lvs. short-petioled, cuneate-obovate or cuneate-oblong, crenate-serrate, glabrous and lustrous above, sparingly hairy below: corymbs villous, 3-7-fl.; stamens 20; anthers red: fr. red, with 5 stones, plain inside. China and Japan. L. I. 5.—*C. cupulifera*, Sarg. Allied to *C. rotundifolia*. Shrub, to 20 ft.: lvs. obovate or rhombic, slightly lobed, lustrous and scabrate above: corymbs slightly villous; fls. cup-shaped; stamens 10, anthers pink: fr. scarlet, with 3-4 stones. N. Y.—*C. Dayana*, Sarg. Allied to *C.*

pedicellata. Tree, to 15 ft., spiny: lvs. broadly ovate, acuminate, rounded or cuneate at the base, dark yellow-green, slightly hairy on the veins below while young; corymbs 10-14-fld.; fls.  $\frac{3}{4}$  in. across; stamens 20; fr. obovoid, crimson, in Sept., soon falling. W. N. Y.—*C. diffusa*, Sarg. Allied to *C. pruinosa*. Intricately branched spiny shrub, to 15 ft., glabrous: lvs. ovate, acuminate, rounded or cuneate at the base, dark bluish green and slightly scabrate above; corymbs 6-12-fld.; stamens 10; fr. subglobose, scarlet, less than  $\frac{1}{2}$  in. across, in Oct. W. N. Y.—*C. Dippehiana*, Lange (*C. tanacetifolia* var. *Leeana*, Hort. *C. tanacetifolia*  $\times$  *C. punctata*?). Small tree, spiny: lvs. rhombic-elliptic, lobed, sparingly pubescent above, densely beneath; corymbs densely villous; stamens 20; fr. subglobose, reddish yellow or dull red. Origin unknown. Gn. 33, p. 468.—*C. dissona*, Sarg. (*C. pruinosa* var. *dissona*, Eggleston). Allied to *C. pruinosa*. Slender spiny shrub, to 10 ft., glabrous: lvs. ovate to rhombic, cuneate at the base, dark bluish green; corymbs 5-7-fld.; stamens 10; anthers purple; fr. subglobose, crimson, in Oct. Mass.—*C. dsungarica*, Zabel. Allied to *C. sanguinea*. Tree:



lvs. deeply lobed, sparingly pubescent or nearly glabrous; corymbs slightly pubescent; fr. black; stones without or with slight furrows. Of unknown origin.—*C. Dúnbari*, Sarg. Shrub, to 12 ft., spiny: lvs. ovate to suborbicular, usually rounded at the base, slightly lobed, glabrous or slightly rough above; corymbs 10-14-fld.; fr. subglobose, crimson,  $\frac{1}{2}$  in. across, in Oct. W. N. Y. Belongs to group *Anomala*, allied to *Tenifolia*.—*C. durobriensis*, Sarg. Allied to *C. coccinioides*. Shrub, to 20 ft., spiny: lvs. ovate, with 3-4 pairs of short lobes, glabrous; corymbs glabrous; stamens 20; fr. bright red, in Oct. N. Y. S.T.S. 1:2.—*C. elliptica*, Ait. (*C. glandulosa*, Moench; *C. flava* var. *pubescens*, Gray). Allied to *C. flava*. Lvs. broader, of firmer texture, more pubescent and glandular; fr. subglobose, red or yellow. Southern states. B.R. 22: 1890 (as *C. spathulata*).—*C. elliptica*, Beadle, is *C. senta*, Beadle, a species allied to *C. flava*. S.S. 13:697.—*C. elliptica*, Mohr, is *C. signata*, Beadle, a species allied to *C. Crus-galli*. S.S. 13:644.—*C. exornata*, Sarg. Allied to *C. pruinosa*. Shrub, to 10 ft., spiny: lvs. ovate, usually rounded at the base, slightly lobed, dark yellow-green and rough above; corymbs 5-6-fld.; stamens 7-10; anthers pink; fr. subglobose, scarlet, less than  $\frac{1}{2}$  in. across, in Sept. Ont.—*C. Pázonii*, Sarg. Allied to *C. rotundifolia*. Shrub, to

10 ft., spiny: lvs. broadly ovate, with 4-5 pairs of short lobes, nearly glabrous at maturity; corymbs villous; stamens 5-10; fr. dark crimson, in Sept. N.H. S.T.S. 1:60.—*C. ferentaria*, Sarg. Allied to *C. macracantha*. Intricately branched shrub, to 12 ft., with stout spines; lvs. rhombic or obovate, puberulous below on the veins; corymbs slightly villous; stamens 7-10; anthers white; fr. subglobose or ovoid,  $\frac{1}{2}$  in. long, scarlet, with usually 2 stones, ripening in Oct. W. N. Y.—*C. flabellata*, Spach (*C. Grayana*, Eggleston). Allied to *C. pedicellata*. Shrub, to 20 ft.: lvs. ovate, with short acute lobes, at first sparingly hairy above and villous at the veins beneath; corymbs slightly villous; calyx-lobes sparingly glandular-serrate; stamens 20; fr. ovoid, crimson, with 3-5 stones, in Sept. Que.—*C. florentina*, Zaccagni—*Pyrus cratægifolia*.—*C. fétida*, Ashe (*C. Baxteri*, Sarg.). Allied to *C. intricata*. Intricately branched, spiny shrub, to 12 ft., glabrous: lvs. ovate or oval; corymbs usually 5-6-fld.; calyx-lobes serrate; fr. subglobose, orange-red or reddish brown, about  $\frac{1}{2}$  in. thick, with 3-4 stones, in Oct. Mass. to Ont. and Va.—*C. Fontanesiana*, Steud. Allied to *C. Crus-galli*. Lvs. elliptic or elliptic-lanceolate, almost glabrous, shining above; corymbs many-fld., pubescent; fr. red. Probably hybrid of *C. Crus-galli*.—*C. Förbesæ*, Sarg. Allied to *C. pastorum*. Shrub, to 15 ft.: lvs. ovate to oval, cuneate or rounded at the base, slightly lobed; stamens 20; anthers dark rose-color; fr. globose or ovoid, scarlet, with thin and juicy flesh. Mass.—*C. formosa*, Sarg. Allied to *C. pruinosa*. Shrub, to 15 ft.: lvs. oblong-ovate, rounded or cuneate at the base, slightly lobed, slightly hairy above while young; corymbs many-fld.; fr. ovoid or obovoid, scarlet, pruinose, with 4-5 stones. N. Y.—*C. gemmōsa*, Sarg. Allied to *C. succulenta*. Tree, to 30 ft., spiny: lvs. broadly obovate to broadly elliptic, doubly serrate and often slightly lobed, at maturity pubescent on the midrib beneath; corymbs villous; fr. scarlet, lustrous, in Oct. N. Y. to Mich. and Ont. S.S. 13:686.—*C. genesensis*, Sarg. Allied to *C. Crus-galli*. Small tree, to 12 ft., spiny, glabrous: lvs. obovate-oblong, pointed at the rounded or acute apex, with prominent veins; corymbs many-fld., lax; anthers pink; fr. ovoid, scarlet,  $\frac{1}{2}$  in. long, with 1-3 nutlets, in Oct. W. N. Y. G.C. III. 53:115.—*C. glandulosa*, Moench=*C. elliptica*.—*C. gloriosa*, Sarg. Allied to *C. pedicellata*. Tree, to 25 ft., with few spines: lvs. ovate, cuneate or rounded at the base, rough above, slightly pubescent on the veins below, sometimes finally glabrous; corymbs 10-15-fld.; stamens 7-10; fr. ovoid, often unsymmetrical, deep crimson, in Sept. W. N. Y.—*C. grandiflora*, Koch (*C. lobata*, Bosc. *Cratægus-mespilus grandiflora*, Camus). Small tree: lvs. elliptic, serrate, often slightly lobed toward the apex, pubescent; fls. 1-3, large; fr. brown, globose, large. Supposed to be a hybrid between *Mespilus germanica* and a *Cratægus*. G.F. 10:35. R.H. 1869, p. 80.—*C. Grayana*, Eggleston=*C. flabellata*.—*C. Hábisonii*, Beadle. Belongs to group *Bracteata* allied to *Intricata*. Tree, to 25 ft.: lvs. oval or broadly obovate, coarsely serrate; petioles glandular; corymbs many-fld., with conspicuous glandular bracts; fr. red or bright red, in Oct. S.S. 13:691.—*C. heterophylla*, Fluegge. Allied to *C. monogyna*. Lvs. larger, usually trifid; fr. larger, bright red; corymbs many-fld. B.R. 14:1161; 22:1847.—*C. hiemalis*, Lange. Possibly *C. Crus-galli*  $\times$  *C. pentagyna*. Lvs. elliptic to ovate, densely serrate or slightly lobed, lustrous above, pubescent on the veins beneath; corymbs villous; stamens 15, with purple anthers; fr. purplish black. Origin unknown.—*C. Holmesiana*, Sarg. Allied to *C. pedicellata*. Tree, to 30 ft.: lvs. oval or ovate, slightly lobed, at maturity yellowish green, glabrous; fls.  $\frac{1}{2}$ - $\frac{3}{4}$  in. across; stamens usually 5, anthers purple; fr. ovoid, crimson, with usually 3 stones. Montreal to Pa., W. N. Y. and Ont. S.S. 13:676.—*C. integriloba*, Sarg. Allied to *C. tomentosa*. Tree, to 10 ft., spiny: lvs. broadly obovate or oval, broadly cuneate at the base, slightly lobed, glabrous; corymbs villous; calyx-lobes entire; fr. subglobose,  $\frac{1}{2}$ - $\frac{3}{4}$  in. across, scarlet, lustrous. Que. G.C. III. 47:60.—*C. irritata*, Sarg. Allied to *C. pedicellata*. Shrub, to 12 ft.: lvs. ovate, cuneate or rounded at the base, slightly lobed, lustrous and glabrous above; stamens 20, anthers yellow; fr. ovoid, dark red, lustrous. Que.—*C. Korolkowii*, Henry=*C. Wattiana*. See also No. 50.—*C. laeta*, Sarg. Allied to *C. Ellwangeriana*. Arborescent shrub, spiny: lvs. ovate, acuminate, scabrate above, sparingly pubescent on the veins below; corymbs 8-12-fld., compact; fr. ovoid, bright orange-red,  $\frac{1}{2}$  in. long, with 5 nutlets, in Sept. Origin unknown, much planted in Boston parks.—*C. leiophylla*, Sarg. Allied to *C. pruinosa*. Slender intricate, spiny shrub, to 15 ft., glabrous: lvs. broadly ovate, usually rounded or truncate at the base, dark dull blue-green above; corymbs 5-7-fld., compact; anthers yellow; fr. obovoid, bright red,  $\frac{1}{2}$  in. long, with usually 4 stones, in Nov. W. N. Y.—*C. livoniana*, Sarg. Allied to *C. Crus-galli*. Tree, to 20 ft., spiny, glabrous: lvs. oblong-obovate, acute or rounded at the apex, finely and often doubly serrate; corymbs lax, 10-18-fld.; calyx-lobes glandular-serrate; fr. subglobose to ovoid, dark crimson,  $\frac{1}{2}$  in. long, with 2-4 stones, in Oct. N. Y. S.T.S. 2:129.—*C. lobata*, Bosc=*C. grandiflora*.—*C. lucorum*, Sarg. Allied to *C. pastorum*. Tree to 25 ft., spiny: lvs. broadly ovate to obovate, slightly lobed, glabrous; corymbs villous, few-fld.; stamens 20, with purple anthers; fr. ovoid, crimson, in Sept. Ill. S.S. 13:679.—*C. maineana*, Sarg. *C. leiophylla* var. *maineana*, (Eggleston). Allied to *C. pruinosa*. Tree-like shrub, to 15 ft., spiny, glabrous: lvs. ovate to deltoid, acuminate, hairy while young; corymbs many-fld.; stamens 10; anthers dark purple; fr. globose, scarlet, scarcely pruinose, about  $\frac{1}{2}$  in. thick, in Oct. W. N. Y.—*C. matra*, Sarg. Allied to *C. pastorum*. Shrub, to 10 ft., with few spines, glabrous: lvs. oval to ovate-oblong, usually cuneate at the base, dark green above, yellow-green below; corymbs many-fld.; stamens 5-10; anthers red; fr. ovoid, dark purplish crimson,  $\frac{1}{2}$  in. long, in Aug. Vt., Mass., N. Y.—*C. Mazimowiczii*, Schneid. (*C. sanguinea* var. *villosa*, Maxim.). Allied to *C. sanguinea*. Small tree, to 20 ft.: lvs. ovate, slightly lobed, pilose below; corymbs densely pilose; fr. pilose when young, finally glabrous. Amurland, Manchuria.—*C. microcarpa*, Lindl.=*C. spathulata*.—*C. opulens*, Sarg. Allied to *C. pruinosa*. Shrub, to 15 ft., spiny, glabrous: lvs. oblong-ovate to oval, acuminate, hairy above while young; corymbs 5-8-



fld., compact: fr. subglobose, obscurely angled, crimson, slightly pruinose,  $\frac{1}{2}$  in. long, in Oct. W. N. Y.—*C. Palmieri*, Sarg. Allied to *C. Crus-galli*. Tree, to 25 ft.: lvs. broadly ovate to oblong, rounded or acute at the apex, coarsely serrate, glabrous: corymbs glabrous; stamens 10, with yellow anthers: fr. dull green, tinged with red, in Oct. S.M. 381.—*C. peregrina*, Sarg. Allied to *C. mollis*. Tree: lvs. ovate, broadly cuneate, with 5-6 pairs of narrow lobes, glabrous above, villous beneath: corymbs many-fld., villous: fr. ovate-globose, dark dull purple, pubescent at the base and apex,  $\frac{1}{2}$  in. across. Origin unknown, probably S. W. Asia. S.T.S. 2:191.—*C. perjuvanda*, Sarg. Allied to *C. pruinosa*. Spiny shrub, glabrous: lvs. ovate, acuminate, dark green above: corymbs 8-10-fld.; anthers white: fr. ovoid, orange-red, finally crimson, slender-stalked, less than  $\frac{1}{2}$  in. long, in Oct. Ont., N. Y.—*C. persimilis*, Sarg. Allied to *C. Crus-galli*. Shrub, to 8 ft.: lvs. oblong-obovate to oval, usually acute, veins prominent, slightly hairy while young: corymbs slightly villous; stamens 10-20: fr. subglobose or ovoid, crimson, lustrous, with 1-2 stones. N. Y.—*C. præcox*, Sarg. (*C. præcoqua*, Sarg.). Allied to *C. rotundifolia*. Shrub, to 10 ft., spiny: lvs. rhomboidal to oval, slightly hairy while young, glabrous at maturity and scabrous above: corymbs slightly villous, many-fld.; stamens 10: fr. subglobose, dark crimson,  $\frac{1}{2}$  in. thick, in Aug. Vt., Que.—*C. promissa*, Sarg. Allied to *C. pruinosa*. Shrub, to 12 ft., spiny, glabrous: lvs. oblong-ovate, acuminate, deeply lobed: corymbs lax, many-fld.; stamens 5-7; anthers pink: fr. ovoid, crimson, not pruinose, less than  $\frac{1}{2}$  in. long, in Sept. W. N. Y.—*C. Pyracantha*, Pers.—*Pyracantha coccinea*.—*C. rivularis*, Nutt. Allied to *C. Douglasii*. Shrub: lvs. ovate-lanceolate, serrate, glabrous at length. Wyo. to Colo. and Utah. S.S. 4:176.—*C. Sargentii*, Beade. Allied to *C. intricata*. Tree, to 20 ft.: lvs. elliptic to oblong-ovate, slightly lobed, glabrous at maturity: corymbs slightly villous or glabrous; stamens 20, with purple anthers: fr. yellow or orange-yellow, tinged with red, in Sept. Ga. to Tenn. and Ala.—*C. songarica*, Regel.—*C. Wattiana*.—*C. spathulata*, Michx. Shrub or tree, to 20 ft.: lvs. cuneate, oblanceolate, crenately serrate or 3-lobed at the apex: corymbs many-fld.: fr. scarlet, globular,  $\frac{1}{4}$  in. across. Southern states. S.S. 4:185. B.R. 22:1846 (as *C. microcarpa*). The only species of the group *Microcarpæ* allied to the *Apiifoliæ*.—*C. triflora*, Chapm. Shrub or small tree, to 20 ft.: lvs. ovate or elliptic, serrate, often slightly lobed, pubescent, 1-2  $\frac{1}{2}$  in. long: corymbs 3-fld., hirsute; fls. 1 in. across; stamens 20; anthers yellow: fr. globose, red. Ga., Ala. Belongs to the group *Trifloræ*, allied to *Intricatæ*.—Very distinct and handsome; has proved hardy at the Arnold Arboretum.—*C. verecunda*, Sarg. Allied to *C. intricata*. Shrub, about 3 ft., spiny, glabrous: lvs. oblong-obovate or oval, acute or acuminate, light bluish green: corymbs 6-10-fld.; stamens 7; anthers white: fr. ovoid or obovoid, less than  $\frac{1}{2}$  in. long, with 2-3 stones, in Sept. or Oct. W. N. Y.—*C. Wattiana*, Hemsl. & Lace. (*C. altaica*, Lange. *C. songarica*, Regel). Allied to *C. sanguinea*. Lvs. smaller, truncate at the base, glabrous: corymbs glabrous: fr. yellow or reddish yellow, smaller. Cent. Asia. Var. *incisa*, Schneid. (*C. Korolkowii*, Henry. *C. sanguinea* var. *incisa*, Regel). Lvs. more deeply and acutely lobed. R.H. 1901:301.—*C. Wilsonii*, Sarg. Allied to *C. tomentosa*. Shrub, to 20 ft.: lvs. ovate or obovate, acute or obtuse, lustrous above, sparingly villous beneath: fr. ovoid, red, nearly  $\frac{1}{2}$  in. long, with 1-3 stones. Cent. China.

ALFRED REHDER.

**CRATÆVA** (after Cratevas, an obscure writer on medicinal plants, not, as sometimes stated, at the time of Hippocrates, but at the beginning of the first century B. C., since he named a plant after Mithridates). *Caparidææ*. Tropical trees and shrubs, sometimes planted in the warm parts of the country.

Leaves 3-foliolate: fls. in corymbs, usually polygamous, with the odor of garlic; sepals and petals 4; stamens 8-20; torus elongated: berries ovate-globose, with a slender stripe.—Ten species, around the globe. The bark of the garlic pear, *C. gynandra*, blisters like cantharides. *C. religiosa*, from Malabar and the Society Isls. is a sacred tree, and is planted in native graveyards. The bitter, aromatic lvs. and bark are used by them in stomach troubles. The above and some other species are cult. in Eu. as ornamental greenhouse shrubs.

*religiōsa*, Forst. f. (*C. Nurvāla*, Buch-Ham.). A spreading unarmed deciduous tree of graceful proportions: lvs. long-petioled, the lfts. 2  $\frac{1}{2}$ -3 times as long as broad: fls. 2-3 in. across, showy, yellow, or purplish yellow, the petals long-clawed.—Once cult. by Franceschi, Santa Barbara, Calif., but reported by him as no longer in cult. there. Excellent greenhouse plant N.

N. TAYLOR.†

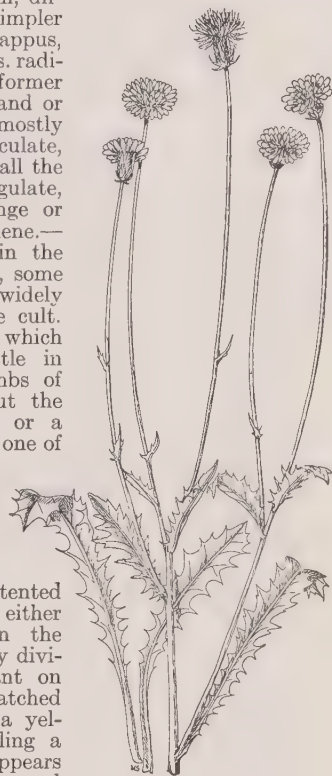
**CRATEROSTIGMA** (Greek, referring to character of stigma). *Scrophulariææ*. *Torenia*-like perennial low nearly stemless herbs of E. and S. Afr., sometimes grown under glass. Lvs. radical, plantago-like, many-nerved, entire: fls. lilac and purple, spicate, racemose or even solitary; calyx tubular, 5-ribbed and narrowly 5-toothed; corolla tubular, 5-ribbed and 5-toothed, the

tube enlarged toward the top, the limb 2-lipped, the dorsal lip concave and entire or emarginate, the other large and spreading and 3-lobed; stamens 4 and perfect, in unequal pairs; style filiform, 2-lobed and dilated at apex: fr. an oblong caps. included in the calyx. Differs from *Torenia* in technical floral characters and in being nearly or quite stemless and with only radical lvs.—About 4 species. *C. pumilum*, Hochst. (*Torenia auriculæfolia*, Dombr.) has fls. on slender pedicels  $\frac{1}{2}$ -1  $\frac{1}{4}$  in. long, the corolla-lobes pale lilac blotched with purple and veined with white: lvs. sessile, ovate, in a basal rosette, pubescent beneath and nearly glabrous above. E. Africa. F.M. 10:534.—A stemless perennial.

L. H. B.

**CRÊPIS** (Greek for *Sandal*; application obscure). *Compositæ*. A large group of annual, biennial and perennial herbs, a few of which are now and then grown in outdoor gardens for the showy flowers.

Much like *Hieracium*, differing mostly in the simpler involucre, white soft pappus, and beaked achene: lvs. radical and cauline, the former mostly runcinate, repand or pinnatisect, the latter mostly clasping: heads pedunculate, solitary or paniculate, all the florets perfect and ligulate, the rays yellow, orange or red: fr. a smooth achene.—Perhaps 250 species in the north temperate zone, some of them weedy and widely dispersed. Among the cult. kinds is *C. sibirica*, which resembles a sow-thistle in habit, and has corymbs of reddish blue fls. about the size of a hawkweed, or a small dandelion. It is one of the coarser border plants, and rare. Rather light, sandy soil, and full exposure to the sun are essentials to the welfare of this plant. It is contented in a rather dry position, either in the rockery, or in the border. It is prop. by division. A common plant on the moss of English thatched cottages is *C. virens*, a yellow-fld. plant, resembling a dandelion. *C. rubra* appears to be the commonest annual species cult. abroad.



1105. *Crepis rubra*. (×  $\frac{1}{4}$ )

*sibirica*, Linn. Perennial, 2-3 ft. high, and at least as wide when in bloom: plant covered with short rough hairs: root large, fleshy: lvs. rough, wrinkled, the lower coarsely dentate, the upper often somewhat cordate, 12 in. long, including a petiole half as long: fls. bright yellow in a strictly terminal corymb; involucre loose, hairy. July. Eu., Asia Minor, Himalayas. Gn. 53, p. 493.—The tallest and largest-fld. of the genus. Its white plummy masses of seeds are also attractive.

*auræa*, Reichb. Black-hairy: height 1 ft. or less: fls. orange, mostly solitary: lower lvs. spatulate-oblong, toothed, shining. June. Alps.—One of the commonest perennial species of the genus abroad. Repays rich soil.

*rubra*, Linn. Fig. 1105. Annual: height  $\frac{1}{2}$ -1  $\frac{1}{2}$  ft.: fls. red, usually solitary, the involucre being hispid. An attractive little flower-garden plant. Var. *alba*, Hort., has flesh-colored or whitish fls. Italy, Greece.

*C. barbata*, Linn.=Tolpis.—*C. montana*, Reich. 12-18 in.; lvs. unequally dentate; fls. yellow in a large head. High mts., Switzerland, etc. Mentioned as grown in this country, but apparently not in the trade. L. H. B.†

**CRESCÉNTIA** (after Crescenzi, thirteenth century Italian agricultural writer). *Bignoniaceæ*. This genus is chiefly interesting for the calabash tree, which has



1106. *Crescentia Cujete*.—The calabash. ( $\times \frac{1}{2}$ )

no near allies of horticultural importance; yields the calabash fruit.

Tropical trees, glabrous: lvs. alternate, solitary or clustered at nodes; fls. large, tubular, with a fluted 5-cut limb, yellowish, with red or purple veins; calyx 2-parted or deeply 5-cut.—About 5 species, in Mex. and Cent. Amer. The calabash tree is a native of Trop. Amer., is especially familiar in the W. Indies, and can be grown outdoors in extreme S. Fla. and S. Calif. The outer skin of the fr. is removed and the seeds and pulp from within, and the hard woody shell is used for water-gourds and for all sorts of domestic vessels, according to size and shape. The growing fr. can be made to assume various forms by skilful tying. It is a tree 20-40 ft. high, and readily distinguished from all others by its peculiar habit of growth, as it bears large, horizontal, scarcely divided branches, which bear clusters of lvs. at intervals. The tree is becoming important in the manufacture of tobacco-pipes.

*Cujète*, Linn. Fig. 1106. A handsome tree when growing in the open, with wide-spreading well-foliated branches: lvs. 4-6 in. long, broadly lanceolate, tapering at the base, dark glossy green; fls. solitary, pendulous; calyx 2-parted; corolla constricted below the middle, and then swollen above, malodorous when decaying; stamens 4, sometimes 5; fr. frequently 18-20 in. through. The growing tree has somewhat the habit of a Burbank plum tree. B.M. 3430. N. TAYLOR.†

**CRESS.** A name applied to the pungent herbage of several species of the *Cruciferae*, used as salad.

The leaves of the ordinary garden cress (*Lepidium sativum*), sometimes called peppergrass, have a pleasant pungency, somewhat like that of the water-cress, which makes the plant well adapted to be used as a popular condiment, served with salads, especially lettuce, and also for garnishing purposes. The quick sprouting habit of the seed is proverbial. Often the plants show above ground the third day after seed is sown. But if cress is wanted in its prime continuously, new sowings must be made every few days. Sow seed rather thickly in rows a foot apart, selecting any good garden loam. The reason that this useful plant is seldom seen in the average home garden is probably

its liability to be attacked by hordes of flea-beetles which seem to have a particular fondness for cress pungency. But it is easily grown under glass, in flower pots, flats, or on a bench, in any light and fairly warm place and in any good soil. Grown thus it is usually free from flea-beetle injury, and goes well with forced lettuce. Seed is easily grown, either in the open or under glass. The plants are allowed to mature their seeds, are then pulled and the seed rubbed or thrashed out and cleaned. There are slight variations in the form of the leaves, some of which are more or less curled, others more of the broad-leaved type.

Water-cress (*Nasturtium officinale* of the older books, but known as *Radicula Nasturtium-aquaticum* and *Roripa Nasturtium* in recent books), Fig. 1107, is a hardy perennial, and finds a congenial place in small, running streams, shallow pools or ditches, wintering well when covered with water. It is usually found freely 'bunched' in most of our markets and at green grocers'. It grows readily from seed as well as from freshly cut pieces of branches, and soon spreads over a large area. The best product comes from clear running water.

Similar to water-cress in pungency is the upland cress (*Barbarea praecox*), a hardy biennial. It also grows easily from seed sown in the open or under glass in ordinary soils and situations. The root-leaves are used for garnishing and seasoning, but they are not of the highest quality. See p. 454, Vol. I.

Other plants sometimes grown under the name of cress are *Cardamine pratensis* (p. 661) and *Spilanthes oleracea* (which see). The very pungent root-leaves of the former are said to be eaten, but apparently the plant is not cultivated for this purpose.

T. GREINER.

**CRĪNUM** (Greek name for a lily). *Amaryllidaceæ*. Large and showy flowering bulbs, mostly tender, closely allied to *Amaryllis* and distinguished by the longer perianth-tube; flowers usually white or in shades of red; largely summer bloomers, but differing widely in this respect.

Stems arising from a tunicated bulb with a more or less elongated neck: lvs. mostly persistent, usually broad, sometimes several feet long; fls. few or many in a 2-bracted umbel, often very fragrant and with 3 types of coloring, pure white, banded red or purplish down the center, or flushed with the same colors; perianth salverform or funnel-shaped, the tube straight or curved, long-cylindrical; segms. linear, lanceolate or oblong, nearly or quite equal; stamens 6, attached on the throat of the corolla, with long filiform filaments and very narrow versatile anthers; ovary 3-celled, the ovules few in each cell, the style long and filiform, somewhat bent



1107. Water-cress—*Radicula Nasturtium-aquaticum*.

downward, the stigma not lobed; fr. a roundish or irregular caps., at length dehiscing; seeds large, green, thick.—Probably 100 species in warm and tropical regions around the world, in moist or wet places. The crinums are amaryllis-like plants of great beauty. They are widely grown, often under the name of "lilies," some of them as greenhouse plants, some as



coolhouse subjects, and a few as hardy border plants. The bulbs are often very large, sometimes as much as 2 or 3 feet long, neck and all, the leek-like neck gradually tapering from the bulb proper. In some species the bulb is short and onion-like. Fig. 1108 shows forms of crinum bulbs. In some species the flowers are 1 foot long and half as broad; and sometimes the leaves reach the length of 6 feet and a width of 5 or 6 inches. The flower-stalk is solid, leafless, usually arising from the side of the bulb-neck. The genus might be roughly divided into the evergreen kinds, mostly with leek-like bulbs and symmetrical star-like straight-tubed usually erect flowers; and the deciduous-leaved kinds, mostly with roundish bulbs and nodding bell-shaped more or less irregular flowers.

The crinums require so much room that they are not often seen in commercial collections in this country. They are particularly adapted to mild and warm climates, and therefore full notes on such handling of them are given here. They are not much grown in American greenhouses. The species cross freely, and many fine hybrids are known, some of them under Latin species-names.

#### Hardy crinums.

The species of *Crinum* require widely different culture, and their geographical distribution furnishes an important clue as to the degree of warmth required. There are two species hardy in the northern states, *C. longifolium* and *C. Moorei*, the latter being less reliable than the former but with finer flowers. These two species differ from others in blooming all summer instead of during a short period, and in the more lasting qualities of their flowers. An interesting hybrid between the two, *C. Powellii*, is hardier than *C. Moorei*, and the flower, though better than *C. longifolium*, is not quite so showy as that of *C. Moorei*. The hybrid has three well-marked colors, white, rosy and purplish. A single bulb of the white variety has given fifty flowering bulbs in four years. It is excellent for placing in conspicuous positions on terraces or lawns, or in corners where flowers are wanted to combine with architecture or statuary for summer effect. The *Agapanthus* is frequently grown also for such purposes. Of course large specimens are needed for this use, but they are easily secured and they last from year to year. The bulbs of crinums are mostly grown in Holland and in Florida. The only native species, *C. americanum*, the "swamp lily of Florida," makes a brilliant and striking spectacle when seen in places far from cultivation, as in the Everglades.

The most reliable of the hardy crinums in the North is probably *C. Powellii*. If the bulbs are planted  $2\frac{1}{2}$  to 3 feet deep (to the bottom of the bulb) in well-drained soil, the plant stands without protection in the neighborhood of New York City. Let them stand 2 to 3 feet apart. This crinum makes a very ornamental summer plant, even the strong foliage producing a tropical effect. It produces offsets very freely, but they are deep in the ground. It seems not to produce seed in the North. *C. longifolium* is also hardy, but is better with a covering in winter; and it is inferior to *C. Powellii* in leaf and flower. *C. Moorei* is equally hardy except that the bulbs grow near the surface and are therefore so much exposed as often to be ruined by frost. It is a very desirable summer species. It often seeds in the latitude of New York City; and these fleshy seeds germinate readily if placed on the surface of moist soil. It produces offsets freely, which are used in propagation. It has very strong fleshy roots; and when grown in pots or tubs (which is a desirable practice) it should be given plenty of room. This species has a long columnar neck with a spreading cap or crown of leaves, and large white or pink flowers. *C. variabile* (*C. capense*) is hardy south of the Ohio. There are a number of half-hardy species; and most of the

greenhouse kinds make very desirable lawn or porch plants when well established in large pots or tubs.

#### Tender crinums.

There are more than fifty species of greenhouse crinums, all of them worth growing because of their handsome flowers; some of them have very ornamental foliage. Most of the species are seldom seen in this country, possibly because they occupy too much space and give a comparatively small number of flowers to recompense the grower for their upkeep. It is not necessary to keep the evergreen species growing all the time after the flowers have been produced. The plants may be put out-of-doors under a lath-house for four or five months. The soil should be of a lasting nature with good drainage so that frequent repotting will not be necessary. When the plants are in a growing state, frequent applications of manure water will be found to be beneficial. In the warmer parts of the country,



1108. *Crinum* bulbs as named in the trade. Left to right, *C. Moorei*, *C. giganteum*, *C. Kirkii*, *C. Powellii*.

many of the tropical species should be plunged or planted out in the open border, where they often give a satisfactory quantity of flowers. In winter, the plants may be carried over under the bench of a temperate house. They should be given water occasionally during April and the first half of May to encourage new root-growth. When planted out in rich soil, nearly all of them will produce their gorgeous flowers out-of-doors; and during winter they are best treated as dormant bulbs with a little more heat than given such plants as cannas and richardias, planting them out as soon as the weather is favorable. A few of the tropical crinums are grown for their foliage principally, and are often seen in public conservatories and palm-houses where they suffer but little from dense shade. The flowers of most species are exceedingly handsome but only for a comparatively short time; during the remainder of the year when out of bloom there are hosts of things that are much more ornamental. Tropical crinums should be grown in this country nearly altogether for outdoor work; we then get the best out of them because our hot summers are favorable to their growth and for the production of bloom. Those species not amenable to this treatment do not give results at all in keeping with the space and time devoted to them. (G. W. Oliver.)

*Crinums in Florida and the South.*

The various species of Crinum belong to the most important, the most beautiful and the most popular of Florida garden plants. No plants grow so easily, with so little attention, and no plants are so floriferous and so deliciously fragrant. Some of the species, as *C. zeylanicum*, *C. erubescens* and *C. Sanderianum*, are so common in gardens, that they are little appreciated by people in general. Planted together in masses or in borders and in front of shrubbery, they look extremely beautiful. They grow best in rich, somewhat moist soil, but they are also perfectly at home in the high pineland ridges when well fertilized and cultivated. There is great confusion in the nomenclature of these plants, scarcely half a dozen being correctly named in the various catalogues. The following notes are based on many years' experience with crinums in Florida, and the names represent plants that the author considers to be proper representatives of the species.

*C. abyssinicum* has white flowers and is attractive, but it does not grow well in the sandy soils of Florida.

*C. amabile*. Very much like *C. augustum* in growth and the flowers also much the same, but it is considerably smaller and multiplies rapidly by offsets. Every three or four years it must be replanted in fresh rich ground, and the offsets must then be removed. It is a very beautiful plant, and much more floriferous than the *C. augustum*, flowering in every month of the year. The perfume of the masses of flowers in spring and summer is so strong that it pervades the entire garden. It does not bear seeds in Florida, but the pollen is fertile and can be used in cross-breeding.

*C. americanum*. Common along muddy banks of lakes and rivers. A very beautiful pure white, intensely fragrant species and very valuable in hybridizing work. Flower-stem usually 3 feet high, bearing mostly four flowers. Grows well in gardens, particularly in rich moist soil.

*C. amatum*. A rather small-growing Asiatic species with long slender bulbs and white flowers tinged red on the outside. Rare.

*C. asiaticum*. The columnar stem-like bulb, about 12 to 15 inches long, grows mostly above the ground. In planting it should never be set deep in the ground; a few inches is sufficient. The leaves are arranged in a rosette. They are about 3 feet long, very broad near the bulb, gradually narrowing to a sharp point at the end. The color is light bluish green. Flowers almost all the year round, even in winter when the weather is warm, usually 20 flowers in an umbel being borne always a little above the foliage on a strong stem. The flowers are pure white, with linear narrow segments; filaments and stigma purplish red, yellowish white in the lower third. Strangely and deliciously fragrant. A real gem among our garden flowers. Hardy all over the Gulf Coast region, where it forms in time large and impressive clumps of tropical foliage. Bears large pea-green fleshy seeds abundantly. Excellent for raising hybrids.

*C. augustum*. "Great Mogul" of Barbados. The largest-growing of all our crinums, specimens 4 feet high and 6 to 8 feet in diameter being not uncommon. It needs rich moist soil and a fair amount of good fertilizer. Leaves are very broad, 4 to 5 feet long, narrowing gradually to a sharp point, deeply channeled. It blooms continually for months. Flower-stem an inch in diameter, purplish-red, 4 feet high, bearing a large umbel of glossy purplish crimson flower-buds which are pink inside after opening. Nearly twenty flowers to each umbel, giving a large mass of very beautiful and deliciously fragrant blossoms. This umbel is so large and heavy that it soon bends over and finally lies on the ground. For this reason, it is necessary to tie it to a strong bamboo stake. It is difficult to propagate, as offsets are formed slowly. A plant five years old has formed only two side-shoots. Although it affords good pollen for hybridizing purposes, it does not seed. Hardy in New Orleans.

*C. campanulatum* (*C. cafrum*). Very distinct, with beautiful glaucous green leaves and umbels of six to eight rosy red campanulate flowers. The flowers are much recurved at their edges. It blooms several times each year. One plant, although eighteen years old, never made a side-shoot. It grows wild in ponds in southern Africa and very likely needs moist soil.

*C. Careyianum* (offered in the trade as *C. virginicum* which is really a white-flowering species from Brazil). It also goes under the name of *C. grandum*. This is a doubtful plant, being perhaps an old English hybrid. It is very distinct from all other crinums, very beautiful and deliciously fragrant and a night-bloomer. Flower-stem 3 feet high, with an umbel of six to eight pure white flowers with a faint red band in the center. The buds are reddish and the stem is purplish grayish green. Bears no seed.

*C. caribaeum*. Reminds one of *C. americanum*, but flower-stem grayish purple on a green ground. Flowers pure white, very fragrant. Rare.

*C. crassipes*. Bulbs conical, very large, 8 to 10 inches in diameter. Forms offsets tardily, if at all. Flower-stem short. Flowers fifteen to twenty in an umbel, white, bell-shaped, faintly keeled with pink.

*C. erubescens* (usually advertised as *C. fimbriatulum*). One of the most common species in Florida gardens. Increases rapidly by offsets. Leaves long, thin and narrow, 2 to 3 feet long; flower-stem 2 to 3 feet tall, purplish green, carrying usually four to six very beautiful fragrant flowers, pure white with a faint pink keel,

outside purplish red. Does not bear seeds, and pollen, and is useless for cross-breeding. Found everywhere in gardens.

*C. fimbriatulum*. Extremely rare, and not in the trade. Flowers pure white, with a soft red band in the center of each petal. One plant formed only five offsets in the course of eight years.

*C. giganteum*. Perhaps the most beautiful species, the leaves being as ornamental as an aspidistra or a dracena. Evergreen like *C. pedunculatum*, *C. amabile*, *C. augustum*, and *C. asiaticum*. The leaves are about 3 feet long, rich deep green with a slight bluish tint. It forms large clumps in the course of a few years. Flowers six to eight in an umbel, bell-shaped, creamy white in the bud, pure white when fully expanded, exhaling a very strong vanilla-like perfume. They appear six or eight times during the year, even in winter when the weather is warm. Needs rich moist soil and does not thrive satisfactorily on high dry land. An excellent species for hybridization.

*C. imbricatum*. Allied to *C. giganteum*, but bulbs much larger and leaves rather glaucous green, strongly nerved, with serrated edges. Flowers similar, but creamy white. Flowers usually two or three times during the year. This is as beautiful as *C. giganteum*, but it does not form such large clumps in the course of a few years. Seeds freely.

*C. Kunthianum*. A large-growing species, with a fine rosette of bright green spreading leaves and large umbels of pure white flowers. Its variety *nicaraguaense* is a still larger-growing plant. The flower-stem is quite short, about a foot high, bearing five or six very large white flowers with a faint pink band in the center, purplish on the outside. The flowers of both are strongly fragrant.

*C. longifolium*. An excellent plant for hybridizing. The leaves are glaucous green, flowers eight to twelve in an umbel, pink, flushed with deeper red on the outside. A fine foliage plant, though flowers not very showy. The white variety, *C. longifolium album*, with very beautiful pure white bell-shaped flowers, is a very showy plant and much superior to the type.

*C. Macowanii*. Forms very large bulbs with long slender necks. A beautiful species with pink flowers, but very difficult to grow in light soils. It does not flower regularly each year.

*C. Moorei*. Bulb very large, 6 to 8 inches in diameter, with a very long slender, stem-like neck about 10 to 12 inches long. The leaves are very beautiful, long and thin and very wavy. It usually flowers in March in central Florida. Flowers four to ten in an umbel, bell-shaped, rosy or pinkish red and deliciously fragrant. There is a beautiful white form of this extremely beautiful species. Var. *Schmidtii*, which usually flowers also in March or April. Both kinds bear seeds if hand-pollinated with their own pollen or crossed with different other species. This crinum will not thrive well in the light sandy soils. It requires a heavier soil with some clay in it, and it grows well only in a lath-house.

*C. pedunculatum*. Very rare in Florida gardens. Reminds one of *C. asiaticum*, but the bulb is shorter, more massive and the leaves thinner and of a brighter green. Flowers twenty to twenty-five in an umbel, pure white and strongly fragrant. This plant needs rich mucky soil to do its best. It does not thrive on dry ground. It is a much shyer bloomer than *C. asiaticum*, with which it is often confounded.

*C. podophyllum*. This is another evergreen species, almost a miniature *C. imbricatum*. Leaves glaucous green, strongly nerved, with serrated edges. Bulb only a few inches in diameter and very short. Flower-stem about 10 inches high bearing only a few pure white strongly fragrant flowers. Flowers only once during the summer.

*C. pratense*. Bulb 5 to 6 inches in diameter. Flowers white. Requires moist rich soil. Rare.

*C. purpurascens*. This small species, with linear undulated leaves about a foot long, forms large clumps in rich moist soil, thriving with caladiums, marantas, ferns, and other shade-loving plants. Flowers five to six in an umbel, slightly red in bud and pink when expanded. Flower-stem purplish, only about 6 to 8 inches high.

*C. Sanderianum* (Milk-and-Wine Lily). Common in Florida gardens. Flowers white, keeled with bright red, deeper red on the outside. Flower-stems 3 feet high, carrying five or six flowers in the umbel. Bears no seed.

*C. scabrum*. One of the showiest. Flowers large, amaryllis-like, pure white, banded crimson, reminding one of *Hippeastrum vittatum*. Very fragrant, but flowers of short duration. Flowers three or four times during spring and summer. Bears seed abundantly and can be easily cross-fertilized with other species. Grows well on high dry pine land, but, like all crinums, requires rich soil.

*C. variabile*. When in bloom, this is the showiest of all the species. Bulbs very large, conical. Flower-umbels consist of fifteen to twenty large pure white bell-shaped flowers, being borne well above the foliage, standing upright. The flowers are faintly striped with pink. Three or four stems are usually pushed up at the same time from one large bulb, and beds consisting of twenty-five or fifty bulbs are a magnificent sight, as almost all the buds open at the same time. This crinum is strictly a night-bloomer, the flowers beginning to open in the dusk of evening, remaining in perfect condition until sunrise. A clump or a bed of this species in full bloom during a moonlight night has a wonderful effect. It looks particularly beautiful under palms. This species is hardy as far north as southern Missouri and Kentucky, with a little protection in the form of stable manure or dry leaves. It has been received under the names *C. Kirkii*, *C. ornatum* and *C. latifolium*. Does not bear seeds.

*C. yemense*. Flowers pure white, bell-shaped and somewhat fragrant. Bears seeds. Excellent for cross-breeding purposes.

*C. zeylanicum* (often sold as *C. Kirkii*). Perhaps the most common of all the crinums, being found in almost every garden, even in the backwoods. The flowers which are intensely fragrant are borne on tall purplish stems. They are deep crimson in the bud



state, white with a red stripe, when fully expanded. They usually flower in June and July after the rainy season has set in. Bears large grayish green fleshy seeds abundantly and is a fine plant to be used in hybridizing.

H. NEHRING

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A. Perianth erect, salver-shaped, with linear segms.; stamens spreading. (*Stenaster*.)

B. Color of perianth white; tube greenish.

1. *asiaticum*, Linn. (*C. toxicarium*, Roxbg.). Bulb 4-5 in. thick; neck 6-9 in. long; lvs. 20-30 to a bulb, 3-4 ft. long, 3-4 in. broad; peduncle  $1\frac{1}{2}$ -2 ft. long, 1 in. thick; fls. 20-50 in an umbel; spathe-valves 2-4 in. long; pedicels  $\frac{1}{2}$ -1 in. long; perianth white; tube erect, tinged with green, 3-4 in. long; segms.  $2\frac{1}{2}$ -3 in. long; filaments tinged red, 2 in. long; ovule 1 in a cell. Trop. Asia. B.M. 1073. G.F. 4:283. Baker gives 5 botanical varieties, of which the most important in the American trade is probably var. *sinicum*, Baker (*C. sinicum*, Roxbg. *C. pedunculatum*, Hort., not R. Br.). St. JOHN'S LILY. Bulb 6 in. thick, 18 in. long; lvs. 5 in. broad, with undulated edges, forming a massive crown 4-5 ft. high; peduncle 2-3 ft. long; fls. 20 or more, the tube and segms. longer than in the type; perianth white. China. The bulb usually divides into 2 of equal size; small offsets are rarely produced. Seedlings flower in 5 years. Var. *declinatum*, Baker (*C. declinatum*, Herb.), has a declined instead of erect bud; perianth-segms. tinged red at tip. B.M. 2231. Var. *procerum*, Baker (*C. procerum*, Carey), is larger than the type with lvs. 5 ft. long, 6 in. wide; perianth-tube and limb 5 in. long, the latter tinged red outside. Rangoon. B.M. 2684. Var. *anomalum*, Baker, is freakish-looking, its lvs. being expanded into a broad, membranous, striated and plaited wing. B.M. 2908 (as *C. plicatum*). *C. eboraci*, Herb. (*C. hybridum* Toddæ, Hort.). Similar to the variety next mentioned, but half the size. Garden hybrid between a small form of *C. asiaticum* and *C. longifolium*. *C. eboraci* var. *cappedum*, Reasoner (*C. cappedum*, Reasoner). Habit much like *C. asiaticum*, but lvs. tapering to a slender point, semi-erect, 4 ft. high; fls. about 20, segms. 4 in. long,  $\frac{1}{2}$  in. broad, spreading, white, sometimes changing to pink. Garden hybrid between *C. asiaticum* var. *sinicum* and *C. longifolium*. Increases both by offsets and splitting of the bulb into two. *C. sinico-scabrum*, Hort., hybrid of *C. asiaticum* var. crossed with *C. scabrum*, and intermediate in aspect and fl.—*C. asiaticum* is the largest of the cult. species, good specimens standing 5 ft. high and having a greater spread. The evergreen reticulated lvs. are ornamental. It blooms several times each year in good warmhouse or greenhouse conditions.

2. *pedunculatum*, R. Br. (*C. australe*, and *C. exaltatum*, Herb. *C. canaliculatum*, Roxbg.). Bulb 4 in. thick; neck 6 in. long. lvs. 25-30 to a bulb; fls. 20-30 in an umbel; spathe-valves 3-4 in. long; pedicels  $1\frac{1}{2}$  in.; perianth greenish white, not tinged with red outside,

the segms. linear and spreading and shorter than the tube; filaments short, bright red; style shorter than the filaments; ovules 3 in a cell. Austral. B.R. 52.—The bulb grows above ground on a large rootstock; summer; coolhouse.

3. *caribæum*, Baker<sup>e</sup> (*C. floridatum*, Griseb., not Fraser). Lvs. lorate-oblong, 1 ft. or less, 3-4 in. broad, narrowed to the base; umbels 3-4 fld.; perianth-tube 3-4 in. long, nearly straight; segms. white, linear, spreading, nearly as long as tube. W. Indies.

BB. Color of perianth purplish red outside; tube purplish red.

4. *amabile*, Donn. Bulb small; neck 1 ft. or more long; lvs. 25-30 to a bulb, 3-4 ft. long, strap-shaped, tapering to the point, the margin entire; peduncle 2-3 ft. long; fls. 20-30 in an umbel, very fragrant; spathe-valves 4-5 in. long; pedicels  $\frac{1}{2}$ -1 in. long; perianth with a crimson center band, tinged outside bright purplish red; tube bright red; segms. 4-5 in. long; stamens an inch shorter than the segms. Sumatra. B.M. 1605. R.H. 1856:241.—Summer; warmhouse. Supposed by Herbert to be a spontaneous hybrid between *C. asiaticum*



1109. *Crinum americanum*. ( $\times \frac{1}{2}$ )

var. *procerum* and *C. zeylanicum*: fls. sterile; bulb increases by small offsets; has been sold under the name of *C. augustum* (Hort., not Roxbg.), which is a similar but smaller natural hybrid presumably between *C. bracteatum* and *C. zeylanicum*, and has more obtuse lvs. than *C. amabile*.

AA. Perianth erect, salver-shaped, with lanceolate segms.; stamens spreading. (*Platyaster*.)

B. Lvs. few, 6-12 to a bulb.

5. *americanum*, Linn. Fig. 1109. FLORIDA SWAMP LILY. Bulb stoloniferous, ovoid, 3-4 in. thick; neck short: lvs.  $1\frac{1}{2}$ -2 in. broad and 2-4 ft. long, curved, denticulate: fls. 3-6, usually 4 on an erect scape 20-30 in. high; pedicels 0 or very short; perianth creamy white, the lobes linear or lance-linear; tube greenish, equaling or exceeding the lobes. Native in river swamps Ga. and Fla. and westward. B.M. 1034.—Blooms in spring and summer, but some fls. may occur in winter far S.

6. *pratense*, Herb. Bulb ovoid, 4-5 in. thick; neck short: lvs. 6-8, linear, suberect,  $1\frac{1}{2}$ -2 ft. long,  $1\frac{1}{2}$ -2 in. wide, channeled, narrowed to point, margin entire: fls. 6-12 on a lateral compressed peduncle 1 ft. or more high; perianth white, the tube greenish and 3-4 in. long, the segms. nearly or quite as long,  $\frac{1}{2}$  in. broad, lanceolate; filaments shorter than segms., bright red. Low grounds, India. Summer. Var. *elegans*, Carey, has a longer-necked bulb, decumbent, peduncle, and tube an

inch shorter than the segms. B.M. 2592. Var. *venustum*, Carey, has about 30 fls. in an umbel. India.

7. *amœnum*, Roxbg. Bulb globose, 2-3 in. diam., with a very short neck: lvs. 10-12, suberect, linear, 2 ft. or less long, rough-edged, tapering to the apex: fls. 6-12, the peduncle standing 1-2 ft. high; perianth-tube greenish, 3-4 in. long; segms. white tinged red outside, 2-3 in. long, lanceolate; filaments bright red, shorter than segms. India. Summer; warmhouse. Var. *Mearsii*, Bedd. (*C. Mearsii*, Bedd.). Very small: lvs. 1 ft. or more long, 1 in. wide, very smooth: peduncle 3-5 in. long, 6-10 fld.; fls. white, the tube slender and 5 in. long; segms. lanceolate,  $2\frac{1}{2}$  in. long and  $\frac{1}{2}$  in. broad. Upper Burma. G.C. III. 42:62.—Whole plant not more than 2 or 3 in. high when not in bloom; blooms well in a 3-in. pot.

BB. Lvs. numerous, 20 or more to a bulb.

8. *augustum*, Roxbg. (*C. amabile* var. *augustum*, Gawl). Bulb conical, 6 in. thick; neck long: lvs. 20-30, strap-shaped, 2-3 ft. long, 3-4 in. broad: fls. 12-30, on a lateral much-compressed peduncle 2-3 ft. high; pedicels sometimes an inch long; color strong purplish red outside, banded within; tube purplish; segms. lanceolate, 4-5 in. long; filaments half length of segms., red. Mauritius, Seychelles. B.M. 2397. B.R. 679.—Warmhouse; effective.

9. *erubescens*, Ait. Bulb ovoid, 3-4 in. thick, the neck short: lvs. many, curved, strap-shaped, thin, 2-3 ft. long and 2-3 in. broad, slightly rough on edges: fls. 4-12, on peduncle 2 ft. or more high, the pedicels 0 or very short; color reddish outside, white within; tube bright red, 5-6 in. long; segms. half as long as tube, lanceolate, reflexing. Trop. Amer. B.M. 1232. L.B.C. 1:31.—Summer; warmhouse.

10. *Kunthianum*, Roem. (*C. erubescens*, HBK., not Ait.). Bulb ovoid, 3 in. diam., with a short neck: lvs. about 20, strap-shaped, spreading, 2-3 in. broad, undulate but entire: fls. 4-5 in an umbel, the peduncle 1 ft. high, the pedicels 0 or very short, pure white; tube 7-8 in. long; segms. lanceolate,  $2\frac{1}{2}$  in. long; filaments less than 2 in. long, bright red. Colombia. Var. *nicaraguense*, Baker, is purple outside, the segms. a little longer and lvs. longer and narrower.

11. *purpurascens*, Herb. Bulb ovoid, short-necked, 2 in. diam., stoloniferous: lvs. 20 or more, linear, thin, 3 ft. or less, prominently undulate: fls. 5-9, on a peduncle 1 ft. or less long; tube very slender, 5-6 in. long; segms. lanceolate, half as long as tube, pink or purplish; filaments bright red. Upper and Lower Guinea, in streams and lakes, the lvs. often floating. B.M. 6525. G.C. III. 47:114.—Amphibious. Summer; warmhouse.

AAA. Perianth funnel-shaped; tube permanently curved; segms. oblong ascending; stamens and style contiguous and declined. (*Codonocrinum*.)

B. Bulbs long-necked (No. 30 omitted).

c. Margin of lvs. not ciliate, but often scabrous.

12. *longifolium*, Thunb. (*Amaryllis longifolia*, Linn. *C. riparium*, Herb. *C. capense*, Herb.). Bulb ovoid, 3-4 in. diam.: lvs. 12 or more, strap-shaped, 2-3 ft. long, 2-3 in. wide, margins rough: fls. 6-12, pedicels 1-2 in. long; perianth tinged red on the back, and sometimes on the face, with a white variety; tube cylindrical, 3-4 in. long, about equaling the limb; segms. oblong, acute, 1 in. or less broad; stamens nearly as long as segms.; filaments red. Cape. Natal. B.M. 661. Var. *album*, Hort. Gn. 52, p. 123.—Probably the hardest pure species of crinum, enduring the win-

ter of the Middle States, if protected with litter during cold weather. Prop. by offsets or seed, which latter is produced abundantly. *C. grandiflorum*, Hort., is a hybrid with *C. Careyianum*, said to partake of the hardness of *C. longifolium*. Sometimes described as having a short-necked bulb.

13. *Macowanii*, Baker. Bulb globular, 9-10 in. diam., with neck 6-9 in. long: lvs. 12-15, strap-shaped, thin, 2-3 ft. long, 4 in. or less broad: fls. 10-15, on a stout green peduncle 2-3 ft. high; tube curved, green, 3-4 in. long; segms. about equaling the tube, pink, oblong, acute,  $1\frac{1}{2}$  in. broad. Natal.—Late autumn; greenhouse, or half-hardy.

14. *Modrei*, Hook. f. (*C. Makoyanum*, Carr. *C. Colensoi*, *C. Mackenii* and *C. natalense*, Hort.). Fig. 1110. Bulb ovoid, neck 12-18 in. long: lvs. 12-15, strap-shaped, 2-3 ft. long, 3-4 in. wide, margin entire, veins rather distant, distinct: fls. 6-12, on peduncle 2-3 ft. high, the pedicels  $1\frac{1}{2}$ -3 in. long; tube greenish, about 3 in. long and with a funnel-shaped pinkish limb of equal length, the segms. oblong, nearly acute, connivent; filaments pink, an inch shorter than segms. Natal and Kaffraria. B.M. 6113. G.C. III. 2:499; 48:59. R.H. 1887:300 and p. 417. R.B. 22, p. 196; 23:61. Var. *album*, Hort. Gt. 31:1072. Gn. 52, p. 122, and var. *platypetalum*, Hort., are cult. *C. Colensoi* has a longer tube, smaller fl., with a paler and narrower limb. *C. Schmidtii*, Regel, is probably a pure white-fl. form of this species.

15. *Powellii*, Hort. Fig. 1111. Bulb about 3 in. diam., with a long slender neck: lvs. about 20, spreading, ensiform, acuminate, 3-4 ft. long, 3-4 in. broad near the base, margin smooth: fls. about 8; perianth dark rose-color; pedicels  $1\frac{1}{2}$  in. long.—Garden hybrid of *C. longifolium* and *C. Moorei*.—A valuable outdoor crinum. Var. *album*, Hort., white. Var. *intermedium*, Hort., light rose-color.

cc. Margin of lvs. ciliated.

16. *Kirkii*, Baker. Bulb globose, 6-8 in. thick, neck 6 in. long: lvs. 12 or more,  $3\frac{1}{2}$ -4 ft. long, 4-4½ in. wide and long-tapering to a point; margin rough, veins close: fls. 12-15 on a stout compressed peduncle  $1\frac{1}{2}$  ft. high; pedicels 0 or very short; color white, with a very distinct bright red band down the center of each oblong acute segm.; tube greenish, 4 in., about equaled by the segms. E. Afr. B.M. 6512.—Probably not in commerce. See No. 17. Sept.; warmhouse.

BB. Bulbs short-necked (not considering No. 30).

c. Fls. numerous, usually more than 8 in an umbel.

17. *zeylanicum*, Linn. Bulb globose, 5-6 in. thick: lvs. 6-10, thin, sword-shaped, 2-3 ft. long, 3-4 in. wide, wavy, margin roughish; peduncle long and not very stout, often tinged red; fls. 10-20 on very short pedicels; tube 3-4 in. long, curved; segms. oblong, acute, 3-4 in. long, 1 in. broad, white with a broad red keel; stamens an inch shorter than segms. Spring to midsummer; warmhouse. Trop. Asia and Afr. B.M. 1171 (as *Amaryllis ornata*).—A warmhouse species. Usually sold as *C. Kirkii*, which is an allied species from E. Afr., probably not known outside of botanic gardens.

18. *variabile*, Herb. (*C. crassifolium*, Herb.). Bulb ovoid, 3-4 in. thick, without distinct neck: lvs. 10-12, linear, glabrous and entire, the outer ones 2 ft. and more long, 2 in. wide, weak: fls. 10-12, on a compressed erect peduncle  $1\frac{1}{2}$  ft. high, the pedicels  $\frac{1}{2}$ -1 in. long; tube greenish,  $1\frac{1}{2}$  in. long; segms. white with red tinge down the keel, oblong, acute,  $2\frac{1}{2}$ -3½ in. long; filaments red, an inch shorter than segms. Cape region. Spring.

19. *latifolium*, Linn. (*C. ornatum* var. *latifolium*, Herb. *C. Linnei*, Roem. *C. jemense*, *C. jemenicum* and *C. yemensse*, Hort.). Bulb nearly globose, 6-8 in. diam., with a short neck: lvs. many, strap-shaped, thin,



1110.  
A young plant of  
*Crinum Moorei*.



2-3 ft. long and 3-4 in. broad, slightly scabrous on the margins: fls. 10-20, on a peduncle 2 ft. or less high; tube curved, 3-4 in. long, greenish; segms. about as long as the tube, oblong-lanceolate and acute, 1 in. broad at middle, whitish tinged red. Trop. Asia.—An excellent species; summer; warmhouse.

20. *Jónstonii*, Baker. Bulb globose, 3-4 in. diam., without neck: lvs. about 20, long-pointed, the outer ones 5-6 ft. long and sword-shaped, the inner linear: fls. about 20 on a peduncle 2 ft. high; tube slightly curved, tinged green, 4 in.; limb shorter than tube, the segms. ovate or oblong, acute, white and tinged pink on the back; stamens nearly as long as limb. Mts. British Cent. Afr. B.M. 7812. G.C. III. 50:170.—Closely allied to *C. longifolium*. Fls. fragrant, 8 in. long.

21. *crassipes*, Baker. Bulb very large, conical, without neck: lvs. sword-shaped, 3-4 ft. long, 4 in. broad and long-tapering to the apex, entire: fls. 15-20, in a stout compressed peduncle less than 1 ft. long, the pedicels 1-1½ in. long; tube about 3 in. long, slightly curved, green; segms. oblanceolate, ½ in. broad, equaling the tube, ascending, white tinged red on the back; filaments purple, nearly equaling the segms. Probably Trop. Afr.

cc. Fls. fewer, usually less than 8 in an umbel.

d. Segms. of perianth red, striped or tinted with red.

e. Tube of perianth usually 3 in. or more long.

22. *Sanderianum*, Baker (*C. ornatum*, Bury). Bulb globose, 2 in. thick; neck short, 2-3 in. long: lvs. 10-12, thin, 1½-2 ft. long, 1½ in. broad, margin denticulate, tapering to a long point: fls. 3-6, nearly sessile, white, keeled with red; tube 5-6 in. long, curved; segms. oblong, acute, ascending, 3-4 in. long and 1 in. or less broad; stamens much shorter than segms. Upper Guinea. Gn. 52:122.—Closely allied to *C. scabrum*. Intermediate house; blooms at intervals.

23. *scabrum*, Herb. Bulb globose, 5-6 in. diam., with short neck: lvs. 12 or more, 2-3 ft. long, 1½-2 in. wide, closely veined, margin scabrous: fls. 4-8, the peduncle 1-2 ft. high; pedicels 0 or very short; tube greenish, 4-5 in. long; segms. white with distinct red keel, oblong, acute, 3 in. or less long; filaments rather shorter than segms. Apr. May. Trop. Afr. B.M. 2180. F.S. 21:2216. A very showy and easily cult. species; spring or early summer; warmhouse. *C. Hébertii*, Sweet (*C. scabro-capense*, Hort. *C. Kunthianum*, Hort., not Roem.). Fls. similar to *C. scabrum*, but color lighter, the plant taller and larger. Garden hybrid between *C. scabrum* and *C. longifolium*. This is a doubtful name. *C. Herbertianum*, Wall. = *C. zeylanicum*. *C. Herbertianum*, Roem. & Schulte = *C. strictum*. *C. virginicum*, garden hybrid, resembles *C. Hébertii*, but the plant is smaller and the fls. larger and brighter in color. See also No. 32.

24. *Careyanum*, Herb. (*C. ornatum* var. *Careyanum*, Herb.). Regarded by Baker as "scarcely more than a variety of *C. latifolium*," confused in cult.: fls. only 4-6 in the umbel, on a subterete green peduncle about 1 ft. high: bulb globose, 3-4 in. diam., short-

necked, with brown coverings: lvs. 8-10, strap-shaped, undulate, thin, 2 ft. or less long, 2-3 in. broad, the margin entire: perianth-tube curved, greenish, 3-4 in. long; segms. (or limb) about as long as the tube, oblong-acute, 1 in. broad, lightly red-tinged at center; stamens a little shorter than segms. Mauritius and Seychelles. B.M. 2466.—Autumn; greenhouse.

25. *fimbriatulum*, Baker. Lvs. linear, 4-5 ft. long, 2 in. broad toward base but long-pointed, glaucous green, margins ciliated with small membranous scales: fls. 3-7, nearly sessile, on peduncle 2 ft. high; tube curved, 4-5 in. long; segms. white with distinct red keel, oblong, acute, ascending, 3 in. long and 1 in. broad; stamens an inch shorter than segms. Lower Guinea. Gn. 55:92. Allied to *C. scabrum*.—A different plant is passing in the trade under this name.

EE. Tube short,—3 in. or less.

26. *campanulatum*, Herb. (*C. aquaticum*, Herb. *C. cæfrum*, Herb.). Bulb small and ovoid: lvs. linear, deeply channeled, 3-4 ft.: fls. 6-8, on a slender peduncle 1 ft. or more long, the pedicels ½-1 in. long; tube slender, 3 in. or less long, about as long as the campanulate limb; segms. bright rose-red, oblong, obtuse, much exceeding the filaments. Cape region. B.M. 2352.—A very distinct species; warmhouse.

27. *lineare*, Linn. f. Bulb small, ovoid: lvs. linear, 1½-2 ft. long, ½ in. broad, glaucous, channeled on the face, the margin entire: fls. 5-6, the peduncle slender and about 1 ft. long, the pedicels ¾ in. or less long; tube slender, 2½ in. or less long; segms. 2-3 in. long, white tinged with red in center, oblong or oblanceolate, acute; stamens much shorter than segms. Cape region. B.M. 915 (as *Amaryllis revoluta*). B.R. 623 (as *A. revoluta* var. *gracilior*).

DD. Segms. of perianth pure white (exception in one form of No. 29).

E. Pedicels very short or 0.

28. *podophyllum*, Baker. Bulb subglobose, 2 in. or less diam., without evident neck: lvs. 5 or 6, 1 ft. long, 2 in. or less wide, oblanceolate, acute, thin, narrowed to base: fls. 2, sessile, the slender compressed peduncle 1 ft. long; tube 5-6 in. long, slender and curved; limb somewhat erect, the segms. oblong-spatulate, pure white; filaments nearly as long as limb. Upper Guinea. B.M. 6483.—Perhaps a form of *C. giganteum*: late autumn; warmhouse.

29. *giganteum*, Andr. Bulb globose, 5-6 in. thick, the neck short:



1111. *Crinum Powellii*.

lvs. 12 or more, lanceolate, narrowed both ways, 2-3 ft. long, 3-4 in. broad, veins distant, with distinct cross veinlets; fls. 4-6, rarely 8-12 on a stout compressed peduncle 2-3 ft. long; tube 5-7 in. long; segms. pure white, much imbricated, oblong; filaments pure white, an inch shorter than segms. Trop. Afr. B.M. 5205. F.S. 23:2443. G.F. 4:223. I.H. 33:617. —A very fragrant species. Var. *nobile*, Baker (*C. nobile*, Bull.), has the peduncle and fl. suffused with tinge of red.—*C. giganteum* is large or gigantic only in its fls.; summer; warmhouse.

30. *Rátrayii*, Hort. Excellent stove plant, 20 in.: lvs. ascending, strap-shaped, acute, entire, dark green; fls. pure white, with a spread of 6 in., in few-fl. umbels; segms. ovate-elliptic, acute or sometimes erose; stamens strongly declined, nearly equaling the segms. Uganda. G.C. III. 38:11 and suppl.

31. *abyssinicum*, Hochst. Bulb ovoid, 3 in. thick, the neck short: lvs. about 6, linear, 1-1½ ft. long, ½-1 in. wide, veins close, margin rough, narrowed to a point: fls. 4-6, on a peduncle 1-2 ft. high, the pedicels very short or 0; perianth white, the tube slender, 2 in. or less long, the segms. oblong, acute, 2-3 in. long and ¾ in. or less broad; filaments less than 1 in. long. Mts. of Abyssinia. Greenhouse.

32. *virgineum*, Mart. Bulb large and brown: foliage as in *C. giganteum*, the lvs. 2-3 ft. long and 3-4 in. broad at the middle, narrowed both ways, pointed: fls. about 6, sessile or very nearly so; tube 3-4 in. long; segms. pure white, connivent, acute, as long as the tube; filaments much shorter than the segms. S. Brazil. See also *C. virginicum* under No. 23.

EE. *Pedicels 1 in. long.*

33. *imbricatum*, Baker. Bulb very large, globose: lvs. strap-shaped, very thin, 3 ft. long, 3 in. broad at middle and narrower toward base, distinctly veined: fls. 5-6, on a stout peduncle 1 ft. or more long; tube slender and curved, 3 in. long, the campanulate limb of equal length; segms. imbricated, oblong-obtuse; filaments 1 in. shorter than segms. S. Afr.—Allied to *C. giganteum*.

Crinums hybridize so freely, and the progeny is so likely to be interesting, that many mongrel forms have been recorded under Latin names. It is not feasible to account for all such names here. Many of the forms are soon lost.—*C. Lugardæ*, N. E. Br. Bulb small: lvs. long and narrow, rough-edged: fls. 2-6, the peduncle 1 ft. or less high; tube nearly or quite 4 in. long; segms. lanceolate, about or nearly as long as tube, white with light pink median stripe. Trop. Afr.—*C. nātans*, Baker. Allied to *C. purpurascens*, but aquatic, the 20 or so strap-shaped undulate lvs. submerged: bulb small, narrow-ovoid, with many long fibrous roots: fls. few, white, the narrow segms. recurved. Upper Guinea. B.M. 7862.—*C. rhodanthum*, Baker. Lvs. lorate, exceeding 1 ft., thick, ciliate-edged: fls. many; tube 3 in. long; segms. red, lanceolate, 2½ in. long, erect-spreading and curved in upper part; stamens as long as segms., the filaments red. Cent. Afr. G.C. III. 33:315.—*C. Samuelii*, Worsley. Bulb 3 in. diam. and 2½ in. long; lvs. sometimes 4 ft. long, rough-edged: fls. 2, sessile, on peduncle 1 ft. high, white slightly flushed with pink, not fragrant, 4½ in. across. Cent. Afr.—*C. Vássel*, Boiss. Bulb ovoid, 4 in. across, without distinct neck: lvs. linear-lorate, 2 ft. or less long, 2 in. broad, rough-edged: fls. about 15, on peduncle 1 ft. or less high, white with red median stripes; perianth funnel-shaped, 8 in. long, the tube curved and red, the segms. linear-lanceolate, and a little shorter than tube. Mozambique. R.H. 1908: 132.—*C. Wimbushii*, Worsley. Differs from *C. Samuelii* in lvs. not rough-edged, fls. on short pedicels, faintly fragrant, less lasting and with longer style. Cent. Afr.—*C. zanzibarëse*, Hort.=(?).

L. H. B.†

**CRÍTHMUM** (Greek for barley, from some resemblance in the seed). *Umbelliferae*. **SAMPHIRE**. A single species, *C. maritimum*, Linn., on shores in Great Britain, W. Continental Eu., and the Medit. region, rarely planted in wild gardens or borders. It is a fleshy glabrous perennial herb, seldom more than 1 ft. high, somewhat woody at the base: lvs. 2-3-ternate, the segms. thick and linear: umbels compound, of 15-20 rays, involucrate, the umbellules with involuclers;

petals very minute, entire, fugacious: fr. ovoid, not compressed, about ¼ in. long. Thrives well in a sunny situation, and will grow at considerable distance from the sea. Prop. by division, and by seeds sown as soon as ripe.

**CROCÓSMIA** (Greek, *odor of saffron*, which is perceivable when the dried flowers are placed in warm water). *Iridaceae*. Gladiolus-like garden plant.

This genus has but one species, and is not clearly distinguished from the closely allied *Tritonia*, but it differs in the stamens being separated at equal distances instead of grouped at one side, the form of the limb, the tube not swollen at the top, and the fr. 3-seeded, sometimes 5-seeded, instead of many-seeded.

The name of this genus is spelled *Crocospma* by Baker, but it was first spelled *Crocospmia*. The fls. with coppery tips shading into orange-yellow are very distinct and attractive. Pax, in Engler & Prantl, combines the genus with *Tritonia*.

*Crocospmia aurea* is a showy bulbous autumn-blooming plant, which is hardy south of Washington, D. C., with slight protection, and in the North is treated like gladioli, the bulbs being set out in the spring, after

danger of frost, and lifted in the fall for winter storage. It is of easy culture, and is propagated by offsets or by seeds which should be sown in pots, under glass, as soon as ripe. Corms should be stored in peat or sphagnum to prevent them from becoming too dry.

*aurea*, Planch. (*Tritonia aurea*, Pappe.). Height 2 ft.: corm globose, emitting offsets from clefts in the side: scape 1½-2 ft. high, leafy below, naked or only bracted above, compressed, 2-winged: lvs. distichous, shorter than the scape, linear, ensiform,

1112. *Crocospmia aurea* var. *imperialis*. (×½)

striated, but with a distinct midrib: fls. sessile in the panicle, perhaps 25 scattered over a long season, with buds, fls. and seeds at the same time; perianth bright orange-yellow toward center; tube slender, curved, 1 in. long; segms. longer than the tube: caps. 3-celled. Trop. and S. Afr. July-Oct. F.S. 7:702. B.M. 4335. B.R. 33:61 (*Tritonia*). Also interesting as one parent of a bigeneric cross resulting in *Tritonia* (*Montbretia*) *crocospmaeflora*. Var. *imperialis*, Hort., Fig. 1112, grows about 4 ft. high. Var. *maculata*, Baker, has dark blotches above the base of the 3 inner segms. J.H. III. 33:567.

J. N. GERARD.

WILHELM MILLER.

**CRÒCUS** (Greek name of saffron). *Iridaceae*. Low spring-flowering and autumn-flowering garden bulbs; showy, and well known.

Stemless plants (the grass-like lvs. rising from the





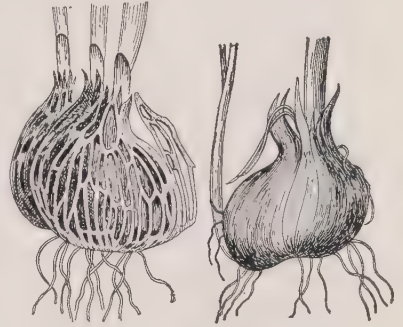
ground or corm), with solid bulbs or corms: fls. showy, in many colors, funnel-shaped and erect, with a very long tube and 6 nearly or quite equal segms.; stamens 3, attached in the throat of the perianth and shorter than the segms.; style 3-cleft, the branches entire or forked or much fimbriated; ovary 3-loculed: seeds many, nearly globular: fr. an oblong 3-valved caps.—Probably 75 species, many of them variable, in the Medit. region and extending into S. W. Asia. The fls. open in sunshine. They come in fall or spring, but the best-known species are spring-flowering, which are amongst the earliest and brightest of spring bloom. Crocuses force easily (see *Bulb*). A half-dozen corms may be planted in a 4-in. pot for this purpose. Crocuses are scarcely known in the American trade under their species names. Inasmuch as the flowers of the common crocus close when taken out of the sun, they are not popular as window-garden or house subjects. Crocuses have been much hybridized and varied. There are many color-forms. The common crocuses of the trade have descended from *C. vernus* chiefly, but *C. susianus*, *C. mæsiacus*, *C. stellaris*, *C. biflorus* and *C. sativus* are frequent. The Dutch bulb-growers cult. many species, and these are offered for sale in their American lists; the species are therefore included in the following synopsis. In this account, the treatment by Baker is followed (*Handbook of the Iridæ*).

Botanically, the genus divides itself into three groups on the characters of the style-branches: the branches entire, once-forked or fimbriated at the apex, or cut into several capillary divisions. Horticulturally, the species fall into two groups,—the spring-flowering and the autumn-flowering. These groups are not so definitely separated as it would seem, however. Some of the species bloom in winter in regions in which the ground does not freeze hard; others begin to bloom in July or August; some may continue to bloom till winter closes in. Yet these two flowering periods mark very important differences in the utilization of the plants and the primary division in the following treatment is made on this basis. The colors are now much varied by cultivation and hybridizing, but they are well marked in the specific types as a rule. They run largely in yellow, white and purple.

The covering or tunic of the bulbs may be uniformly membranaceous, or it may be composed of strongly reticulated or parallel fibers. Fig. 1113. The flowers appear usually just in advance of the grass-like foliage-leaves. The floral leaves are small and more or less dry or scarious and arise directly from the corm and may be seen as a spathe-like structure inside the leaf-tuft; this is usually known as the basal spathe. The real spathe subtends the bloom, and it is always one-flowered; this floral spathe may be one-leaved or two-leaved.

*Culture*.—Many forms of crocus are well known, where they are justly valued as among the showiest and brightest of winter and spring flowers. They thrive in any ordinary soil. About two-thirds of the species are classed as vernal and the remainder as autumnal flowering; but the various members of the tribe would furnish nearly continuous bloom from August to May were the season open. While there are numerous species interesting to a botanist or a collector, practically the best for general cultivation are *Crocus Imperati*, *C. susianus* (Cloth of Gold crocus) and the Dutch hybrids, mostly of *C. mæsiacus*. These bloom in about the order named. The rosy flowers of *C. Imperati* may be expected with the earliest snowdrops. The named species, having shorter flower-tubes than the Dutch hybrids, are not so liable to injury by the severe weather of the early year. The autumnal species are not satisfactory garden plants, the flowers mostly appearing before the leaves, and being easily injured. *C. speciosus* and *C. sativus* are probably the most satisfactory. The latter species has been cultivated from time immemorial, the stamens having a medi-

cinal reputation, and being a source of color (saffron). The cultivation of this species is a small industry in France, Spain and Italy.—The corms of crocuses should be planted about 3 or 4 inches deep, in a well-worked and perfectly drained soil which is free from clay or the decaying humus of manure. They should be set only 2 or 3 inches apart if mass effects are desired. They may be planted in September or October for bloom in the spring or the following autumn; or the autumn kinds may be planted early in spring. The corms should be carefully examined and all bruised and imperfect ones rejected, as they are very susceptible to attacks of fungi, which, gaining a footing on decrepit corms, will spread to others.—The careful gardener will examine all exotic small bulbs annually, or at least biennially, until they show by the perfection of their new bulbs that they have become naturalized, or are suited to their new environment. In this case they may be allowed to remain until crowding requires their division. This examination should take place after the leaves are matured and dried up. Inasmuch as new corms form on top of the old ones, the plants tend to get out of the ground; it is well therefore to replant the strongest ones every two or three years. Increase may be had from new corms which are produced more or less freely in different species on top or on the sides of old corms.—Seeds are often produced freely, but are likely to be overlooked, as they are formed at the surface of the soil. These germinate readily and most freely at the growing time of the plant. They should preferably be germinated in seed-pans, which should be exposed to freezing before the natural germinating time. Seedlings usually flower the third season.—The dutch hybrid crocus is often useful for naturalizing in the lawn, although the grass may run out the plants in a few years, if the bulbs are not replaced by strong ones; they will not last more than a year or two if the foliage is mown off, but if the foliage is allowed to remain until ripe and if the lawn is fertile, the plants may remain in fair condition three or four years or more. (J. N. Gerard.)



1113. Reticulated and membranaceous tunics. *Crocus susianus* (left) and *C. sativus* (right).

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A. *Blooming in spring (sometimes in midwinter and continuing toward spring).*

B. *Style-branches entire or merely toothed.*

C. *Fls. yellow, at least inside (varying to whitish forms): basal spathe absent.*

D. *Outer segms. striped or feathered outside.*

1. *susianus*, Ker. CLOTH-OF-GOLD CROCUS. Fig. 1114. Corm  $\frac{3}{4}$  in. diam.: lvs. 6-8 in a tuft, reaching to the fl., narrow-linear, with revolute edges and a central band of white: upper spathe 2-lvd.: perianth-segms.  $1\frac{1}{2}$  in. or less long, orange-yellow, becoming reflexed, the outer ones brownish or striped on the outside; anthers orange, longer than the filaments; style-branches long and spreading. Crimea. B.M. 652 (adapted in Fig. 1114).—Blossoms very early, Feb., Mar.

2. *chrysanthus*, Herb. (not B.R. 33:4, fig. 1, which = *C. Olivieri* var. *Suterianus*). Corm small: lvs. as high as the fl., very narrow: upper spathe 2-lvd., nearly as long as perianth-tube: perianth-tube 2-3 times as long as the segms., the latter  $1\frac{1}{4}$  in. or less long, and plain orange-yellow (varying tinted or striped on the outside, or even nearly white); throat glabrous; anthers orange, twice as long as the roughened filaments; style-branches red-orange. Macedonia and Asia Minor. Gn. 74, p. 140. Var. *albidus*, Hort. Fls. whitish. Gn.W. 25:229.



1114. *Crocus susianus*. ( $\times \frac{1}{2}$ )

per spathe 2-lvd.: perianth-tube short, the segms.  $1-1\frac{1}{2}$  in. long, bright orange, the outer ones striped and feathered with brown on the back; anthers pale orange, a little longer than the filaments; style-branches somewhat overtopping the anthers. Mar.

DD. *Outer segms. not striped (at least not in the specific types).*

4. *mæsiacus*, Ker (*C. aureus*, Sibth. & Smith). DUTCH CROCUS. Later: corm larger: lvs. 6-8 in a tuft, overtopping the fl., narrow-linear, with reflexed edges and white central band: upper spathe 2-lvd., inner valve very narrow or obsolete; segms. very obtuse, bright yellow,  $1\frac{1}{2}$  in. long, one-half to a third the length of the tube: anthers pale yellow, hastate at the base, somewhat longer than the filaments; style-branches overtopped by the anthers. Transylvania to Asia Minor. B.M. 2986.—Variable. A sulfur-yellow form is *C. sulphureus*, Ker. B.M. 1384. There is a striped form. B.M. 938. A cream-white form is *C. lacteus*, Sabine.

5. *ancyrénsis*, Maw. Corm  $\frac{3}{4}$  in. diam.: lvs. 3-4, as tall as the fl., very narrow: upper spathe 2-lvd.: perianth-tube exserted; segms. bright orange-yellow, 1 in. or less long, not striped nor colored outside; anthers orange-yellow, much longer than the filaments; style-branches red-orange. Asia Minor.—Blossoms early.

6. *Korolkôwii*, Maw & Regel. Corm globose, 1 in. diam. with matted fibers: lvs. 8-12, very narrow, with

reflexed edges and a central white band: upper spathe of 1 or 2 membranous valves: perianth-tube shortly exserted; segms. about 1 in. long, bright orange-yellow and not striped, the outer ones grayish brown on the outside; anthers orange-yellow; style-branches entire and orange-yellow. Turkestan, etc. Var. *dytiscus*, Bowles, has the outer segms. deep brown outside and with narrower margins of yellow.

CC. *Fls. lilac, purple or white.*

D. *Basal spathe (rising directly from the corm inside the lvs.) absent.*

7. *biflorus*, Mill. SCOTCH CROCUS. Corm  $\frac{3}{4}$  in. or less in diam.: lvs. 4-6, overtopping the fls., very narrow, with deflexed edges and a white central band: upper spathe 2-lvd.: perianth-tube exserted, the segms.  $1\frac{1}{2}$  in. long, purple-tinged, the outer ones 3-striped down the back, the throat bearded and yellowish; anthers orange, exceeding the filaments; style-branches orange-red. S. and S. W. Eu. B.M. 845.—Runs into many forms, some of them almost white. Some of the named botanical forms are: Var. *argenteus*, Baker (*C. argenteus*, Sabine, *C. præcox*, Haw. *C. lineatus*, Jan). Less robust and with only 3 or 4 lvs. to a tuft and smaller fls. more tinged with purple and the outer segms. dark-striped outside. Italy. B.M. 2991 (as *C. minimus*). Var. *pusillus*, Baker (*C. pusillus*, Tenore). Fls. smaller than in var. *argenteus*, paler, the 3 outer segms. striped with dark purple. Italy. B.R. 1987 (var. *estriatus*, with petals pale purple and not striped). Var. *Weldenii*, Baker (*C. Weldenii*, Hoppe), with uniform slaty purple limb. Dalmatia. B.M. 6211. Var. *Adamii*, Baker (*C. Adamii*, Gay). Limb pale purple, the outer segms. 1-colored or with 3 pale purple stripes. Caucasus. B.M. 3868 (as *C. annulatus* var. *Adamicus*). Var. *nubigenus*, Herb. Segms. very small and nearly white, the outer ones with a broad band of purple on the back. Asia Minor. Var. *Pestalózzæ* (*C. Pestalózzæ*, Boiss.). Small-fl., with 1-colored whitish segms. Asia Minor. Var. *Alexándri*, Hort. (*C. Alexándri*, Velen. Fls. larger than in *C. biflorus* type; outer segms. flushed all over the back with bright lilac and with a narrow margin of white, or often with only feather-like stripes on white grounds. B.M. 7740.

8. *ærius*, Herb. (*C. Sibthorpianus* var. *stauricus*, Herb.). Corm globose,  $\frac{3}{4}$  in. or less diam., the tunic bristle-ringed at top: lvs. 3-6 in the tuft, as high as the fl., very narrow, with reflexed margins and a white band: upper spathe 2-lvd.: perianth-tube little exserted; segms. 1 in. or less long, unstriped, pale or dark lilac, the throat yellow and glabrous; anthers orange, twice the length of the slightly papillose filaments. Armenia, Kurdistan. B.M. 6852B. Gn. 74, p. 212. Early.

DD. *Basal spathe present.*

E. *Throat of perianth glabrous.*

9. *versicolor*, Ker (*C. fragrans*, Haw. *C. Reinwardtii*, Reichb.). Corm  $\frac{3}{4}$  in. or less in diam., with tunics of matted parallel fibers: lvs. 4-5, as high as the fls., otherwise like the last: upper spathe 1- or 2-lvd.: perianth-tube exserted; segms.  $1\frac{1}{2}$  in. long, pale or dark purple, often striped and feathered with dark purple; throats glabrous, whitish or yellowish; anthers yellow, twice as long as the filament; style-branches, orange-yellow, equaling or overtopping the anthers. S. France. B.M. 1110.

10. *banaticus*, Heuff. Corm globular,  $\frac{1}{2}$  in. diam.: lvs. usually 2, thin and flattish, and becoming  $\frac{1}{4}$  in. broad, glaucous beneath: upper spathe 1-lvd.: perianth-tube scarcely exserted; segms.  $1\frac{1}{2}$  in. or less long, bright purple, and never striped, but often dark-blotched toward the tip; throat glabrous; anthers orange, a little longer than the white filaments; style-branches short, orange-yellow, somewhat fringed at the tip. Hungary.



11. *Tommasiniäus*, Herb. Corm globular,  $\frac{1}{2}$  in. diam.: lvs. appearing with the fls., narrow ( $\frac{1}{8}$  in. broad): upper spathe 1-lvd.: perianth-tube little exserted; segms.  $1\frac{1}{2}$  in. or less long, pale red-bluish, sometimes dark-blotched at the tip; throat glabrous; anthers orange, a little longer than the white glandular filaments; style-branches short, orange-yellow. Dalmatia and Servia.—Distinguished from *C. vernus* by its glabrous throat.

12. *Sièberi*, Gay. Corm globular,  $\frac{3}{4}$  in. diam.: lvs. 4-6, as high as the fl., glaucous beneath,  $\frac{1}{8}$  in. broad: upper spathe 2-lvd.: perianth-tube short-exserted; segms.  $1-1\frac{1}{2}$  in. long, color of *C. vernus*; throat yellow and glabrous; anthers orange, twice as long as filaments; style-branches nearly entire, orange-red. Greece, Crete. Gn. W. 22:287. G.M. 49:54. Var. *purpureus*, Hort. Fls. darker purple than the type. Var. *versicolor*, Hort. Outer perianth-segms. white feathered with purple or dark violet; inner segms. white, yellow at base inside. Gn. 73, p. 201.

13. *reticulatus*, Bieb. Corm  $\frac{3}{4}$  in. diam., covered with honeycombed fibers: lvs. 3-5, as high as the fl., very narrow, with reflexed edge and a white band: upper spathe 2-lvd.: perianth-tube much exserted; segms.  $1-1\frac{1}{2}$  in. long, white to purple, the 3 outer ones striped; throat glabrous; anthers orange, twice the length of the orange filaments; style-branches scarlet, overtopping the anthers. S. E. Eu.—Varies to white.

EE. Throat of perianth pubescent or bearded.

14. *vérus*, All. Fig. 1115. Corm 1 in. or less diam.: lvs. 2-4, as high as the fl., often  $\frac{1}{4}$  in. broad, glaucous beneath, but green above, with reflexed edges, and a central white band: upper spathe 1-lvd., about as long as perianth-tube: perianth-segms.  $1-1\frac{1}{2}$  in. long, lilac, white or purple-striped; throat pubescent, never yellow; anthers lemon-yellow, exceeding the filaments; style-branches orange-yellow. S. Eu. B.M. 860, 2240. R.H. 1869, p. 331. Gn. 54, p. 79.—The commonest garden crocus.

15. *etrúscus*, Parl. Corm 1 in. or less in diam.: lvs. about 3, very narrow, as tall as the fl.: upper spathe 1-lvd.: perianth-tube short exserted; segms.  $1-1\frac{1}{2}$  in. long, lilac, or the outer ones cream-colored and sometimes purple-feathered outside; throat yellow, slightly pubescent; anthers orange, twice as long as the glabrous filaments; style-branches nearly entire, orange. Italy.

16. *Mályi*, Vis. Corm depressed-globose, 1 in. or less diam., with fine parallel fibers in the tunic which is slightly reticulated upward: lvs. narrow-linear, not so tall as the fl., with reflexed margins and white central band: upper spathe 2-lvd., foliaceous: perianth-tube yellow, scarcely exserted; segms. white,  $1\frac{3}{4}$  in. long; throat orange-yellow and bearded; anthers orange, twice as long as the filaments; style-branches orange, slightly divided at tip. Dalmatia. G.C. III. 37:163. G. M. 51:455.

BB. Style-branches fimbriate at the top, or once-forked.

17. *Imperati*, Tenore. Fig. 1116. Corm nearly or quite 1 in. diam.: basal spathe present: lvs. 4-6, exceeding the fls., very narrow: upper spathe 1- or 2-lvd.:

perianth-tube little exserted; segms.  $1-1\frac{1}{2}$  in. long, lilac or even white, the outer ones buff and 3-striped on the outside; anthers yellow, exceeding the filaments; style-branches fimbriate. Italy. B.R. 1993. Gn. 54, p. 79. Very early.

18. *Ólivieri*, Gay. Corm nearly globose,  $\frac{1}{2}-\frac{3}{4}$  in. diam.: basal spathe absent: lvs. 4-5, as tall as the fl., becoming  $\frac{1}{4}$  in. broad: upper spathe 2-lvd.: perianth-tube little exserted; segms. bright orange-yellow and never striped,  $1\frac{1}{2}$  in. or less long; throat glabrous; anthers orange, twice the length of the roughish filaments; style-branches orange, slender-forked. Var. *Suterianus*, Baker (*C. chrysanthus*, Bot. Reg.) has narrower and more rolled lvs. Greece to Asia Minor. No. 2.

BBB. Style-branches cut into capillary divisions: basal spathe absent: upper spathe 2-lvd.

19. *vitellinus*, Wahl. (*C. syriacus*, Boiss. & Gaill.). Corm  $\frac{3}{4}$  in. or less diam.: lvs. 4-6, as high as the fls., narrow-linear: perianth-tube short, exserted; segms. 1 in. or less long, orange-yellow, the outer brown-tinged outside; style-branches divided into many capillary parts. Asia Minor. B.M. 6416.—Rare in cult. Var. *graveolens*, Baker (*C. graveolens*, Boiss. & Reut. *C. syriacus*, Baker). Lvs. narrower: outer segms. flushed with black or bearing 3 distinct stripes of black down the back.

20. *Fleischeri*, Gay (*C. Fleischerianus*, Herb. *C. smyrnensis*, Poech). Corm  $\frac{3}{4}$  in. or less diam., the tunics a dense mass of regularly interlacing fibers: lvs. about 6 to a tuft, as high as the fls., very narrow and having reflexed edges and a white band: perianth-tube not exserted; segms.  $1-1\frac{1}{4}$  in. long, white, acute, the outer with 3 slender lilac lines on the back; throat yellow and glabrous; anthers small, orange, about as long as the filaments; style-branches brick-red. Asia Minor, on limestone hills.

21. *cándidus*, Clarke (*C. Kirkii*, Maw). Corm globose,  $\frac{3}{4}$  in. diam.; tunics of matted parallel fibers: lvs. as high as the fl., becoming  $\frac{1}{4}$  in. broad, the margin ciliated and the keel very narrow: perianth-tube little exserted; segms.  $1-1\frac{1}{4}$  in. long, white tinged yellow towards throat (which is glabrous), the outer ones tinged or feathered with purple on back; anthers orange, about as long as the filaments; style-branches cream-white. Asia Minor. G. 31:17. Var. *luteus*, Hort. Fls. yellow, more deeply colored at the base, 3 outer segms. veined and mottled with purple.

22. *hyemális*, Boiss. & Blanche. Corm globose,  $\frac{3}{4}$  in. or less diam., the tunic membranous: lvs. about 4 to the tuft, as high as the fl., with reflexed margins and a white band: perianth-tube little exserted; segms.  $1-1\frac{1}{2}$  in. long, white, with a long central purple line and three shorter lines; throat yellow, glabrous; anthers orange, twice as long as filaments; style-branches red. Palestine. Var. *Fóxi*, Maw, has nearly black anthers. Gn. 74, p. 188.

AA. Blooming in autumn (sometimes in late summer and continuing toward autumn).

B. Style-branches entire or very nearly so.

C. Fls. white or lilac: basal spathe present (except in No. 26); upper spathe 2-lvd.

23. *sativus*, Linn. SAFFRON CROCUS. Fig. 1117. Corm 1 in.



1115. *Crocus vernus*. ( $\times \frac{1}{2}$ )



1116. *Crocus Imperati*. ( $\times \frac{1}{2}$ )

or more diam.: lvs. 6–10, as tall as the fl., very narrow, ciliate-edged: perianth-tube little exserted; segms. oblong and obtuse, bright lilac or even white; throat pubescent; anthers yellow, longer than filaments; style-branches 1 in. or more long, bright red (the source of saffron). Asia Minor. R.H. 1895, p. 573.—The commonest fall-blooming species.

24. *hadriaticus*, Herb. Much like *C. sativus*: usually smaller-fl., pure white, the segms. pubescent at base: anthers bright orange, more than twice longer than the white or purple filaments. Greece, etc.—Runs into several forms. Var. *melitensis*, Hort. Fls. feathered with purple and brown. Malta. Var. *Wilhelmii*, Hort. Fls. pale, with purple markings outside near the throat.

25. *zonatus*, Gay. Corm somewhat flattened or deflexed,  $\frac{1}{2}$ – $\frac{3}{4}$  in. diam.: lvs. appearing after the fls., narrow-linear: perianth-tube exserted, 2–3 in.; segms. 1–2 in. long, rose-lilac, purple-veined and orange-spotted within; throat yellow, pubescent; anthers white, 2–3 times longer than the yellow filaments; style-branches short and yellow. Cilicia. G.C. III. 23:85.

26. *caspicus*, Fisch. & Mey. Corm ovoid,  $\frac{3}{4}$  in. or less diam., with rigid tunic that has matted parallel fibers toward base: lvs. 4–5 in a tuft, not reaching the fl., very narrow, with a white band and reflexed margins: perianth-tube much exserted; segms. white, not striped, 1– $1\frac{1}{4}$  in. long; throat yellow, glabrous or slightly pubescent; anthers pale yellow or cream-colored, twice the length of filament, style-branches much exceeding anthers, slender, yellow. Near Caspian Sea. Oct. G.C. III. 34:443.

cc. Fls. yellow: basal spathe present; upper spathe 1-lvd.

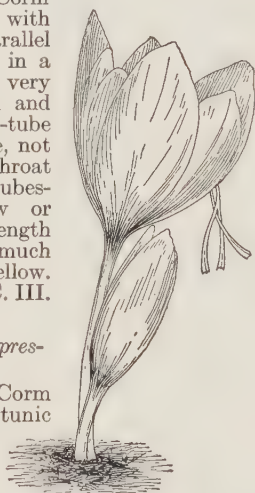
27. *Scharojänii*, Rupr. Corm globose and very small, the tunic membranous: lvs. developed in spring and remaining till the fl. appears; perianth-tube much exserted; segms. bright yellow, 1-colored,  $1\frac{1}{2}$ – $1\frac{3}{4}$  in. long; throat yellowish white; anthers pale yellow; style-branches nearly entire, orange-red, shorter than the stamens. Caucasus, Armenia, blooming end of July and in Aug. G.C. III. 32:321.

BB. Style-branches fimbriated or forked at the top: basal spathe present; upper spathe 1-lvd.

28. *longiflorus*, Raf. Corm  $\frac{1}{2}$  in. diam.: lvs. 3–4, very short at flowering time, very narrow: perianth-tube much exserted; segms. oblong and bright lilac,  $1\frac{1}{2}$  in., never striped; throat slightly pubescent, yellow; anthers orange, more than twice as long as the filaments; style-branches scarlet, slightly compound. S. Eu. B.R. 30:3.—Not frequent.

29. *serotinus*, Salisb. Corm 1 in. or less: lvs. 4–6, as high as the fl., very narrow: perianth-tube little exserted; segms. oblong,  $1\frac{1}{2}$  in., lilac or purple, indistinctly or not at all striped; throat glabrous; anthers yellow, much exceeding the filaments; style-branches orange-yellow, fimbriated. Spain. B.M. 1267.—Not frequent.

30. *Sälzmännii*, Gay (*C. tingitanus*, Herb.). Corm somewhat depressed, 1 in. diam.: lvs. about 6, not prominent at flowering time, very narrow: perianth-tube much exserted; segms.  $1\frac{1}{2}$  in. long, plain lilac; throat pubescent, yellowish; anthers orange, longer than the filaments; style-branches slender, orange. Morocco. B.M. 6000.



1117. *Crocus sativus* (X $\frac{3}{4}$ )



1118. *Crocus speciosus* var. *Aitchisonii*. (X $\frac{1}{2}$ )

BBB. Style-branches capillary-divided.

c. Fls. white.

D. Basal spathe present.

31. *niveus*, Bowles. Very robust and vigorous: corm globose,  $\frac{3}{4}$ –1 in. diam., the tunic of fine reticulated fibers; lvs. 6 in the tuft, equaling the fls.: basal spathe  $2\frac{1}{2}$  in. long; spathe 2-lvd., 4 in. long, leafy at top: perianth-tube  $5\frac{1}{2}$  in. long, the segms. white but with an orange glabrous throat; anthers yellow, 3 times as long as the filament. Probably Greece.—Differs from *C. Boryi*, to which it is closely related, by the basal spathe being present, yellow anthers, naked filaments, and reticulated tunic.

DD. Basal spathe absent.

32. *laevigatus*, Bory & Chaub. Corm ovoid,  $\frac{3}{4}$  in. or less diam., with rigid tunic broken into many small imbricated parts: lvs. 3–4 in a tuft, as high as the fl., very narrow, with reflexed margins and a white band: upper spathe 2-lvd., very short: perianth much exserted; segms. about 1 in. long, white and 1-colored or with 3–5 stripes of lilac on the back of outer segms.; throat yellow, glabrous; anthers white, about as long as the papillose filaments; style-branches bright yellow, exceeding the anthers. Greece. Var. *Fontenayi*, Bowles, is very late-blooming, and the fl. has a buff tint, outside finely feathered with purple, and clear lilac inside. Gn. 74, p. 176.

33. *Boryi*, Gay. Corm globular,  $\frac{3}{4}$  in. or less diam.: lvs. 3–6, narrow-linear, as high as the fls.: upper spathe 2-lvd.: perianth-tube short-exserted; segms. 1– $1\frac{1}{2}$  in. long, white, sometimes lilac-lined at the base outside; throat yellow, glabrous; anthers white, somewhat longer than the orange filaments; style-branches scarlet, divided into many capillary segms. and exceeding the anthers. Greece. Var. *Tournefortii*, Baker (*C. Orphanidis*,

Hook. f. B.M. 5776), has lilac fls. Var. *marathoniseus*, Baker (*C. marathonienseus*, Heldr.), has style-branches less divided than in the type, shorter and not overtopping the anthers. G.C. III. 40:335. Gn. 70, p. 273. G.M. 49:767.

cc. Fls. lilac (varying to white in No. 39).

D. Basal spathe present; upper spathe 1-lvd.

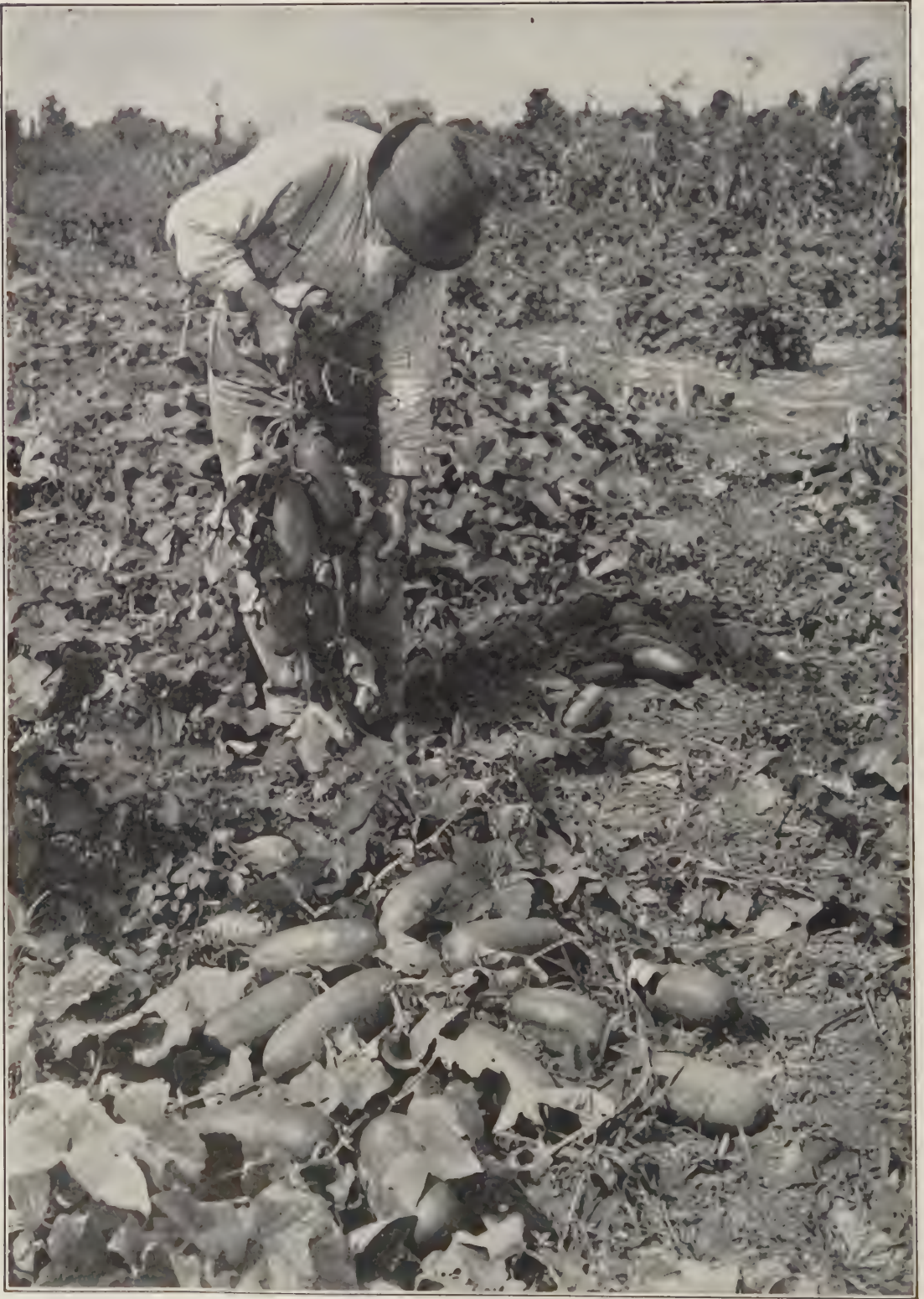
34. *mèdius*, Balb. Corm globular, 1 in. or less diam.: lvs. 2–3, appearing in spring, narrow, becoming a foot or more high: perianth-tube much exserted; segms.  $1\frac{1}{2}$ –2 in. long, bright lilac; throat glabrous, whitish; anthers pale orange, twice the length of the yellow filaments; style-branches scarlet, with many capillary divisions. S. France, Italy.

35. *nudiflorus*, Smith. Corm very small, stoloniferous: lvs. 3–4, appearing after the fls., very narrow: perianth-tube much exserted; segms.  $1\frac{1}{2}$ –2 in., lilac; throat glabrous; anthers large and yellow, twice as long as the filaments. Mts. S. France and Spain.—Long known in cult., but not common.

36. *astiricus*, Herb. Corm globular,  $\frac{3}{4}$  in. or less in diam.: lvs. about 3, appearing in fall but not maturing till spring: perianth-tube short-protruded; segms.  $1\frac{1}{2}$  in. long, lilac; throat pubescent; anthers bright yellow, longer than the white filaments; style-branches orange, with many capillary divisions. Spain.







XXXI. The White Spine cucumber.



37. *byzantinus*, Ker (*C. iridiflorus*, Heuff.). Corm  $\frac{1}{2}$  in. diam.: lvs. 2-4, developing after the fls.: perianth-tube much exserted; segms. 2 in. or less long, the outer ones dark lilac and acute, the inner ones shorter and pale lilac or white; anthers orange, longer than the filaments. S. E. Eu. B.M. 6141. B.R. 33:4.—An old garden plant, but rarely seen in this country.

dd. *Basal spathe absent; upper spathe 2-lvd.*

38. *pulchellus*, Herb. Corm small, somewhat depressed: lvs. produced after flowering, maturing in spring; perianth-tube much exserted; segms.  $1\frac{1}{2}$  in. long, bright lilac, more or less indistinctly striped; throat glabrous, bright yellow; anthers white, longer than the pubescent yellow filaments; style-branches orange, with many capillary branches. Greece to Asia Minor. B.R. 30:3.

39. *speciosus*, Bieb. Corm not stoloniferous, 1 in. or less. lvs. usually 3, developing after the fls., thin, very narrow, becoming 1 ft. long: perianth-tube much exserted; segms.  $1\frac{1}{2}$ -2 in., lilac and feathered with darker color; anthers very large, bright orange, much exceeding the filaments. S. E. Eu. and Asia. B.M. 3861. Gn. 62, p. 265; 71, p. 613. B.R. 25:40.—Handsome and variable. Var. *albus*, Hort. Fls. white. Var. *Aitchisonii*, Foster (*C. Aitchisonii*, Hort.). Fig. 1118. More graceful than the type and larger, fls. paler in color, the segms. more pointed, divisions of stigma more numerous and more spreading or even drooping: fls. very pale bluish lilac. Asia. G. 28:415. Gn. M. 8:228.

L. H. B.

**CROP.** The product secured from an area of cultivated plants; as, a crop of wheat, a crop of mushrooms, a crop of violets. The word is used generically for classes of products, as grain crop, root crop, forest or timber crop, fiber crop, flower crop, seed crop, salad crop. It is employed also as a verb,—the cropping of the land, to crop to fruit.

Other limitations of the word refer to duration and inter-relations: *catch-crop*, a secondary crop grown between the succession of other crops, as in the time between a crop of radishes and a crop of cabbages; or between the rows or stands of other plants; *companion-crop*, a catch-crop grown between other growing plants, as lettuce between rows or hills of beans; *succession-crop*, a catch-crop succeeding another crop as late celery following early potatoes; *cover-crop*, a catch-crop grown usually late in the season, or in winter, to protect the land and to afford green-manure. Rotation-cropping is a form of succession-cropping. Double-cropping may be either companion-cropping or succession-cropping, or both.

L. H. B.

**CROSSÁNDRA** (Greek, *fringed anthers*). *Acanthaceæ*. Warmhouse evergreen shrubs of minor importance.

Upright, with entire or somewhat toothed, often verticillate lvs., glabrous, or the infl. hairy: fls. in dense sessile spikes, red or yellow, with prominent bracts; corolla cylindrical, more or less curved, somewhat enlarged at the throat, with a flat or spreading oblique limb; stamens 4, in pairs.—Perhaps 20-25 species from India, Trop. Afr., and Madagascar. The one commonly in the trade has handsome 4-sided spikes of scarlet-orange fls.; perianth has 5 segms., the 2 upper ones being smaller; stamens 4, of 2 lengths: caps. oblong, acute, 4-seeded. It is cult. S. outdoors to a slight extent, and also rarely in northern greenhouses. Should be grown in rich loam, peat or leaf-mold, and sand. Prop. by cuttings in sand over bottom heat, preferably under a bell-jar.

*undulæfolia*, Salisb. (*C. infundibuliformis*, Nees). Height 1 ft., rarely 3 ft.: lvs. opposite, ovate-acuminate, stalked: fls. scarlet-orange, overlapping one another in dense closely bracted, æchmea-like spikes, 3-5 in. long. India. B.M. 2186. R.H. 1891:156. B.R. 69.

*C. flava*, Hook. Unbranched shrub, 6-8 in. high: st. green, glabrous: lvs. opposite, close together, large for the size of the plant, 6 in. long, obovate-lanceolate, dark green above, paler beneath, wavy, more obtuse than in the above; lower lvs. stalked, upper ones sessile: spike 4-sided, spiny; fls. yellow; tube much exserted, jointed. Trop. W. Afr. B.M. 4710.—*C. guineensis*, Nees. Height 2-6 in.: st. light red, rusty pubescent: lvs. 2-4 pairs, 3-5 in. long, elliptic, green above, with golden netted nerves, reddish beneath: spike solitary, terminal, slender, 3-5 in. high; fls. numerous, small, pale lilac, with 2 darker spots on the 2 smallest segms. and a white eye. Guinea. B.M. 6346.—A handsome foliage plant.

N. TAYLOR.†

**CROSSOSÔMA** (Greek, referring to a fringe-like body on the seeds). *Ranunculaceæ*; by Bentham & Hooker referred to *Dilleniaceæ*, and by Engler made the type of the family *Crossosomataceæ*. Four much-branched woody plants of Mex., Ariz. and S. Calif.: very glabrous, with grayish bark and whitish wood: lvs. oblong or narrower, entire, alternate, nearly or quite sessile, some of them fascicled: fls. mostly white, solitary and short-stalked at the ends of the branchlets. *C. californicum*, Nutt., has been mentioned in gardening literature abroad: 3-15 ft. high: lvs. 1-3 in. long, not much fascicled: fls. large, with nearly orbicular white petals more than  $\frac{1}{2}$  in. long, the anthers long-oblong: follicles  $\frac{3}{4}$  in. or more long, many-seeded. Isl. of Santa Catalina. *C. Bigelovii*, Wats., is lower, the lvs. mostly fascicled and fls. only half as large, the petals white or purplish. Ariz. to S. E. Calif.

**CROTALÀRIA** (Greek, *rattle, castanet*; from the rattling of the seeds in the pod). *Leguminosæ*. RATTLE-BOX. Annual outside herbs, and shrubs grown in greenhouses or in the open far South.

Herbs or shrubs of various habit: lvs. simple (actually unifoliate) or compound: fls. in terminal racemes or rarely the racemes opposite the lvs.; calyx-tube short, the teeth narrow, as long as or a little shorter than the pea-like corolla.—A cosmopolitan genus of perhaps 250 species, in tropics and subtropics mostly. For best results, the seed should be started early indoors, after being soaked in warm water. The name is sometimes misspelled *Crotolaria*. Greenhouse kinds are subject to red spider. *C. juncea* yields the Sunn hemp of India. Our common rattle-box, *C. sagittalis*, is often a troublesome weed.

A. *Lvs. apparently simple.*

*retusa*, Linn. Annual,  $1\frac{1}{2}$  ft. high: branches few, short: lvs. entire, very various in shape, but typically obovate with a short mucro, clothed beneath with short appressed hairs: fls. about 12 in a raceme, yellow, streaked or blotched with purple; standard roundish, notched. Cosmopolitan. June-Aug.—Intro. 1896, as a novelty and called "dwarf golden yellow-flowering pea," "golden yellow sweet pea," etc. The fls. are much less fragrant than the true sweet pea.

*verrucosa*, Linn. Annual, erect and nearly glabrous, the branches and fl.-stalks 4-angled: lvs. ovate, shortly petioled, blunt: fls. racemose, numerous, their variegated blue corollas making a magnificent show in early spring. Cosmopolitan in the tropics. B.M. 3034. B.R. 1137. P.M. 13:223.

AA. *Lvs. foliolate (compound).*

B. *Fls. striped with brown or red.*

*longirostrata*, Hook. & Arn. Greenhouse plant, herbaceous or somewhat shrubby, much branched, 3 ft. high: branches long, slender, glabrous: petioles  $1\frac{1}{2}$  in. long; lfts. 3, oblong, with a minute mucro, glabrous above, hoary beneath, with very short, appressed, silky hairs: racemes erect; calyx with 2 upper lobes ovate, the 3 lower ones lanceolate; fls. as many as 25 in a raceme, yellow with reddish or reddish brown stripe along the back of the unopened fls.; standard wider than long, reflexed, notched. W. Mex., Guatemala. B.M. 7306. F.R. 1:809.—Flowering from Dec. to March. Intro. into Kew through the U. S. Dept. Agric. in 1891.

BB. Fls. not striped, pure yellow.

*incana*, Linn. A woody perennial, 2-4 ft., with stout round branches, the whole plant silky-hairy: lfts.  $1\frac{1}{2}$ -2 in. long, obtuse, cuneate below, membranous: fls. 12-20 in a raceme, yellow, at least  $\frac{1}{2}$  in. long: pod nearly sessile, loosely hairy. Common throughout the tropics. B.R. 377.

*capensis*, Jacq. Stout, much-branched shrub, 4-5 ft. high: branches terete, appressedly silky; stipules when present petiolulate, obovate and lf.-like, obsolete or wanting on many petioles: lfts. broadly obovate, obtuse or mucronulate, glabrous or minutely pubescent on one or both sides: racemes terminal or opposite the lvs., loose, many-fld., the fls. usually more than 1 in. long; calyx and pod pubescent; wings transversely wrinkled and pitted. S. Afr.—Cult. in S. Fla.

*C. Trôpez*, Mattei. An erect or prostrate annual: racemes lateral, often 20-fld. or more; fls. small, yellowish. Italian Somaliland.

WILHELM MILLER.

N. TAYLOR.†

**CRÔTON** (Greek name, probably of the castor bean). *Euphorbiaceæ*. Herbs, shrubs or trees of no special horticultural value; some cultivated for economic products which they yield.

Pubescence stellate or scaly: lvs. usually alternate: fls. mostly in terminal spikes or racemes, usually monœcious, sometimes diœcious; sepals usually 5-10, small, petals present at least in the staminate fls.; stamens 5 to many, incurved in the bud; ovary 3-celled, 1 ovule in each cell.—Five hundred or more species in the warmer parts of the world, chiefly in Amer. Several herbaceous species native in S. and W. U. S.



1119. *Croton alabamensis*.

For *Croton tinctorius*, see *Chrozophora*; for *C. sebiiferus*, see *Sapium*. See also *Codiaeum* for the commonly cultivated crotons of florists.

**Tíglium**, Linn. CROTON-OIL PLANT. PHYSIC-NUT. PURGING CROTON. Small tree: lvs. ovate, acuminate, serrate, petiolate, varying from metallic green to bronze and orange: pistillate fls. apetalous. S. E. Asia. Blanco. Fl. Fil. 383.—The powerful purgative, croton oil, is obtained from the seeds. Offered in S. Calif. as an ornamental and curious plant.

**Elutéria**, Benn. CASCARILLA. SEASIDE BALSAM. SWEETWOOD. Petals in both staminate and pistillate

fls.: lvs. ovate-lanceolate, acuminate subcordate. Bahamas. B.M. 7515.—This species and *C. Cascarilla*, Benn., Bahamas and Fla., yield the cascarilla bark.

*alabamensis*, E. A. Smith. Fig. 1119. Shrub, 6-9 ft. high: lvs. evergreen, nearly entire, oblong-lanceolate, upper side nearly smooth, lower side densely silvery scaly: both staminate and pistillate fls. with petals. Local in Ala., rarely cult. G.F. 2:594 (see Fig. 1119).

J. B. S. NORTON.

**CROWFOOT:** *Ranunculus*.

**CROWN IMPERIAL:** *Fritillaria Imperialis*.

**CRUCIANÉLLA** (Latin, a little cross; from the arrangement of the leaves). *Rubiaceæ*. CROSSWORT. Hardy rock plants of minor importance.

Herbs, often woody at the base: branches usually long, slender, 4-cornered: upper lvs. opposite, without stipules; lower lvs. or all in whorls of 3 or more, linear or lanceolate, rarely ovate or obovate: fls. small, white, rosy or blue.—About 30 species, natives of the Medit. region and W. Asia. The genus is closely related to *Asperula*, and is distinguished by the fls. having bracts, not an involucre, and the style-branches distinctly unequal instead of nearly equal. The first species below has lately been referred to *Asperula*. It is of easy cult., preferring light, moderate loam and partial shade. A delicate plant for the front of borders, and capital for the rockery. Prop. chiefly by division, and also by seeds.

*stylôsa*, Trin. (*Aspérula ciliata*, Rochel). Annual, prostrate, 6-9 in. high: lvs. in whorls of 8 or 9, lanceolate, hispid: fls. small, crimson-pink, in round terminal heads  $\frac{1}{2}$  in. diam.; floral parts in 5's; style club-shaped, long exserted, very shortly twice cut at the top. June-Aug. Persia.—Grown, and often acting in England, as a perennial.

*angustifolia*, Linn. Annual: lower lvs. 6 to a whorl, linear, on an erect or sometimes branching, smooth st.: fls. white, in spike-like clusters, small, the petals sometimes short mucronate. Medit. region. July.

*C. chlorostachys*, Fisch. & Mey. Annual, rough and spreading, but the whole plant only 4-6 in. high: fls. small, in spike-like clusters.—*C. glomerata*, Bieb. (*Asperula glomerata*, Griseb.), has yellowish green fls. in many interrupted spikes. Palestine to Persia. Properly an *Asperula*.

N. TAYLOR.†

**CRYPTÁNTHE** (Greek, for hidden flower). *Boraginaceæ*. NIEVITAS. This genus includes many species referred by some writers to *Eritrichium* and *Krynitzkia*, but probably none of them is in cult. They are mostly annuals, with white fls., which are usually sessile: calyx 5-parted to the base, as long as the corolla-tube; segms. more or less hispid or with hooked bristles, in fr. closely embracing the nutlets, eventually deciduous: nutlets 4, sometimes 3, 2 or 1, smooth, papillate, or muriculate, never rugose.—Over 60 species, in Pacific N. Amer., southward, into N. Mex. and Chile. *C. glomerata*, Lehm. (*Krynitzkia glomerata*, Gray), is a coarse biennial, 1-3 ft. high: lvs. spatulate or linear-spatulate. Plains, along eastern base of Rocky Mts. *C. barbígera*, Greene (*K. barbígera*, Gray. *Eritrichium barbígerrum*, Gray). Nine to 12 in. high: lvs. linear. S. Calif.

**CRYPTÁNTHUS** (Greek, for hidden flower). *Bromeliaceæ*. Brazilian epiphytal bromeliads, differing from *Echmea* and *Billbergia* (which see for culture) in the tubular calyx and the dense heads of flowers nearly sessile amongst the leaves.

Leaves crowded in a rosette, recurved-spreading, spinulose-serrate: fls. in a terminal head, nearly buried beneath the bracts; petals oblong, joined at the base; stamens attached to corolla-tube.—Monogr. by Mez (who recognizes 8 species) in DC. Monogr. Phaner. 9 (1896); by some, all are considered to be forms of one species.



*A. Lvs. not narrowed or petiolate above the sheath.*

**acaülis**, Beer (*Tillandsia acaülis*, Lindl. *C. undulatus*, Otto & Dietr.). A few inches high, suckering freely: lvs. sea-green, long-pointed and spreading, weak-spiny: fls. white, nestling deep in the foliage. B.R. 1157.—A very variable plant, of which Mez recognizes the following leading types:

**Var. genuinus**, Mez. Stemless or very nearly so: lvs. sub-elliptic-lanceolate, strongly undulate, gray-scurfy beneath, scurfy above.

**Var. discolor**, Mez (*C. discolor*, Otto & Dietr.). Stemless or nearly so: lvs. elongated, scarcely undulate, silvery-scurfy below, glabrous or nearly so above.

**Var. ruber**, Mez (*C. ruber*, Beer). Produces a branching st. or trunk: lvs. short, strongly undulate, reddish.

**Var. bromelioides**, Mez (*C. bromelioides*, Otto & Dietr.). St. tall: lvs. much elongated, scarcely undulate, remotely spinulose.

**Var. diversifolius**, Mez (*C. diversifolius*, Beer). St.-bearing: lvs. elongate-lingulate, deep green above, silvery-scurfy beneath.

**zonatus**, Beer. Fig. 1120. Lvs. oblong-lanceolate, the margin undulate and densely serrate-spinulose, marked with transverse bands of white: fls. white.

**bivittatus**, Regel (*Billbergia bivittata*, Hook. *B. vittata*, Hort.). Nearly or quite stemless: lvs. long-oblong, curving, long-pointed, somewhat undulate, spiny, dull brown beneath, green above and with 2 narrow buff or reddish bars extending the length of the lf.: fls. white. B.M. 5270.

*AA. Lvs. narrowed or petiolate above the sheath.*

**Beückeri**, Morr. Lvs. 10–20, oblong, pointed, canaliculate at base, very finely spiny, brownish green or rosy and spotted or striped with light green: fls. white.

*C. nitidus*, Bull. A recent importation from Brazil, described as a stemless species with sessile dark olive-green lvs., marked with a band of cream-color each side of the midrib.

L. H. B.

GEORGE V. NASH.†

**CRYPTOCORÏNE** (Greek-made name, referring to the spadix being inclosed or hidden in the spathe). Syn. *Myrioblástus*. *Aracæ*. Aquatic or paludose herbs of 20–30 species in Trop. Asia and the Malayan Archipelago, rarely seen in choice collections but apparently not in the trade. They have creeping and stoloniferous rhizomes, strongly ribbed oblong or linear or ovate lvs., monœcious fls. without perianth, the upper ones on the spadix staminate and the lower pistillate: spathe closed, the infl. wholly included. The species require the treatment given tender arums. *C. ciliata*, Fisch., 1 ft. lvs. narrow, stalked: fls. fragrant in a long tubular peduncled spathe which is fringed at the top. *C. retrospirâlis*, Fisch., plant slender with very narrow almost grass-like lvs., and small spathe terminating in a spiral or twist. *C. Griffithii*, Schott, with lvs. ovate or orbicular-oblong marked with fine red lines; spathe purple. B.M. 7719.

**CRYPTOGAMS** are flowerless plants, producing not seeds but spore. The whole vegetable kingdom was formerly thrown into two classes, the flowering plants or phanerogams and the flowerless or cryptogams. Cryptogam means “concealed nuptials,” and phanerogam “visible nuptials.” These names were given when it was thought that the sexual parts of the flowerless plants were very obscure or even wanting. The word is now falling into disfavor with botanists. Cryptogams are of less horticultural interest than the flowering plants, although they include the ferns, and some interesting smaller groups, as selaginellas, lycopods or club mosses. The word cryptogam is now mostly given up by botanists as representing a taxonomic group, as the name is founded on imperfect

or false analogies. The plants covered by this name are now distributed in the great divisions of thallophytes, bryophytes and pteridophytes; and the phenogams or phanerogams are spoken of as spermatophytes (see the categories on p. 2, Vol. I.).

**CRYPTOGRÁMMA** (Greek, *a concealed line*, alluding to the sub-marginal sori). *Polypodiaceæ*. Hardy subalpine ferns of both hemispheres of interest mainly to the collector.



1120. *Cryptanthus zonatus*.

Leaves of 2 sorts, the fertile lvs. contracted and the sori covered by the infolded margin of the segms., forming pod-like bodies. Besides our native species, a third one, *C. crispa*, is found in Eu., and a fourth in the Himalayas. Name often incorrectly written *Cryptogramme*. Cult. simple.

**acrostichoides**, R. Br. **ROCK-BRAKE**. Height about 8 in.: lvs. numerous, 4–6 in. long, on tufted straw-colored stalks, tri-quadriripinnatifid, with toothed or incised segms., the sporophylls with longer stalks, less divided and with pod-like segms. Canada to Colo., Calif., and northward.

**Stélleri**, Prantl (*Pellaea gracilis*, Hook. *P. Stélleri*, Baker). **SLENDER ROCK-BRAKE**. Lvs. 4–10 in. long, very delicate in texture, withering by Aug., few to a plant, about 2 pinnate.—Grown best in loose well-drained leaf-mold. A rather rare rock fern of the eastern states, offered by some dealers in hardy ferns. Grows in crevices of cliffs, or in moss.

R. C. BENEDICT.†

**CRYPTÓLEPIS** (Greek, *hidden scale*). *Asclepiadaceæ*. Shrubs, erect or twining, of Trop. Asia and Afr. Lvs. opposite: fls. in a loosely forking, few-fl. cyme; calyx deeply 5-parted, with 5 scales at base; corolla with spreading limb, the tube short-cylindrical or campanulate, the lobes 5 and linear, spreading or deflexed and twisted; corona of 5 scales attached at or near the middle of the tube: follicles terete and smooth, spreading.—Species 20. Cult. only in S. Calif. and S. Fla. *C. Buchananii*, Roem. & Schult. A twining shrub with yellow fls., resembling those of an echites: lvs. 3–6 in. long, leathery, shining above: cymes very short-stalked, paniculate. India. *C. longiflora*, Regel. Dwarf and compact growing, with long lvs. tinted with red; tubular white fls., as in *Bowardia jasminiflora*. Native country unknown.

**CRYPTOMÈRIA** (Greek, *kryptos*, hidden, *meros*, part; meaning doubtful). *Pinacæ*. Ornamental evergreen cultivated for its handsome habit and foliage.

Large pyramidal tree, with a straight slender trunk, covered with reddish brown bark and with verticillate spreading branches, ascending at the extremities: lvs. spirally arranged, linear-subulate, acute, slightly curved, decurrent at the base: fls. monœcious; stami-

nate oblong yellow, forming short racemes at the end of the branches, pistillate globular, solitary, at the end of short branchlets: cone globular, with thick, wedge-shaped scales, furnished with a recurved prict on the back and with pointed lobes at the apex, each scale with 3-5 narrow-winged, erect seeds.—One species in China and Japan, extensively planted for avenues, and as timber trees in the latter country, where the light and easily worked but durable wood is much used.

It is hardy as far north as New York, and thrives in sheltered positions even in New England. It seems, however, in cultivation, not to assume the beauty it possesses in its native country. With us, it looks best as a young plant, when it much resembles the *Araucaria excelsa*. It is therefore sometimes grown in pots. It thrives best in a rich, loamy and moist soil and sheltered position. Propagated by seeds or by cuttings of growing wood, especially var. *elegans*, which grows very readily. The horticultural varieties are also sometimes increased by grafting.

**japónica**, Don. Tree, attaining 125 ft.: lvs. linear-subulate, compressed and slightly 4- or 3-angled, bluish green,  $\frac{1}{2}$ -1 in. long: cone brownish red,  $\frac{3}{4}$ -1 in. across. S.Z. 124. H.I. 7:668. R.H. 1887, p. 392. Gng. 4:197. F.E. 10:510. G.F. 6:446.—Of the garden forms, the most desirable is var. *elegans*, Beissn. (*C. elegans*, Veitch). Low, dense tree, with horizontal branches and pendulous branchlets: lvs. linear, flattened, soft, spreading, longer than in the type, bright green, changing to bronzy red in fall and winter. Very handsome when young, but short-lived. Var. *araucarioides*, Carr. Of regular pyramidal habit, with short, thick falcate lvs., resembling *Araucaria excelsa*. Var. *compacta*, Beissn. Of very compact habit, with bluish green foliage. Var. *pyramidalis*, Carr. Of narrow pyramidal compact habit, dark bluish green, not changing to reddish brown during winter. Var. *Löbblii*, Carr. Of compact habit, with shorter and more appressed bright and deep green lvs. Var. *nana*, Knight. Dwarf and procumbent, densely veined form; adapted for rockeries. Var. *spiralis*, Veitch. Slender shrub, with strongly falcate lvs., twisted spirally around the branchlets. S.Z. 124, fig. 4. ALFRED REHDER.

**CRYPTOPHORÁNTHUS** (Greek, meaning to *bear hidden flowers*). *Orchidaceæ*. A few Trop. American orchids closely allied to Masdevallia and Pleurothallis, remarkable for the almost closed fl. within which is hidden the lip: sepals united at the base into a short tube and joined also at the apex, the petals being inside; there are openings or "windows" on either side where the sepals spread apart at their middles. The species require the cult. given Pleurothallis. Apparently none is in the American trade. *C. maculatus*, Rolfe (*Pleurothallis maculata*, Rolfe), is a little plant with numerous yellow densely crimson-spotted fls. *C. Dayanus*, Rolfe (*Masdevallia Dayanus*, Reichb. f.) and *C. atropurpureus*, Rodr. (*Pleurothallis* and *Masdevallia fenestrata*, Hort.), may be expected; the former has upper sepal yellowish white and purple-spotted keels, and inferior sepals (joined) orange with brown spots; the latter has dark purple solitary fls. *C. Moorei*, Rolfe, has small dull red-purple fls. with darker lines, the lateral openings about  $\frac{1}{2}$  in. long: lvs. broadly elliptic, purple beneath, about  $1\frac{1}{2}$  in. long.

**CRYPTOPYRUM**: *Triticum*.

**CRYPTOSTÈGIA** (Greek, *krupto*, conceal, and *stego*, cover; referring to the 5-scaled crown in the corolla-tube, which is not exposed to view). *Asclepiadaceæ*. Tropical climbers.

Leaves opposite: fls. large and showy in a terminal trichotomous cyme; corolla funnel-shaped, the tube short.—Only 2 species, 1 from Trop. Afr., and 1 from Madagascar. The juice of *C. grandiflora*, when exposed

to the sunshine, produces caoutchouc. See Dict. Economic Products India 2:625. The plant is cult. in India for this purpose. It is rarely cult. in Old World greenhouses for ornament. It is said to be of easy cult. in a warmhouse and prop. by cuttings.

**grandiflora**, R. Br. (*Nerium grandiflorum*, Roxbg.). St. erect, woody: branches twining: lvs. opposite, short-stalked, oblong, entire, 3 in. long,  $1\frac{1}{2}$  in. wide: fls. in a short spreading cyme, reddish purple, becoming lilac or pale pink, about 2 in. across, twisted in the bud: fr. a follicle. Old World, probably Indian origin, but established in the African Isls. of the Indian Ocean, especially Reunion. Hooker, however, thinks that it was originally a Trop. African plant. B.R. 435.—Once cult. at Oneco, Fla., by Reasoner, and not uncommon in botanic gardens under glass. Called pulay or palay in India where it is widely cult. as an ornamental. Not important as a rubber plant.

**madagascariensis**, Hemsl. A climbing glabrous shrub: lvs. short-petioled, leathery, variable in outline, 2-4 in. long: fls.  $2\frac{1}{2}$ -3 in. across, pink or whitish, not lilac as in many specimens of *C. grandiflora*; corolla-lobes longer than the tube. Madagascar.—A very showy greenhouse climber with cymose infl.

N. TAYLOR.†

**CRYPTOSTÈMMA** (Greek, *hidden crown*). *Compositæ*. Two or 3 hoary herbs, by some united with *Arctotis*, apparently not in the trade, but sometimes mentioned in gardening literature: diffuse or creeping, with basal or alternate lvs. that are dentate or lyrate-pinnatisect, villous above and white-tomentose or woolly beneath: heads radiate, yellow or more or less purplish, rather large, peduncled, or solitary on leafless scapes, the rays sterile: achene densely villous, 5-ribbed, the pappus paleaceous and in 1 series. *C. calendulaceum*, R. Br. (*C. lusitanicum*, Hort.), is a free-blooming annual with pale yellow rays and a dark brown disk, the heads on 1-fl. peduncles: lvs. pinnatifid, 3-nerved. Cape and Austral. B.M. 2252. G.C. III. 28:390, desc. *C. Forbesianum*, Harv., and *C. niveum*, Nichols. (*Microstèphium niveum*, Less.), of S. Afr., may be more or less in cult. Both have yellow rays, in the latter the heads being solitary and the plant decumbent or creeping and the lvs. ovate, cordate or orbicular; in the former the lvs. are mostly pinnatisect, the margins revolute.

**CRYPTÓSTYLIS** (*hidden style*, Greek). Syn. *Zosterostylis*. *Orchidaceæ*. Eight or 10 terrestrial orchids of the E. Indies, Malaya and Austral., allied to Pogonia. Lvs. solitary or few, narrow and membranaceous, on stiff petioles: fls. rather large, racemose or spicate on simple sheathed scapes, the sepals and petals very slender or even awl-like and nearly or quite equal; lip large, sessile, the broad base inclosing the column and then expanding into a broad blade. *C. arachnites*, Blume. Rootstock fleshy: lvs. erect, green, lanceolate: fls. on a scape 18 in. or less high, many and spider-like, the sepals and petals green and the fleshy lip purple and mottled, pubescent and grooved. India (Ceylon, Khasia). B.M. 5381. A curious indoor orchid.

**CTENÁNTHE** (Greek, *comb-flower*). *Marantaceæ*. About a dozen Brazilian plants closely allied to Calathea and Maranta, differing from the former in belonging to the 1-seeded section of the family and from the latter in having a shorter corolla-tube and different shaped fls. Sepals 3, free and equal, somewhat parchment-like; corolla-tube short but wide, the lobes 3 and nearly equal and hooded at the apex; staminal tube very short; 2 exterior staminodia petal-like, short, obovate and hooded, with lateral deflexed lobes. The ctenanthes are perennial herbs with basal and cauline lvs. that are more or less petiolate, and crowded fls. in terminal spikes or racemes. They are glasshouse plants requir-



ing the treatment of calathea; apparently little known in American collections. The species fall into two groups, those with variegated and those with green lvs. Of the former group are *C. Kummeriana*, Eichl., and *C. Oppenheimiana*, Schum., the former being 20 in. or less tall and with villous ovary and raceme, the latter robust and 3 ft. or more tall and ovary glabrous. Of the plain-lvd. kinds, *C. Luschnathiana*, Eichl. (*C. compressa* var. *Luschnathiana*, Schum.), and *C. setosa*, Eichl., may be found in choice collections; both species grow about 3 ft. high, the former having ovate-acute bracts and the latter long-acuminate brown-villous bracts.

**CUCKOO FLOWER:** *Cardamine pratensis*.

**CUCKOO-PINT:** *Arum*.

**CUCUMBER.** Plate XXXI. The common cucumbers are derived from an Asian species, *Cucumis sativus* (see *Cucumis*), which has long been known in cultivation. The so-called West India gherkin, which is commonly classed with the cucumbers, is *Cucumis Anguria*. The snake, or serpent cucumber is more properly a muskmelon, and should be designated botanically as *Cucumis Melo* var. *flexuosus* (cf. A. G. 14:206). The "musk cucumber" is *Cucumis moschata*, Hort., which is probably identical with concombres musqué, referred to *Sicana odorifera* by Le Potager d'un Curieux, known in this country as cassabanana. The Mandéra cucumber is *Cucumis Sacleuxii*, Paill. et Bois. (Pot. d'un Curieux), but it is not in cultivation in this country. None of these is of any particular importance except the common types of *Cucumis sativus*. These are extensively cultivated in all civilized countries as field and as garden crops. They come into commerce as pickles packed in bottles and barrels, and are very extensively used in this form. Of late, the forcing of cucumbers under glass has come to be an important industry in the eastern states.

#### Field culture.

The common cucumber is an important field and garden crop and may be classed as one of the standard crops of the vegetable-garden. The fruit is used as a table salad, eaten raw, with the usual salad seasonings, and is pickled in large quantities. The cucumber is pickled in both large and small sizes, both by the housewife and commercially on a large scale. The small fruit, of not more than a day or two's growth and measuring from 1 to 2 inches in length, makes the most desirable and delicate of pickles. These are packed in bottles for the commercial trade and bring fancy prices. Larger sizes are pickled and sold by the keg or barrel.

The cucumber is a native of the tropics and tender of frost. It should be planted in a warm location, after danger from frost is past. For the early crop—and earliness is of prime importance to the commercial vegetable-grower—a sandy soil is preferable, supplied with an abundance of well-rotted stable manure. The seed may be sown in hills 3 feet apart with rows 6 feet apart, or may be planted by machine (the common seed-drill) in drills 6 feet apart. In either case, an abundance of seed should be used, for severe injury by insect pests often occurs in the early stages of the cucumber's life. Plants may be started under glass to hasten maturity. The seed is sometimes sown in pots or baskets or in inverted sods and these protected and so managed that the cucumber plant receives those conditions most suitable to its rapid and healthy growth. These conditions are: a temperature between 60° and 65° at night, which may be allowed to rise to 100° in bright sunshine; an ample supply of moisture; sufficient ventilation, without draft, to prevent a soft brittle growth. It is almost impossible to transplant cucumber seedlings and secure satisfactory results if the roots are disturbed. A glass-covered frame may be used over seed planted in the field, and yields good returns on labor and equip-

ment. Any method whereby marketable cucumbers may be obtained a few days earlier, if not extravagant of time and labor, will pay handsomely.

The cucumber, in the field, should yield marketable fruits in seven to eight weeks from seed and continue in profitable bearing until frost. It is customary among commercial growers to allow two or three plants to the hill, and when grown in drills, one plant is left every 18 to 24 inches.

During the height of the growing season, which is usually in August when the days are hot and nights moist and warm, the cucumbers need to be picked every day. The fruit is ready to harvest when it is well filled out, nearly cylindrical in shape. When immature it is somewhat furrowed. When allowed to remain too long, it becomes swollen in its middle portion and cannot be sold as first quality. Cucumbers are marketed by the dozen, the field crop often bringing as much as 60 cents a dozen at the first and selling as low as 5 cents a dozen at the glut of the market.

The cucumber plant is affected by serious insect pests and fungous diseases. Of the insect pests, the striped cucumber beetle is the most serious and difficult to combat. It feeds on the leaves, usually on the



1121. House of English cucumbers.

under sides, and appears soon after the cucumber seedlings break ground. This cucumber beetle seems to be little affected by the common remedies for chewing insects. This is probably largely due to its activity, the beetle moving to unpoisoned parts of the plant, and also to the fact that rarely, in commercial practice, is the under side of the leaves thoroughly poisoned. Arsenate of lead applied in more than ordinary strength is the most satisfactory remedy. Hammond's Slug Shot, dusted lightly over the plants, will drive the bugs away, while a teaspoonful of paris green mixed with two pounds of flour makes also an excellent mixture with which to fight the bugs. Or cover the young plants with small wire or hoop frames, over which fine netting is stretched. If the plants are kept quite free from attack till these protectors are outgrown, they will usually suffer little damage. Plants started in hotbeds or greenhouses may usually be kept free at first, and this is the chief advantage of such practices. The cucumber beetles are kept away somewhat at times by strewing tobacco stems thickly under the plants; and kerosene emulsion will sometimes discommode the young squash bugs without killing the vines, but usually not. What is known as the cucumber blight (*Pseudoperonospora cubensis*) has done much to discourage the growth of cucumbers. This fungus may be repulsed by thorough spraying with bordeaux and the plants should



be kept covered with bordeaux throughout their growth. This will require at least three or four sprayings. The growth of the vines, which usually completely covers the ground, prevents late sprayings, which are often necessary to maintain healthy growth and insure maximum returns.

The common field varieties most popular in the United States grown for a slicing cucumber are of the White Spine type. Many of the so-called White Spine varieties now on the market are not typical of the original White Spine cucumber, which is a fruit averaging about 6 inches in length, rather blunt on both ends, with white prickles appearing at frequent intervals over the surface. The seed end is light-colored, in mature specimens almost white with whitish stripes extending toward the stem end from one-third to one-half the length of the cucumber. What is often cata-



1122. Three prominent varieties of English or Forcing cucumber. S. Sion House; E. Duke of Edinburgh; T. Telegraph. ( $\times \frac{1}{2}$ )

logued as the Improved White Spine has become more popular among growers within recent years. This type possesses some of the characteristics of the popular English type of cucumber known as the Telegraph. The improved type has been obtained by crossing the White Spine with the Telegraph or some closely related variety. This cross has resulted in an increased length and darker green color, with a fewer number of spines and seeds and a more common tapering of the ends. All of these changes have apparently been beneficial and have been well fixed by careful selection. This is well illustrated by the cucumber of the White Spine type sold as Woodruff Hybrid.

The English type of cucumbers is raised on a small scale in this country but infrequently for market purposes.

#### *Forcing of cucumbers.*

The commercial production of cucumbers under glass has assumed large proportions. This crop ranks second in commercial importance among greenhouse-

grown vegetable crops, lettuce only exceeding it in importance. The cucumber crop is ordinarily grown in the spring of the year after two or three crops of lettuce have been removed, and it continues to occupy the ground until the vines cease bearing, due either to poor management, pests or some similar trouble. The cucumber should come into bearing six to eight weeks after setting in the houses. It is the customary plan to plant the seed in 4- to 6-inch clay pots about two weeks before the house to be used is ready for setting. These pots are often placed over manure heat and should always be in a warm house separate from the lettuce. Two weeks should be sufficient to allow the plant a good start, two or three pairs of leaves being all the development desired before setting in the permanent location. Careful management is essential to a healthy growth, for many pests prove more serious in the glasshouse than in the field. A night temperature not below 60° F. is very essential, while the day temperature may go to 90° F. without danger in bright sunshine. The appearance of the plants will immediately indicate, to the experienced observer, the conditions under which the crop has been grown. A short stocky growth between joints with dark green foliage is desirable. There are localities in which growers make cucumbers the all-the-year-round crop in the glasshouse, usually growing crops from two seedings during the entire season. It requires more skill to produce good cucumbers during the fall and winter months than from February on, and the yield is much lighter in the late fall and early winter than for the spring crop. All cucumbers require an abundance of moisture and food. It has become a common practice in certain sections to mulch the cucumber vines in the greenhouse with good quality straw manure to the depth of 3 or 4 inches and apply the water directly on the manure. This practice eliminates the packing and puddling of the soil often caused by direct heavy watering, increases the supply of readily available plant-food and gives the roots a good opportunity to grow near the surface where air is available and still be protected from the drying out which occurs when the soil is directly exposed to the sun.

The pruning and training of the cucumbers in the greenhouse is of much importance. A number of methods are in common use, one of the most common and practical of which is: Stretch a wire tightly the length of the house at the base of the plants which may be set in rows 3 feet apart and 18 inches to 2 feet apart in the rows; fasten at the base of each plant a soft but strong twine known in tobacco-growing sections as tobacco twine, securing this single twine to an overhead wire running parallel and directly over the ground wire, but not stretching the string tight. As the cucumber plant grows, it is twined about this string to which it clings by tendrils. When the plant reaches the upper wire it is either allowed to grow at will over wires provided for an overhead support and from which the cucumbers usually hang down where they can be easily picked, or it is pruned and the encouragement of fruiting along the upright stem continued. In the meantime more or less fruit has been harvested and at each joint a lateral branch has appeared. It is necessary to cut these off. Some growers prefer to take them off back to the main stem, while others, if a cucumber is obtainable on the first joint of the lateral, nip the lateral just beyond this point.

"In the greenhouse, cucumbers are liable to damage from mite, aphid, root-gall and mildew. For the mite, syringe the plant and pick off the infested lvs.; for aphid, use tobacco fumigation and pick infested lvs.; for root-gall, use soil which has been thoroughly frozen; for mildew, improve the sanitary conditions, and then use sulfur."—Bailey, "Forcing-Book."

Yields of twenty-five to one hundred and twenty-five cucumbers have been secured from single plants. The expert growers, under normally good circumstances,



may expect to obtain a yield of six to seven dozen marketable cucumbers from a plant.

#### Varieties of cucumber.

There are a great many varieties of cucumbers in cultivation. This means that the group is variable, the varieties comparatively unstable, and varietal distinctions somewhat uncertain. Nevertheless, there are certain dominant types which may be separated, and around which most of the varieties may be conveniently classified. The principal types are the following:

#### Common cucumber, *Cucumis sativus*.

I. English forcing type (var. *anglicus*): Fig. 1122. Large-lvd., strong-growing, slow-maturing plants, not suited to outdoor cult.: fr. large, long, smooth, usually green, with few or early-deciduous black spines. Telegraph, Sion House, Tailby Hybrid, Kenyon, Lorne, Edinburgh, Blue Gown.

#### II. Field varieties (hill or ridge cucumbers).

##### a. Black Spine varieties.

1. Netted Russian type: Small, short-jointed vines, bearing more or less in clusters, small, ellipsoidal fr. covered with many small, black, deciduous spines: fr. green, ripening to dark reddish yellow, on a cracking, chartaceous skin. Early-maturing and prolific. Netted Russian, Everbearing, New Siberian, Parisian Prolific Pickle.
2. Early Cluster type: Small or medium vines: fr. small, usually less than twice as long as thick, indistinctly ribbed, green, ripening yellow, with scattered, large, black spines. Early Cluster, Early Frame.
3. Medium Green type: Intermediate in size of vine and fr. between the last and next: fr. about twice as long as thick, green, ripening yellow, with scattering, large black spines. Nichols Medium. Green, Chicago Pickle.
4. Long Green type: One of the best fixed types, representing, perhaps, one of the more primitive stages in the evolution of the group. Vines large, long and free-growing: fr. large and long, green, ripening yellow, with scattered, large, black spines. Long Green, Japanese Climbing.

##### b. White Spine varieties.

5. White Spine type: A strong and important type: plants medium large, vigorous: fr. medium large, about thrice as long as thick, green, ripening white, with scattering, large, white spines. There are many selected strains of White Spine. Cool and Crisp, Davis Perfect and Fordhook Famous belong here.
6. Giant Pera type: Mostly poorly fixed varieties, having large rather unthrifty vines, bearing large frs. tardily and sparsely, which are white or whitish, smooth or with scattering, deciduous, usually white spines. Chicago Giant, Goliath, Giant Pera, White Wonder, Long Green China.

Sikkim cucumber, *Cucumis sativus* var. *sikkimensis*. Plant small and stocky, much like the common cucumber: fr. large, reddish brown marked with yellow. (The Egyptian hair cucumber, of Haage & Schmidt, as we have grown it, is apparently an odd form of *Cucumis sativus*, and may belong here. It has a medium-sized white fr., densely covered with soft, white hair. The plant resembles the Sikkim cucumber.) Not in general cult.



1123. Staminate flower of *Cucumis Melo*. (Nat. size)

Snake or Serpent cucumber, *Cucumis Melo* var. *flexuosus*. Vines resembling those of muskmelon: fr. very long, twisted, ribbed-cylindrical, green, tardily yellowing, covered with dense, woolly hairs.

West India gherkin, *Cucumis Anguria*. Figs. 1127, 1128. Vines small and slender, somewhat resembling a slender watermelon plant: fr. very abundant, small, ellipsoid, covered with warts and spines, green, tardily whitening. Good for pickles.

These varieties are mostly all good for one purpose or another. The small sorts are naturally preferred for

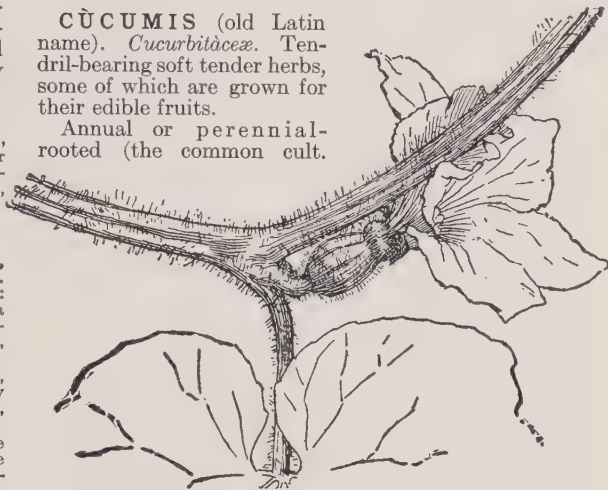
pickling, the medium sorts for slicing, and the large, late varieties for ripe fruits. The White Spine varieties are great favorites for slicing, and only less so for pickling.

F. A. WAUGH.  
H. F. TOMPSON.

#### CUCUMBER TREE: *Averrhoa* and *Magnolia*.

**CÛCUMIS** (old Latin name). *Cucurbitaceæ*. Tendril-bearing soft tender herbs, some of which are grown for their edible fruits.

Annual or perennial-rooted (the common cult.

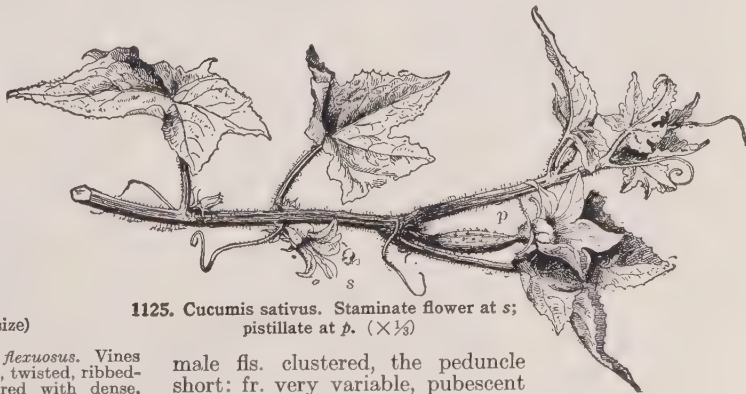


1124. Pistillate flower of *Cucumis Melo*. (Natural size.)

species annual), with large alternate entire or palmately lobed or dissected lvs.: monœcious (rarely diœcious); sterile fls. in clusters, not long-stalked, the fertile ones solitary and mostly short-stalked in the axils; corolla of 5 deep acute lobes; stamens not united; stigmas 3, obtuse; tendrils simple: fr. a pepo, mostly 3-celled, usually indehiscent, fleshy or thick, globular, oblong or cylindrical, sometimes echinate, many-seeded.—About 30 species of villous or spinescent climbers and trailers with annual sts., in warm parts of the globe, most abundant in Afr. Monogr. by Cogniaux, DC. Monogr. Phaner. 3. See, also, Naudin, Ann. Sci. Nat. (Bot.) IV. 11:9; 12:108.

A. The melon group: fr. smooth at maturity or only pubescent (not spiny or tuberculate).

**Mêlo**, Linn. **MELON**. **MUSKMELON**. Figs. 1123, 1124. Long-running, hairy or villous annual: lvs. large, soft-hairy, round-heart-shaped or reniform, sometimes rounded-lobed and more or less denticulate:



1125. *Cucumis sativus*. Staminate flower at s; pistillate at p. ( $\times \frac{1}{2}$ )

male fls. clustered, the peduncle short: fr. very variable, pubescent or becoming glabrous. S. Asia and Trop. Afr.—Very variable, and widely cult.

1. Subspecies or var. *agr stis*, Naudin. The wild or run-wild or spontaneous plant: slender: fls. small, short-peduncled, often in 2's or 3's: fr. oblong or turbinate, size of a plum, not edible.—To this subspecies

Cogniaux refers such names as *C. Chate*, Linn., *C. pubescens*, Willd., *C. maculatus*, Willd., *C. campechianus* Kunth, *C. Gurmia* and *C. Chaeta*, Wall., *C. maderas-patanus*, Roxbg., *C. eriocarpus*, Boiss., *C. picrocarpus* and *C. jucundus*, Muell., *C. trigonus*, Benth. (not Roxbg.), *C. Pancherianus*, Naudin, and the varietal names *maculatus*, *Cossonianus*, *texanus*, *cantonianus*, *saharunporensis*, *anatolicus*, *æthiopicus* of Naudin.

2. Subspecies or var. *culta*, Kurz. The many forms of the cult. melon: plant very robust; fls. longer-pedunculate, 3-5 together and large; fr. large to very large, edible; widely variable; when forced under glass the lvs. tend to be more prominently lobed. See *Melon*. Forms of this group may be distinguished as follows: Var. *Chito*, Naudin (*C. Chito*, Morr.). ORANGE MELON. MANGO MELON. MELON APPLE. VINE PEACH. GARDEN LEMON. VEGETABLE ORANGE. Vine less robust than that of the muskmelon, and lvs. smaller: fr. size, shape and color of an orange or lemon, without markings, with a white or pale yellow cucumber-like flesh, with no muskmelon odor. Not edible in its natural state, but useful for the making of preserves (or "mangoes") and pickles. Name pronounced *keeto*. Cf. Bull. 15, Cornell Exp. Sta.; A.G. 14:206.—The "Lemon cucumber" offered by dealers is apparently a form of *C. sativus*, the fruit being nearly round with yellow and green markings and smooth skin, like the lemon.—

Var. *Dudaim*, Naudin (*C. Dudaim*, Linn. *C. odoratissimus*, Moench). DUDAIM MELON. POMEGRANATE MELON. QUEEN

ANNE'S POCKET MELON. Vine small, as in the last: fr. size and shape of an orange, somewhat flattened at the ends, very regular and smooth, marbled with

longitudinal markings of cinnamon-brown overlying yellow, exceedingly fragrant. A most handsome gourd-like fr. and highly and deliciously perfumed. Not eaten. A nearly odorless and scarlet-rind form is separated by Naudin as var. *erythraeus*.—Var. *acidulus*, Naudin. CUCUMBER MELON. Frs. oblong or cylindrical, mottled or unicolored, the flesh white and cucumber-flavored. No varieties in the American trade are of this group, but they are occasionally seen in botanical gardens and experimental grounds that import seeds of oriental plants.—Var. *flexuosus*, Naudin (*C. flexuosus*, Linn.). SNAKE MELON. SNAKE CUCUMBER. Fr. many times longer than broad, greenish at maturity, variously curved and furrowed. A.G. 14:203. Fr. often 2-3 ft. long, and 1-3 in. diam. Grown mostly as an oddity, but it is useful for the making of conserves. The hard-shelled snake gourd is a *Lagenaria* (which see).—Var. *inodorus*, Naudin. WINTER MELON. Lvs. lighter colored, less hairy, narrower: frs. possessing little or none of the common musk-

melon odor, and keeping long. The winter muskmelons are little known in this country, although they are worthy of popularity. Much cult. in parts of the Mediterranean.—Var. *saccharinus*, Naudin. PINEAPPLE MELON. Comprising varieties of oblong shape and very sweet flesh. Not sufficiently distinct from the next.—Var. *reticulatus*, Naudin. NUTMEG or NETTED MELONS. Frs. softer rinded, more or less netted, or sometimes almost plain or smooth. Comprises the common muskmelons, aside from cantaloupes.—

Var. *cantalupensis*, Naudin. CANTALOUPE.

ROCK MELONS. Frs. mostly hard-rinded, more or less warty, scaly or rough, often deeply furrowed or grooved.

Name derived from Cantalupi, near Rome, a former country seat of the Pope, whither this type of melons was brought from Armenia. In the U. S. the word cantaloupe is often used as a generic name for muskmelon, but it is properly a name of only one group of muskmelons—the hard and scaly-rinded (see Waugh, G.F. 8:183).

AA. The cucumber group: fr. spiny or tuberculate (nearly unarmed in *C. Sacleuxii*).

*sativus*, Linn. CUCUMBER. Figs. 1125, 1126. Long-running, prickly: lvs. usually 3-lobed (or strongly angled), the middle lobe most prominent and often pointed: fr. prickly or muricate, at least when young, but in some varieties becoming smooth, mostly oblong, the flesh white. S. Asia. See *Cucumber*. Runs into many fr.-forms in cult., but not so widely polymorphous as *C. Melo*.—Var. *anglicus*, Bailey. Figs. 1121,

1122. ENGLISH or FORCING CUCUMBER. A product of cult. and selection, distinguished from the common or field cucumbers as follows: frs. (and ovaries) very long and slender, little if any furrowed, spineless or nearly so when

grown, nearly or quite green at maturity, comparatively few-seeded: fls. very large: lvs. very broad in proportion to their length,

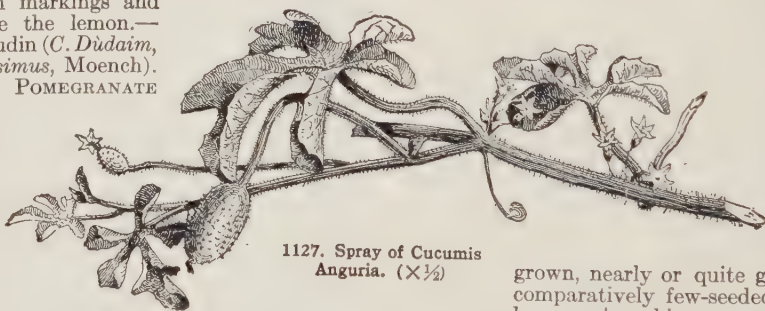
with shallower sinuses: vines very vigorous, with long and thick tendrils.—Var. *sikkimensis*, Hook. f., cult. in the Himalayan Mts., but not known to be in this country; has large 7-9-lobed lvs. and cylindrical-club-shaped fr. B.M. 6206.

*Anguria*, Linn. (*C. echinatus*, Moench. *C. anguriformis*, Roem. *C. grossulariæformis*, Hort.). BUR CUCUMBER. WEST INDIAN GHERKIN. GOOSEBERRY GOURD. Figs. 1127, 1128. Sts. slender, hispid: lvs. deeply cut into 3-5 narrow obovate or spatulate divisions, watermelon-like: fls. small, the pistillate long-stalked: fr. 1-3 in. long, cucumber-like but more spiny. Supposed to be native to the American tropics. B.M. 5817.—Cult. both for the oddity of its frs. and for the making of pickles. The gherkins of mixed pickles, however, are young cucumbers.

*dipsaceus*, Ehr. (*C. bcrdàna* and *C. ambigua*, Fenzl. *C. erinaceus*, Hort.). DIPSACEOUS GOURD. OSTRICH-EGG GOURD. HEDGEHOG GOURD. Plant and foliage like that of *C. Melo*: fls. long-stalked: fr. 1-2 in. long, oblong or nearly spherical, becoming hard and dry, densely beset with long scales or hairs, and looking like a bur. Arabia,



1126. Branch of *Cucumis sativus*.



1127. Spray of *Cucumis Anguria*. (×½)



1128. Fruit of *Cucumis Anguria*. (×½)



Afr. R.H. 1860, p. 210.—Cult. as an ornamental gourd.

**Sacleuxii**, Paill. & Bois. **MANDERA CUCUMBER.** Slender, hairy, whitish: lvs. roundish-reniform, obscurely lobed and irregularly dentate, scabrous on both surfaces and grayish green: fls. solitary; males on long-filiform peduncles, the females on shorter but slender peduncles and with hairy ovary: fr. ovoid, 3-4 in. long and half as thick at the middle, somewhat scabrous, with longitudinal stripes of lighter green; seeds brown,  $\frac{1}{5}$  in. long. Zanzibar.—Said to be ornamental and the fruits useful for pickles.



1129. Young Turban squash, on which the remains of the corolla still persist. The central part of the fruit is the ovary.

*C. acutangulus*, Hort.=Luffa.—*C. Citrullus*, Ser.=*Citrullus vulgaris*.—*C. Colocynthis*, Linn.=*Citrullus Colocynthis*.—*C. metuliferus*, Mey. Hispid annual, with palmately somewhat 3-lobed cordate petiolate lvs., and oblong-obtuse spiny fr., about 4 in. long. S. Afr.—*C. perennis*, James=Cucurbita.—*C. prophetarum*, Linn. Slender perennial with ashy scabrous long-stalked mostly 3-5-lobed lvs., and longitudinally white-striped softly spinose fr. 1-1 $\frac{3}{4}$  in. long. Afr.—*C. Vilmorinii*, Hort. A plant of unrecorded origin, with cut lvs. and abundance of canary-yellow soft-spined frs.

L. H. B.

**CUCURBIT:** A plant of the genus *Cucurbita*. Sometimes shortened to *Cucurb.*

**CUCURBITA** (classical name). *Cucurbitaceæ*. **GOURD. PUMPKIN. SQUASH.** Vine-like tender herbs, tendril-bearing, grown for their edible and ornamental fruits.

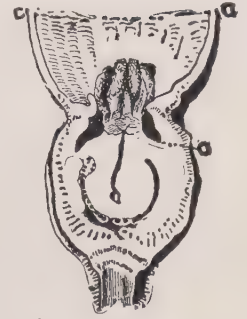
Annual, or the root perennial-rhizomatous, rough-hairy and scabrous, with large often palmately lobed lvs., the tendrils bifid or multifid: fls. monœcious, large, yellow, solitary in the axils, the staminate long-stalked, the pistillate short-stalked; corolla 5-lobed; stamens 3, arising from the bottom of the fl., and united in a column; stigmas 3, but 2-lobed; ovary inferior, inclosed in a hollow receptacle; tendrils 2-3-forked.—About 10 species in warm parts of Asia, Afr., Amer. The morphology of the pepo or gourd-fruit may be illustrated by the Turban squash. Figs. 1129-31. In this fr., there is a "squash inside a squash." The inner part bears the

corolla and the styles. It is the ovary. The corolla is attached about the edge of the inner squash, as the withered remains in Fig. 1129 show. Sometimes the withered corolla becomes detached, but hangs to the withered remains of the stigmas, as in Fig. 1130. The longitudinal section of the flower



1130. Young Turban squash, in which the withered corolla has become detached, but hangs to the remains of the styles and stigmas.

(Fig. 1131) explains the structure. The corolla is shown at c, d. The top of the ovary is at o. The stigmas are on the ovary. The part encircling the ovary (outside of o) is the hollowed receptacle. Ordinarily the receptacle is closed at the top, completely confining the ovary; but in the Turban squashes the receptacle does not extend over the top of the ovary, and the ovary therefore protrudes. The older morphologists held this outer part of the squash to be adnate calyx, rather than receptacle. The cucurbits are monographed by Cogniaux, DC. Monogr. Phaner. 3. Also by Naudin, Ann. Sci. Nat. (Bot.) IV, vol. 6. See *Pumpkin* and *Squash*.



1131. Section of flower of Turban squash. Showing the ovary inside the hollowed receptacle.

The terms squash and pumpkin are much confused. In Europe, the large varieties of *Cucurbita maxima* are known as pumpkins, but in this country the fruits of this species are known usually as squashes. In America, the words pumpkin and squash are used almost indiscriminately, some varieties in all species being known by those names. The field or common pie pumpkins are *C. Pepo*; so are vegetable marrows; also the summer squashes, as the Scallop, Pattypan and Crookneck varieties. The Hubbard, Marblehead, Sibley and



1132. Plant of *Cucurbita Pepo*.

Turban kinds are *C. maxima*. The Cushaws, Canada Crookneck, Japanese Crookneck, Dunkard, and Sweet Potato pumpkins (or squashes) are *C. moschata*. The fruit stem (as shown in Figs. 1133, 1136, 1141) is a distinguishing characteristic of the ripe fruits. *C. Pepo* and *C. maxima*, and *C. maxima* and *C. moschata* apparently do not intercross. *C. Pepo* and *C. moschata* have been crossed, but it is doubtful if they intermix when left to themselves. In Europe, the word gourd (or its equivalent in various languages) is used generically for cucurbits; but in this country it is restricted mostly to the small, hard-shelled forms of *C. Pepo* (var. *ovifera*) grown for ornament, and to *Lagenaria vulgaris*.

A. Plant annual.

B. Lvs. lobed: stalks of frs. strongly ridged.

**Pèpo**, Linn. (*C. Melopèpo*, Linn.). **PUMPKIN.** Figs. 1132, 1133. Annual: long-running, prickly on sts. and petioles: lvs. 3-5-lobed, dark dull green: corolla-tube widening upwards, the pointed lobes erect; calyx-lobes narrow, not lf.-like; peduncle very hard and deeply furrowed when mature, not enlarging next the fr.: the fr. very various in form, color, season, size. Probably native to Trop. Amer., but unknown wild.—Cult. by the Indians when Amer. was discovered, in fields of maize. For studies in the nativity



1133. Stem of *Cucurbita Pepo*.—Early Sugar pumpkin.

of the pumpkins and squashes, see De Candolle, Origin of Cultivated Plants; Gray and Trumbull, Amer. Journ. Sci. 25:372; Sturtevant, Amer. Nat. 1890:727; Wittmack, Ber. der Deutschen Bot. Gesell. 6:378 (1888).

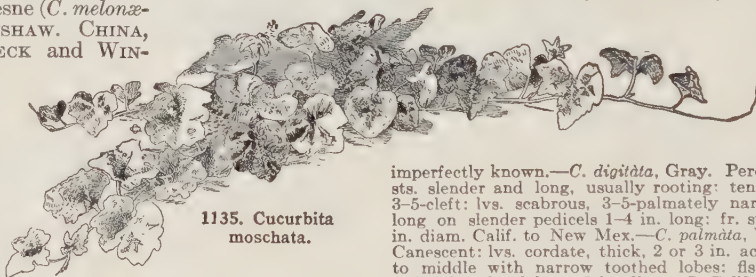


1134. *Cucurbita Pepo* var. *ovifera*.

Var. *condensa*, Bailey. BUSH PUMPKINS. SCALLOP and SUMMER CROOKNECK SQUASHES. Plant compact, little or not at all running. Of horticultural origin.

Var. *ovifera*, Bailey (*C. ovifera*, Linn.). GOURD. Fig. 1134. Plant slender, running: lvs. smaller than in *C. Pepo*, usually very prominently lobed: fr. small, hard and inedible, egg-shaped, globular, pear-shaped, oblate, often striped. R.H. 1894:429.—Sold in many vars. by seedsmen, under the names of *C. Pepo* vars. *pyriformis*, *depressa*, *annulata*, etc. See Gourd.

*moschata*, Duchesne (*C. melonæformis*, Carr.). CUSHAW. CHINA, CANADA CROOKNECK and WINTER CROOKNECK SQUASHES. Figs. 1135–37. Annual: long-running, less prickly and sometimes soft-hairy: lvs. more rounded than those of *C. Pepo*, but lobed, often grayish: fl. with a widening tube, and large, erect lobes; calyx-lobes large, often lf.-like; peduncle becoming deeply ridged and much enlarged next the fr. Possibly of E. Asian origin.



1135. *Cucurbita moschata*.

BB. Lvs. not lobed (except sometimes on young shoots): stalks of frs. not prominently ridged.

*máxima*, Duchesne. SQUASH. Figs. 1138–41. Annual: long-running, the sts. nearly cylindrical, little prickly and often hairy: lvs. orbicular or kidney-shaped, commonly not lobed, the basal sinus wide or narrow, the margin shallowly apiculate-sinuate: corolla-tube nearly the same diam. at top and bottom (Figs. 1139, 1140), the corolla-lobes large and soft, and wide-spreading or drooping: peduncle at maturity soft and spongy, not ridged nor prominently enlarged next the fr.: fr. very various, but not light yellow nor warty nor crookneck-shaped, usually late-ripening, the flesh orange and not stringy. Nativity undetermined. Var. *sylvestris*, Naudin. A form found wild in the Himalayan region, with fr. as large as a man's head.

AA. Plant with perennial root.

*foetidissima*, Kunth (*C. perennis*, Gray. *Cucumis perennis*, James). CALABAZILLA. Fig. 1142. Perennial: long-running, scarcely prickly: lvs. large, cordate-

triangular, grayish pubescent, the margin shallowly apiculate-crenate: fl. nearly as large as in *C. Pepo* and similar in shape, the pistillate on a peduncle 2–3 in. long: fr. size and shape of an orange, smooth, green and yellow splashed, not edible. Sandy arid wastes, Neb. and Colo. to Texas and Mex. and westward to Calif. R.H. 1855:61; 1857, p. 54.—In its native haunts, the root is tuberous, 4–7 in. diam. and penetrating the earth 4–6 ft. Roots at the joints. The plant has a fetid odor. Sold by seedsmen as a gourd, but the fr. does not often ripen in the northern states. Useful on arbors and small trees, when coarse vines are wanted.

*ficifolia*, Bouché (*C. melanosperma*, A. Br.). St. very

long, stout, becoming somewhat woody: lvs. pale green, often marbled, in outline ovate or suborbicular, cordate at base, roundly 5-lobed and the sinus rounded: calyx-tube short and campanulate: fr. large (often 1 ft. long), fleshy, round-ovoid, white-striped, the flesh white; seeds ovate, black. E. Asia, but widely cult. in warm countries for its ornamental watermelon-like frs. A var. *mexicana*, Hort. (*C. mexicana*, Spreng.), is mentioned, with seeds twice the size of those of the type, and said to grow wild in the neighborhood of Mazatlan, Mex.

*C. Andreana*, Naudin. Allied to *C. moschata*: sts. long and rooting at the nodes: lvs. large, marbled with white: fls. of the form of those of *C. maxima* but much smaller: fr. obovoid, 8 in. long, marked with white and yellow. Uruguay. R.H. 1896, pp. 542–3.—*C. californica*, Torr. Canescent: lvs. thick, 2 in. across, 5-lobed, the lobes triangular and mucronate: tendrils parted to the base: fls. 1 in. or more long on pedicels  $\frac{1}{2}$ –1 in. long. Calif.;

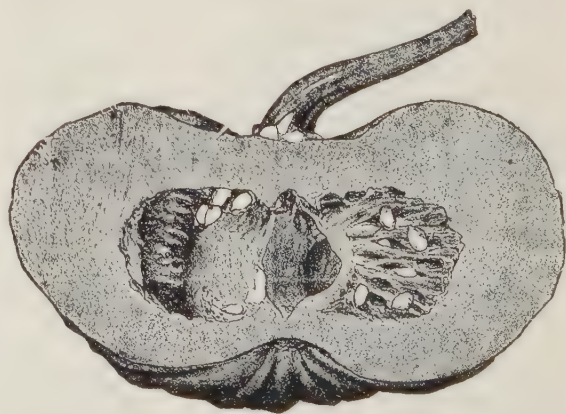
imperfectly known.—*C. digitata*, Gray. Perennial, the root fleshy: sts. slender and long, usually rooting: tendrils short and weak, 3–5-cleft: lvs. scabrous, 3–5-palmately narrow-lobed: fls. 2–3 in. long on slender pedicels 1–4 in. long: fr. subglobose, yellow, 2–4 in. diam. Calif. to New Mex.—*C. palmata*, Wats. MOCK ORANGE. Canescent: lvs. cordate, thick, 2 or 3 in. across, palmately 5-cleft to middle with narrow toothed lobes: fls. 3 in. long on stout peduncles: fr. globose, 3 in. diam. S. Calif.

L. H. B.

**CUDRANIA** (derivation unknown). *Moræceæ*. Woody subjects cultivated for their foliage and as hedge plants. Deciduous trees or shrubs, often thorny, with alter-



1136. Stem of *Cucurbita moschata*. Large Cheese pumpkin



1137. Fruit of *Cucurbita moschata*—Tonasu, a Japanese variety.



nate, petioled and stipulate lvs.: fls. dioecious, in axillary globular heads; staminate with 4 sepals and 4 stamens and 2-4 bracts at the base; pistillate with 4 sepals inclosing the 1-ovuled ovary, growing into a fleshy subglobose fr. with a crustaceous rind.—About 3 species, in S. and E. Asia and Trop. Austral., of which only one is sometimes cult. It requires protection in the N. and is usually prop. by greenwood cuttings in summer under glass.

*tricuspidata*, Bureau (*Maclura tricuspidata*, Carr. *C. triloba*, Hance). Shrub, or small tree, to 20, rarely to 60 ft., with slender, thorny branches: lvs. elliptic-ovate, acuminate, entire, sometimes 3-lobed at the apex and on young plants even tricuspidate, nearly glabrous, 1½-3 in. long: fl.-heads axillary, solitary or in 2's, on short peduncles: fr. globose, about 1 in. across. China. R.H. 1864, p. 390; 1872, p. 56; 1905, p. 363 (habit). H.I. 18:1792.—Recently recommended as an excellent hedge-plant for the S. In China the lvs. are used as a substitute for mulberry lvs. and it is called silkworm thorn; the fr. is edible. Between this species and *Maclura pomifera*, a hybrid has been raised, described as *Maclurandra hybrida*, André. R.H. 1905:362. ALFRED REHDER.

**CULINARY HERBS** are those herbs used for flavoring in cookery, but the term has a wide application, including species used for garnishing and sometimes as potherbs. The culinary herbs are of very minor importance in American gardens, and yet a few of them, as anise, caraway and coriander, are well and favorably known. The species are mostly aromatic. They are largely of the Umbelliferae and Labiatae. No special

**Basil** (*Ocimum basilicum*). *Labiatae*. Annual. *Uses*: As flavor in highly seasoned dishes; oil as perfumery. Propagated by seeds.  
**Borage** (*Borago officinalis*). *Boraginaceae*. Annual. *Uses*: Herbage as potherb and salad; garnish; flavor in beverages. Propagated by seeds in spring.  
**Caraway** (*Carum Carvi*). *Umbelliferae*. Biennial or annual. *Uses*: Herbage eaten cooked or as salad; roots as vegetable; seeds for flavoring; oil in manufacture of perfumery and soaps. Propagated by seeds in May or early June.



1138. *Cucurbita maxima*.

**Catnip or catmint** (*Nepeta Cataria*). *Labiatae*. Perennial. *Uses*: As bee forage; leaves as condiment; formerly a medicinal remedy. Propagated by seeds in autumn or spring.  
**Chervil** (*Anthriscus Cerefolium*). *Umbelliferae*. Annual. *Uses*: Leaves for seasoning and for mixed salads. Propagated by seeds.  
**Chives** (*Allium Schanoprasum*). *Liliaceae*. Perennial. *Uses*: Leaves for flavoring. Propagated by individual bulbs or division of clumps in early spring.  
**Clary** (*Salvia Sclarea*). *Labiatae*. Perennial. *Uses*: Leaves in cookery; wine made from plant when in flower. Propagated by seeds in spring.  
**Coriander** (*Coriandrum sativum*). *Umbelliferae*. Annual. *Uses*: Seed in confectionary and as ingredient in condiments; flavor in beverages. Propagated by seeds in spring or autumn.  
**Cumin** (*Cuminum odorum*). *Umbelliferae*. Annual. *Uses*: Seeds as ingredient in curry powder; for flavoring pickles, pastry and soups. Propagated by seeds in spring.  
**Dill** (*Anethum graveolens*). *Umbelliferae*. Annual. *Uses*: Seed as seasoning, extensively for commercial pickles; oil for perfuming soap; young leaves as seasoning and salads; dill vinegar as condiment. Propagated by seeds in spring.  
**Fennel** (*Foeniculum vulgare*). *Umbelliferae*. Biennial or perennial. *Uses*: Herbage as garnishes and flavors; as salads; seeds for flavoring beverages, and for confectionary; oil as perfumery. Propagated by seeds, and grown as an annual.  
**Finocchio or Florence fennel** (*Foeniculum dulce*). *Umbelliferae*. Annual. *Uses*: As a vegetable. Propagated by seeds.  
**Fennel Flower** (*Nigella sativa*). *Ranunculaceae*. Annual. *Uses*: Whole plant or seed used in cookery. Propagated by seeds in spring.  
**Hoarhound, or horehound** (*Marrubium vulgare*). *Labiatae*. Perennial. *Uses*: Formerly in cookery and medicine; now for candy only. Propagated by seeds in spring.  
**Hyssop** (*Hyssopus officinalis*). *Labiatae*. Perennial. *Uses*: Herbage in salads; oil in preparation of soaps, etc. Propagated by divisions, cuttings and seeds in spring.  
**Lavender** (*Lavandula angustifolia*, L. *Spica*). *Labiatae*. Perennial. *Uses*: Flowers and oil in perfumery; sometimes as condiment and in salads. Propagated by divisions or cuttings, or rarely seeds.  
**Lovage** (*Levisticum officinale*). *Umbelliferae*. Perennial. *Uses*: Young stems in confectionary. Propagated by division or seeds in late summer.

**Marigold** (*Calendula officinalis*). *Compositae*. Annual. *Uses*: Flower-heads as seasoning; fresh flowers to color butter. Propagated by seeds in spring.  
**Marjoram** (*Origanum vulgare* and *O. Marjoram*). *Labiatae*. Perennial (*O. Marjoram* treated as annual). *Uses*: Herbage for seasoning; oil in perfuming soaps, etc. Propagated by cuttings, division or layers and seeds in spring.  
**Mint** (*Mentha spicata*). *Labiatae*. Perennial. *Uses*: Herbage as seasoning; leaves in jelly. Propagated by cuttings, offsets and divisions in spring.  
**Parsley** (*Petroselinum hortense*). *Umbelliferae*. Biennial. *Uses*: Roots as vegetable; top as potherb; leaves for seasoning and garnish. Propagated by seeds in spring.  
**Pennyroyal** (*Mentha Pulegium*). *Labiatae*. Perennial. *Uses*: Leaves as seasoning; pennyroyal oil. Propagated by division, or rarely cuttings.  
**Peppermint** (*Mentha piperita*). *Labiatae*. Perennial. *Uses*: Oil as flavoring; perfume in soaps, etc. Propagated by division or running rootstocks.



1141. Stem of *Cucurbita maxima*—Hubbard squash.



1139. Staminate flower of *Cucurbita maxima*—Hubbard squash. (×½)



1140. Pistillate flower of *Cucurbita maxima*—Hubbard squash. (×½)

difficulty attaches to their cultivation, and little more may be said here than to present an alphabetical list with statements as to uses, duration of plant, and means of propagation. They all thrive in mellow fertile garden land. Usually they are grown at the side of the main garden plantation, and they may add a certain charm to the garden as well as to supply an agreeable aroma to the kitchen products. See the little book on "Culinary Herbs" by M. G. Kains, 1912.

**Angelica** (*Archangelica officinalis*). *Umbelliferae*. Biennial or perennial. *Uses*: Stems and leaf-stalks as salad, or roasted like potatoes; garnish; as "candied angelica;" stems blanched and used as vegetable; leaves as spinach; seeds for flavoring; oil of angelica obtained from seeds for flavoring. Propagated by seeds in late summer or early autumn.  
**Anise** (*Pimpinella Anisum*). *Umbelliferae*. Annual. *Uses*: Leaves as garnish, flavoring, and potherb; seeds and oil for flavoring and perfumery. Propagated by seeds in early spring.  
**Balm** (*Melissa officinalis*). *Labiatae*. Perennial. *Uses*: Foliage for flavoring and salad; oil for perfumery and flavoring beverages. Propagated by divisions, layers, cuttings and seeds.

**Rosemary** (*Rosemarinus officinalis*). *Labiatae*. Perennial. *Uses*: Herbage as seasoning; oil for perfuming soaps and in perfumery. Propagated by cuttings, root division, layers in early spring, and seeds.

**Rue** (*Ruta graveolens*). *Rutaceae*. Perennial. *Uses*: Leaves as seasoning and flavor in beverages; oil for aromatic vinegar and toilet preparations. Propagated by seeds, cuttings, layers or division of tufts.

**Sage** (*Salvia officinalis*). *Labiatae*. Perennial. *Uses*: Leaves for seasoning dressings, sausages, cheese, etc.; oil in perfumery. Propagated by division, layers and cuttings, also seeds.

**Samphire** (*Critium maritimum*). *Umbelliferae*. Perennial. *Uses*: Leaves pickled in vinegar, sometimes with other vegetables. Propagated by seeds in autumn.

**Savory, Summer** (*Satureia hortensis*). *Labiatae*. Annual. *Uses*: Seasoning. Propagated by seeds in spring.

**Savory, Winter** (*Satureia montana*). *Labiatae*. Perennial. *Uses*: Seasoning. Propagated by seeds, cuttings, layers and division.

**Southernwood** (*Artemisia Abrotanum*). *Compositae*. Perennial. *Uses*: Young shoots for flavoring cakes, etc. Propagated by seed; also cuttings in early summer.

**Tansy** (*Tanacetum vulgare*). *Compositae*. Perennial. *Uses*: Seasoning. Propagated by division of clumps, or seeds.

**Tarragon** (*Artemisia Dracunculus*). *Compositae*. Perennial. *Uses*: Herbage in salads and with meats; seasoning; as a decoction in vinegar; oil to perfume soaps, etc. Propagated by cuttings, layers and division.

**Thyme** (*Thymus vulgaris*). *Labiatae*. Perennial. *Uses*: Herbage as seasoning; oil as perfumery; oil-crystals as disinfectant. Propagated by seeds in spring; also cuttings, layers and divisions.

L. H. B.

**CUMIN, or CUMMIN**: The seeds of *Cuminum odorum* (or less properly *C. Cyminum*); black cumin, *Nigella sativa*; sweet cummin, or anise, *Pimpinella Anisum*. See *Culinary Herbs*.

Flowers small, white or purplish, 2-lipped, borne in corymbed cymes or clusters. The genus contains not more than 16 species, 2 N. American, 2 Mexican, and the others S. American. They are somewhat woody, and usually have small lvs.: the whorls of fls. are sometimes loosely corymbose, sometimes axillary, few-fl'd., much shorter than the lvs., sometimes many-fl'd., in dense spikes or terminal heads; calyx 10-13-nerved, 5-toothed; perfect stamens 2.

**mariāna**, Linn. (*C. origanoides*, Brit.). **MARYLAND DITTANY**. **STONE-MINT**. Height 1 ft.: lvs. smooth, ovate, serrate, rounded or heart-shaped at the base, nearly sessile, dotted, 1 in. long; fls. purple-pink in a loose cymose cluster which is terminal. Dry hills, S. N. Y. to Ohio., south to Fla. J.H. III. 35:321. Mn. 7:201. See also *Dittany*.

**CUNNINGHAMIA** (after J. Cunningham, botanical collector, who discovered this conifer in China in 1702). *Pinaceae*. Evergreen trees cultivated for their handsome foliage.

Trunk stout; branches verticillate, spreading, pendulous at the extremities: lvs. linear-lanceolate, rigid, densely spirally arranged and 2-rowed in direction: fls. monœcious; staminate oblong, pistillate globose, both sexes in small clusters at the end of the branches: cones roundish-ovate, 1-2 in. long, with roundish-ovate,



1142. *Cucurbita foetidissima*.

**CUMMINGIA** (for Lady Gordon Cumming) of gardeners (name bestowed by D. Don in 1828), sometimes spelled *Cumingia* (Kunth, 1843), is now referred to *Conanthera*. *Amaryllidaceae*. The *conantheras* are of about four species in Chile, one of which is rarely in cult. as a tender summer-blooming bulb. They are said to be difficult to keep long in cult. They are cormous plants, with basal linear or linear-lanceolate lvs., erect sts. paniculate-branching above, fls. blue on bractless pedicels: perianth funnelform, the tube short; lobes longer than tube, oblong, nearly equal, spreading or becoming reflexed; stamens 6, attached in the throat, shorter than the perianth-lobes, all perfect, the filaments very short; ovary 3-celled, the style subulate. *Conanthera campanulata*, Lindl. (*C. Simsii*, Sweet. *C. bifolia*, Sims, not Ruiz & Pav. *Cummingia campanulata*, D. Don) is 1-1½ ft. high, with linear lvs. shorter than the st. or peduncle and blue paniculate pretty fls. B.M. 2496.

**CUNILA** (origin unknown). *Labiatae*. A low-growing tufted hardy native perennial of this genus is rarely cultivated in borders for its profusion of bloom.

serrate and pointed, coriaceous scales, each with 3 narrow-winged seeds at the base.—Two species, in S. W. China and in Formosa. The species in cult. is a very decorative conifer for warmer temperate regions, much resembling the *Araucaria brasiliensis*. It prefers a half-shaded position and sandy and loamy humid soil. Prop. by seeds or cuttings of half-hardy wood in late summer under glass; short sprouts from the old wood of the trunk or larger branches are the best; cuttings from lateral branches grow into weak and one-sided plants.

**lanceolata**, Hook. (*C. sinensis*, R. Br.). Tree, attaining 80 ft.: lvs. linear-lanceolate, with broad, decurrent base, sharply pointed, finely serrulate, light green and shining above and with 2 broad, whitish bands beneath, 1½-2½ in. long: cones 1-2 in. high. China, cult. in Japan. B.M. 2743. S.Z. 104, 105. R.H. 1903, pp. 549-551. G.W. 13, p. 330; 14, p. 13. J.H. III. 49:447. F. 1854, p. 169.—The second species, *C. Konishii*, Hayata, from Formosa, is not in cult.; it has narrower and much smaller lvs., glaucescent on both sides, and smaller cones; it is very different and forms a transition to *Taiwania*.  
ALFRED REHDER.



**CUNONIA** (named for John Christian Cuno, who catalogued his garden in Amsterdam at the middle of the 18th century). *Cunoniaceae*; formerly included in the *Saxifragaceae*. A half dozen trees or shrubs of the southern hemisphere, one of which is sometimes grown



1143. *Cuphea hyssopifolia*.  
( $\times \frac{1}{2}$ )

Colony, is a large glabrous shrub or tree to 50 ft.: lfts. 2-3 pairs, oblong-lanceolate, sharply serrate; fls. small, very numerous, in opposite racemes, the stamens much exserted. Said to be of easy cult. in a sandy-peaty soil; prop. by cuttings of half-ripened wood. L. H. B.

**CUPANIA:** *Blighia*.

**CÛPHEA** (Greek, *curved*; referring to the prominent protuberance at the base of the calyx-tube). *Lythraceae*. Mostly small greenhouse and conservatory plants.

Plants often clammy: lvs. opposite, rarely whorled or alternate, ovate, lanceolate, or linear, entire: the fls. are often borne in 1-sided racemes, and some of the species have a very odd look from the bold angle made by the slender ascending pedicel and the descending calyx-tube, with an odd projection at the base.—An exceedingly interesting genus of 200 species of tropical and subtropical American herbs and shrubby plants, with remarkable variations in the petals. In *C. ignea*, perhaps the most attractive of the group, the petals are entirely absent, and the showy part is the brilliantly colored calyx-tube. At the other extreme is *C. hyssopifolia* with 6 petals (the normal number in the genus), and all of equal size. Between these two extremes (shown in Figs. 1143 and 1145) are at least two well-marked intermediate types. One of these (exemplified in *C. procumbens*) has 2 large and 4 small petals: the other (*C. Llavea*) has 2 conspicuous petals and the other 4 are completely abortive. These two types are unique among garden plants. The series of intergradient forms is completed by *C. cyanea*, in which there are only 2 petals, and these minute, and *C. micropetala* in which there are 12 barely visible petals, alternating with and shorter than the calyx-teeth. In addition to the species described below, *C. Hookeriana*, Walp., is cult. as *C. Roezlii*, Carr. It has lanceolate lvs., with vermilion and orange calyx. R.H. 1877: 470. According to many American botanists, the correct name for these plants is *Parsonsia*, *Cuphea* applying only to another widely separated genus.

Nearly all cupheas are grown from seed and treated as tender annuals, but *C. ignea* is chiefly propagated by cuttings. They are of easy culture, and the whole series is worth growing.

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#### A. Petals 6, but very minute and inconspicuous.

1. *micropetala*, HBK. (*C. éminens*, Planch. & Lind.). St. shrubby, more or less branched, 1-2 ft. high: branches and calyx scabrous: lvs. oblong-lanceolate, acute at both ends, but without a distinct petiole, rigid, scabrous: fls. borne singly in succession at a point above the axils, which distinguishes this species from all others here described; petals 6, minute, borne between the calyx-teeth, and shorter than them; calyx 12-toothed, scarlet at the base, yellow towards the top, greenish at the mouth; stamens and filaments red; ovary 2-celled, many-seeded. Mex. HBK. Nov. Gen. Sp. 6, p. 209, t. 551. R.H. 1857, p. 151. F.S. 10:994.—The picture first cited shows a 1-sided raceme, the second a panicle and the third a common raceme. In this species the calyx-tube is the attractive portion, while the petals are inconspicuous. The tube is not 2-lipped, but almost regular. See page 3567.

AA. Petals 6, all conspicuous, but 2 of them much larger than the others.

2. *lanceolata*, Hook. (*C. Zimpánii*, Roetzl). An erect sticky annual, 3-4 ft. high, the branches stout, purplish green: lvs. petiolate, opposite and alternate,  $\frac{3}{4}$ -3 in. long, entire: fls. axillary, solitary, purple or reddish purple, often deflexed; stamens hardly longer than the petals. Sept., Oct. B.M. 6412.—A good, showy herbaceous border plant.

3. *procumbens*, Cav. Annual, herbaceous, 1 ft. high, procumbent, sticky-pubescent, with characteristic purplish hairs: lvs. ovate-lanceolate, with white hairs,  $1\frac{1}{2}$ -3 in. long, gradually decreasing in size until they become bract-like; petiole short: fls. numerous, peduncles longer than the petioles, 2 or 3 times shorter than the calyx; calyx 6-toothed, purplish at the base, green at the tip, with 12 raised streaks, and a pubescence like that of the st.; petals 6, the 2 larger ones on the upper lip of the calyx purple; filaments included. Mex. B.R.



1144. *Cuphea Llavea*.  
(Natural size)

182. *C. purpurea*, Hort. F.S. 4:412. R.B. 22:85, said to be a hybrid between *C. miniata* and *C.*

*viscossima*, is probably not distinct.

4. *pinetorum*, Benth. Perennial and somewhat woody, usually procumbent: lvs. lanceolate, ciliate, 1-2 in. long: fls. purple, the calyx  $\frac{3}{4}$  in. long, colored; stamens 11, the filaments unequal. In sandy plains. Mex.—A useful plant S.

AAA. Petals 6, all of the same size.

5. *hyssopifolia*, HBK. Fig. 1143. St. shrubby: branches numerous, strigose: lvs. lanceolate, rather acute, obtuse at the base, glabrous above, strigose-pilose along the midrib and veins, as may be seen with a hand-lens: fls. with their slender pedicels scarcely longer than the lvs.; calyx glabrous; petals 6, somewhat



unequal, dilute violet; stamens 11, included; filaments villous; ovary 5-6-seeded. Mex.—This is the least attractive of the species here described, and is no longer advertised, but it probably still lingers in conservatories. It is readily distinguished from its showier relatives by its much smaller lvs. (less than  $\frac{1}{2}$  in. long) and much-branched and woody appearance.



1145. *Cuphea ignea*.  
( $\times \frac{1}{2}$ )

Mex. B.R. 32:14 (as *C. strigillosa*, Lindl.) F.S. 1:15 and P.M. 11:241 as *C. strigillosa*, but neither of these plates is the *C. strigillosa*, HBK., which is a different species, with a shrubby st.: branches and calyx clammy-hispid: lvs. ovate-oblong, acute at both ends, clammy, glabrous above, strigose-scabrous below: petals nearly equal; ovary about 8-ovuled.

BB. Size of petals larger, half as long as the calyx or longer.  
c. Calyx 6-toothed.

7. *Llavea*, Lindl. RED-WHITE-AND-BLUE FLOWER. Fig. 1144. Sts. numerous, herbaceous, hispid: branches ascending: lvs. almost sessile, especially near the top, ovate-lanceolate, strigose: racemes short, few-fl.; calyx green on the ventral side, purple on the back and at the oblique-6-toothed mouth; petals 2, large, scarlet, obovate, the other 4 abortive; stamens 11. Guatemala. B.R. 1386. J.H. III. 31:305.—It is doubtful whether the plant described by Lindley is the same as the Mexican plant originally described by Lexarza, which was said to have petals of "dilute scarlet." Lindley's plant had a green calyx, but the plant in the trade is colored. Used for baskets and bedding. Often misspelled *Llavea*.

cc. Calyx 12-toothed.

8. *miniata*, Brongn. St. shrubby, erect: branches few, hispid: lvs. opposite, the upper ones not quite opposite, with a very short petiole, ovate, acute, entire, with white, silky hairs which are denser beneath: fls. solitary, subsessile, axillary, the peduncle adnate to the branch in such a way as to appear between and below the petioles; raceme few-fl., 1-sided. F.S. 2:73. P.M. 14:101. R.H. 1845: 225. R.B. 22:85. Var. *alba*, Hort. A white-fl. variety. Var. *compacta*, Hort. S.H. 2:43. Gt. 46, p. 637.—This is referred to *C. Llavea* of Lexarza, by Index Kewensis. The above description is from the original in F.S. 2:73. Van Houtte describes several hybrid varieties in F.S. 5, p. 487, which differ chiefly in size, color, and marking of petals. Calyx 1 in. long, hispid, green at the base, purple above, 12-toothed at the tip; petals 2, scarlet, wavy. The specific name *miniata* means cinnabar-red, and refers to the petals.

AAAAA. Petals 0.

9. *igneae*, DC. (*C. platycentra*, Hort., not Benth.). Fig. 1145. Branches somewhat angled: lvs. petioled, ovate-lanceolate, acuminate, narrowed at the base, lightly scabrous: fl.-stalks 2-4 times longer than the lf.-stalks: calyx glabrous, shortly 6-toothed, bright

red except at the tip, which has a dark ring and a white mouth; petals 0; stamens 11 or 12, glabrous. Mex. F.S. 2:180. P.M. 13:267.—This is still sold as *C. platycentra*, although De Candolle corrected the error in 1849 (F.S. 5:500 c). This is a remarkable instance of the persistence of erroneous trade names.

WILHELM MILLER.  
N. TAYLOR.†

**CUPRESSUS** (ancient Latin name from Greek, *Kuparissos*). **CYPRESS**. *Pinaceae*. Evergreens, cultivated for their graceful habit and the dark green or glaucous foliage; some are timber trees.

Trees, rarely shrubs, with aromatic evergreen foliage: branchlets quadrangular or nearly so: lvs. opposite, small, scale-like, appressed, minutely denticulate-ciliate, on young seedling plants linear-subulate and spreading: fls. monœcious, minute, solitary on short branchlets; staminate ovate or oblong, yellow; pistillate subglobose: cones globular or nearly so, consisting of 3-7 pairs of ligneous, petate scales, with a mucro or boss on the flattened apex, each bearing many or numerous seeds, but the lower scales usually sterile and smaller; they ripen the second year.—About 12 species in Cent. Amer., north to Calif. and Ariz., and from S. Eu. to S. E. Asia. Monogr. by M. T. Master; in Journ. of Linn. Soc. 31:312-51 (1895). By some botanists, the allied genus *Chamaecyparis* is included.

The cypresses are highly ornamental evergreen trees, greatly varying in habit, hardy only in California and the Gulf states. The hardiest seems to be *C. Macnabiana* and *C. arizonica*, which will stand many degrees of frost in a sheltered position; also *C. macrocarpa*, *C. sempervirens*, *C. funebris* and *C. torulosa* are of greater hardiness than the others. They stand pruning well, and some species are valuable for hedges, *C. macrocarpa* being especially extensively planted for this purpose in California. *C. arizonica* yields excellent timber. The cypresses seem not to be very particular in regard



1146. *Cupressus sempervirens*. Verona.



to soil and situation, but prefer a deep, sandy-loamy soil. For propagation, see *Chamaecyparis*. The young plants should be removed several times in the nursery to secure a firm root-ball; otherwise they will not bear transplanting well.

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A. Branches and branchlets erect or spreading; branchlets short and usually rather stout.

B. Cones 1-1½ in. across, with 6-14 scales.

c. Lvs. obtuse; bark scaly.

1. *sempervirens*, Linn. Fig. 1146. Tree, to 80 ft., with erect or horizontal branches and dark green foliage: lvs. closely appressed, ovate, obtuse, glandular: cones oblong or nearly globose; scales 8-14, with a short boss on the back, bract free at the apex. F.S. 7, p. 192. (as *C. torulosa*). S. Eu., W. Asia. Var. *stricta*, Ait. (*C. fastigiata*, DC. *C. Bedfordiana*, Hort.). ITALIAN CYPRESS. With erect branches, forming a narrow, columnar head. The classical cypress of the Greek and Roman writers, much planted in S. Eu. G.W. 9, p. 127. Gn. 33, p. 3 (as *C. stricta*). Var. *cereiformis*, Rehd. (*C. fastigiata cereiformis*, Carr.). A form with very short branches, forming a narrow and slender columnar head. Var. *indica*, Parl. (*C. Roylei*, Carr. *C. Whitleyana*, Hort.). Similar to var. *fastigiata* in habit: cones globose, with 10 scales; bract acutely mucronate at the apex. Var. *horizontalis*, Gord. (*C. horizontalis*, Mill.). Branches horizontally spreading, forming a broad, pyramidal head. The famous avenue of *C. sempervirens* in the Villa Giusti, Verona, Italy, is shown in Fig. 1146 (G.F. 2:464).

2. *macrocarpa*, Hartw. (*C. Hartwegii*, Carr.). MONTEREY CYPRESS. Tree, to 40 ft., occasionally to 70 ft., with horizontal branches, forming a broad, spreading head: branchlets stout: lvs. rhombic-ovate, obtuse, closely appressed, not or obscurely glandular, dark or bright green: cones globular or oblong; scales 8-12, with a short, obtuse boss on the back. Calif., Bay of Monterey. S.S. 10:525. G. 22:30. G.M. 52:952. G.W. 2, p. 497. G.C. III. 18:63; 22:53. Gn. 29, p. 36; 30, p. 189; 38, p. 363; 53, p. 219; 68, p. 237. G.F. 7:245. Var. *Crippsii*, Mast. Lvs. spreading, light glaucous. A juvenile form. Var. *fastigiata*, Knight. Of narrow, pyramidal, fastigiate habit. Var. *Lambertiana*, Mast. (*C. Lambertiana*, Carr.). Dark green form with spreading branches. R.H. 1870, p. 191; 1907, p. 565. Var. *lutea*, Hort., has yellow foliage. Gn. 68, p. 237. J.H.S. 1902, p. 426, fig. 111.

cc. Lvs. acute; bark exfoliating, cherry-like.

3. *guadalupensis*, Wats. (*C. macrocarpa* var. *guadalupensis*, Mast.). Wide-spreading tree, 40 ft. high or more: bark grayish brown, exfoliating, brownish red below: branchlets drooping, slender: lvs. bluish green, scentless, acute or acutish, obscurely glandular: cones globose, 1 in. across or more, with 6-8 very thick strongly bossed scales. Guadalupe Isl. G.C. III. 18:62.

BB. Cones ½-1 in. across, with 6-8 scales.

c. Lvs. distinctly glandular.

4. *Macnabiana*, Murray (*C. glandulosa*, Hook.). Fig. 1147. Shrub with several sts., or small tree, to 20 ft., forming a dense, pyramidal head: lvs. ovate, obtuse,

thickened at the apex, glandular, dark green or glaucous: cones oblong, ¾-1 in. high; scales usually 6, with prominent conical and curved bosses on the back. Calif. S.S. 10:528. R.H. 1870, p. 155. G.C. III. 9:403. F. 1874, p. 88.

cc. Lvs. inconspicuously glandular.

D. The branchlets slender: lvs. green or sometimes glaucous.

5. *Goveniana*, Gord. (*C. californica*, Carr.). Tree, to 50 ft., with slender, erect or spreading branches, forming a broad, open or pyramidal head: branchlets slender: lvs. ovate, acute, closely appressed, inconspicuously glandular: abundant staminate fls. in spring: cones subglobose or oblong; scales 6-8, with short, blunt bosses. Calif. S.S. 10:527. R.H. 1875, p. 108. F. 1876, p. 197. Var. *compacta*, André. Of compact, pyramidal habit. R.H. 1896, p. 9. Var. *glauca*, Carr., with glaucous, and var. *viridis*, Carr., with bright green foliage. Var. *cornuta*, Carr. A form with strongly developed bosses. R.H. 1866, p. 251.

6. *Benthonii*, Endl. (*C. excelsa*, Scott. *C. Karwinskiana*, Regel. *C. thurifera*, Schlecht., not HBK.). Tree, to 70 ft., with horizontal branches, forming a pyramidal head: branchlets slender: lvs. ovate, obtuse or acute, keeled and somewhat thickened at the apex, inconspicuously glandular, bright green: cones globular, ½-¾ in. across; scales 6-8, with short-pointed bosses. Mex. Var. *Lindleyi*, Mast. (*C. Lindleyi*, Klotzsch). Branchlets regularly arranged, of nearly equal length: cones small, with small-pointed bosses. Var. *Knightiana*, Mast. (*C. elegans*, Hort.). Branchlets very regularly arranged, fernlike, drooping, glaucous: cones with stout, conical-pointed bosses. G.C. III. 16:669. *C. Benthonii* has been found in prehistoric asphalt beds at Los Angeles.

DD. The branchlets stout: lvs. glaucous.

7. *arizonica*, Greene (*C. Benthonii* var. *arizonica*, Mast.). Tree, to 40, rarely to 70 ft., with horizontal branches, forming a narrow, pyramidal or broad, open head: branchlets stout: lvs. ovate, obtuse, thickened at the apex, usually without glands, very glaucous: cones subglobose, ¾-1 in. across; scales 6-8, with stout, pointed, often curved bosses. Ariz., Calif. S.S. 10:526. G.C. III. 18:63. I.T. 4:145. M.D. 1904:50.

AA. Branchlets slender, more or less pendulous: lvs. usually acute and keeled, not thickened at the apex: cones about ½ in. or less across (see No. 6).

B. The branchlets not or only slightly compressed.

8. *torulosa*, Don (*C. nepalensis*, Loud.). Tall, pyramidal tree, to 150 ft., with short, horizontal branches, ascending at the extremities: branchlets slender, drooping: lvs. rhombic-ovate, acutish or obtusish, appressed or slightly spreading at the apex, bright or bluish green: cones globular, nearly sessile, ½-¾ in. across; scales 8-10 with a short, obtuse, inconspicuous boss. Himalayas. Gn. 27, p. 39. Var. *Corneyana*, Mast. (*C. Corneyana*, Knight). With distinctly pendulous branches: cones oblong, larger. Var. *ma-*



1147. *Cupressus Macnabiana*.  
(From a cultivated tree.)

*jéstica*, Gord. (*C. majéstica*, Knight). Of more vigorous growth, with drooping branchlets, grayish green.

9. *lusitánica*, Mill. (*C. glauca*, Lam. *C. pëndula*, L'Her. *C. sinënsis*, Hort.). Tree, to 50 ft., with spreading branches and more or less pendulous branchlets; lvs. ovate, acutish, glaucous: cones peduncled, about  $\frac{1}{2}$  in. across, covered with glaucous bloom; scales 6-8, with an elongated, pointed and usually hooked boss. Habitat unknown; cult. in Portugal and naturalized; possibly intro. from India.

BB. *The branchlets distinctly flattened.*

10. *fùnebris*, Endl. (*C. pëndula*, Lambert). Tree, to 60 ft., with wide-spreading, pendulous branches and branchlets, branchlets flattened: lvs. deltoid-ovate, acute, light green, often slightly spreading at the apex: cones short-peduncled, globose,  $\frac{1}{2}$ - $\frac{1}{2}$  in. across; scales 8, with a short-pointed boss. China. G.C. 1850:439. Gn. 28, p. 62. F.S. 6, p. 91.

11. *cashmeriàna*, Royle (*C. torulòsa* var. *kashmiriàna*, Kent. *C. pëndula* var. *glauca*, Nichols.). Tree: branchlets very slender, pendulous, flattened: lvs. rhombic-ovate, spreading at the acute tips, glaucous: cones  $\frac{1}{2}$  in. across. Intro. from Kashmir.

*C. formosënsis*, Henry=Chamæcyparis formosensis.—*C. Lawsoniàna*, Murr.=Chamæcyparis Lawsoniana.—*C. nootkatënsis*, Lambert=Chamæcyparis nootkatensis.—*C. obtusa*, Koch=Chamæcyparis obtusa.—*C. pisifera*, Koch=Chamæcyparis pisifera.—*C. pygmæa*, Sarg. (*C. Goveniana* var. *pygmæa*, Lemm.). Tree, to 30 ft., often fruiting when only 1 or 2 ft. tall: branchlets rather stout: lvs. dark green, without glands: cones ovoid,  $\frac{1}{4}$ - $\frac{3}{4}$  in. long, with 6-10 scales; seeds black. Calif., Mendocino Co. S.S. 14:740.—*C. thurifera*, HBK. Tree with spreading branches: lvs. oblong-lanceolate, upright-spreading, not closely appressed: cones globose, about 1 in. across, with slightly mucronate scales.—*C. thyoides*, Linn.=Chamæcyparis thyoides.

ALFRED REHDER.

**CURATÉLLA** (name refers to the plants being used or worked: used for polishing weapons and metal). *Dilleniaceæ*. Three or 4 S. American and W. Indian small trees or scandent shrubs, of which one is sometimes mentioned in horticultural literature. They are warmhouse evergreens, with white fls. in dense panicles. Sepals and petals 4-5; stamens many; carpels 2 (rarely 1), more or less cohering, follicular. *C. ameri-*

*cana*, Linn., of W. Indies and S. Amer., grows to 10 ft., erect, tortuous: lvs. oval, rough on the upper side, toothed; fls. malodorous, in lateral compound racemes: bark wrinkled and cracked.

**CURCÛLIGO** (Latin, *curculio*, weevil; referring to the beak of the ovary). *Amaryllidacæ*. Warmhouse and conservatory foliage plants with the habit of a young palm and an odd flower-cluster.

Stemless herbs, with short rhizomes, radical long narrow usually plicate lvs., and small fls. in spikes or clusters on short scapes that may be nearly concealed at the base of the plant: perianth 6-parted, the segms. spreading and about equal; stamens 6, attached at the base of the segms.; ovary 3-celled.—The genus is closely related to *Hypoxis*, but differs in its succulent indehiscent fr., and because in many species the ovary has a long beak which looks like a perianth-tube, but this beak is always solid, and bears on its summit the style which is in the center of the perianth.—Twelve species in eastern and western tropics of which *C. recurvata* is grown S. and N., being used by florists for vases, jardinières, and general decorative work, and also used outdoors in summer. It is of easy cult., but requires perfect drainage. It is a question to be determined whether the plants mostly in cult. are *C. recurvata* or *C. latifolia*; the recurved dense ovoid head of fls. quickly distinguishes the former species.

The curculigos are very ornamental plants for large greenhouses, where a high temperature is maintained. To have them looking their best they should, if possible, be planted out in a bed, where they will attain a height of 5 feet. Their gracefully arching leaves are so constructed that they move continually from side to side with the slightest movement of the air. The variety *variegata* is one of the best variegated-leaved plants. While not so robust as the green form, it is more adapted to pot culture. The soil should be two parts loam and another of rotted cow-manure and sand. Drainage must be carefully arranged, as the plants need an abundance of water. The green-leaved kind stands the summers well in the neighborhood of Washington, D. C., if protected from the sun and afforded an abundant supply of water. As house-plants they are likely to suffer for lack of moisture.

Propagation is by division. The pieces, before potting, will make new roots rapidly if placed in the sand-bed of a warm propagating-house for a few days.

*recurvata*, Dry. Height 2½ ft. or more: root tuberos: lvs. from the root, 1-3 ft. long, 2-6 in. wide, with a channeled stalk one-third or one-fourth the length, the blade lanceolate, recurved, plaited: scapes very rarely as long as the lf.-stalks, covered with long, soft brown hairs, recurved at the end, bearing a head of drooping yellow fls., each  $\frac{3}{4}$  in. across; the scape is frequently only 1-3 in. long, the fls. appearing almost on the ground; bracts 1 to each fl. and about as long. Trop. Asia, Austral. B.R. 770. (with scape abnormally long). Var. *striata*, Hort., has a central band of white. Var. *variegata*, Hort., has longitudinal bars of white.

*latifolia*, Dry. Fig. 1148. Height 2-3 ft.: differs from *C. recurvata* in having a very short-stalked erect infl., the bright yellow fls. in a dense cluster near the base of the plant: lvs. lanceolate, 1-2 ft. long and 1-5 in. wide, the petiole 12 in. or less: fr. 1 in. long, club-shaped or pyriform, hairy, with black seeds: the plant produces numerous suckers which, when removed, are easily grown, and bloom in about a year; said to be a beautiful and hardy house-plant, more satisfactory than palms for one without a conservatory. India, Malaysia. B.M. 2034. B.R. 754. L.B.C. 5:443 (as *C. sumatrana*).—Variable in foliage.

G. W. OLIVER.  
WILHELM MILLER.



1148. *Curculigo latifolia*.







XXXII. The Fay currant, one of the large red varieties.



**CURCUMA** (Arabic name). *Zingiberaceae*. Curious and showy warmhouse herbaceous plants with great spikes of large concave or hooded bracts, from which the flowers scarcely protrude.

Erect herbs, the st. rising to 10 ft. from a thick tuberiferous rootstock: lvs. usually large: fls. in a dense cone-



1149. *Curcuma petiolata* leaves. ( $\times \frac{1}{2}$ )

like thyrses, borne behind concave or hooded imbricated obtuse often colored bracts; calyx and corolla tubular, the former 2-3-toothed, the latter dilated above and with 5 ovate or oblong lobes; staminodium petal-like, 3-parted, the middle lobe anther-bearing; fr. inclosed by the bracts. The latest monograph, 1904 (by Schumann in Engler's *Pflanzenreich*, hft. 20), recognizes 42 species, mostly in Trop. Asia and some in Trop. Afr. The fleshy bracts are perhaps the showiest feature of the plant, the topmost ones being colored with gorgeous tropical hues. Rhizomes of some of the species yield East India arrowroot, while others furnish turmeric. The rhizome of *C. zedoaria* of India is very pungent and has properties similar to ginger. The genus is allied to *Alpinia* and *Amomum*.

In spring the tubers should be deprived of last year's mold and repotted in a fresh mixture of light loam, leaf-mold and turfy peat, the pots being well drained, and placed in a warm pit or frame in bottom heat. Water should be given sparingly until after the plant has made some growth. The young roots are soft and succulent, and are likely to rot if the soil remains wet for a long time. After flowering, the leaves soon show signs of decay, and water should be gradually withdrawn. During the resting period the soil should not be allowed to get dust-dry, or the tubers are likely to shrivel. The plants are propagated by dividing the tubers in spring.

**cordata**, Wall. Lvs. 1 ft. long, sheathing, ovate, acuminate, the same color on both sides, obliquely penninerved: bracts in a cylindrical spike, the upper part forming a sterile part called a coma, which is a rich violet, with a large, blood-colored spot: fls. yellow, with a pink hood. Burma. B.M. 4435.—This is now referred to *C. petiolata*, Roxbg., but it seems at least horticulturally distinct, with its rose-pink bracts.

**petiolata**, Roxbg. **QUEEN LILY**. Figs. 1149, 1150. Lvs. 6-8 in. long, peculiar in this genus as being more or less rounded or cordate at the base, the stalk 4-5 in. long: fls. spicate, the spikes 5-6 in. long; bracts 20-30, connate at their bases, and wholly including the pale yellow fls. India. B.M. 5821.—The most beautiful and showiest of the curcumas.

**longa**, Linn. Lvs. 2-2½ ft., the blade about 1 ft. and narrowed at the base: fls. spicate, autumnal. the spikes

4-6 in. long; bracts pale green, not wholly inclosing the pale yellow fls. India. B.R. 886.—The dried rhizomes of this furnish the well-known turmeric of India, used as a condiment and as a dye. Intro. by the Royal Palm Nurseries.

*C. albiflora*, Thwaites, differs from some others here described in having its spikes sunk below the lvs., instead of standing high above the lvs., and all the bracts have fls., while the others have a sterile portion of the spike which is brightly colored. In this species the spike is short and green and the fls. are prominent and white. Ceylon. B.M. 5909.—*C. australasica*, Hook. f., has its upper bracts soft, rosy pink and the fls. pale yellow. Austral. B.M. 5620.—*C. Roscoeana*, Wall., has a long and splendid spike, with bracts gradually changing from green to the vividdest scarlet-orange: fls. pale yellow. Burma. B.M. 4667.—*C. rubescens*, Roxbg. (*C. rubraulis*, Link). Lvs. stalked, oblong, with red sheaths, said to be brown in the center: fls. red. E. Indies.—*C. zedoaria*, Roscoe, has the upper bracts white, tinged with carmine, and handsomely variegated lvs., which, with the green of the lower bracts and the yellow of the fls. makes a striking picture of exotic splendor. Himalayas. B.M. 1546.

WILHELM MILLER.  
N. TAYLOR.†

**CURMÈRIA:** *Homalomena*.

**CURRANT**. The currants grown for their fruit in America are derived mainly from two species, namely, the European red currant, *Ribes vulgare* (*R. rubrum*) (Fig. 1151), and the European black currant, *R. nigrum* (Fig. 1152). There are two promising American species, of which few, if any, improved varieties have been introduced, the swamp red currant (*R. triste*) and the wild black currant (*R. americanum*). Another American species of which at least one named variety has been offered for sale is the Buffalo or Missouri currant (*R. aureum*) (Fig. 1154), also grown because of its ornamental flowers. The currant is not known to have been under cultivation before the middle of the sixteenth century. It is not mentioned by any of the ancient writers who wrote about fruit, and was evidently not known to the Romans.

Currants are natives of comparatively cold or very cold climates; hence most varieties succeed over a very wide area in America. They are among the hardiest of fruits from the standpoint of resistance to cold or changes of temperature, but in hot and dry sections they do not thrive, and, on this account, are unsatisfactory in parts of the southern states.

The currant is not so generally used in America as some other fruits, as few persons care for them when eaten raw, and when cooked they are usually made into jelly and consumed by only a comparatively small proportion of the people. In the coldest parts where other fruits do not succeed well, the currant is more popular, and is used much more generally. It is a wholesome and refreshing fruit and deserves much more attention than it receives at the present time.

The currant does not vary so much when grown from seed as most cultivated fruits, and, being so easily propagated from cuttings, it has not been improved so much as it otherwise would have been. Moreover, size in currants was not of great importance until recent years, when competition in marketing has become keener. It is only during the past fifty or sixty years



1150. *Curcuma petiolata* in flower. ( $\times \frac{1}{6}$ )

that many new varieties have been introduced. At the beginning of the nineteenth century, few named sorts were recognized, the currant being generally known simply under the names black, red and white.

#### *Propagation of currants.*

The usual method of propagating currants is by means of cuttings. These root very readily and good plants are secured after one season's growth. The best time to make the cuttings is in the autumn, as currants begin to grow very early in the spring, and once the buds have swollen they cannot be rooted successfully. Wood of the current season's growth is used. This may be cut early in the autumn as soon as the wood has ripened, from the end of August to the middle of September being the usual time. It should be cut in as long pieces as possible to save time in the field, and put in a cool moist cellar or buried in sand. If the cuttings can be made at once, it is best to do so. These are made by cutting the wood into pieces, each about 8 to 10 inches long, although an inch or two more or less is not of much consequence. The base of the cutting should be made with a square cut just below the last bud. There should be at least  $\frac{1}{2}$  inch of wood left



1151. Common currant—*Ribes vulgare*, in bloom. ( $\times \frac{2}{3}$ )

above the top bud of each cutting, as there should be a strong growth from the upper bud, and if the wood is cut too close it is liable to be weakened. A sloping cut is best for the upper cut, as it will shed rain better, but this is not important. When made, the cuttings should be planted at once, which is usually the best plan, or heeled in. If heeled in, they should be tied in bundles and buried upside down in warm well-drained soil, with about 3 inches of soil over them. The object of burying them upside down is that by this method the bases of the cuttings will be nearer the surface where the soil is warmer and there is more air, and will callus more quickly than if they were further down. The cuttings should callus well in a few weeks, and may then be planted outside, if thought advisable. Cuttings may be kept in good condition over winter by heeling-in

or burying in sand in a cool cellar, or after callusing under a few inches of soil outside, they may be left there over winter if covered with about 4 to 5 more inches of soil to prevent their drying out. Good results are secured with the least trouble by planting the cuttings in nursery rows as soon as they are made. The soil should be well prepared and should be selected where water will not lie. Furrows are opened 3 feet apart and deep enough so that the top bud, or at most two buds, will be above ground. The cuttings are placed about 6 inches apart on the straight side of the furrows and soil thrown in and tramped well about them. When only a smaller number are to be planted a trench may be opened with a spade. It is important to have a large proportion of the cutting below ground, as more roots will be made and the plants will be stronger. There would also be danger of the cuttings drying up before rooting if too much of the wood is exposed. If the season is favorable the cuttings should callus well and even throw out a few roots by winter. Where there is little snow in winter, it is a good practice to cover the tops of the cuttings with about 2 inches of soil, which will be a good protection for them. This soil should be raked off in spring. In the spring, cultivation should be begun early and kept up regularly during the summer to conserve moisture and favor rooting and the development of the bushes. By autumn they should be large enough to transplant to the field.

In Great Britain and Europe, currants are often grown in tree form and are prevented from throwing up shoots from below ground by removing all the buds of the cuttings except the top one before planting in the nursery. This system is not recommended for most parts of America as it has been found by experience that snow breaks down currants grown in this way, and when borers are troublesome it is not wise to depend on one main stem.

Most of the cultivated varieties of currants have originated as natural seedlings, little artificial crossing having been done with this fruit. Currants grow readily from seeds, and it is easy to get new varieties in this way. The seeds are washed out of the ripe fruit, and after drying, may either be sown at once or mixed with sand and kept over winter in a cool dry place and sown very early in the spring. The best plan is to sow them in the autumn in mellow well-prepared and well-drained soil, since when this is done they will germinate very early in the spring, while if sown in the spring the seed may be all summer without sprouting. The seed should not be sown deep, from  $\frac{1}{4}$  to  $\frac{1}{2}$  an inch being quite sufficient. If sown very deep they will not germinate. The young plants may be transplanted from the seed-bed to the open in the autumn of the first year if large enough, but if the plants are very small they may then grow another season, when they should be planted out at least 4 by 5 feet apart, so as to give them room enough to fruit for several seasons, in order that their relative merits may be learned. If intended to remain permanently, the plants should be at least 6 by 5 feet apart. The bushes should begin to bear fruit the second or third year after planting out. Each bush will be a new variety, as cultivated fruits do not come true from seed. If a seedling is considered promising it may be propagated or increased by cuttings, as already described.

#### *The soil and its preparation.*

Currants should be planted in rich soil in order to get the best results. The soil should also be cool, as the currant is a moisture-loving bush. The currant roots near the surface; hence if the soil is hot and dry the crop will suffer. A rich, well-drained clay loam is the best for currants, although they do well in most soils. If the soil is not good, it should receive a good dressing of manure before planting, which should be well worked into the soil, the latter being thoroughly



pulverized before planting is done. A northern exposure is to be preferred, as in such a situation the currants are not likely to suffer in a dry time.

#### *Planting.*

The best time to plant currants is in the autumn. If planted in the spring, they will probably have sprouted somewhat before planting, and on this account their growth the first season will be checked. When the soil is in good condition, currants, especially the black varieties, make strong growth, and the bushes reach a large size; hence it is best to give them plenty of space, as they will do better and are more easily picked than if crowded. Six by 5 feet is a good distance to plant. If planted closer, especially in good soil, the bushes become very crowded before it is time to renew the plantation. Strong one-year-old plants are the best, but two-year-old plants are better than poorly rooted yearlings. It is better to err on the side of planting a little deeper than is necessary than to plant too shallow. A good rule to follow is to set the plants at least an inch deeper than they were in the nursery. The soil should be well tramped about the young plant so that there will be no danger of its drying out. After planting, the soil should be leveled and the surface loosened to help retain moisture.

#### *Cultivation.*

As the currant, to do well, must have a good supply of moisture, cultivation should be begun soon after planting, and the surface soil kept loose during the summer. While the plants are young the cultivation may be fairly deep between the rows, but when the roots begin to extend across the rows, cultivation should be shallow, as many of the roots are quite near the surface.

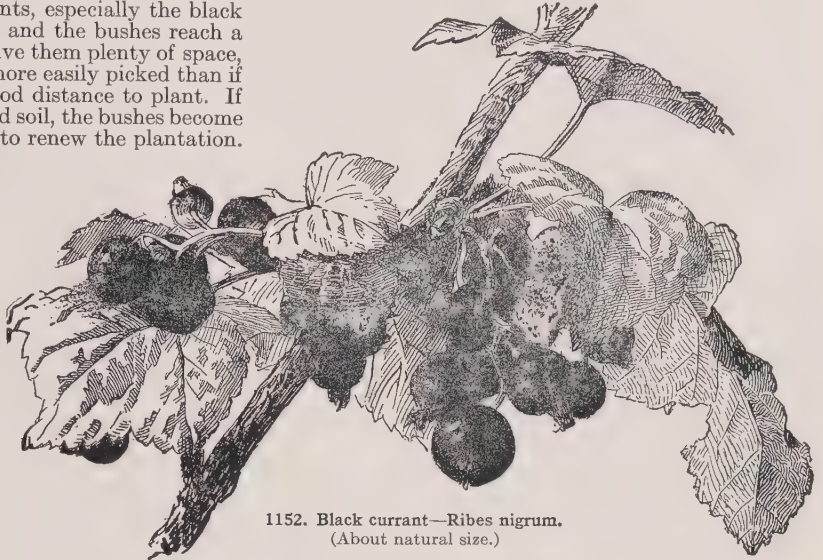
#### *Fertilizers.*

After the first application of manure, no more should be necessary until the plants begin to fruit, unless other crops are grown between, after which an annual top-dressing of well-rotted barnyard manure is desirable. When only a light application of manure is given, the addition of 200 to 300 pounds to the acre of muriate of potash would be very beneficial. Wood-ashes also would make a good fertilizer with barnyard manure. There is little danger of giving the currant plantation too much fertilizer. Unfortunately, it is usually the other way, this fruit being often very much neglected.

#### *Pruning.*

The black and red currants bear most of their fruit on wood of different ages; hence the pruning of one is a little different from the other. The black currant bears most of its fruit on wood of the previous season's growth, and it is important always to have a plentiful supply of one-year-old healthy wood. The red and white currants produce their fruit on spurs which develop from the wood two or more years of age, and it is important in pruning red and white currants to have a liberal supply of wood two years and older; but, as the fruit on the very old wood is not so good as that on the younger, it is best to depend largely on two- and three-year-old wood to bear the fruit. A little pruning may be necessary at the end of the first season after planting in order to get the bush into shape. From six to eight main stems, or even less, with their side branches, will, when properly distributed, bear a good crop of fruit. Future pruning should be done with the aim of having

from six to eight main branches each season and a few others coming on to take their places. By judicious annual pruning, the bush can be kept sufficiently open to admit light and sunshine. A good rule is not to have any of the branches more than three years of age, since when kept down to this limit the wood will be healthier, stronger growth will be made, and the fruit will be better.



1152. Black currant—*Ribes nigrum*.  
(About natural size.)

#### *When to renew the plantation.*

A currant plantation will bear a great many good crops if well cared for, but if neglected the bushes lose their vigor in a few years. The grower will have to decide by the appearance of the bushes when to renew the plantation; but as a currant plantation can be renewed at comparatively little labor, it is best to have new bushes coming on before the old ones show signs of weakness. At least six good crops may be removed with fair treatment, and ten or more can be obtained if the bushes are in rich soil and well cared for. When one has only a few bushes for home use, they may be reinvigorated by cutting them down to the ground in alternate years, and thus securing a fresh supply of vigorous young wood.

#### *Yield of currants.*

The red currant is one of the most regular in bearing of all fruits, and as it is naturally productive, the average yield should be large. Bailey, in the "Farm and Garden Rule-Book," puts the average yield at 100 bushels per acre. Card, in his book on "Bush-Fruits," says that it ought to be 100 to 150 bushels, "with good care," and reports 320 bushels. At the Central Experimental Farm, Ottawa, Canada, the Red Dutch averaged for four years at the rate of 7,335 pounds to the acre, or over 183 bushels. The largest yield from red currants obtained at the Central Experimental Farm was in 1900, when six bushes of the Red Dutch currant yielded 73 pounds, 15 ounces of fruit. The bushes were 6 by 5 feet apart. This means a yield at the rate of 17,892 pounds to the acre, or, at 40 pounds per bushel, 447 bushels 12 pounds to the acre. The same variety in 1905, in a new plantation, yielded 55½ pounds from six bushes, or at the rate of 13,431 pounds to the acre, or 335 bushels 31 pounds. These are very large yields, and while half of this amount may not be expected in ordinary field culture, the fact that such yields can be produced on a small area should be an inspiration to get more on a larger one.

The average yield of black currants has been somewhat less than the red, although individual yields have been large. The Saunders currant yielded for four years at the rate of 6,534 pounds to the acre, or over 163 bushels; the Kerry at the rate of 6,382 pounds to

the acre, or over 159 bushels. The highest yield of black currants was obtained in 1905, when six bushes of Kerry planted 6 by 5 feet apart, yielded 62 pounds of fruit, or at the rate of 15,004 pounds to the acre, equal to 375 bushels, estimating at 40 pounds to the bushel.

#### Red and white currants.

The red currant makes excellent jelly, and its popularity is largely due to this fact. A large quantity of red currant jelly is made every year in Canada. Red currants are used to a less extent for pies and as jam and are also eaten raw with sugar. As a fruit for eating out-of-hand, the red currant is not very popular, but there are few fruits so refreshing. The white currants are better liked for eating off

the bush than the red, as they are not so acid. The Moore Ruby is a red variety, however, which is milder than most others, and for this reason is better adapted for eating raw. The red currant does not vary so much in quality as the black.

Red currants will remain in condition on the bushes for some time after ripening, and therefore do not have to be picked so promptly as the black.

**Varieties.** Varieties of red currants vary considerably in hardiness, the Cherry, Fay, Comet, Versailles, Wilder and others, while bearing very large fruit, are decidedly more tender than some of the others, hence they should not be planted in the coldest parts. The Franco-German and Prince Albert currants are later than most other varieties, and when it is desired to lengthen the season, these may be planted.

**Varieties of red and white currants recommended:** Red—for general culture—Pomona, Victoria, Cumberland Red, Red Dutch, Long Bunched Holland, Red Grape. Where bushes are protected with snow in winter, and for the milder districts.—Pomona, Victoria, Cumberland Red, Wilder, Cherry, Fay, and Red Cross. White.—White Cherry, Large White, White Grape.

#### Black currants.

There are not so many black currants grown in America as red, but there is a steady demand for them, and it is thought there will be an increasing demand as they become better appreciated. They make excellent jelly and the merits of black currant jam have long been known.

Black currants vary considerably in season, yield and quality, and therefore it is important to know those

that are the best. As most varieties of black currants drop badly from the bushes as soon as ripe, it is important to pick them in good time.

**Varieties of black currants recommended:** Saunders, Collins Prolific, Buddenborg, Victoria, Boskoop Giant. Of those not yet on the market which are considered equal or better than those above, the following are the best: Kerry, Eclipse, Magnus, Clipper, Climax and Eagle, and the Success, for an early variety when yield is not so important as size and quality.

#### Crandall currant.

This is a variety of the Buffalo or Missouri currant (*Ribes odoratum*). A tall, strong, moderately upright grower; moderately productive. Fruit varies in size from small to large, in small, close bunches; bluish black, skin thick; sub-acid with a peculiar flavor. Quality medium. Ripens very unevenly. Season late July to September. As this variety ripens after the others, the birds concentrate on it and get a large proportion of the fruit.

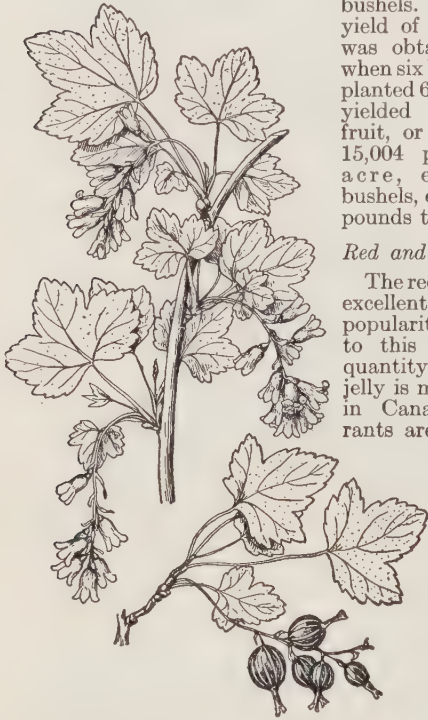
#### Some of the most injurious insects affecting the currant.

**Currant aphid (*Myzus ribis*).** When the leaves of currant bushes are nearly full grown, many of them bear blister-like elevations of a reddish color, beneath which will be found yellowish plant-lice, some winged and some wingless. The blisters are due to the attacks of these insects, and when, as is sometimes the case, they are very abundant, considerable injury is done to the bushes. Spraying forcibly with whale-oil soap, or kerosene emulsion will destroy large numbers of these plant-lice at each application; but the liquid must be copiously applied and driven well up beneath the foliage by means of an angled nozzle. Two or three applications at short intervals may be necessary.

**Currant borer (*Sesia tipuliformis*).** Early in June a beautiful little bluish black fly-like moth, with three bright yellow bands around the body may be seen darting about, around, or at rest on the leaves of currant bushes of all kinds. This is one of the most troublesome enemies of these fruits. The moth lays an egg at a bud on the young wood, and the caterpillar, when hatched, eats its way into the cane and destroys the pith. It remains in the wood during the winter, and the moth emerges during the following summer. Close pruning is the best remedy. Burn the wood.

#### Currant maggot (*Epochra canadensis*).

Red, black and white currants are in some places seriously attacked by the maggots of a small fly. These maggots come to full growth just as the berries are about to ripen, causing them to fall from the bushes, when the insects leave them and burrow into the ground to pupate. Attacked fruit is rendered useless by the presence of the maggots inside the berries; and frequently it is not until the fruit is cooked that



1153. Native black currant—*Ribes floridum*.  
The fruit is immature. ( $\times \frac{1}{2}$ )



1154. Buffalo currant.  
*R. aureum* ( $\times \frac{1}{2}$ )



the white maggots can be detected. Gooseberries are sometimes injured but far less frequently than black and red currants. The only treatment which has given any results is the laborious one of removing about 3 inches of the soil from beneath bushes which are known to have been infested, and replacing this with fresh soil. That which was removed must be treated in some way, so that the contained puparia may be destroyed. This may be done either by throwing it into a pond or by burying it deeply in the earth.

*Currant worm* or *imported currant sawfly* (*Pteronius ribesii*). By far the best known of all the insects that injure currants and gooseberries, is the "currant worm." The black-spotted dark green false caterpillars of this insect may unfortunately be found in almost every plantation of currants or gooseberries, every year in almost all parts of America where these fruits are grown. The white eggs are laid in rows along the ribs of the leaf on the lower side, toward the end of May. From these the young larvæ hatch and soon make their presence known by the small holes they eat through the leaves. Unless promptly destroyed, they will soon strip the bushes of their leaves, thus weakening them considerably so as to prevent the fruit from ripening the first year, and also reducing the quality of the crop of the following season. There are at least two broods in a season in most places; the first appears just as the leaves are attaining full growth, and the second just as the fruit is ripening. The perfect insect is a four-winged fly which may be seen flying about the bushes early in spring. The male is blackish, with yellow legs and of about the same size as a housefly, but with a more slender body. The female is larger and has the body as well as the legs yellow. For the first brood a weak mixture of paris green, one ounce to ten gallons of water, may be sprayed over the bushes, or a dry mixture, one ounce to six pounds of flour, may be dusted over the foliage after a shower or when the leaves are damp with dew. For the second brood paris green must not be used, but white hellebore; or hellebore may be used for first brood, but it is necessary to kill quickly. This is dusted on as a dry powder, or a decoction, one ounce to two gallons of water, may be sprayed over the bushes. It is, of course, far better to treat the first brood thoroughly, to reduce the number of females which lay eggs for the second brood.

1155.  
Currant  
cutting.



*Oyster-shell scale* (*Lepidosaphes ulmi*). Several kinds of scale insects attack currants. These plants seem to be particularly susceptible to the attacks of the well-known oyster-shell scale of the apple, and the San José scale. In neglected plantations these injurious insects increase rapidly, and a great deal of injury results to the bushes. The remedies for scale insects are direct treatment for the destruction of the infesting insect, and preventive measures, such as the invigoration of the bush by special culture and pruning, to enable it to throw off or outgrow injury. Infested plantations should be cultivated and fertilized early in the season, and all unnecessary wood



1156. To illustrate the pruning of a currant bush. The old cane, a, is to be cut away. The straight new canes at left are to remain.

should be pruned out. As direct remedies, spraying the bushes at the time the young scale insects first appear in June with kerosene emulsion or whale-oil soap, or spraying in autumn before the hard weather of winter sets in with a simple whitewash made with one pound of lime in each gallon of water, give the best results. Two coats of the whitewash should be applied, the second one immediately after the first is dry. In putting on two thin coats of the wash instead of one thick one, far better results have been secured.

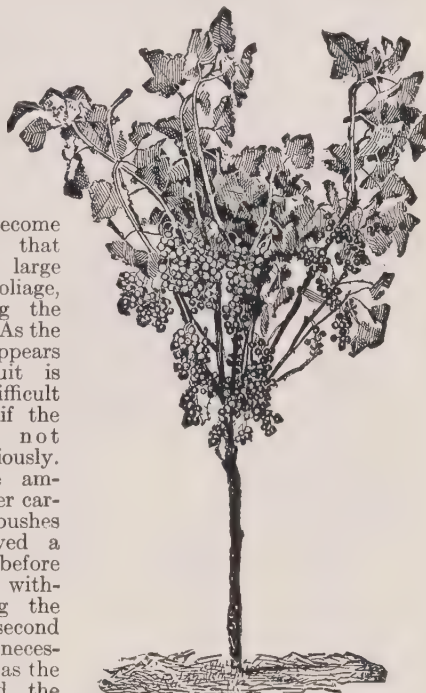
For the San José scale, the lime-and-sulfur wash is necessary, and must be repeated every year.

#### *Diseases of the currant.*

The currant is affected by very few diseases. The only ones that do much injury are the following:

*Leaf-spot, rust* (*Septoria ribis*). The leaf-spot fungus affects black, red and white currants, causing the leaves to fall prematurely, and thus weakening the bushes. This disease is first noticed about mid-summer, when small brownish spots appear on the leaves. These often become so numerous that they affect a large part of the foliage, soon causing the leaves to fall. As the disease often appears before the fruit is picked, it is difficult to control it if the bushes are not sprayed previously. By using the ammoniacal copper carbonate the bushes may be sprayed a week or two before it is expected, without discoloring the fruit, giving a second application, if necessary. As soon as the fruit is picked, the bushes should be thoroughly sprayed with bordeaux mixture. Experiments have shown that this disease can be controlled by spraying.

*Currant anthracnose* (*Gloeosporium ribis*). This disease, which may be mistaken for the leaf-spot, affects different parts of the bush, including the leaves, leaf-stalks, young branches, fruit and fruit-stalks. On the leaves it is made evident during the month of June by the small brown spots which are usually smaller than those made by the leaf-spot fungus. The lower leaves are affected first, and finally the upper ones. They turn yellow and gradually fall to the ground, and when the disease is bad the bushes are defoliated before their time. On the petioles or leaf-stalks, the disease causes slightly sunken spots. The fruit is affected with roundish black spots which are more easily seen when the fruit is green. On the young wood the diseased areas are light in color and are not so noticeable. The wood is not nearly so much injured by the disease as the leaves. The spores which spread this disease are formed in pustules, the majority of which are under the upper epidermis of the leaf. Where the spores are to appear, the surface of the leaf is raised and blackened

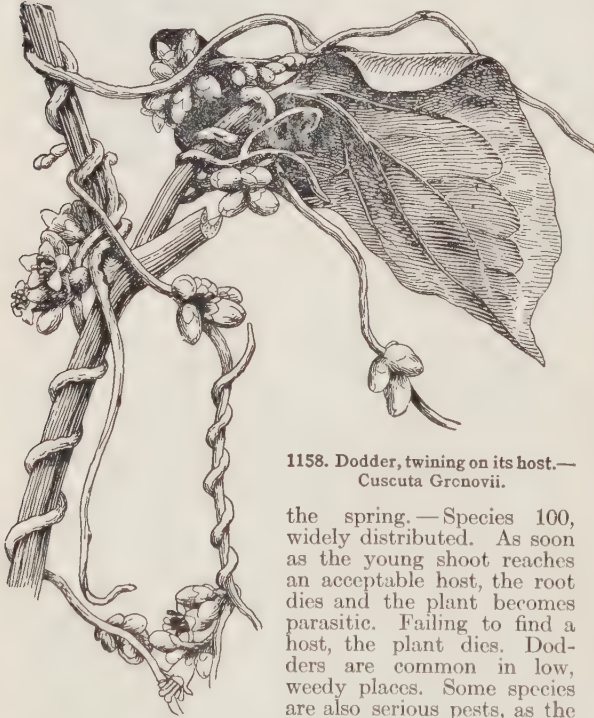


1157. Tree-form training of currant.

in spots looking like small pimples. When the spores are ready to come out the skin breaks and they escape and re-infect other parts. When the foliage drops early on account of this disease the fruit is liable to be scalded by the sun. The fruit may also wither before ripening properly, owing to lack of food or of moisture, as, the leaves having fallen, they are unable to keep up the necessary supply. The premature falling of the leaves prevents the buds from maturing properly, hence they are not in so good condition to bear fruit the next year. Spraying with bordeaux mixture is recommended as an aid in controlling this disease. It would be wise, when currant anthracnose is troublesome, to spray the bushes thoroughly before the leaves appear. A second spraying should be made when the leaves are unfolding, and successive sprayings at intervals of ten to fourteen days until the fruit is nearly full grown, and there is danger of its being discolored by the spray when ripe. Paris green should be added to the mixture when the first brood of the currant worm appears. A thorough spraying after the fruit is harvested is desirable.

W. T. MACOUN.

**CŪSCUTA** (origin of name obscure). *Convolvulaceæ*. **DODDER.** Degenerate parasitic twiners, bearing clusters of small flowers. They are leafless annuals, with very slender yellow, white, or red stems, which become attached to the host-plant by means of root-like suckers. The seeds fall to the ground and germinate in



1158. Dodder, twining on its host.—*Cuscuta Gronovii*.

the spring.—Species 100, widely distributed. As soon as the young shoot reaches an acceptable host, the root dies and the plant becomes parasitic. Failing to find a host, the plant dies. Dodders are common in low, weedy places. Some species are also serious pests, as the clover dodder, alfalfa dodder, and flax dodder. One of the common species (*C. Gronovii*, Willd.), of low grounds, is shown in Fig. 1158.

**CUSHAW:** *Cucurbita moschata*.

**CUSTARD APPLE:** *Annona*.

#### CUT-FLOWER INDUSTRY IN NORTH AMERICA.

The feature that most distinguishes American floriculture from that of Europe is the great preponderance of the cut-flower trade as compared with the sales of plants. Forty years ago the passion of Americans for cut-flowers was remarked by travelers, but however

important the cut-flower trade may then have appeared it has had a marvelous growth since that time. Prior to the Civil War it would have been impossible to purchase any considerable quantity of cut-flowers in the winter season in any of the large cities. The green-houses were small flue-heated structures in which a great variety of plants was grown; hence it would have been impossible to secure a quantity of any one kind. There were no middlemen to collect even the small quantities produced in a locality, and when large numbers of blooms were required, advance notice was expected and the person wishing the flowers had to do the collecting from the various establishments. After the period mentioned, floricultural establishments rapidly increased in number and size. This growth has continued until today. Instead of being concentrated about large cities, there is scarcely a city of 5,000 or even less that does not have its florist. Not less than \$100,000,000 is now invested in the cultivation and sale of cut-flowers in America. Although statistics of the cut-flowers alone are not available, a conservative estimate based on the United States census of 1910 places their annual value at \$25,000,000.

From forty to sixty years ago the camellia was the most valued cut-flower, either for personal adornment or for bouquets, and sometimes as much as \$1, \$2 and even \$3 were obtained for single flowers at the height of the holiday season. Then came a period of decline during which they were almost forgotten except in a few private collections, but now they are seen upon the market as pot-plants. The florist of the present generation wonders how they could have been admired to the extent that they should lead as cut-flowers. Perhaps no better idea of the requirements of the former cut-flower trade can be given than to quote the record of a leading New York florist establishment for 1867 which shows a product as follows: Camellias about 45,000, bouvardias 20,000, carnations 70,000, double primroses 100,000, and tuberose 50,000. Other flowers on the market in those days were daphne, abutilon, callas, sweet alyssum, poinsettia, eupatorium, heliotrope and a few tea roses. The most profitable white cut-flowers, in the opinion of many florists, were *Stevia serrata*, Double White camellia, *Calla æthiopica*, *Lilium candidum*, *Deutzia gracilis*, and Double White Chinese primrose.

It will be noted that roses were not important in the cut-flower trade of this period. It is a fact that very few were grown under glass. A few florists were growing Bon Silene, Lamarque and Safrano roses, occasionally devoting an entire house to them, but more often in houses with other flowers. The rapidly-awakening demand for all kinds of flowers brought good prices for roses and stimulated the florists to give this flower more attention. The time was one of changing ideals and the old formal camellia, show dahlia and Chinese chrysanthemum were passing, while new and less formal flowers were coming into favor. The flower-buying public, however, wanted something larger than the small tea varieties then grown. Every new variety from Europe that had any promise was tried, and from that day to this scarcely a new introduction has escaped a searching test as to its adaptability for culture under glass. The Marechal Niel was grown for the discriminating trade, and it continued the leading variety until it was supplanted by the everblooming, more prolific and more easily cultivated Perle des Jardins. Likewise, the hybrid perpetuals were tried, and some of them, notably General Jacqueminot, were found to force well. This variety, when it could be had for the holidays, brought \$1 and \$2 a bud.

The roses of this time were produced on plants grown in deep beds or in pots or boxes. The latter method enabled the grower better to time his crops, while the former involved less time and attention. The endeavor to secure the advantages of both naturally resulted in



the shallow raised bench, and this method of growing cut-flowers has been adopted for practically all now grown in large quantities; in fact, this system of culture is perhaps the greatest single feature which distinguishes American floricultural methods from those of Europe. Simultaneously it became very generally recognized that to grow roses successfully required separate houses and a different temperature. For a long time it was thought that a special form or construction was necessary, viz., the three-quarter span, but now the even-span house is in general use.

#### *The present cut-flower production.*

Having made these important advances in cultural methods, it needed but the introduction of the epoch-making rose, Catherine Mermet, to place the rose in the first place among cut-flowers. This variety came at once into great popularity with the flower-buying public and was very profitable to the growers, thereby attracting capital to the flower business. The competition to produce and market the best quality of flowers elevated the standards in cut-flowers to a higher level. Although the introduction of Catherine Mermet did much for the flower business, it is as the parent of Bride and Bridesmaid that the variety is generally remembered. These "sports" have been the leading white and pink varieties for twenty years, and have been displaced only during the last five years by White Killarney and Killarney, although many claimants arose to dispute their leadership. These roses succeeded because they were profitable with every florist who could grow roses, and it is doubtful whether we shall ever see varieties so generally successful over so wide a territory. The market is seeking a greater variety among roses than it did during the years these roses held sway, but all this is advantageous to the rose specialists. Next in importance to Bride and Bridesmaid and their successors, White Killarney and Killarney, is the American Beauty (Madame Ferdinand Jamain). This variety can be grown successfully and profitably only by growers who have special conditions. As the variety is still without a rival, it continues to be popular with the wealthy flower-buyers.

The American carnation may be regarded as the greatest contribution America has yet made to the floriculture of the world. The plant is unlike any type grown in Europe and its development is due to American plant-breeders, Dorner, Fisher, Ward and many others. During the last fifty years it has been improved in form, size, color and productiveness. Hundreds of varieties have been introduced and the progress has been so rapid that the best have lasted but a few years. Within the last ten years the American carnation has become popular in England, and now new varieties are appearing from over the sea. The United States census of 1890 shows that roses were first, carnations second, and that the two comprised 65 per cent of all cut-flowers. This relative standing has been maintained to the present time.

The development in chrysanthemums has been no less marked. From the old formal Chinese sorts, the popular fancy turned to the large informal Japanese kinds. Now a change to the single and pompon types is being experienced. The varieties of greatest commercial importance have been for the last ten or fifteen years of American origin. The English, French and, finally, the Australian varieties have led as exhibition flowers, but only an occasional variety has proved meritorious as market cut-flowers. (See *Carnation*, *Chrysanthemum*, *Rose*, and other special articles.)

At the present time the important cut-flowers are roses, carnations, violets, chrysanthemums, sweet peas, lilies, narcissi, orchids, lilies-of-the-valley, mignonette, snapdragons, marguerites and gardenias. A modern cut-flower establishment in the region of New York

grows for its wholesale trade the following numbers of plants:

Roses.....	100,000
Chrysanthemums.....	240,000
Carnations.....	45,000
Lilies.....	(75,000 for Easter) 150,000
Lilies-of-the-valley.....	300,000
Orchids.....	25,000

These are grown in a range of houses comprising 900,000 square feet of glass requiring 8,000 tons of coal, 300 employees, 25 horses, 4 automobiles, and a 250-acre farm with a dairy of 160 cows to supply the manure required.

The past ten years have witnessed the development of the new winter-flowering types of sweet peas, and now these flowers bid fair to rival the violet and chrysanthemum for position after roses and carnations.

Orchids, particularly cattleyas, now are being grown by commercial florists for cut-flowers. Although of recent development, during the last ten or twelve years, all large establishments have an orchid department, while many smaller growers are specializing in their culture.

Lilies, through the means of cold storage, may now be had by forcing throughout the year. The varieties of Japanese longifloras have largely supplanted the old *Lilium Harrisii* kind. *Lilium speciosum* varieties are now largely grown.

The antirrhinum is now being grown by several specialists and doubtless will yield varieties adapted to greenhouse culture.

The most important outdoor flowers for cutting are peonies, gladioli and asters. The peony is now a most important Memorial Day cut-flower, and many acres are devoted to its culture in regions in which the improved varieties mature their flowers early enough. By means of cold storage, flowers of certain varieties may be kept in good condition for as much as four weeks. The florists are enabled to have a supply of this flower for commencements, weddings, and the like, throughout the latter part of May, June and early July.

Gladioli are increasing in popularity as summer cut-flowers because of their keeping qualities under ordinary conditions. Not only are the white varieties useful, but the magnificent colored varieties are being used in large numbers for bouquets on dining-tables in hotels and restaurants.

#### *The selling.*

The marketing of cut-flowers is a business of itself. Many an excellent grower fails because he is not expert in selling his blooms. The cutting of the blooms must be properly done and at the right stage of development. The proper stage in the development when cutting should be done varies with the variety and the season. Roses should be cut as the petals begin to unfold, when the tip of the bud is bursting and the outer petals have reached the proper color. Carnations are picked when fully developed or when three-quarters developed. The latter stage is determined by the pistils having reached an even length with the center petals. Most flowers should be cut early in the morning, and as soon as cut should be placed in clean fresh water, after which they are carried to the cooling-room. The vases in which the flowers are placed should be deep enough to allow plunging the stems two-thirds their length in water. The temperature of the water should be 10° to 15° higher than that of the cooling-room which is 45° to 50°. The temperature is thus gradually lowered to that of the storage-room. The flowers remain in the cooling-room until the picking is done, when they are graded.

Along with the advance in cultural methods and to meet market requirements, flowers have been graded. Although the kinds of flowers grown and the quality

differ but little in the various flower markets, the grades are not yet uniform. However, this ultimately will be brought about through the Florists' Telegraph Delivery Association, an organization which enables a resident of San Francisco, for example, to have an order filled and delivered at an address in Boston, Montreal, Baltimore or elsewhere. The American Rose Society adopted the following grades for tea and hybrid tea roses: 9, 12, 15, 18, 24 inches of stem. Of course the flowers must be good to accord with this standard. American Beauty is graded: Specials, above 38 inches; fancy, 32 to 36 inches; extras, 24 to 32 inches; firsts, 13 to 23 inches; seconds, 8 to 13 inches; thirds all under 8 inches. On the Chicago market this variety is graded into specials, 36-, 30-, 24-, 20-, 18- and 12-inch stems. Carnations on the New York market are usually graded into fancies, extras and firsts. Fancies are all perfect blooms, from  $2\frac{3}{4}$  to  $3\frac{1}{2}$  inches in diameter, with straight stems 16 to 24 inches or more in length. Extras are those blooms which fall short in one or the other of the above requirements. Firsts comprise all merchantable flowers which do not pass as extras or fancies. During the grading, all the leaves from the lower 6 inches are stripped off as well as any side shoots in the axils of the remaining leaves. Chrysanthemums are classed as small, medium, fancy and special. Whatever the grades used in any market, it is important that they be definite, and that the grower use care in grading his own products.

The present methods of the growers in disposing of their flowers to the retail florists are as follows: The large wholesale growers maintain wholesale stores of their own, dealing with the retailers direct and conducting a shipping trade. The growers at a distance from the city market usually consign to the wholesale commission florist whose field is as broad as that of the wholesale grower. These two classes of florists keep in close touch with their customers, even those at a distance, by the ordinary means of communication and in some cases by traveling representatives. The smaller growers living close to a large city adopt any one of five methods, that is, (1) form a coöperative association with an expert salesman to sell the flowers; (2) organize a flower-market and operate a flower-stand; (3) consign the flowers to a commission florist; (4) supply certain retailers regularly; (5) operate their own retail stores. The particular method to be adopted in any individual case depends upon the local conditions and the business ability of the grower. The grower-specialist usually will find it more remunerative to arrange with retailers better able to dispose of his high-class product.

The development of the methods of packing and handling flowers has been a great factor in the business. In the old days flowers were brought to market, or as was more often the case, the retailers went to the growers and carried them into the city in market-baskets. They were delivered to the customers in the same way. When flowers were to be shipped, which was seldom, any convenient box was adapted to the

purpose. At present the florists employ wooden and folding paper boxes for different classes of trade. These are in various sizes adapted to the kind of flower to be packed and to the quality shipped. Furthermore, the package is clean, light, strong and entirely in keeping with the goods. The perfection of the railway and express service has facilitated the delivery of flowers to the consignee. Not only has this enabled growers to get their flowers to the city, but has made it possible for florists over the country to secure flowers when they do not have a sufficient supply. The great wholesale flower business of Chicago is built in a large measure upon the demand of florists in towns and cities over the vast territory extending from Winnipeg to the Gulf of Mexico, and from the Alleghanies to the Rockies.

The packages now used to carry the flowers to the wholesale market are either return or gift boxes; the former, are strong wooden boxes with a hinged lid 12 to 16 inches wide and 5 to 6 feet long. These packages are returned to the grower. Some do not find it profitable or possible to have shipping-boxes or crates returned and must use gift boxes which may be of wood or heavy paper. The common box used by the wholesalers in shipping flowers to distant customers when the package must be handled many times, is the light wooden box. This is made of thin wood,  $\frac{1}{2}$ -inch ends and  $\frac{1}{4}$ -inch tops, bottoms and sides, with two interior cleats to hold the flowers down. These boxes are made in sizes 4 to 8 inches deep, 12 to 16 inches wide, and 36 to 50 inches or more long. The boxes are first lined with paper,



1159. Carnations packed for shipment.

usually four to eight thicknesses of newspapers, according to the season. Then a layer of waxed paper is put in. Roses, whether on their way into or out of the wholesale market, are seldom bunched. Carnations, when shipped out or when sent in by a wholesale grower to his own store, are usually not bunched, but growers who sell through the commission florist should bunch the flowers as it facilitates handling when the flowers arrive on the market. Sweet peas, violets and similar flowers are always bunched. The number of flowers in a bunch will depend upon the requirements of the market. Usually sweet pea bunches contain twenty-five; violets, fifty or one hundred; peonies, thirteen; and carnations, twenty-five flowers. The bunches of violets are encircled by a rim of twenty to thirty leaves and the combination must be attractively done if even the best flowers are to bring a good price. Sweet peas are bunched without foliage, while most flowers bear their natural foliage.

Long-stem flowers, such as roses and carnations, when not tied in bunches, are packed one by one in rows across the width of the box, beginning at one end. The first row rests upon a pillow made of a roll of paper, and each succeeding row is separated from the preceding row by a strip of wax paper. This continues until five rows have been put in each end of the box. Five or six rows of flowers in each end constitute a layer. The flowers of each layer are covered with a sheet of wax paper, and the packing goes on until the box is filled; but only four to six layers should be put in a box.



Over the stems in the center are placed eight to ten thicknesses of well-saturated newspapers, after which cleats are nailed in place. This will prevent the flowers from becoming disarranged in shipping. When different grades of roses are to be packed in the same box, the specials are placed in first unless shipment has a long distance to travel, when two or three rows of the cheap, short grades should go next the end of the box because of danger of injury to the flowers. Each grade is separated from the next by sheets of tissue paper and the different grades are filled in until the short lengths complete the box. It should be a general rule to pack white flowers in the top of the box. Every box should contain a statement of the contents for the information of the recipient. No icing is usually needed in winter, but in warm weather the foliage of roses may be sprinkled with water or chipped ice. Carnations are cooled by lumps of ice wrapped in wet newspapers and placed between the cleats of the boxes. Violets are preserved by wrapping the stems in soft tissue paper and dipping this in cool water. Sweet pea stems are wrapped in wet cotton wool, great care is being taken to prevent wetting the blooms.

In the early days of the cut-flower business, the grower retailed his own flowers. He found time to propagate the plants, tend the furnace, grow the crops, cut the blooms, make floral designs and, if necessary, pack and ship his product. The rapid growth of the cities, making it impossible for the florist to conduct his business near the centers of trade, led to the retail florist. This man, having no glass, could open a flower-stand or store in the most favorable locations, giving it his entire time. The present-day flower stores are the achievements of his skill and industry in developing the art side of the florist business.

#### *The changing demands.*

The uses to which cut-flowers are put have changed. Forty years ago the taste was for formal designs. The flowers were picked with short stems, and in the case of carnations only the open buds were cut, while the remaining buds on the stem were allowed to develop. These flowers were wired to wooden sticks for basket work or to broom-corn straws for bouquets. The details for making the formal pieces of that time will be found in Henderson's "Practical Floriculture." That the florists of that day enjoyed a good trade is seen in the fact that on New Year's Day, 1867, one New York firm sold \$6,000 worth of flowers, and it was estimated that the total sales in the city amounted to \$50,000. The same authority estimates the annual sales of flowers in New York at \$400,000 and in Boston \$200,000. Probably the sales of the whole country did not exceed \$1,000,000. Often \$200 or \$300 were spent for flowers for a reception, and the spending of \$1,500 for a similar purpose, as well as a \$6,000 church decoration, were then the highest achievements of the profession.

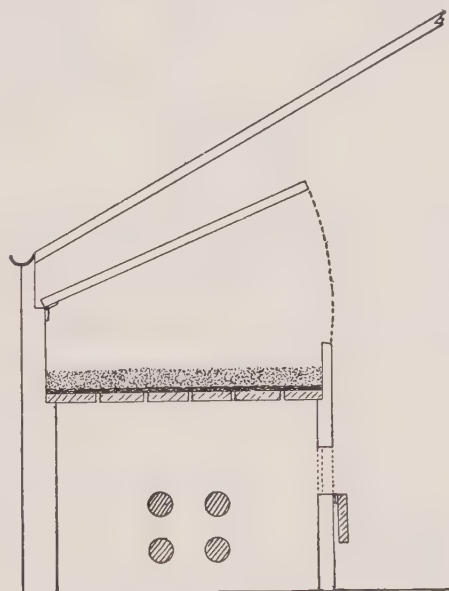
The public taste of the present day is for loose, artistic arrangements of long-stemmed flowers. The popular funeral emblems are forms of the wreath which are either made of one kind of flowers or of a great variety of material. Flat sprays and bunches of flowers, and palm (sago) leaves tied with ribbon are also commonly used. House decorations consist of vases of long-stemmed flowers. Roses, carnations, chrysanthemums, peonies and gladioli are suitable for this purpose. Table decorations for dinner are also made of long-stemmed flowers in vases, with some placed on the cloth with ferns or asparagus. Bridal bouquets are arranged often in shower effects by means of narrow ribbon. A remarkable advance has been made in the use of ribbon. Instead of the florist going to the nearest drygoods store for the ribbon he needed, the present-day florist carries his own supply of specially prepared ribbon. As soon as a new shade of color appears in roses, a new ribbon is manufactured to match the

color. The accessories now required to conduct a successful florist business are numerous, requiring a considerable outlay of money; and the trade in this class of floral supplies is a very large one. Every large city now has its supply houses. The kinds of flowers used throughout the United States and Canada vary very little and this is confined to varieties rather than species. The growth of the cut-flower business in Canada also has been rapid, and artificial boundaries have not divided the florists of the two countries. A good book on cut-flower culture is "How to Grow Cut-Flowers," by M. A. Hunt. There are no works on the handling of cut-flowers. On the use and arrangement of flowers, the best literature is found in the current trade papers. Among the foreign works which may prove helpful are "Floral Decoration," by Felton; "The Book of Cut-Flowers," by R. P. Brotherston; and the German special journal, "Die Bindekunst."

A. C. BEAL.

**CUTTINGS, PROPAGATION BY.** A cutting is the gardener's name for a piece of stem, root, rootstock or leaf, which, if cut off and planted under suitable conditions, will form new roots and buds, reproducing the parent plant.

The word cutting, when unrestricted, is given to parts of the stem; a part or the whole of the leaf, when so used, is called a leaf-cutting; a piece of root or rootstock is called a root-cutting. The scales of some bulbous plants, as of the lily, can also be used as cuttings. A cion used in grafting might be called a cutting which unites and grows on another plant. Plants secured by division or layering are provided with roots before they are detached from the parent plants, and, therefore, are not properly cuttings. There are intermediate states between these different categories, however, so that hard-and-fast definitions do not hold.



1160. Section of propagating-bed. Shows four pipes beneath, the door in the side, and the frame cover.

The practice of propagating by means of cuttings, together with the discussion of the reasons, results and bearings, constitutes a department of horticultural knowledge that has been denominated *cuttage*, as the practices, reasons and philosophy of tilling have been called tillage.

Multiplication by cuttings is a form of bud-propagation in contradistinction to sexual reproduction, i.e.,



1161. Permanent propagating-frames in a greenhouse.

propagation by seeds. It is a cheap and convenient way of securing new plants. All plants cannot be profitably increased by these means. Why they differ we do not know; the gardener learns by experience what species yield a good percentage of healthy plants, and acts accordingly.

The following table will show the different ways in which cuttings are made:

Cuttings	Stem. ....	Growing wood.	Soft e.g., verberna.
			Hardened e.g., tea roses.
		Ripened wood.	Long, in open air e.g., grape.
			Short, under glass e.g., Japanese cedar.
	Roots or rootstocks.		Short, under glass e. g., <i>Anemone japonica</i> .
			Long, in open air e. g., blackberry.
	Leaf. ....		Entire e. g., echeveria.
			Divided e. g., <i>Begonia Rex</i> .
			Bulb-scales e. g., lilies.

There is less variation in cutting-progeny than in seed-progeny, and therefore cuttings (or layers or cions) are used when it is desired to keep a stock particularly true to name. They are used largely for the multiplication of forms that are specially variable from seed (which have not become fixed by seed selection), and of mutations as between the different branches or parts of a plant (bud sports). Thus, the varieties of roses, chrysanthemums, carnations, most begonias, and currants and grapes can be grown from cuttings. Cuttings are also employed when seeds are difficult to secure, as in many greenhouse plants, or when propagation by seeds is difficult and cuttings are easy, as in poplars and willows.

#### The cutting-bed.

Under glass cuttings are commonly planted in pure sand, such as a mason would use for making mortar. Sphagnum moss is sometimes used and various substances like brick-dust, coal-ashes jadoo fiber have been tried, but without much success. Sand and well-rotted leaf-mold mixed half and half, is occasionally employed for geraniums, for lily scales, root-cuttings and some succulent plants.

Sphagnum is useful in rooting *Ficus elastica*, the base of the cutting being wrapped in a ball of moss and plunged in a bed of moss. English

ivy, oleander and other plants can be struck in water, but this method is cumbersome. Peter Henderson's saucer method is valuable in hot weather: the cuttings are planted in sand, kept saturated and fully exposed to sun.

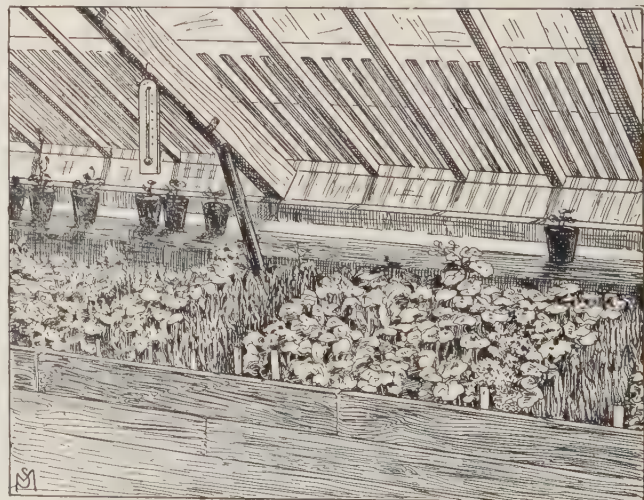
In the open air, a well-protected place, a part of the frame-yard, for example, should be chosen for a cutting-bed. The aspect should be southerly and the soil must be well drained. The soil should also be trenched to the depth of 2½ to 3 feet, all poor material removed and additions of humus, in the form of peat, leaf-mold or well-rotted barnyard manure incorporated. Provision for watering should be easy. If the soil is a heavy clay, add sand.

Structures in which cuttings are started.  
Figs. 1160-1165.

Large establishments have one or more houses set apart for this and similar purposes called "propagating-houses." In smaller places a propagating-bed or -bench can be made at the warmest end of the warmest house. It should be placed over the pipes where they leave the boiler, and, in order to secure bottom heat when needed, the space between the bench and the floor should be boarded up, having a trap-door to open on cold nights (Fig. 1160). Cutting-frames inside a greenhouse are also shown in Fig. 1161. Side partitions should also be provided to box in all the heat from the pipes under that part of the bench. Good dimensions for such a bed are, width 3 feet, length 6 feet or any multiple of six thus making it simple to use a hotbed sash when confined air is wanted. The depth of the frame should be from 6 to 10 inches in front and about the same behind. The bottom of the bed may be either wood, slate or metal and should be well drained: place a layer of potsherds first, then moss, and from 2 to 3 inches of sand on top. The sand should be clean, sharp and well compacted: before planting it should be watered if at all dry. It is sometimes advisable to have the bed filled with moss (sphagnum), into which pots or boxes containing cuttings are plunged: the moss should be moist, neither too wet nor dry, and well packed.

In many cases, when large quantities of one sort of easily struck cuttings are to be planted, the ordinary greenhouse bench covered with sand is sufficient (Fig. 1162).

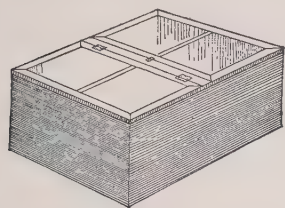
Hand-lights and bell-glasses are sometimes used under glass for small quantities of cuttings instead of frames. They may be of every convenient size up to 12 or 15 inches in diameter. The important point is that



1162. Cutting-bench shaded with lath.



provision for good ventilation be always provided: if too much water accumulates inside the glass it can be wiped off with a cloth. They are somewhat obsolete devices for providing a close atmosphere and intensifying bottom heat. The modern gardener finds that sunlight and shading with awnings put directly over the cuttings is quite sufficient for all plants except a few



1163. Propagating-box.

difficult subjects. Figs. 1163-1165 illustrate forms of hand structures. Out-of-doors cold-frames are employed for striking cuttings in summer. They are made of concrete or plank, and are about 5½ feet wide, 18 inches deep behind and 12 inches in front. They are of any convenient length, which is a multiple of three and are covered with standard hotbed sash. Instead of coldframes, light hotbeds are sometimes employed for rooting cuttings in the open air in summer. They entail more care and the results do not offset the gain.

*Cuttings of growing wood.* Figs. 1166-1171.

These cuttings are made either of the soft growing tip, as in coleus (Fig. 1166; also Fig. 1027, p. 827), salvia, verbenas (Fig. 1167), geranium (Fig. 1168) and others, or, of the same wood in more mature condition, but by no means ripe, as in tender roses (Fig. 1169), and *Azalea indica*. The cuttings of plants like *Euphorbia pulcherrima*, erica, epacris, are used in the soft growing state, if a well-built propagating-house is obtainable; but in an ordinary house, a part of which is used for other purposes, the older and better ripened wood will be more successful.

It is generally true that cuttings of hardened wood will always root, although they require more time and may not make the best plants, but it is not true that cuttings of the soft wood will always root. In many cases, as in the rose, they succumb before they callus, much less produce roots. In plants of rapid growth and good vitality, the proper condition of the soft growing wood for cuttings can be determined by its readiness to snap, not bend, when bent back: the hardened wood is in the right state as long as it continues to grow.

The treatment of cuttings in both classes is practically the same. They should be planted in sand under glass.

The wood for soft cuttings should be fresh, and precautions should be taken to prevent wilting during making and planting: if the weather is hot, sprinkle the floor and bench of the workroom: if they are delicate and exposed for an hour or more, lay them between folds of moistened paper. The average length of these cuttings is from 1 to 3 inches, but they can be made longer or shorter; much depends upon the nature of the plant. The best growers prefer short cuttings; the advantage of a long piece to begin with is more than offset by greater danger of wilting and consequent retrogression. It is not necessary to cut to a bud, i. e., at the node, in the more easily

handled plants except in some herbaceous tuberous-rooted plants, like dahlia (see Fig. 1170), and *Salvia patens*, in which a crown must be formed to insure future growth. Make the cut where it will give the proper length. A part of the leaves should be removed, always enough to secure a clean stem for planting, and as many more as are needed to prevent disastrous wilting: this factor varies greatly. In a hardwood cutting of lemon verbenas all leaves are taken off, in zonale geraniums from the open ground few if any are left, in coleus and verbenas about one half are removed, while in *Olea fragrans*, *Daphne odora*, and heath, only enough for planting. Use a sharp knife; but scissors are handy for trimming and sometimes for making cuttings of those small-wooded plants which root easily.

The cuttings of plants with milky juice should be washed before planting. Sometimes the lower ends are allowed to dry for several hours, the tops being protected against wilting. Large and succulent cuttings, e. g., of pineapple, cotyledon and cactus, should be dried before planting by letting them lie on the surface of the propagating-bed for several days, or they may be planted in dry sand at first. Under these conditions a callus forms which tends to prevent decay; but the wood must not shrivel.

Peter Henderson has introduced a method which is likely to increase the percentage of rooted plants, and which is desirable in slow-growing varieties, like the tricolor geraniums. He advises that the cutting should be partly severed and allowed to hang to the parent plant for a few days; this results in a partial callus or even roots, before the cutting is entirely removed.

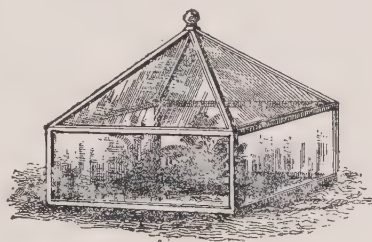
In planting cuttings, use a dibble or open a V-shaped trench. Never thrust the cutting directly into the soil. Plant deep enough to hold the cutting upright and no deeper (as in Fig. 1171), making due allowance for the sand settling; the distance apart should be just enough to prevent them from pressing against each other. It must be remembered that they stay in the bed only until rooted. As soon as growth begins, they are potted off. When the cuttings are inserted, the sand should be firmly pressed about them, and they should be watered with a syringe or with a fine rose; the forcible application of water compacts the sand, thus excluding air, and prevents undue wilting.

Give shade immediately, using lath shutters outside, cloth screens or papers placed directly on the cuttings within, and attend to this very carefully for the first few days. Lift the shades early in the afternoon, and put them on late in the morning, but keep them on during the middle of the day, thus gradually accustoming them to full light.

Cuttings should never suffer from dryness. The sand should always be kept moist to the verge of wetness. Ventilation should be given on bright days, but all exposure to draft avoided. A good temperature for propagating is from 60° to 65° F., increasing these figures for tropical plants and reducing them for more hardy kinds. It is debatable whether bottom heat and



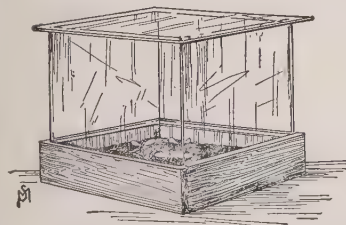
1166. Cutting of soft growing wood. (as of Coleus.)



1164. Propagating-box or hood.

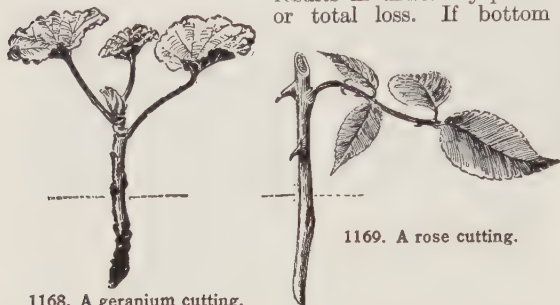


1167. A rooted verbenas cutting.



1165. Small propagating-box, adapted to a window.

confined air are advisable for cuttings of growing wood. The older gardeners employed both, but now neither is commonly used, except for tropical plants, like croton, or when a constant succession of crops of cuttings is required. There is no doubt that with this aid cuttings will root more quickly, but more skill and care are required, neglect bringing on fungous disease, which results in unhealthy plants or total loss. If bottom



1168. A geranium cutting.

1169. A rose cutting.

heat is used, the average temperature of the bed should be 10° or so above that of the air, but less will suffice. Indeed, in beds made as described above, in good weather the sand is enough warmer than the greenhouse atmosphere to answer every purpose. If a confined air is wanted, ventilation and shading must be carefully looked after, and precautions taken against the accumulation of condensed moisture within the bell-glass or frame.

Although it is tender plants, in the main, that are propagated by cuttings of growing wood, the above methods can be practised advantageously with some hardy plants. The wood, which is invariably more successful if hardened, is obtained either from plants forced for this purpose, e. g., *spirea*, *Deutzia gracilis*, or it is gathered in June and July out-of-doors, e. g., lilac, hydrangea. They should be potted off in 2- or 3-inch pots, in a rather sandy soil, when the roots are from  $\frac{1}{4}$  to  $\frac{1}{2}$  inch long. It is sometimes good economy to box them, i. e., plant them a few inches apart in flats, when not immediately required.

Some hardy perennials, like *Phlox subulata*, *Campanula carpatica*, *Gentiana acaulis* and the hardy candytuft, can also be easily increased in this way. Make the cuttings 2 to 3 inches long and plant in flats or pots in sand or a sandy soil in October, November or December, before any hard frost. Keep in a coolhouse and pot off when rooted. They make nice plants for planting out the following spring. Plants of this same nature can also be propagated in the open air in autumn. Make the cutting longer, 6 inches when possible, and do the work earlier, in September or in August in some cases.



1170. Hardened-wood cutting of dahlia.

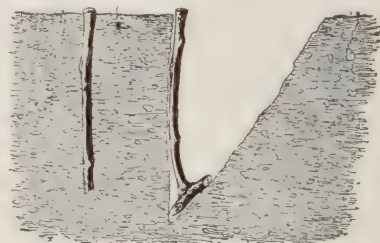
1171. A carnation cutting.

1172. Hardwood cutting of currant.

*Cutting of ripened or dormant wood.* Figs. 1172-1174.

Many plants grow readily from twigs of the year's growth taken in fall or winter or very early spring. The "soft-wooded" plants usually propagate most readily by this means. These cuttings of mature wood may be either long or short.

*Long cuttings of ripened wood in open air.*—This method is used to propagate many hardy trees and shrubs, e. g., willows, currants, grapes, forsythia. Wood of the current year's growth is gathered in autumn or early winter, before severe frost, and either stored in a wool cellar, covering with moss or fresh earth to prevent drying, or immediately made into cuttings. These cuttings are usually 6 inches or more long and should contain at least two buds. It is not necessary to cut to a bud at the base, but the upper cut should be just above one. Figs. 1172, 1173. They should be tied in bundles with tarred rope, taking care to have them lie "heads and tails" to facilitate planting, and with the butts on the same level, to promote callusing. They should then be buried in well-drained soil, with the butts down and protected against frost. In early spring they should be firmly planted in V-shaped trenches in well prepared soil: set an inch or so apart, with the rows 1 or 1½ ft. apart. The upper bud should be just at the surface; to prevent suckers the lower buds may be removed. In autumn they should be dug, graded and heeled-in for winter. Some varieties will require a second or third year's growth in the nursery; others are ready for permanent planting, as willows and poplars, which often grow 6 feet the first year. This is one of the very cheapest ways of propagating, and will pay when only 25 per cent root. This method is generally used with deciduous-leaved plants, but some conifers, e. g., Siberian arbutus, will strike. Remove enough twigs to get a clean stem for planting, and allow 2 or 3 inches of top above ground.



1173. Cuttings of grape, to show how planted.

The excrescences, knots or knaurs, which are found on the trunks and the main limbs of olive trees, are sometimes used as cuttings for propagation.

*Short cuttings of ripened wood.* (Fig. 1174.) Cuttings of this class are used under glass with tender or half-hardy species, and sometimes with new introductions, in cases in which the grower is short of stock, and when the plant is delicate and small. The wood should be gathered before severe frost and the cuttings made and planted directly in October and November. Make them from 2 to 4 inches long (sometimes a single eye only is used), and plant with a dibble, in pure sand in pots, pans or flats (boxes about 16 inches square and 3 inches deep). If a layer of potting soil is placed under the sand, the young plants have something to feed on and do not need to be potted so soon after rooting; if this is done, drainage should be given. It is important to keep them cool until a callus is formed or roots produced. If the buds start into growth before this, the cuttings become exhausted and are likely to die. After rooting,—the time required varies from one to six months—they may either be potted or the strong-growing sorts be planted out in well-prepared beds in May or June, where they are likely to make a satisfactory growth. The weaker kinds may remain a year in pots or flats, be wintered in a pit, and planted out the next spring. Some greenhouse plants, e. g., camellia, laurustinus, tender grapes,



are propagated in this way with cuttings of fully ripened wood, and others, as cactus and dracena, with wood which is much older. They should be given the care described under the head of "Cuttings of growing wood" (p. 927), but they must not be forced too hard at first. The temperature should be regulated by the nature of the plant. The safest rule to follow is to give a few degrees more heat for propagating than the plant received when the cutting was removed.

Hardy shrubs can also be propagated by cuttings of growing wood, somewhat hardened, planted in coldframes in June and July. They are called "cuttings of green wood," and are made from 4 to 6 inches long and sometimes longer. They are closely planted in sand, or soil one-half sand and one-half leaf-mold, in rows 4 to 6 inches apart. They must be carefully watered, shaded and ventilated for ten days or more after planting. Much of the success of this method depends upon the weather; it brings in a gambling element: a few hot and dry days are dangerous. A light hotbed may be used instead of a coldframe but this means more care. The rooted plants are left in the frame all winter, protected and planted out the following spring.

#### Root-cuttings. Fig. 1175.

The cuttings of this class are made of either root or rootstock and are useful in propagating some plants, either in the greenhouse or in the open air. Tender plants, like bouvardia, and those which are hardy but of delicate growth, e.g., *Anemone japonica*, are handled under glass; blackberries, horse-radish, and so on out-of-doors. The cuttings are made in autumn or winter, the roots of hardy plants being gathered before severe frost and either planted directly or kept in moss until spring. This process of storing develops a callus and has a tendency to produce buds. For greenhouse work, the cuttings are made from 1 to 2 inches long, the larger roots being selected, although the small ones will grow. They are planted in pans or flats, in soil composed of equal parts sand and well-rotted leaf-mold. Ordinarily they are set horizontally. If planted vertically, in cuttings from the true root, the end which was nearest the crown should be uppermost; but if made from the rootstock, that end should be uppermost which grew farthest from the crown. In either case they should be covered, as seeds are covered, and the whole made firm. Root-cuttings of hardy plants should be kept cool at first and brought into heat only when ready to grow. They may be kept in a pit or cool cellar. Tender plants require the same or a little higher temperature than that in which they thrive.

In sweet potato, the tuber is cut lengthwise and laid, with the cut side down, on moist sand or moss, the edges being slightly covered. Buds develop on these edges and are removed when of proper size and treated as cuttings of growing wood, or allowed to remain until rooted. In dracena (see Fig. 1052, page 842)—and this applies to stem- as well as root-cuttings—the buds are not taken off until rooted the original cutting remains



1175. Root-cutting of blackberry.  
( $\times \frac{1}{2}$ )

in the sand and sometimes produces a second or even a third crop. The tuberous rootstock of *Arum maculatum*, and plants of like nature, can be cut into pieces, remembering that the bud-producing portion of arum is the top, and each part will grow successfully. Exercise care in watering and maintain a good temperature.



1174. Short cuttings of ripened wood.

The rootstocks of cannas are cleaned and cut into pieces  $1\frac{1}{2}$  to 2 inches long and planted in a warmhouse in February (Fig. 784, p. 657). As soon as buds push and roots form they are potted off and grown until the season for bedding out. Dahlias are not, properly speaking, propagated from rootstock, but by division; the plant cannot produce adventitious buds. There must always be a bit of the crown attached to the tuber. The propagation of dahlias so closely resembles the methods here described that it is perhaps well to mention it.

Root-cuttings for planting in the open ground are made from 4 to 6 inches long, and are planted firmly in V-shaped trenches or furrows in spring, being covered 2 inches or more deep. Roots as large as one's little finger are chosen, and good results are secured with plants of vigorous growth. In plants like lily-of-the-valley, common lilac, calycanthus, Scotch and moss roses, unless short of stock, it is better to encourage the natural growth of the suckers and propagate by division, but they all can be multiplied as above described.

Variation, curiously enough, is not always reproduced by means of root-cuttings.

#### Leaf-cuttings. Fig. 1176.

Many leaves are capable of producing roots. Some have the further power of developing buds after rooting, and of these last a few furnish an economical means of bud-propagation, particularly when the stem growth is insufficient. In cotyledon (echeveria) the whole leaf is used, the smaller ones from the flower-stalk being often the best. Choose those that are fully matured, and dry them for a few days on sand, but do not let them shrivel. The treatment, otherwise, is as given above for cuttings of growing wood. In gloxinia and other Gesneraceæ, the whole leaf (Fig. 1176), half a leaf, or even a lesser portion, is used. When enough clear petiole is obtainable, no further preparation is needed. When a part only of the leaf is planted, some of the blade must be cut away. As a rule, no bud is developed the first season: a tuber is formed, which will grow in due time.



1176. Leaf-cutting of gloxinia.



1177. Lily scale producing bulblets.

The common *Begonia Rex* is increased by leaves in various ways. The whole leaf may be planted as a cutting, keeping the petiole entire or cutting it off where it unites with the blade; or the whole leaf may be pinned or weighted to the surface of moist sand (Figs. 501-503, p. 470), and, if the principal veins are severed at intervals of an inch, a plantlet will appear at every cut. The best way is to divide the leaf into somewhat triangular pieces, each part having a strong vein near the center. Plant in sand, in good temperature, and treat precisely as if they were cuttings of growing wood. Roots and buds will soon grow, and a good plant will result within a reasonable time. Pot off when roots are  $\frac{1}{4}$  inch long. Certain other begonias may be similarly multiplied.

#### Other cuttings.

The thickened scales of bulbs, like lilies, can be used for propagation. Remove the scales intact and plant upright, like seeds, in soil made of equal parts of sand and rotted leaf-mold (Fig. 1177). September and October are the usual months for this work. If they

are kept in a cool greenhouse, the young bulblets will appear in the course of the winter, but top growth will come later, in summer. This is a slow, laborious process, and is seldom practised except in propagating new varieties. The granular scales of achimenes and plants of like nature can be used for propagating, sowing them in a sandy soil as seeds are sown; but this method is not a good one in ordinary cases. The scales of *Zamia horrida* have been made to produce new plants, as have also the tunicated scales of an amaryllis.

For further details of cuttage, consult Lindley's "Theory and Practice of Horticulture," 2d ed.; Burbidge, "The Propagation and Improvement of Cultivated Plants;" Peter Henderson's "Practical Floriculture;" Bailey's "Nursery-Book."

B. M. WATSON.

**CYANÁNTHUS** (Greek for blue flower). *Campanulaceæ*. Ten or a dozen herbs, probably mostly perennial, of the high mts. of Cent. and E. Asia, with showy blue fls. terminating the ascending mostly simple hairy sts.: corolla funnelform, tubular or bell-shaped, 5-lobed; stamens free from the corolla, the ovate anthers more or less connate around the pistil; fr. a caps. with persistent calyx, loculicidally 3-5-valved; lvs. alternate, usually small, entire or somewhat lobed. *C. lobatus*, Wall., may be expected in collections of choice alpine: 4-5 in.: lvs. small, narrowing to base, tooth-lobed at summit; fls. bright blue, 1 in. diam., resembling a shining periwinkle fl., funnelform with reflexed lobes, the corolla exceeding the calyx-tube and hairy in the throat. B.M. 6485. Other species mentioned in recent horticultural literature are *C. microphyllus*, Edgew. (*C. linifolius*, Wall.), with slender wiry sts., small entire lvs., and fls. like those of *C. lobatus* but with very hairy throat and longer narrower segms.; *C. incanus*, Hook. f. & Thoms., with numerous wiry sts., small nearly sessile lvs., and yellow campanulate fls. with hairy calyx; the W. China form of this (var. *leiocalyx*) has a less hairy calyx; *C. Hookeri*, Clarke, is an annual with small stalked lvs. and blue fls., from China and India; has rigid sts. with short lateral fl.-branches. L. H. B.

**CYANÉLIA** (from the blue color). *Amaryllidaceæ*; it has been referred to *Liliaceæ* and also to *Hemodoraceæ*. A half-dozen or less small bulbs from S. Afr., sometimes grown in the way of ixiads. Plants with rhizomes or tunicate corms, radical or basal lanceolate or linear lvs., and simple or rarely branched sts.: fls. violet, rose, yellow or white, solitary or racemed-paniculate; perianth-tube 0, the segms. distinct or very nearly so; stamens 6, attached to base of segms., all perfect, often dimorphous; fr. a loculicidal 3-angled caps., on bractless pedicel. The cyanellas are summer- and fall-flowering bulbs with us. The following are the kinds likely to be found: *C. capensis*, Linn. Lvs. lanceolate, undulate: st. paniced, leafy, 1 ft.: fl. purple. B.M. 568. *C. lutea*, Linn. f. (*C. odoratissima*, Lindl.). Less branched; lvs. linear-lanceolate, acuminate, not undulate: fls. rose, changing to yellow. B.R. 1111.

L. H. B.

**CYANIDING, CYANIDIZING:** *Diseases and Insects*, p. 1044, discussion of fumigating by hydrocyanic acid gas.

**CYANOPHYLLUM:** *Tamonea*.

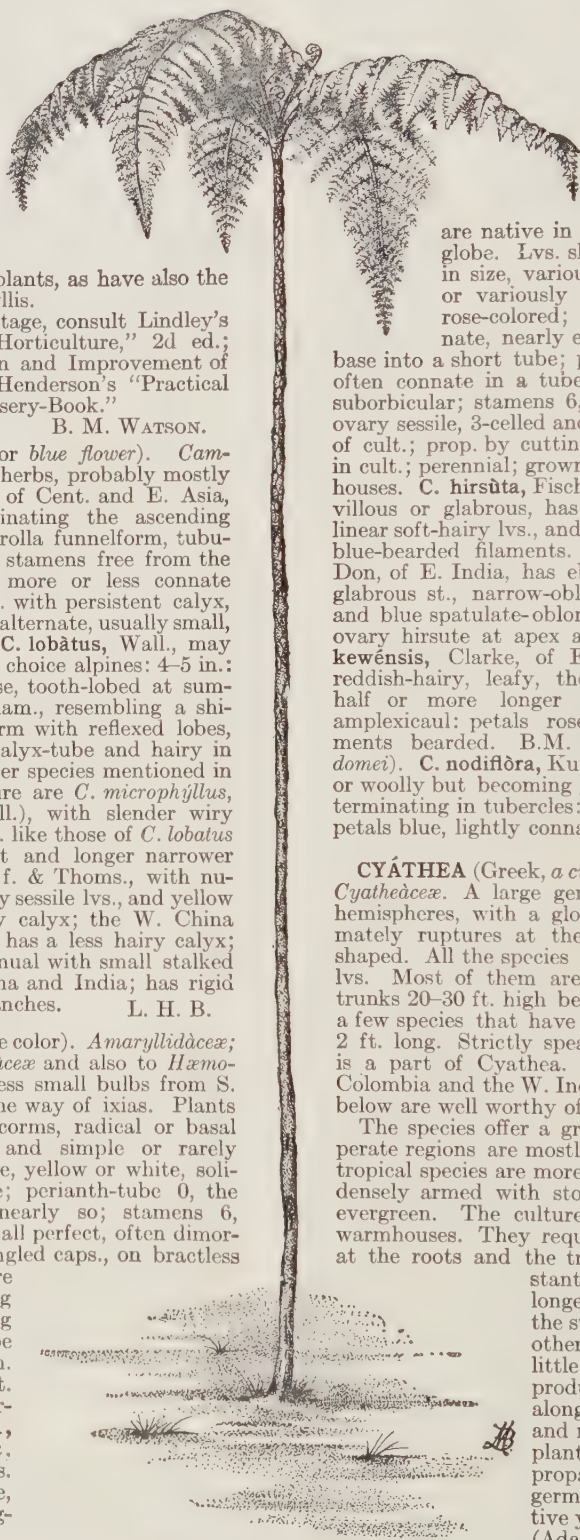
**CYANÔTIS** (Greek, referring to the blue petals). *Commelinaceæ*. Probably 40 creeping, ascending or weak branching often woolly or hairy herbs, much like Tradescantia; they

are native in warm countries about the globe. Lvs. sheathing, small or medium in size, various: fls. in scirpioid cymes or variously disposed, mostly blue or rose-colored; sepals 3, lanceolate-ciliate, nearly equal, usually combined at

base into a short tube; petals 3, also nearly equal, often connate in a tube, the limb spreading and suborbicular; stamens 6, all perfect, nearly equal; ovary sessile, 3-celled and each cell 2-ovuled. Easy of cult.; prop. by cuttings. There are few species in cult.; perennial; grown in greenhouses or warm-houses. *C. hirsuta*, Fisch. & Mey., from Abyssinia, villous or glabrous, has erect st., globose tubers, linear soft-hairy lvs., and rose-colored perianth and blue-bearded filaments. B.M. 7785. *C. barbata*, Don, of E. India, has elongated branching nearly glabrous st., narrow-oblong or nearly linear lvs., and blue spatulate-oblong petals free to the base: ovary hirsute at apex and the style bearded. *C. kewensis*, Clarke, of E. Indies, is procumbent, reddish-hairy, leafy, the branches fleshy: lvs. a half or more longer than broad, sessile and amplexicaul: petals rose-purple, ovate, free; filaments bearded. B.M. 6150 (as *Erythrotis Beddomei*). *C. nodiflora*, Kunth, of S. Afr., is cobwebby or woolly but becoming glabrous, the fibrous roots terminating in tubercles: lvs. narrowly lance-linear: petals blue, lightly connate. B.M. 5471. L. H. B.

**CYÁTHEA** (Greek, *a cup*, alluding to the indusia). *Cyatheaceæ*. A large genus of tree ferns in both hemispheres, with a globose indusium which ultimately ruptures at the apex and becomes cup-shaped. All the species in cult. have decompound lvs. Most of them are large plants, species with trunks 20-30 ft. high being common, but there are a few species that have lvs. and sts. no more than 2 ft. long. Strictly speaking, the genus *Alsophila* is a part of *Cyathea*. Many other species from Colombia and the W. Indies besides those described below are well worthy of cult.

The species offer a great variety. Those of temperate regions are mostly stout and not spiny; the tropical species are more slender and in many cases densely armed with stout spines. All species are evergreen. The culture of cyatheas is simple in warmhouses. They require an abundance of water at the roots and the trunks should be kept constantly moist. The foliage lasts longer if it has been inured to the sun during summer. Like all other tree ferns, cyatheas need little pot-room. They rarely produce adventitious growths along the trunk or at the base and none is proliferous. The plants are, therefore, usually propagated by spores, which germinate freely, making attractive young plants in two seasons. (Adapted from Schneider, "Book of Choice Ferns.")



1178. *Cyathea meridensis*.







XXXIII. *Cycas circinalis*, the male plant.

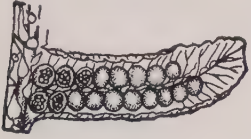


*A. Rachides unarmed: lvs. white beneath.*

**dealbata**, Swartz. Rachides with pale rusty wool when young; lvs. firm, bi-tripinnate, almost pure white beneath. New Zeal.—*C. Smithii*, Hort., is regarded by some as a horticultural variety.

*AA. Rachides unarmed: lvs. green beneath.*

**Búrkei**, Hook. Stalks with tubercles near the base bearing large, glossy rusty scales: lvs. bipinnate, with broad pinnules. S. Afr.



1179. Fruiting pinnule of *Cyathea meridensis*.

**meridensis**, Karst. Figs. 1178, 1179. Lvs. tripinnatifid, with oblong-lanceolate pinnæ and rather narrow lanceolate pinnules; segms. scaly on the ribs beneath. Colombia.

*AAA. Rachides spiny: lvs. green beneath.*

**medullaris**, Swartz. Lvs. bi-tripinnate, densely scaly when young, with soft, deciduous hair-like scales; segms. coarsely serrate or pinnatifid, on spore-bearing lvs. New Zeal.

*C. angolensis*, Welw. A greenhouse species said to have fronds 6-8 ft. long produced from a trunk which attains 12-15 ft. Trop. W. Afr.

L. M. UNDERWOOD.

**CYCAS** (Greek *kúkas*, the name of a palm tree). *Cycadaceæ*. Several beautiful palm-like plants, common in cultivation under glass. Plate XXXIII.

The *Cycadaceæ* are of great interest because they occupy a place intermediate between flowering plants and the cryptogams. Like the former they have fr. with a large starchy endocarp; but like the latter their sexual prop. is accomplished by means of spermatozoids and archegonia, corresponding to the male and female elements in animals. The plants are dioecious; the male infl. is in the form of an erect cone composed of modified staminal lvs. which bear on the under surface globose pollen sacs corresponding to microsporangia; the female infl. consists of a tuft of spreading carpellary lvs. having their margins coarsely notched; in the notches are situated the ovules, which are devoid of any protective covering, and correspond to macrosporangia. Pollination under natural conditions is effected by the wind. The pollen settles on the ovules and sends down a tube into the tissue of the nucellus. Archegonia are formed; egg-cells develop, and in the pollen-tube are produced spermatozoids provided with minute movable cilia by which they are propelled, very much as in the spermatozoa of animals. These are discharged over the archegonia and fecundate the egg. The discovery of spermatozoids in the cycads was made by a Japanese student, S. Ikeno, while investigating the process of reproduction of *Cycas circinalis*. Those of *Zamia*, endemic in Fla., were described and figured by H. J. Webber, who found the mature spermatozoids of the latter genus to be the largest known to occur in any plant or animal.

Most of the species of *Cycas* are arborescent, having a trunk marked with rings of growth and with the scars of fallen petioles. The trunk is usually simple and columnar (though sometimes it is branched), and is elongated by a terminal bud. The pinnate leaves form a beautiful terminal crown like that of a palm or tree-fern. Cycads are found among the fossils of many geological formations, especially in those of the early Mesozoic. The latter formations are grouped together on this account, and the geological epoch which they represent is sometimes designated as the "Age of the Cycads."

Cycads are among the most ornamental plants of tropical and subtropical gardens. In the United States they are often designated "sago palms," although they have nothing in common with a palm except the general habit of growth. In Florida, according to H. Nehrling who has a plantation at Gotha, near the center of the

state, they thrive equally well on high pine land and in the rich soil of the low hummocks. *C. circinalis* is apparently the most sturdy of the cultivated species. It is almost free from diseases; but it is more sensitive to cold than *C. revoluta*. The latter, on the other hand, is subject to diseases in low flat wooded situations. A third species, *C. siamensis*, which is comparatively rare, seems to be perfectly hardy in Florida. In cultivating cycads, Nehrling has attained the best results by keeping the weeds away from the base of the trees and loosening the soil from time to time, taking care not to injure the small network of tubercle-bearing roots surrounding the trunk. The tubercles, which are about the size of a pea, are interesting to the plant physiologist, and are apparently conducive to the plant's well-being. Nehrling gathers the pollen from the male plants and sprinkles it by hand over the female flowers to insure fertilization of the naked ovules.

Plants are propagated by seeds, which keep well for a month or more after ripening. According to E. N. Reasoner, they should be sown in shallow boxes or the greenhouse bench, lightly covered with sand, and after germination, potted off in small pots of moderately rich, light soil. The growing plants do best in partial shade. The old plants frequently send up suckers around the base of the trunk. These may be taken off when in a dormant state and rooted, care being taken to remove the leaves to guard against excessive transpiration. Growing cycads require sunshine and moisture.

The beautiful glossy leaves of cycads are used in many countries for ornamenting temples and for decorating altars. On the island of Guam they are used for palm leaves on Palm Sunday, and in the early days they were carried by children in religious processions, marching from one village to another under the guidance of the Jesuit missionaries. Cycads are popular conservatory plants, of easy culture, and tenacious of life, even when neglected for a long time. Their stems



1180. *Cycas pectinata*.

deprived of leaves are easily transported in bulk and will soon resume growth when planted. In the southern United States, cycads are injured by frost but often revive after having apparently been killed.

*A. Margins of pinnæ flat.*

*B. Modified fr.-bearing lvs. (carpophylls) spinous-toothed along the margin.*

*c. Scales of male infl. tapering into a long spine.*

*D. Lvs. 5-8 feet long, with pinnæ 10-12 in. long.*

**circinalis**, Linn. (*C. Thouarsii*, R. Br.). **FERN PALM**. A palm-like tree with cylindrical trunk and a crown of

glossy, fern-like, stiff but gracefully curved pinnate lvs.: trunk clothed with the compacted woody bases of petioles, usually columnar and simple, but often branching when the terminal bud has been cut off, or in clusters of several springing from the base of an old trunk which has been cut down; in addition to the true lvs., modified lvs. in the form of simple short subulate woolly prophylla; true lvs. 5-8 ft. long, long-petioled, the petiole bearing short deflexed spines near the base; pinnæ alternate, 10-12 in. long and quite narrow, linear-lanceolate, acuminate, subfalcate, the midrib stout and prominent beneath, bright green above, paler beneath; male infl. in the form of an erect woolly cone composed of scales bearing globose pollensacs on the under surface and tapering at the apex into a long spine; female infl. in the center of the crown of lvs., consisting of a tuft of spreading buff-colored, woolly, pinnately-notched lvs. (carpophylls) about 6-12 in. long, spinous toothed along the margin, and bearing in the notches the naked ovules; ovules 3-5 pairs, borne above the middle; fr. about the size of a walnut, with a thin fleshy covering, and a fleshy starchy endosperm resembling that of a horse-chestnut. S. India, Ceylon, Sumatra, Java, Philippines, Madagascar, E. Trop. Afr., Guam.—In Fla. the lvs. of this species are often destroyed by sharp frosts, but the trunk is rarely injured and will soon send forth new lvs. when the weather becomes warm again. Nehrling recommends that fine specimens be protected by a tent or by a house of lattice-work covered with canvas, and with the sides also inclosed if necessary. In this house a large kerosene lamp will be sufficient to keep the plant from freezing. In Tampa, Fla., this species appears to flourish, some of the specimens having trunks 6-8 ft. high. It grows best in rich moist soil and in partial shade. On the island of Guam, the nuts of this species form a food staple for the natives in times of famine following hurricanes. These are so poisonous that the water in which the kernels are soaked is fatal to animals. After having been soaked for some time and the water repeatedly changed, the kernels become harmless, and are ground up into meal and dried for future use. They are usually prepared in the form of cakes, which are said to be nutritious although rather tasteless.

DD. Lvs. less than 5 ft. long; pinnæ 3-8 in. long.

mèdia, R. Br. NUT PALM of Australia. Trunk attaining height of 8-10 ft. or sometimes twice this



1181. *Cycas revoluta*.

height, rarely branched at the top: lvs. 2-4 ft. long or more, the pinnæ very numerous, straight or falcate, obtuse or pungent-pointed, flat or slightly concave above when young, prominently keeled beneath, the margins often slightly decurrent on the rachis, glabrous or slightly pubescent when young, the longer ones varying from 3-8 in., the lower ones shorter and more contracted at the base, the lowest ones prickly-like, sometimes continuing to base of petiole: cones variable in size, but apparently smaller than in *C. circinalis*, which this species otherwise resembles; seeds 1-1½ in. long, glabrous. Austral, along the northern coasts; also Queensland.

cc. Scales of male infl. shortly acuminate.

Rúmpíi, Miq. Closely related to the preceding, but growing taller in its natural habitat, sometimes reaching a height of 20 ft. or more: lvs. shorter and with fewer lfts.: scales of male cone thickened and obliquely truncate at the tip, with a short upcurved sometimes caducous point; carpophylls a foot long, narrower than in *C. circinalis*, with an entire often elongate subulate tip; seeds oval or subglobose, 2-2¾ in. long by 1½-1¾ in. diam. Moist wooded regions of Burma, Ceylon (possibly intro.), Andaman Isls., Nicobar, Malaya, New Guinea, and N. Austral.—This species when growing in cult. is usually much lower, and has a full large crown of lvs., with lanceolate pinnæ thinner and paler than those of *C. circinalis*. Much grown in tropical gardens of E. Indies; male plants rare.

BB. Modified fr.-bearing lvs. pectinate along the margins.

c. Trunk much swollen at the base: blade of carpophyll ovate-rhomboid.

siaménsis, Miq. A small palm-like tree: sts. 2-6 ft., much swollen at the base: lvs. 2-4 ft., stiff spreading; pinnæ 3-8 in. long, linear mucronate-acuminate; blade of carpophyll tawny-woolly when young, at length glabrescent above, ovate-rhomboid, long-acuminate, margin deeply pectinate lacerate: scales of male infl. about ¾ in. long, with a slender terminal point of the same length: seeds 1½ in. long, obovoid-oblong. Burma, Siam, Cochín China.—Apparently hardy in Fla. It is rare, occurring in only a few gardens. It is a beautiful species, easily recognizable by its trunk which is swollen very much like that of *Dasyllirion*, and according to Nehrling grows much faster than the species more commonly cult. It is certainly deserving of more general cult.

cc. Trunk not swollen at the base: blade of carpophyll broadly orbicular.

pectinàta, Griff. Fig. 1180. A glabrous evergreen palm-like tree, to 10 ft. high in its native habitat but usually much shorter in cult.: lvs. ascending, recurved, 5-7 ft. long; pinnæ 7-10 in. long, narrowly linear tapering into a minute apical spine, subfalcate; blade of carpophyll covered with dense tawny wool throughout, 6 in. long, broadly orbicular, long-acuminate, its margin deeply subulate-pectinate, stalk about equal in length to the blade with 2 or 3 pairs of ovules above the middle; spiny marginal teeth ¾ in. long; terminal point 1½ in. long, tapering from a flat base, with 1 or 2 spinous teeth: seeds about 1½ in. long, ovoid: male cone 18 in. long, 6 in. diam., cylindric-ovoid; anther-bearing scales 1½ in. long, 1 in. diam., deltoide-clavate, the apex much thickened, abruptly acuminate, terminal point 1½ in. long, spine-like, ascending. India, Nepaul, East Bengal, 2,000 ft. elevation, Assam, Martaban, in pine forests. G.F. 4:114 (adapted in Fig. 1180).

AA. Margins of pinnæ revolute.

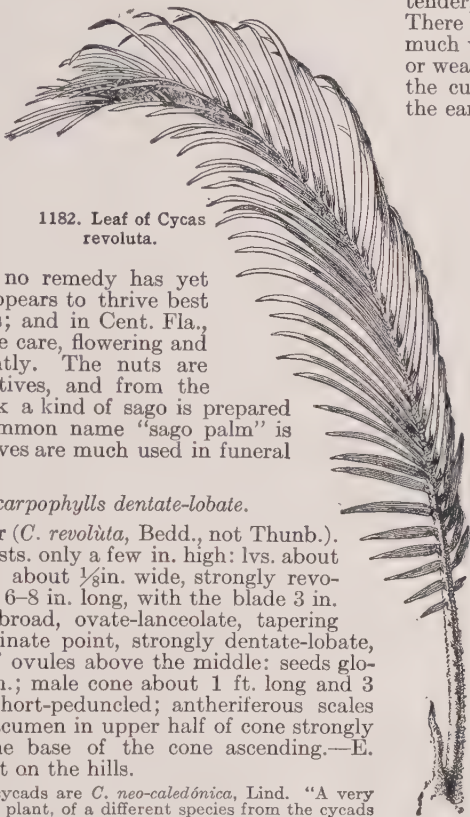
B. Blade of carpophyll pectinate.

revolùta, Thunb. SAGO PALM. Figs. 1181, 1182. A graceful palm-like tree or shrub, becoming 6-10 ft. high, with the trunk simple or branching: lvs. long and recurved (2-7 ft.); pinnæ numerous, subopposite, curved downward, narrow, stiff, acute, terminating in a spine-like tip, dark shining green, the margin revolute; carpophylls with the blade broadly ovate, densely clothed with brownish felt-like wool, pectinate; ovules 2 or 3 pairs borne near the base: fr. ovate, compressed, red, about 1½ in. long. S. Japan.—This is the most common cycas in conservatories. It is of Javanese origin and is much hardier than the species mentioned above. In Fla. it is usually found in all of the better parks and gardens, where it is suitable as a center about which to arrange other ornamental



shrubs. According to Nehrling, this species is of slow growth. In the male plants there are usually several heads. The male infl. is usually 18-20 in. long and cylindrical in form. The female infl. is in the form of a semi-globose head, yielding 100-200 large bright red nut-like seeds, which ripen about Christmas time. The new lvs. appear all at one time, usually in May. They have a beautiful glaucous green color and at first stand erect. Young plants are easily grown from seeds. Unfortunately this beautiful species is, in Fla., subject to blight for which no remedy has yet been found. It appears to thrive best in open situations; and in Cent. Fla., it grows with little care, flowering and fruiting abundantly. The nuts are eaten by the natives, and from the pith of the trunk a kind of sago is prepared for which the common name "sago palm" is given it. The leaves are much used in funeral decorations.

1182. Leaf of *Cycas revoluta*.



BB. *Blade of carpophylls dentate-lobate.*

**Béddomei**, Dyer (*C. revoluta*, Bedd., not Thunb.). A low shrub with sts. only a few in. high: lvs. about 3 ft. long; pinnae about  $\frac{1}{2}$  in. wide, strongly revolute; carpophylls 6-8 in. long, with the blade 3 in. long and 1 in. broad, ovate-lanceolate, tapering into a long-acuminate point, strongly dentate-lobate, bearing 2 pairs of ovules above the middle: seeds globose,  $\frac{1}{2}$  in. diam.; male cone about 1 ft. long and 3 in. diam., very short-peduncled; antheriferous scales long-acuminate, acumen in upper half of cone strongly deflexed, near the base of the cone ascending.—E. Madras, abundant on the hills.

Other cultivated cycads are *C. neo-calédonica*, Lind. "A very ornamental palm-like plant, of a different species from the cycads ordinarily grown," intro. into the U. S. by W. T. Swingle. Much like *C. circinalis* but with fronds narrower and pinnae closer.—*C. Normanbyana*, Muell., intro. into the U. S. from France by W. T. Swingle, a species with oblong-obovate lvs., having numerous linear pinnae 6 in. long. Austral.—*C. Ruminiana*, Regel. St. rather stout: lvs. bright green, erect, spreading in a vase-like crown, the pinnae fine-pointed. Philippines. I.H. 11:405.

W. E. SAFFORD.

**CYCLAMEN** (classical name, probably from the Greek word for circle, in allusion to the spirally twisted peduncles). *Primulaceae*. Herbaceous and low plants, with a flattish tuber or corm, grown sometimes in the open and one of them much prized as a florist's and window-garden subject.

Flower single, on a scape, with usually 5-parted calyx and corolla (the parts strongly reflexed), 5 connivent stamens, with pointed sessile anthers, 1 style and stigma, and a 5-splitting caps.: lvs. cordate or reniform, long-petioled, entire or sinuate-dentate: fls. nodding or declined, purple, rose or white.—About 20 species of the Medit. region, extending to Cent. Eu. *C. persicum* is the source of the standard florists' cyclamens. Most of the other species are essentially outdoor plants. They are little known in outdoor planting in N. Amer., however. The European catalogues list several species aside from *C. persicum*, and they are here described; and others are included in the supplementary list that are recently mentioned in horticultural literature. Old English name sow-bread, from the tubers being sought by swine. Consult Fr. Hildebrand, *Die Gattung Cyclamen*, Jena, 1898; also Pax & Knuth in Engler's *Pflanzenreich*, hft. 22, 1905.

All cyclamens are very beautiful, and would be much

more popular were they hardy in our eastern climate. On the Pacific slope many of them probably would be perfectly at home as outdoor plants, producing a great number of flowers above the bare soil in the depth of winter before the leaves are developed.—It is, however, with the Persian cyclamen (*C. persicum*), which is tender, that florists have had the greatest success. There is no common winter-flowering subject of as much value for duration in bloom, variety of coloring, or wealth of color. It is preferable at all times to begin the culture of Persian cyclamen with seeds, sown in the early winter months. Grow on without any check

for the following year. They should bloom freely about fifteen months from planting. Old tubers, such as are offered in fall with other florists' bulbs, rarely give satisfaction as compared with a packet of seeds. It is not the nature of the plant to have all its roots dried off, as if it were a hyacinth or tulip. Our summers are rather too warm to suit cyclamen perfectly, and it will be found that the most growth is made in the early autumn. It is best to give the plants a little shade in the hot months, such as a frame outdoors near the shade of overhanging trees at midday. This is better than growing them under painted glass, as more light is available, together with plenty of fresh air on hot days. It will be found that cyclamen seeds require a long time in which to germinate,—often two months. This is due to the fact that the seed produces a bulb or corm before leaf-growth is visible. As soon as two leaves are well developed, place the plants around the edge of 4- or 5-inch pots until every one is large enough for a 3-inch pot. The roots are produced sparingly in the initial stages, and too much pot-room would be fatal at the start. By the middle of summer another shift may be given, and in September all will be ready for the pots in which they are to flower,—5- or 6-inch pots, according to the vigor of the plants. It will always be found, however, that there will be a certain percentage that will not grow, no matter how much persuasion is used. These may be

thrown away, to save time and labor early in the season. In the house they should have the lightest bench. It is impossible to grow them in a warm, shady house. About 50° at night is the ideal temperature when in flower. The best soil is a fresh, tufty loam, with a fourth or fifth of well-rotted horse-manure, to which add some clean sand if the soil is heavy. At all times, the pots should be well drained.—The Giganteum strains of the Persian cyclamen produce the largest blooms, but at the expense of quantity. For the average cultivator it is better to try a good strain that is not gigantic. There is a recent departure in the form of crested flowers. Cyclamens come true to color from seeds, and one can now buy named varieties that will reproduce themselves almost to a certainty.—Of recent years cultivators have had much trouble with a tiny pest or mite that attacks the plants and renders them useless for bloom. Its work is done mostly after the plants are taken into the greenhouse and when about to mature into blooming specimens. If the first flowers come deformed or abnormally streaked with colors that are darker in shade, it is a sure indication that the pest is present. Frequent light fumigation with hydrocyanic acid gas as soon as the pest is discovered will in time eradicate it, but being very small, and able to hide under the divisions of the calyx, seldom coming out except on bright days, makes the pest a difficult one to fight. The gas cannot be used during sunshine. Tobacco stems used freely between the pots is a good preventive measure. Greenfly is likely to attack the

plants at all stages of growth. In the frames the plants may be plunged in tobacco stems, and in the greenhouse they must be fumigated or vaporized with some of the nicotine extracts. Great vigilance must be exercised in growing cyclamens. (E. O. Orpet.)

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## A. Plant blooming in spring (or in winter under glass).

## B. Corolla-lobes not eared.

1. *persicum*, Mill. (*C. hederæfolium*, Sibth. & Smith. *C. indicum*, Linn. *C. latifolium*, Sibth. & Smith. *C. macrophyllum*, Sieb. *C. punicum*, Pomel. *C. pyrolæfolium*, Salisb.). Fig. 1183. The common greenhouse or Persian cyclamen, in many forms: tuber large, flattened endwise, corky on the outside: lvs. appearing with the fls., ovate, crenate-dentate, base deeply cordate, usually marbled or variegated with white: fls. on scapes 6-7 in. high, large, scentless, white, purple-blotched at the mouth, but with rose-colored, purple and spotted forms, the segms. oblong-spatulate in shape, not eared or lobed at the base: pedicel not coiling in fr. Greece to Syria. The large-fl. cult. forms are grouped as follows by Pax & Knuth: Var. *album* (*C. aleppicum*, Hort.). Pure white. Var. *giganteum*. White with red throat; very large. Var. *magnificum* (var. *punctatum*). White, speckled with red, large. Var. *rubrum*. Red. Var. *sanguineum*. Light blood-red, large. Var. *rosea-superbum*. Brilliant rose-red, large. Var. *purpureum*. Purple with bluish markings, large. Var. *violaceum*. Violet-red. Var. *atro-rubrum* and var. *splendens*. Dark red, large. The var. *giganteum* (*C. giganteum*, Hort.) is the common large-fl., improved form of the florist's cyclamen. There are also double-fl. forms (R.H. 1886, p. 250); also fimbriate or crested forms, *C. Papilio* (I.H. 43:63. G.F. 5:235. G.C. III. 21:71; 23:173). Other portraits of *C. persicum* are: B.M. 44. I.H. 35:43. Gn. 47:378; 48:182. J.H. III. 34:578. Gt. 44, p. 203; 45, p. 164. F.S. 22:2345. A.G. 14:390-2; 17:261. A.F. 7:521-5; 11:1176-9; 12:499. The species is frequently figured in the trade catalogues.

2. *coum*, Mill. (*C. vernum*, Sweet). Tuber smaller than in the last, globose or flattened: lvs. with or preceding the fls., nearly orbicular or round-reniform, entire, firm, not marbled nor variegated: fls. small, scentless, half or less as large as those of the last, purple and spotted in the throat. S. E. Eu. to Persia. B.M. 4. L.B.C. 2:108. F.S. 22:2345. —There is a white-fl. form (*C. album*, Hort.).

3. *ibericum*, Goldie (*C. coum* var. *ibericum*, Boiss. *C. elegans*, Boiss. & Buhse. *C. vernale*, Koch). Dwarf: lvs. appearing before the fls., ovate-orbicular and rounded at the apex, entire or obscurely undulate, more or less zoned with white above: fls. purple with a darker colored throat. Caucasus.—Perhaps a geographical form of *C. coum*. *C. Atkinsii*, Moore, is *C. coum* × *C. ibericum*, Hildeb. Lvs. reniform, apex rounded, more or less shining, deep green, spotted silver-white, the corolla-lobes pale rose or white and usually lined or spotted red. F.S. 23:2425.

## BB. Corolla-lobes eared.

4. *libanoticum*, Hildeb. Tuber globose with a cork-like covering: lvs. autumnal, the blade orbicordate, sinuate, dentate or crenulate or rarely entire, marked with white above, deep violet or purple beneath: fls. fragrant; calyx-lobes oblong-acuminate, the margin lightly undulate, 5-nerved; corolla-tube somewhat globose-campanulate, the lobes lightly eared at base and broad-ovate, entire, pale or deep rose-color with a deep red T-form mark at the base; style exserted. Lebanon.

## AA. Plant blooming in summer and autumn.

## B. Corolla-lobes not eared.

5. *europæum*, Linn. (*C. Clusii*, Lindl. *C. æstivum*, Park. *C. cordifolium*, Stokes. *C. floribundum*, Salisb. *C. orbiculatum*, and *C. purpurascens*, Mill.). Tuber with corky exterior: lvs. ovate-orbicular or reniform, entire or nearly so, with a deep and narrow basal sinus, more or less white-marbled above, purple-tinted beneath: fls. on scapes 4-5 in. high, bright red and very fragrant, not spotted; the corolla-segms. oblong-spatulate ( $\frac{3}{4}$  in. or less long); calyx glabrous: pedicel spirally coiling in fr. Cent. and S. Eu. B.R. 1013.—Lvs. appearing with the fls., more or less evergreen. Variable.

6. *cilicicum*, Boiss. & Heldr. Much like *C. europæum*: tuber hairy: fls. pale rose, with purple at the mouth, about twice larger; corolla-lobes elongated; calyx puberulent. Sicily. G.C. III. 23:81.

## BB. Corolla-lobes eared.

7. *africanum*, Boiss. & Reut. (*C. saldense*, Pomel). Large: tuber large: lvs. ovate-cordate to reniform, coarsely toothed, pale beneath, dull and pale green marbled above: calyx pubescent, the lobes broadly ovate-acuminate; corolla nearly white, faintly rose- or purple-tinged, the segms. 1 in. long and deep purple at the base; calyx-lobes lanceolate. Algeria. B.M. 5758. F.S. 8:841.—Little known in this country, but sold by the American agencies of the Dutch bulb houses.

8. *neapolitanum*, Tenore (*C. autumnale*, Boos. *C. ficariæfolium* and *C. subhastatum*, Reichb. *C. hederifolium*, Ait. *C. vernale*, Mill.). Tuber very large, black, thick-rinded: lvs. variable, from hastate to round-reniform, more or less wavy-plaited on the edges, green or somewhat parti-colored: calyx small; corolla pink or rarely white, the segms. short and twisted and the edges raised and white-edged at the base; calyx-lobes triangular to oblong. S. and E. Eu. B.R. 24:49. Gn. 51, p. 37



1183. *Cyclamen persicum*. Showing a flower of perfect form, and the crested variety. ( $\times \frac{1}{2}$ )



*C. aquileticum*, Hildeb. Intermediate between *C. græcum* and *C. pseudo-græcum*; from the former it differs in its small fls. and other parts and from the latter in having more rounded lvs. Greece. —*C. græcum*, Link. Autumn-flowering: lvs. obcordate, irregularly cartilaginous-dentate: corolla-lobes lanceolate or oblong-lanceolate, eared at base, rose-colored with deep purple at base. S. E. Eu. —*C. hiemale*, Hildeb. Winter-flowering: lvs. round-reniform, bright green and silver-zoned: fl. purple with deep red in the throat; corolla-lobes round-ovate, not eared. Asia Minor. —*C. Jovis*, Hildeb. Differs from *C. neapolitanum* in its more slender fls. with longer lobes of calyx and corolla. Asia Minor. —*C. maritimum*, Hildeb. Lvs. variable in form, mostly ovate, brown-green: fls. in Sept., inconspicuous, pale rose with marked throat, the corolla-lobes rounded. Asia Minor. —*C. Meliarskii*, Hort. = *C. græcum*. —*C. pseudo-græcum*, Hildeb. Differs from *C. græcum* in having filaments and anthers longer, the latter 3-angled and acuminate: corolla pale rose or almost white. Crete. —*C. pseudo-ibericum*, Hildeb. Spring-flowering: lvs. obcordate, rounded at base and top, the margin cartilaginous-crenulate, deep green and spotted silvery white: fl. violet, spotted with darker color, white at base; corolla-lobes oblong-ovate, not eared; pedicel spiral in fr. Probably Asia Minor. —*C. pseudo-maritimum*, Hildeb. Differs from *C. maritimum* in lvs. being lanceolate-acuminate, calyx-lobes rounded and corolla-lobes long-acuminate. Asia Minor. —*C. repandum*, Sibth. & Smith. Spring-flowering: tuber small: lvs. cordate, undulate-lobed, the lobes usually mucronate: fl. beautiful purple, the throat constricted and deeper-colored. Cent. and E. Medit. basin. L. H. B.

**CYCLANTHÈRA** (Greek, *anthers in a circle*). *Cucurbitaceæ*. Annual- or perennial-rooted herbs, one of which is sometimes grown for its ornamental character.

Climbing by tendrils, glabrous or pubescent: lvs. entire, lobed or 5-7-foliolate: fls. monœcious, minute, yellow, greenish or white, with their parts in 6's, stamen 1 with a 1-celled anther. The plant is a climbing half-hardy annual of easy cult. The seed should be started indoors early. The genus is near *Echinocystis* and *Elaterium*, and has more than 30 species, all from Trop. Amer.

*pedata*, Schrad. Annual: st. glabrous: lvs. pedately 5-7-foliolate, the lfts. sessile or nearly so and lanceolate or oblong-lanceolate, serrate: tendrils 3-4-parted: male fls. small, in panicles equaling or exceeding the lvs.: fr. nearly sessile, somewhat soft-prickly or smooth, oblong and attenuate at base, green becoming yellowish white, 2-locular. Mex. south.—A strong ornamental climber. *C. explodens*, Naudin, with somewhat 3-lobed lvs. and short spiny explosive fr., may be in cult. L. H. B.

**CYCLÁNTHUS** (*flowers in a circle*). *Cyclanthaceæ*. A Trop. American genus of 4 species giving name to a small order which is allied to the palms. They are acaulescent palm-like herbs with a milky juice: lvs. long-stalked, entire or bi-furcate, the segms. lanceolate, 1-nerved: fls. fragrant. The species are not in the American trade. Cult. of *Carludovica* (which see). *C. bipartitus*, Poit., of Guiana, has lvs. sometimes divided into 2 long narrow lobes, the petioles being 3-6 ft. long: spadix straight and cylindrical, in a 4-lvd. yellow spathe, the scape 2 ft. long. G.W. 8, p. 153; 15, p. 610. *C. cristatus*, Klotzsch, of Colombia, has short-stalked bifid lvs., with the parts falcate and connivent: spadix about 8 in. long. G.W. 8, p. 202. *C. discolor*, Hort., has young lvs. streaked with brown-orange: lvs. bifid, the parts lanceolate, acuminate, the margins frilled. Probably S. Amer. *C. Godseffianus*, Hort., exhibited in 1892, "has noble lvs. of a rich green color, oblong, obovate, tapering to a sheathing stalk." Sander.

**CYCLOBÔTHRA**: *Calochortus*.

**CYCLOLÔMA** (Greek for *circle and border*, from the encircling wing of the calyx). *Chenopodiaceæ*. One weedy herb, *C. atriplicifolium*, Coulter (*C. platyphylum*, Moq.), of sandy soils from Minn., west and south, which was once intro. as the "cyclone plant," since the plant is a tumble-weed or rolls before the wind when it is matured and becomes detached from the soil. The plant is a much-branched rank-growing annual, 1-2 ft. high, pubescent or nearly glabrous, with narrow but flat and sinuate lvs., and bractless fls. in an open panicle. The fls. are very small, perfect or sometimes

lacking the stamens; calyx 5-cleft, the lobes strongly keeled and becoming winged and inclosing the seed. Plant not fleshy or jointed.

**CYCLÓPHORUS** (Greek, *circle-bearing*). *Polypodiaceæ*. An E. Indian and Malaysian genus of simple-lvd. ferns, related to some species of *Polypodium*. The genus is characterized by having creeping scaly root-stocks, simple lvs. usually densely covered with star-shaped scales, at least on the back. The sori are round, naked, and placed so closely together as to appear often completely to cover the back of the lf. The venation consists of a very fine close network difficult to distinguish. Often listed in trade under *Polypodium*.

*Lingua*, Desv. (*Niphobolus Lingua*, Spreng.). Lvs. 6-12 in. long, on short stalks, the lf.-blades thick, leathery, narrowly oblong, 4-8 in. long, 1-2 in. broad, densely covered beneath with rusty white scales. Var. *corymbifera*, Hort. A form with the tips of the lvs. much forked, making the blade much broader than in the type. Var. *variegata*, Hort. A form with "light yellow lines about 1/8 in. wide and 3/4 in. apart, running across the fronds at right angles to the midrib." See also *Polypodium*. R. C. BENEDICT.

**CYCNOCHES** (Greek, *swan's neck*, referring to the shape of the column). *Orchidaceæ*. Epiphytic orchids, requiring warmhouse treatment when growing.

Pseudobulbs fusiform: lvs. plicate: fls. of 2 sexes, the perianth alike, the lip entire, or that of the staminate very different, with the sepals and petals narrower, the lip clawed and with finger-like projections from the side, the column much elongated and arched; pollinia 2. Both sexes may be produced in the same plant. A third form of fl., usually perfect, occasionally appears; this is intermediate between the others.—About a dozen species of Trop. Amer.

A. *Perianth alike in both sexes; lip entire.*

*chlorochilon*, Klotzsch. Pseudobulbs 5-7 in. tall: lvs. lanceolate: raceme erect, 2- or 3-fld.; fls. 4-6 in. across; sepals and petals yellowish green, acute, the lateral sepals broader than the dorsal; lip obovate or elliptic, acute, a dark green depression near the triangular erect callus. Venezuela. G.C. III. 3:145. I.H. 35:65. R. 1:39. J.H. III. 35:285. Gn. 49, p. 403; 51:172.

*ventricosum*, Batem. Pseudobulbs 8-10 in. tall: lvs. lanceolate: raceme drooping, 4-6-fld.; fls. 4-5 in. across; sepals and petals yellowish green, acute, the petals broader than the sepals; lip white, cordate, acuminate, clawed, a black callus at the junction of the claw with the lip. Guatemala.

AA. *Perianth differing in the sexes; lip with finger-like lateral projections.*

*aureum*, Lindl. Male racemes pendulous, 8-12-fld.; fls. 2-3 in. across, yellow, red-spotted; sepals and petals similar, the former spreading, the latter reflexed; lip clawed, the dilated middle giving rise to a number of projections, forked at the end. Cent. Amer. J.F. 3:264.

*pentadactylon*, Lindl. Male racemes usually pendulous, many-fld.; sepals and petals greenish yellow barred with brown; lip white, red-spotted, with 5 finger-like projections; female racemes erect, few-fld.; sepals and petals broader than in the male fls., spotted; lip ovate, entire. Brazil. B.R. 29:22. J.H. III. 62:305. O.R. 8:312.

*peruviana*, Rolfe. Male racemes pendulous, many-fld.; sepals and petals light green, copiously brown-spotted; lip, with its projections, white. Peru. Lind. 7:301.

*C. densiflorum*, Rolfe. Male racemes pendulous, many-fld., the fls. greenish with purple blotches; female racemes short, erect, 2-fld., the sepals and petals green, the lip ivory-white. Colombia. O.E. 17:204; 20:331. B.M. 8268.—*C. maculatum*, Lindl. Male racemes pendulous, the sepals and petals light yellowish green, spotted with red-purple, the lip white. Mex. O. 1910:104. O.R. 17:273; 20:315.

(GEORGE V. NASH.)

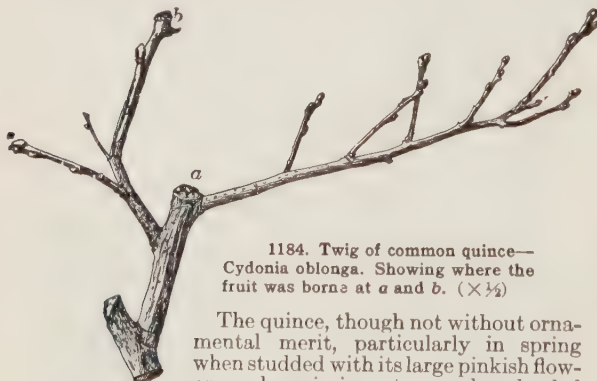
**CYDISTA** (Greek, *kydistos*, most glorious; alluding to the beautiful flowers). *Bignoniaceæ*. Ornamental vines, grown for their beautiful flowers.

Evergreen shrubs, climbing by lf.-tendrils: lvs. opposite, with 2 lfts., the rachis elongated into a simple slender tendril, sometimes wanting: fls. in terminal or axillary panicles, sometimes 2; calyx campanulate-turbinate, truncate or with 5 short teeth; corolla funnel-form-campanulate, with imbricate lobes; stamens 4, inclosed, with spreading anther-cells; disk wanting; ovary linear, with numerous ovules in 2 rows: caps. linear, septicid, with numerous, nearly orbicular, winged seeds.—One or 2 species in the W. Indies and S. Amer. Closely allied to *Bignonia*, but easily distinguished by its simple slender tendrils, by the paniculate fls., the usually truncate calyx and the wanting disk. Suited for cult. in tropical and subtropical regions only and as a stove plant in the N. For cult. and prop., see *Bignonia*.

*æquinoctialis*, Miers (*Bignonia æquinoctialis*, Linn.). High climbing: lfts. ovate to ovate-oblong, obtuse-acuminate, undulate, lustrous, reticulate, 3-4 in. long; petioles  $\frac{1}{8}$ - $\frac{3}{4}$  in. long; calyx campanulate-turbinate, truncate; corolla white or pink, with dark pink or purplish veins,  $2\frac{1}{2}$  in. long. W. Indies, Brazil.—The *B. æquinoctialis* var. (B. R. 9:741) with yellow fls. in elongated racemes is *Anemopaegma Chamberlaynii*, Bur. & Schum. (*Bignonia Chamberlaynii*, Sims B. M. 2148. F. S. 3:235. P. M. 14:3.). See page 502. ALFRED REHDER.

**CYDONIA** (the fruits known to the Romans as *Mala Cydonia*, apples from Cydon, now Canea, in Crete). *Rosaceæ*, subfamily *Pomææ*. QUINCE. Shrub or small tree, grown for its fruit, which is much used for preserves and sometimes baked.

Branches unarmed: lvs. deciduous, alternate, petioled, stipulate, entire: fls. white or light pink, rather large, terminal on short leafy branchlets; petals 5; stamens numerous; styles 5, free; ovary 5-celled, cells with many ovules; fr. a 5-celled, many-seeded pome.—One species from Persia to Turkestan. The genus *Chenomeles*, often included under *Cydonia*, is easily distinguished by the serrate or crenate chartaceous lvs. and the connate styles.



1184. Twig of common quince—*Cydonia oblonga*. Showing where the fruit was borne at a and b. ( $\times \frac{1}{2}$ )

The quince, though not without ornamental merit, particularly in spring when studded with its large pinkish flowers and again in autumn when loaded with its golden fragrant fruits, is rarely planted as an ornamental shrub, but chiefly, though not very extensively, grown for its fruit which is made into preserves. It is of slow growth and prefers heavy and rather moist soil. It may be propagated by seeds stratified and sown in spring, but is usually increased by cuttings of one to four-year-old wood, taken in fall and stored until spring in sand or moss in a cellar or frame; also by layers and budding, or by grafting on vigorous growing varieties. See *Quince*.

*oblonga*, Mill. (*C. Cydonia*, Pers. *C. vulgaris*, Pers. *Pyrus Cydonia*, Linn.). QUINCE. Fig. 1184. Shrub or small tree to 15, rarely to 25 ft., with slender, spineless

branches: lvs. oval or oblong, rounded or slightly cordate at the base, acute, entire, villous-pubescent beneath, 2-4 in. long: fls. white or light pink, 2 in. across: fr. large, yellow, villous, pyriform or globular. May; fr. in Sept. and Oct. Cent. and E. Asia. Gn. 33, p. 491. F. S. R. 2, p. 379: 3, p. 283. Seeds have mucilaginous and demulcent properties. Var. *pyriformis*, Rehd. (*C. vulgaris* var. *pyriformis*, Kirchn.) Fr. pear-shaped, the typical form. Var. *lusitanica*, Schneid. (*C. lusitanica*, Mill.). Fr. pear-shaped and ribbed: lvs. larger; of more vigorous growth. Var. *maliformis*, Schneid. (*C. maliformis*, Mill.). Fr. apple-shaped. Var. *pyramidalis*, Schneid. Of pyramidal habit. Var. *marmorata*, Schneid. Lvs. whitish and yellow variegated. For pomological varieties, see *Quince*.

For *Cydonia japonica*, Pers., *C. Maulei*, Moore, and *C. sinensis*, Thouin, see *Chenomeles*.

ALFRED REHDER.

**CYMBIDIUM** (*boat*, from the Greek, referring to the shape of the lip). *Orchidaceæ*. Handsome epiphytal, rarely terrestrial orchids, requiring greenhouse conditions.

Stems pseudobulbous or not so: lvs. coriaceous, long, rarely short, persistent: sepals and petals sub-equal, labellum usually tri-lobed, adnate to the base of the column; column erect; pollinia 2.—Species 30 and more, tropical or subtropical, found on mountains at high elevations in Asia, and a few species in Afr. and Austral.

These are among the most decorative of orchids when in bloom, and are attractive all the time owing to the graceful foliage seen on well-grown specimens. There are now many handsome species and varieties and these in their turn have produced, at the hands of the hybridizer, many fine decorative plants, so that a house of cymbidiums produces flowers most of the time, and these last many weeks in full beauty. There are few orchids whose flowers last so long, and the spikes of bloom, often 2 to 3 feet in length, are useful for decorative purposes of all kinds, either on the plants or cut. The recent species, *C. insignis*, is the most beautiful of all and has already lent itself to hybridization, so that to the very many known hybrids *C. insignis* will soon add its influence and coloring.—Cultivated cymbidiums are terrestrial, with thick fleshy roots best contained in pots. A portion of tough fibrous loam should be added to the osmundine, about half of each with plenty of broken charcoal to keep the whole porous. The plants will do well for years without disturbance at the roots, but when this is necessary, great care must be taken not to injure them. Division is, in fact, very difficult to accomplish when the pots are full of roots, and it is best practice to pot the plant in a larger receptacle if the roots are healthy, washing out loose earth and removing dead portions of roots first. Cymbidiums may be grown in a temperature of 50° as a minimum in winter, must not be subjected to strong sunlight after March, and never allowed to become dry at the roots, as these are more or less active, even in winter. Being terrestrial, weak manure-water may be applied during active growth. Many species thrive well when planted out in large palm and fern houses among rocks arranged in a natural manner, and when the plants are placed so that the flower-spikes are on a level with the vision, they have a charming effect for many weeks when in bloom, and the environment suits them well. Of the few well-marked species, there are many forms that have been collected and when flowered in cultivation, proved distinct. These in some cases have been called new species, but are now being better understood; some prove to be natural hybrids, others are varieties. (E. Ö. Orpet.)

A. Fls. white.

*eburneum*, Lindl. Sts. tufted: lvs. distichous at base, 1 or 2 ft. long, linear or lorate, bifid at apices;



peduncles not so long as the lvs., few-fl'd.; fls. about 3 in. across, ivory-white, sometimes tinged with rose; sepals and petals oblong-lanceolate; lip 3-lobed with a golden yellow ridge running down the center. Khasia Hills, at an elevation of 5,000-6,000 ft. B.R. 33:67. B.M. 5126. Gn. 46, p. 398. G.C. III. 35:99. Var. *Goodsonianum*, Hort. Fls. white, with broad rose-purple band down middle of lip. Var. *Dayanum*, Hort. (*C. Dayanum*, Reichb. *C. eburneum* Dayi, Jenm.). Lvs. longer and narrower; lip with a row of purple spots each side of disk.



1185. *Cymbidium giganteum*. ( $\times \frac{1}{3}$ )

AA. Fls. not white.

B. Infl. arching or erect.

c. Sepals and petals veined with red, brown or purple.

d. Ground-color of sepals and petals not white.

E. Middle lobe of lip purple-maroon, margined yellow.

**Lowianum**, Reichb. f. Pseudobulbs oblong; lvs. 2-3 ft. long, linear-acute, recurved; racemes many-fl'd.; fls. about 20 in number, 3-4 in. across; sepals and petals oblong-lanceolate (lateral ones sub-falcate), greenish yellow marked with brown; lateral lobes of lip yellowish; midlobe reflexed, purple-maroon, margined with yellow. Burma. Gn. 48, p. 263. Gng. 5:73. A.F. 34:1089. R.B. 30:276. Var. *Mandaiianum*, Hort. (*C. Mandaiianum*, Hort.), has yellow fls.

EE. Middle lobe of lip yellow, spotted.

**giganteum**, Wall. Fig. 1185. Fls. dull purple (brownish, or yellowish green striped with purple); sepals and petals oblong, the petals narrow and shorter; midlobe of lip reflexed, yellow, spotted with red; lateral lobes yellowish green. Nepal. B.M. 4844. P.M. 12:241.

**Traceyanum**, Hort. Pseudobulbs and foliage as in *C. giganteum*; racemes 3-4 ft. long, ascending, 15-20 fl'd.; fls. 4-5 in. across; sepals and petals greenish yellow, lined with crimson; middle lobe of lip oblong, reflexed, crisped, cream-white, crimson-spotted. Burma. C.O. 4. R.B. 29:25.—By some considered a natural hybrid between *C. grandiflorum* and *C. giganteum*.

DD. Ground-color of sepals and petals white, flushed rose.

**insigne**, Rolfe (*C. Sanderi*, Hort. *C. insigne Sanderi*, Hort.). Lvs. up to 3 ft. long; infl. long, ascending; fls. rosy white; sepals and petals elliptic; lip marked with lines of purple dots, the middle lobe short, obtuse, emarginate; disk yellow. C.O. 10. B.M. 8312. O. 1911:64. R.B. 33:53. R.H. 1907:496. G.C. III. 37:115.

cc. Sepals and petals not veined.

**tigrinum**, Parish. Lvs. oblong-lanceolate; peduncles slender, 3-6 fl'd.; sepals and petals linear-oblong, acute,

green, spotted at base; petals often paler and with more spots than the sepals; lip with yellow, red-brown striped lateral lobes; midlobe white, transversely streaked with purple. Burma. B.M. 5457. A.G. 22:715.

**grandiflorum**, Griff. (*C. Hookerianum*, Reichb. f.). Lvs. about 2 ft. long, acute; peduncle arching above, erect at base; fls. from 6-12, large, sepals and petals oblong, greenish; lip yellow, spotted with purple. Sikkim. B.M. 5574.

BB. Infl. pendulous.

**pendulum**, Swartz. The leathery lvs. distichous, 2-3 ft. long, broadly linear; fls. yellowish; side lobes and midlobe of lip rose-color; the disk more or less white with yellow crests; sepals and petals narrowly oblong, with a purple median line. E. Indies.

**Finlaysonianum**, Lindl. (*C. pendulum*, Lindl.). Lvs. ensiform; raceme many-fl'd.; sepals and petals linear-oblong, obtuse, dull yellow, sometimes with a reddish median line; lateral lobes of lip crimson; midlobe white, tipped with crimson. Malaysia. Var. *atropurpureum*, Hort. Lvs. narrower, racemes longer, with larger fls.; sepals and petals purplish, front lobe of lip white, spotted with purple. Borneo.

*C. Alexandri*, Hort. Hybrid between *C. eburneo-Lowianum*  $\times$  *C. insigne*.—*C. aloifolium*, Swartz. Racemes many-fl'd., arched; fls. pale purple, black-striped. E. Indies. *C. Ballianum*, Hort. Natural hybrid between *C. eburneo*  $\times$  *C. Mastersii*.—*C. Colmanae*, Hort. Hybrid between *C. eburneo-Lowianum*  $\times$  *C. eburneo*  $\times$  *C. Cravenianum*, Hort. Hybrid between *C. Lowianum*  $\times$  *C. Traceyanum*.—*C. Devonianum*, Paxt. Racemes many-fl'd., pendulous; sepals and petals greenish or reddish yellow, spotted or lined with purple; lip purple. India. C.O. 8.—*C. eburneo-giganteum*, Hort. Hybrid between *C. eburneo*  $\times$  *C. giganteum*.—*C. eburneo-Lowianum*, Hort. Hybrid between *C. eburneo*  $\times$  *C. Lowianum*.—*C. ensifolium*, Swartz. Lvs. ensiform, acute; racemes many-fl'd.; fls. greenish yellow, purple-veined; sepals and petals linear-oblong, acute; lip spotted. India. Japan. B.M. 1751.—*C. erythrostylum*, Rolfe. Sepals and petals white; lip yellowish white, lined red-purple; column crimson. Annam. B.M. 8131. G.C. III. 40:286.—*C. galtonense*, Hort. Hybrid between *C. Lowianum*  $\times$  *C. Traceyanum*.—*C. Gammiesianum*, Rolfe. Supposed to be a natural hybrid between *C. giganteum*  $\times$  *C. elegans*. G.C. III. 38:427.—*C. glebeldandense*, Hort. Hybrid between *C. Schraderi*  $\times$  *C. insigne*.—*C. Gottianum*, Hort. Hybrid between *C. eburneo*  $\times$  *C. insigne* Sanderi. Fls. white, the sepals with a faint greenish tinge, the lip blotched with ruby-purple. G.C. III. 49:180.—*C. Holfordianum*, Hort. Hybrid between *C. grandiflorum*  $\times$  *C. eburneo*.—*C. Holmesii*, Hort. Hybrid between *C. Mastersii*  $\times$  *C. giganteum*.—*C. Huttonii*, Hook. f. = *Grammangis*.—*C. langleyense*, Hort. Hybrid between *C. Lowianum*  $\times$  *C. Devonianum*. Sepals and petals greenish brown, the lip marked with reddish brown. G.C. III. 49:146.—*C. Lindleyi* (?).—*C. longifolium*, Don. Lvs. linear, acuminate; racemes suberect; fls. about 12; sepals and petals green, striped brownish purple, the sepals oblong, the dorsal one broader and incurved; lip with the lateral lobes purple-lined, the middle lobe and disk white. Himalayas. G.M. 54:472.—*C. lowianum*, Hort. Hybrid between *C. Lowianum*  $\times$  *C. tigrinum*.—*C. Lóvi-grandiflorum*, Hort. Hybrid between *C. Lowianum*  $\times$  *C. grandiflorum*.—*C. Lóvi-Mastersii*, Hort. Hybrid between *C. Lowianum*  $\times$  *C. Mastersii*.—*C. Mastersii*, Griff. = *Cyperorchis*.—*C. Párisii* var. *Sánderei*, Rolfe (*C. Sanderi*, Hort.). Sepals and petals ivory-white, the front lobe of lip heavily blotched with crimson-purple, the crests orange-yellow. Burma. G.C. III. 35:338.—*C. Pavluetsii*, Hort. = *C. insigne*  $\times$  *C. Lowianum* concolor. —*C. pumilum*, Rolfe. Scape 4-6 in. long, many-fl'd.; sepals light reddish brown; lip white with red-brown spots; disk and keels bright yellow. China.—*C. rhodochilum*, Rolfe. A striking plant; raceme many-fl'd.; sepals and petals pale green; the latter with darker green spots; lip with the lateral lobes pale green, margined crimson, the middle lobe obovate, crimson, with a yellow central band which is green-spotted. Madagascar. B.M. 7932-3. O.R. 14:209. A.F. 18:810. G.C. III. 37:378. Gn. 61, p. 383.—*C. roseifolense*, Hort. Hybrid between *C. Traceyanum*  $\times$  *C. grandiflorum*.—*C. Sándersonii* = *Ansellia*.—*C. Schraderi*, Rolfe. Petals and sepals lanceolate, green, lined and dotted with reddish brown; lip light yellow striped with brown. Annam.—*C. Simonsianum*, Ruiz & Prantl. Sepals and petals grayish white, streaked blood-red in the center; lip white, streaked blood-red, the middle lobe revolute, with a yellow blotch. Assam. B.M. 7863.—*C. Steppedunum*, Pynart. Hybrid between *Cyperorchis* *Mastersii*  $\times$  *Cymbidium* *giganteum*. Sepals and petals yellowish green, the lip white marked brown and yellow. R.B. 36:397.—*C. Veitchii*, Hort. Hybrid between *C. eburneo*  $\times$  *C. Lowianum*. Fls. fragrant, about 5 in. across; sepals and petals white, tinted yellow; lip white, tinted yellow, with a large Y-shaped purple-crimson spot on the middle lobe. G.C. III. 47:407. O.R. 12:369; 16:325. C.O. 1.—*C. viridescens*, Lindl. Sepals and petals greenish, the lip yellow, red-blotched. Japan.—*C. Wiganianum*, Hort. Hybrid between *C. eburneo*  $\times$  *C. Traceyanum*.—*C. Wilsonii*, Hort. Sepals and petals green, indistinctly marked at base with lines of reddish dots; lip cream, the lateral lobes lined with sepia-brown and reddish markings on the front lobe. China. G.C. III. 35:157.—*C. Winnianum*, Hort. Hybrid

between *C. giganteum* × *C. eburneum*. Racemes 10-15-fl.; fls. about 4 in. across; sepals and petals ivory-white; lip ivory-white, spotted with crimson. O.R. 1:361; 12:369. G.M. 51:179.—*C. Woodhamsianum*, Hort. Hybrid between *C. Lowianum* × *C. Veitchii*. G. 30:107.—*C. woodlandense*, Hort. Hybrid between *C. Traceyanum* × *C. Mastersii*.—*C. Zaleskianum*, Hort. Natural hybrid between *C. giganteum* × *C. grandiflorum*.

GEORGE V. NASH.†

**CYMBOPÉTALUM** (Latin, signifying *boat-petal*, from the shape of its petals). *Annonaceæ*. A group of plants remarkable for the fragrance of their aromatic flowers.

Flowered with the 3 inner petals having the margin incurved somewhat like the upper part of the human ear, the several-ovuled carpels forming a cluster issuing from a globose mass of stamens: fr. in the form of separate oblong berries borne on the hardened torus or receptacle and resembling that of our papaw (*Asimina triloba*).—Several species, all of them endemic in Trop. Amer. Among the species thus far described are *C. brasiliensis*, Benth. (*Uvaria brasiliensis*, Velloso). *C. penduliflorum*, Baill. (*Unona penduliflora*, Dunal). *C. longipes*, Diels, and *C. stenophyllum*, Donnell Smith.

*penduliflorum*, Baill. XOCHINACAZTLI. TEONACAZTLI. SACRED EARFLOWER of the Aztecs. OREJUELA. FLOR DE LA OREJA. MEXICAN EARFLOWER. Figs. 1186, 1187. A shrub or small tree with distichous, membranaceous, subsessile lvs. oblanceolate in form, subcordate and usually unequal at the base, acute at the apex: solitary fls. borne on long slender peduncles issuing from the internodes of the smaller branches; sepals broadly ovate or suborbicular, cuspidate, reflexed at length; outer petals similar to the sepals but much larger; inner petals thick and fleshy, their margin involute, causing them to resemble a human ear.—The pungently aromatic fls. when fresh are greenish yellow, with the inner surface of the inner petals inclining to orange-color, at length turning brownish purple or maroon, breaking with a bright orange-colored fracture. The tree is planted for the sake of its fragrant fls., the petals of which are dried and are used medicinally as well as for imparting a spicy flavor to food. They were used by the ancient Mexicans before the intro. of cinnamon and other spices from the E. Indies for flavoring their chocolate. Though described by Hernandez more than two centuries ago, the botanical identity of the xochinacaztli remained unknown until quite recently (see Smithsonian Report for 1910, pp. 427-431, 1911). This species is native of the mts. of S. Mex. and Guatemala. A closely related species, *C. stenophyllum*, Donnell Smith, was discovered by Capt. John Donnell Smith in the Dept. of Quetzaltenango, Guatemala; and another species, *C. costaricensis*, Safford (*Asimina costaricensis*, Donnell Smith) was collected by Adolfo Tonduz in the Dept. of Talamanca, Costa Rica, in April, 1894. Steps have been taken by the Bureau of Plant Industry to intro. into

the U. S. *C. penduliflorum*, seeds of which have been sent from Guatemala by the American Consul-General, George A. Bucklin. The other Cent. American species, as well as *C. brasiliense*, recently collected by Henry Pittier in Venezuela, are equally worthy of cult. in greenhouses and in the warmer regions of Fla., Calif. and the Island possessions.

W. E. SAFFORD.

**CYMBOPÔGON** (Greek *kumbo*, a cup, and *pogon*, beard). *Gramineæ*. Oil-producing grasses.

The genus resembles *Andropogon*, of which it is considered by some a subgenus, but differs in having some of the lower pairs of spikelets in each spike staminate. The spike-like racemes are borne in pairs at the ends of the short branches of the infl. and are subtended by a somewhat inflated sheath.—About 40 species, mostly of the tropics of the Old World. Several species furnish essential oils and some are cult. for that purpose. They are known under the general name of oil grasses or lemon grasses. Some of the more important are: *C. Schenanthus*, Spreng. CAMEL HAY. Fig. 1188. G.W. 14:399; *C. Nardus*, Rendle. CITRONELLA GRASS. Gn. 12:495; *C. citratus*, DC. LEMON GRASS. Gn. 12:495. For a full account of these, see Kew Bull. Misc. Inf. No. 8, 1906. See also *Vetiveria*.

A. S. HITCHCOCK.

**CYNÁNCHUM** (Greek, *dog strangle*). *Asclepiadaceæ*. Herbaceous or sometimes half woody at the base, twining, sometimes seen in gardens.

In the restricted sense as limited by Bentham & Hooker, perhaps 25 species differing from *Vincetoxicum* in having a scale or ligule on the inside of each of the 5 parts of the crown: lvs. opposite, cordiform or hastate; fls. small, in umbelliform or racemiform cymes; calyx 5-parted; corolla nearly rotate, deeply 5-cut, the lobes oblong or roundish; corona membranaceous, adnate to the stamens, tube, cup-shaped or at base ringed, 5-lobed opposite the anthers and with inner scales or small lobes: follicles rather fleshy, acuminate and smooth.—The genus is mostly of S. Eu., Afr., Asia and Austral. Schumann in Engler & Prantl combines *Vincetoxicum* and other genera with it, making more than 100 species in the warmer parts of both hemispheres. *Vincetoxicum* is here kept distinct.

*acuminatifolium*, Hemsl. (*Vincetoxicum acuminatum*, Deene. *V. japonicum*, Hort.). MOSQUITO PLANT. CRUEL PLANT. Perennial: erect or nearly so, or the tips showing a somewhat twining habit: sts. grayish and more or less angular: lvs. opposite, broadly ovate and acuminate, short-petioled, strongly pinnate-veined, entire, usually conspicuously gray-pubescent beneath:



1186. *Cymbopetalum penduliflorum*. (× ½)



1187. *Cymbopetalum penduliflorum*.



fl.-clusters lateral (1-2 between the lvs.), shorter than the lvs.; fls. white, small, in umbel-like cymes: fr. a milkweed-like follicle. Japan.—In the fls. mosquitos and other insects are caught, much as they are in other asclepiadaceous plants. The native *Amsonia Tabernaemontana* is sometimes sold as this plant, and it has been figured as such. This plant attracted attention some years ago as a curious garden subject. Other species are mentioned in foreign gardening literature, but they are apparently not in the American trade. *C. acutum*, Linn., with cordate smooth lvs. and white or rose-colored fragrant fls., is a climber in S. Eu., reaching 10 or 12 ft. *C. formosum*, N. E. Br., is glabrous, with petiolate ovate, elliptic or oblong-ovate acuminate lvs.: fls. in large lateral pedunculate cymes; corolla pale green, deeply lobed; corona tubular - bell-shaped, 15-crenulate, prominent. Peru.

L. H. B.

**CYNARA** (involucre spines likened to a dog's tooth). *Compósitæ*. ARTICHOKE and CARDOON.

Thistle-like perennial herbs, mostly coarse, and sometimes prickly: lvs. commonly large, variously lobed or pinnatisect; head large, terminating important branches, the corollas violet, blue, or white; involucre broad or nearly globular, with bracts in many series and more or less enlarged at the base; receptacle fleshy and plane, bristly; corolla slender-tubed, 5-parted, not ligulate: fr. a thick glabrous compressed or 4-angled achene with a truncate apex.—Ten or a dozen species in the Medit. region and Canary Isls., two of which are grown as garden vegetables.

**Cardunculus**, Linn. CARDOON (which see). Robust, to 6 ft. tall and more: st. grooved: lvs. very large, deeply pinnatifid, grayish green above and whitish beneath, prominently spiny: heads purple-fl., with sharp-pointed scales. S. Eu., but extensively run wild on the pampas of S. Amer. B.M. 3241.—In cult., the thickened lf.-stalks or ribs are blanched and used as a pot-herb, and the root is also edible.

**Scôlymus**, Linn. ARTICHOKE (which see). Not so stout, usually 3-5 ft.: lvs. less pinnatifid and spiny: scales of involucre broad, thickened at base, unarmed: heads larger than in *C. Cardunculus*, the receptacle enlarged and fleshy.—Probably a derivative of the last.

L. H. B.

**CYNODON** (Greek *kuon*, a dog, and *odons*, a tooth). *Graminææ*. Low creeping perennials, used for lawns and pasture.

Flowers in slender digitate spikes; spikelets 1-fl., compressed, awnless, sessile in 2 rows along one side of a slender rachis.—Species 4, in warm regions.

**dáctylon**, Pers. (*Capriola dáctylon*, Kuntze). BER-MUDA-GRASS. WIRE-GRASS. Fig. 1189. Sts. flattened, slender, creeping and rooting at the nodes, producing numerous slender or stout creeping root-stocks: blades hairy around the base: spikes 4-5, 1-1½ in. long. Dept. Agric., Div. Agrost. 20: 99.—A native of the warmer parts of the Old World, now widely distributed in the warmer parts of the western hemisphere. Cult. as a pasture and lawn grass in the southern states. Often a troublesome weed in cult. ground. A fine-ld. form with runners above ground, much used in the S. for lawns, is called St. Lucie grass. In Eu. the stolons are said to be used medicinally like couch-grass, principally as a diuretic.

*C. incompletus*, Nees. BLUE COUCH-GRASS. Occurs in E. and S. Afr. and also New S. Wales, where it is used as a pasture grass. It is reported as poisoning stock, at certain stages of its growth producing hydrocyanic (prussic) acid.

A. S. HITCHCOCK.

## CYNOGLOSSUM

(Greek, *hound's tongue*, from the shape and soft surface of the lvs. of the commonest species). *Borraginææ*. A widely dispersed genus of little horticultural interest, being mostly tall, coarse, weedy herbs. Lvs. alternate: fls. always in elongated, often 1-sided racemes.—Species 75. *C. officinale*, Linn., Fig. 1190 (stick-tight), has a bur that becomes attached to clothing and to fleece of sheep. It is a biennial weed, naturalized from the Old World;

1188. *Cymbopogon Schoenanthus*. (×½)

grows about 2 ft. high in pastures and waste places of the Atlantic states, and has soft-pubescent, lanceolate lvs., and dull red-purple (sometimes white) fls. in panicle racemes. Root and herbage possess medicinal properties. *C. grande*, Douglas. Once cult. from Calif.

as a hardy border perennial; grows about 2 ft. high, with lower lvs. ovate-oblong, or somewhat heart-shaped at the base, acute or acuminate, 4-8 in. long, on margined petioles

of about the same length: upper lvs. smaller, ovate to lanceolate, abruptly contracted into shorter winged petioles: fls. violet or blue. For *C. appenninum*, Linn., see *Solenanthus*. A new plant, *C. furcátum*, Wall., has recently been



1190. Bur of Hound's tongue or stick-tight. (×1½)



1189. *Cynodon dactylon*. (Natural size.)

intro. It is a hairy herb, 1–3 ft. high, with large lvs. and numerous blue fls. in clusters as in forget-me-not. India. Fls. in June. See page 3567.

*C. amabile*, Stapf & Drummond. Allied to *C. furcatum*, but has larger fls. Perennial. S.W. China. N. TAYLOR.†

**CYNÓRCHIS** (Greek for *dog orchid*). *Orchidaceæ*. Terrestrial orchids, grown in the warmhouse.

Flower-clusters loose; sepals and petals similar, or the petals smaller, spreading; lip spreading, 3–5-lobed, spurred; anther short, with 2 points, between which arises the middle lobe of the beak.—About 25 species, of the Mascarene Islands and tropical Africa.

The following have been in cult.: *C. compacta*, Reichb. f. Fls. white, the disk of lip red-spotted. Natal. B.M. 8053. O.R. 19:265. —*C. Loviana*, Reichb. f. Lateral sepals light green, the lip bright rose-purple, the spur clavate. Madagascar. B.M. 7551. (as *C. purpurascens*). O.R. 19:273. G. C. III. 43:184. —*C. Morlandii*, Rolfe. Racemes 5–9-fld.; fls. medium-sized, lilac. Mozambique. —*C. purpurascens*, Thomas. Fls. numerous in a spike-like raceme or head, rose, with the disk of the lip white. Mascarene Isls. B.M. 7852. O.R. 14:305; 15:121; 19:272. G. C. III. 29:87; 35:227. —*C. villosa*, Rolfe. Raceme spike-like, densely fld.; fls. rose-purple, the sepals glandular-hairy. Madagascar. B.M. 7845.

GEORGE V. NASH.

**CYNOSÛRUS** (Greek *kuon*, a dog, and *oura*, a tail). *Gramineæ*. Dog's-TAIL-GRASS. Cespitose grasses with flat blades and spike-like panicles, two species of which are cultivated as ornamental grasses and in lawns and pastures.

Spikelets of 2 forms in small fascicles, the terminal spikelets perfect, the lower sterile, consisting of several empty glumes.—Species about 6, in the north temperate regions of the Old World.

*cristatus*, Linn. CRESTED DOG'S-TAIL. Fig. 1191. Perennial, 1–2 ft.: spike 1–3 in. long; awns shorter than the lemmas. Eu. Dept. Agric., Div. Agrost. 20:146. —Sometimes used in mixtures of lawn or pasture grasses.

*élégans*, Desf. Annual, 6–18 in.: panicle loose, 1-sided, about 1 in. long; awns silky, longer than the lemmas, sometimes as much as 1 in. Eu.—Used for dry bouquets.

A. S. HITCHCOCK.

**CYNTHIA**: Krigia.

**CYPÉLLA** (application obscure). *Iridaceæ*. South American bulbs, resembling Iris.

Half-hardy: bulb tunicate; lvs. radical or cauline; fls. 1–3 from a spathe, yellow, orange or blue; segms. free, narrow or broadly unguiculate, the outer ones spreading and the inner erect and somewhat recurved at the apex. The genus differs from Iris and Moræa in its stigmas, which are neither petal-like nor filiform, but erect, and in the anthers, which are broad, erect, not curved, bearing the pollen on their edges, also in the plaited lvs. Perhaps a half-dozen species.—The bulbs should be set out in spring, lifted in fall and stored over winter. Prop. by offsets or by seed, which should be sown as soon as ripe. The blue-fld. species are presumably equally worthy of cult. For the still showier *C. cerulea*, see *Marica*.

A. *Style appendages spur-like*.

**Hérbertii**, Herb. Lvs. about 1 ft. long, linear, acuminate, twice plaited, the angles of the plaits winged: scape 2–3 ft. high, erect, flexuose, glaucous, branched, many-fld.; fls. 3 in. across, chiefly yellow, odorless, soon withering; outer segms. bearing a rather long cusp or

tail. S. Brazil. Uruguay. Argentina. B.R. 949 (as Moræa) and B.M. 2599 (as Tigridia) show very distinct colors, but Baker says there is a lilac variety.

**plúmbea**, Lindl. Three to 4 ft., the st. glaucous, round and thickish; lvs. not very close together, sheathing at the base, plicate and glaucous: fls. fleeting, at their best early in the morning, not unlike those of *Iris versicolor*, and the same color; style slender, broadening at the apex into a spur-like appendage. Trop. S. Amer.—Has been offered under the name *C. platensis*, which is otherwise unknown in botanical and horticultural literature.

AA. *Style appendages petal-like, flat*.

**peruviána**, Baker. Lvs. 6–9 in. long, linear, narrowed gradually from the middle both ways, glabrous, plaited: fls. 2–3 in a solitary stalked cluster, soon withering, chiefly yellow; segms. with a distinct long claw and a proportionately shorter and broader blade and a shorter cusp, at the base spotted brown. Peru. B.M. 6213.

N. TAYLOR.†

**CYPERÓRCHIS** (*Cyperus* and *Orchis*, from the sedge-like appearance). *Orchidaceæ*. Epiphytic orchids, thriving in the warmhouse.

Very closely allied to *Cymbidium*, from which it differs in the narrower sepals and petals which are connivent to the middle or beyond, thus preventing the full expansion of the fl., and by the straight narrow lip.—There are 3 species, natives of the Himalayas and the Khasia Hills.

*élégans*, Blume. Fig. 1192. Pseudobulbs short, 2–3 in. long; lvs. linear, up to 20 in. long, streaked, pale yellow-green: raceme many-fld., dense, pendulous; fls. yellow, 1½–2 in. across; sepals and petals linear-oblong, the recurved tips acute; lip cuneate, 3-lobed, the middle lobe oblong, short, obtuse; disk with 2 raised orange lines. Himalayas. B.M. 7007.

**Mástersii**, Benth. (*Cymbidium Mástersii*, Griff.). Pseudobulbs 4–10 in. long; lvs. up to 2½ ft. long, acute: racemes 6–10-fld.; fls. about 2 in. across, almond-scented, ivory-white; sepals and petals oblong-linear; lip usually spotted rose-purple, the lateral lobes roundish-oblong, the middle lobe undulate, reflexed, oval;



1192. *Cyperorchis elegans*.  
(× ⅓)

disk with 2 raised orange lines. Sikkim and Khasia Hills. B.R. 31:50. F.M. 1879:346; 1880:391. Lind. 5:222. J.F. 3:289. O. 1910:8.

GEORGE V. NASH.

**CYPÉRUS** (ancient Greek name). *Cyperaceæ*. A large genus of the sedge family, inhabiting both tropical and temperate regions. The species in cult. are all perennials from rootstocks or tubers: lvs. grass-like: st. simple and mostly naked above: fls. perfect, without



perianth, borne in small, compressed spikes, which are variously aggregated in compound umbels, the latter surrounded by foliaceous bracts; styles and stamens 3.—A few are cult. in jardinières, aquatic gardens and aquaria. Several others are pests in cult. fields. P. 3567.

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## A. Basal lvs. much reduced or wanting.

## B. Umbel-rays nearly 100, much longer than the 3–10 involucre lvs.

1. *Papyrus*, Linn. (*Papyrus Antiquorum*, Willd.). EGYPTIAN PAPER PLANT. PAPHYRUS. Cespitose, strict, tall and stout, 4–8 ft. high: st. obtusely 3-angled, smooth: involucre lvs. only 3–10, small, 3–6 in. long, 3–12 lines wide, lanceolate, acute: primary rays of the umbel very numerous, slender, furrowed, equal and drooping, 10–20 in. long; secondary bracts prominent, filiform, 1–6 in. long; spikelets clustered and sessile, pale chestnut; scales obtuse, rachis strongly winged. Egypt, Palestine. Gn. 30, p. 348; 57, p. 105. G.M. 40:799. G.W. 2, p. 571.—For aquaria and damp soil. Not hardy N.

## BB. Umbel-rays 25 or less.

## C. Involucre lvs. very numerous, somewhat separated, much exceeding the umbel; rachis scarcely winged.

## D. Scales broadly ovate: lvs. scabrous throughout.

2. *flabelliformis*, Rottb. Rhizome horizontal, stoloniferous, stout: st. stout, spongy at base, 2–4 ft. high, obtusely angled: involucre lvs. 15–25, 2–8 lines wide, 6–16 in. long, strongly nerved or plicate: umbel lax, about a third as long as involucre; spikelets very numerous, elliptic-oblong, very flat, lustrous, 1½–3½ lines long; scales firm, lustrous, scarcely striate, carinate, barely acute, closely imbricated, pale brown with dark brown area on each side. Afr.—Rare in American trade. Tall and palm-like; used by the natives for wickerwork; very ornamental in water-gardens.

## DD. Scales lanceolate: lvs. scabrous only at apex.

3. *alternifolius*, Linn. UMBRELLA PLANT. UMBRELLA PALM. Fig. 1193. Cespitose, strict, 1–4 ft. high: st. nearly terete, ribbed, smooth and slender: involucre lvs. about 20, spreading or slightly drooping, linear, 4–8 in. long, 2–5 lines wide, plain: umbel open; rays only 1–3 in. long; spikelets numerous, ovate-lanceolate acute, very flat, 2 lines long, pale brown suffused with darker brown, dull; scales thin, very acute, somewhat nerved. Madagascar.—Much used for aquaria and jardinières. Gn. 35, p. 573. A.G. 17:57. V. 4: 159; 5:39. Var. *variegatus*, Hort. St. and lvs. striated with white, sometimes entirely white. Var. *gracilis*, Hort. Plant smaller and more slender: involucre lvs. much narrower and shorter, and not so spreading.—The above description is from Boeckeler, and from a specimen from Madagascar. The plant in cult. under the name *C. alternifolius* may not be that species. The lvs. are too long, too scabrous and too veiny; and the spikelets are elliptic-oval, or oval, 2 lines long, and have broader and more closely overlapping scales than in the typical form. The illustrations cited are probably of the garden plant.

## CC. Involucre lvs. about 3, contiguous, shorter than umbel; rachis strongly winged.

4. *natalensis*, Hochst. Rhizome long, stout and hard, 2 lines thick, scaly: st. solitary, 2–3 ft. high, the size of a goose-quill, triangular: lvs. 2–6 in. long, often wanting; involucre lvs. 3, only 1–3 in. long: umbel rather dense; spikelets 5–9 (rarely 12) lines long, linear-

lanceolate, scarcely compressed, rigid; scales obtuse, not carinate, nerved, shining, pale or brownish. Natal.—Decorative. Not hardy.

## AA. Basal lvs. well developed.

## B. Sts. very short, 3–5 in. high: umbel-rays up to 2 ft. long, weak, decumbent.

5. *fertilis*, Boeck. Roots fibrous: lvs. numerous, about equaling the st., 3–7 lines broad, margins strongly scabrous; involucre lvs. 6–7, short: rays flaccid, pendulous, often rooting at apex; spikelets few, ochraceous or olive, oblong or oblong-lanceolate, obtuse, slightly compressed, 8–10-fl., 3–4 lines long; scales obtuse, nerved. W. Afr. G.W. 8, p. 523.—Recently intro., and excellent for hanging-baskets. The umbel-rays often bear plantlets instead of spikelets.

1193. *Cyperus alternifolius* or umbrella plant.

## BB. Sts. longer than the umbel-rays.

## C. Rachis of spikelet wingless: scales broad, much overlapping, acute or mucronate: spikelets lanceolate or lance-oblong.

## D. Involucre bracts 2–6 lines broad, about 6–12 in number.

6. *diffusus*, Vahl (*C. elegans*, Hort. *C. laxus*, Hort.). Roots fibrous: st. solitary, 1–3 ft. high: basal lvs. many, equaling the st., 2–7 lines broad; margin scabrous; involucre lvs. 4–15 in. long, 2–6 lines broad, longer than the infl.: umbel diffuse; spikelets greenish yellow or pale brown, linear oblong or ovate-lanceolate, 3–8 lines long; scales loose, soft, dull; midrib deeply striate, cuspidate. Tropics. G.C. II. 1874:99; III. 13: 41.—For table decoration. As now interpreted, *C. elegans*, Linn., is a more rigid plant with narrower lvs.

## DD. Involucre bracts 1½ lines broad, or less, 3–6 in number.

## E. Lvs. flaccid: infl. usually open; spikelets very flat; scales 1½ lines long.

7. *compressus*, Linn. Roots fibrous: st. cespitose, 2–16 in. high: lvs. 2–3, slightly shorter than the st., scabrous only near apex: umbel of several pedunculate, sessile heads, or reduced to 1 sessile head; spikelets lance-oblong or lance-linear, 4–12 lines long; scales soft, carinate, acuminate, striate close. Tropics.—Cult. in Eu.

EE. *Lvs. rigid: infl. congested; spikelets thicker; scales*  
 $2\frac{1}{2}$  lines long.

8. *pungens*, Boeck. Roots of coarse lanate fibers: st. 6–20 in. high, stiff, terete above: lvs. several, with conspicuous, loose, brownish sheaths, equaling the st.



1194. *Cyperus esculentus*.—Chufa.

or shorter, narrow,  $\frac{1}{2}$  to  $\frac{3}{4}$  lines broad, thick and rigid: umbel congested, often simple; spikelets 5–9 lines long, lanceolate or ovate-lanceolate, pale brown; scales firm, with thin margins, obscurely carinate, inconspicuously striate, apiculate; midrib obscure, close. N. Afr. and S. W. Asia.—By some authors united with *C. conglomeratus*, Rottb., under the latter name. There is some reason to suspect that the plant in the trade under this name may not be this species.

CC. *Rachis of spikelet with scarious, winged margin; scales obtuse or obtusish, less overlapping; spikelets linear.*

D. *Lvs. thick, glossy.*

9. *lucidus*, R. Br. Rhizomes short and thick: sts. stout, 2–3 ft. or even 4 ft. high, sharply 3-angled: lvs. equaling the st. or longer, 3–6 lines wide, margins scabrous; involucrel lvs. 3–6, the lower very broad, often  $1\frac{1}{2}$ –3 ft. long: umbel large, lax, compound; rays many, 9 in. long or less; spikelets spicate, rich deep brown, lustrous, linear, flattish, acute, 4–6 (rarely 7–8) lines long; wings of rachis narrow; scales loosely imbricated, few-nerved, 2 lines long. Austral.

DD. *Lvs. thinner, duller.*

E. *Rootstock long, stout, 2–2½ lines thick.*

10. *longus*, Linn. Sts. 2–4 ft. high, acutely angled, stoutish: lvs. several, with long sheaths, about equaling the culm 2–4 lines wide; margins finely scabrous; involucrel bracts very long, often 8–24 in.: umbel lax, the rays 12 in. or less long; spikelets 3–15 lines long, linear, dull, dark chestnut-brown, rarely paler, slightly compressed; scales  $1\frac{1}{4}$ – $1\frac{1}{2}$  lines long, scarcely carinate, obscurely striate; midrib green. Eu.—Cult. in Eu.

EE. *Rootstock long, slender, tuber-bearing.*

F. *Scales dark reddish brown.*

11. *rotundus*, Linn. NUT-GRASS. COCO-GRASS. Rootstocks  $\frac{1}{4}$  line thick: sts. 4–24 in. high, bulbous, thickened at the base, rather slender, 3-angled: lvs. several, usually shorter than the st., only 1–2 (rarely 3) lines wide; margins finely scabrous; involucrel bracts 2–4, scarcely longer than the infl.: umbel lax; rays few, 4 in. long or less; spikelets linear, 5–12 lines long, inconspicuously spicate on the branches, few in a cluster, dull; scales  $1\frac{1}{4}$  lines long, scarcely striate, obscurely carinate; midrib green: achenes linear, acute. Tropics and subtropics.—A weed southward.

FF. *Scales brownish chestnut or stramineous.*

12. *esculentus*, Linn. CHUFA. Fig. 1194; also Fig. 959. St. 8 in. to 3 ft. high, stoutish: lvs. several, equaling the st. or slightly shorter, rarely longer, 2–4 lines wide; involucrel lvs. exceeding the infl.: umbel open; rays  $\frac{1}{2}$ –4 in. long; spikelets very numerous, spicate on the branches, crowded, divaricate, brownish stramineous, linear, 4–12 lines long, scarcely compressed; scales lax, several-nerved, dull, rarely carinate; midrib somewhat green: achenes oblong, obtuse. Tropics and subtropics.—A weed in sandy cult. fields northward and southward; rarely grown for the edible tubers.

EEE. *Rootstock globular; spikelets stramineous.*

13. *strigosus*, Linn. Running rootstocks absent, not tuber-bearing: sts. rather stout, 1–3 ft. high, sharply 3-angled; base bulbous: lvs. numerous, usually equaling the st., 2–4 lines wide, more or less scabrous; involucrel bracts 6–12 in. long, usually exceeding the infl.: umbel open, rays several, 6 in. long or less; spikelets very numerous, spicate on the branches, crowded, divaricate, linear-subulate, 5–8 lines long, scarcely compressed; scales  $1\frac{1}{2}$  to 2 lines long, appressed, dull, striate; midrib green. N. Amer.—Hardy perennial, used for the border of aquatic gardens. K. M. WIEGAND.



1195. *Cyphomandra betacea*. ( $\times\frac{1}{2}$ )



**CYPHOKENTIA** (allied to *Kentia*, differing, among other things, in having a lateral protuberance or tumor on the fr., whence the name). *Palmaceæ*. Feather-lvd. robust spineless palms, of very few species in New Caledonia, suitable for the warmhouse but little grown. The lvs. are terminal and pinnate-parted, the segms. long-sword-shaped and narrowed at apex, the margins at base recurved: spathe-valves 2, deciduous, bearing stout glabrous branching spadices; fls. declinuous, the stamens 6 or 12: fr. small, globose or ellipsoidal. Engler and Prantl combine *Cyphosperma* and *Microkentia* with this genus, comprising, about 10 species, all of New Caledonia. The original species are: *C. robusta*, Brongn., with the branches of the spadix thick and long-cylindrical, fr. reniform-ellipsoidal, stigma not prominent above the base, and seeds reniform; *C. macrostachya*, Brongn., with long flexuose spadix branches, globose fr., lateral stigma, and usually subglobose seeds. The cyphokentias probably require the treatment given arecas.

L. H. B.

**CYPHOMÁNDRA** (from the Greek, referring to the hump-shaped anthers). *Solanaceæ*. South American spineless shrubs or small trees, one of which is sometimes grown for its edible fruit.

The genus is distinguished from *Solanum* chiefly by the thickened connective of the anthers: the plants are erect and usually stout and the large lvs. are entire, 3-lobed, or pinnatisect: fls. pedicellate, in racemes, scorpioid cyme-branches, or arising below the nodes; calyx and corolla 5-lobed, the corolla somewhat rotate, the tube very short; anthers porose or acuminate at apex; ovary 2-celled: fr. an ovoid or oblong fleshy berry, many-seeded.—Some 30 or more species, of little concern to the horticulturist.

**betacea**, Sendt. (*Solanum fragrans*, Hook.). TREE TOMATO. Fig. 1195. Cult. occasionally for the egg-shaped, reddish brown, faintly striped frs., and under such conditions it becomes a tree-shaped, half-woody plant 6-10 ft. high: lvs. large, soft-pubescent, cordate-ovate, more or less acuminate, entire: fls. small, pinkish, fragrant, in small axillary or super-axillary clusters: fr. about 2 in. long, on slender stalks, 2-loculed and seedy, musky-acid and tomato-like in flavor, agreeable to those who like tomatoes. Brazil. B.M. 3684. J.H. III. 31:470. G.C. III. 25:105. A.G. 11:409.—Bears the second and third year from seed, under glass (where it must be grown in the northern states). Grown mostly as a curiosity.

L. H. B.

**CYPHOPHÈNIX** (*hump* and *Phoenix*, a palm). *Palmaceæ*, tribe *Arèceæ*. A rather unimportant genus of unarmed, stout-stemmed palms, with terminal pinnatisect leaves.

Leaflets acute at the apex, sword-shaped, the base often with a thickened and recurved margin; rachis stout and broad, a little convex on the lower side: spadix glabrous, with many long stout branches bearing short bracts and numerous monoecious fls.; sepals thick and leathery, round and a little concave: fr. elongate-ovoid or rarely ellipsoid.—There are only 2 species, both from New Caledonia. They have something the aspect of *Kentia* from which they differ in having only 6 stamens. They are almost unknown in the trade. For cult., see *Kentia* or *Howea*.

**élegans**, Benth. & Hook. (*Kéntia elegans*, Brongn. & Griseb.). Rachis convex below, keeled above; lfts. alternate, not close together, scaly along the mid-nerve below, 3-nerved: spadix more or less spreading or reflexed in age, simply branched: fr. oblong-elliptical, acute.

**fulcita**, Benth. & Hook. (*Kéntia fulcita*, Brongn.). St. clothed at the base with smooth aerial roots: fr. ovoid, attenuate above.—A tall graceful palm scarcely known outside of botanic garden collections.

N. TAYLOR.†

**CYPHOSPÉRMA** (Greek, *hump* and *seed*). *Palmaceæ*, tribe *Arèceæ*. Unarmed stout-stemmed palms with a crown of pinnately divided, terminal leaves.

Leaflets leathery, sword-shaped, the apex narrowly oblique, the base with a thickened recurved margin: rachis broad and stout, slightly convex beneath, channelled above: spadix smooth and much branched, the branches distichous; fls. spirally disposed on the spadix, brownish, otherwise as in *Cyphophœnix*: fr. globose or 4-5-angled.—Two species of New Caledonian palms, rare in cult. in U. S. and only doubtfully in the trade. See *Cyphokentia*; for cult. see *Areca*. The young plants have rather stiff petioles, but graceful, arching lf.-segms. G.C. II. 24:362.

**Vieillardii**, Benth. & Hook. (*Cyphokéntia Vieillardii*, Brongn.). St. medium height: lvs. pinnatisect, the lfts. thick and narrowly sword-shaped: fr. obtuse, 4-5-angled, the seed also acutely angled.—A rare palm, known also under the names *Kentia robusta* and *K. Vieillardii*.

N. TAYLOR.

**CYPRESS**: *Chamæcyparis*, *Cupressus* and *Taxodium*.

**CYPRESS VINE**: *Ipomœa*.

**CYPRIPEDIUM** (*Venus'-slipper*). LADY'S SLIPPER. MOCCASIN-FLOWER. *Orchidaceæ*. Attractive hardy orchids, often planted in moist cool borders, bogs, and sometimes in rock-gardens.

Stems very short, with a pair of lvs. close to or near the ground, or long and leafy: lvs. commonly many-nerved: fls. terminal, 1 to few, withering on the ovary; lateral sepals free, or united nearly or to the apex, the dorsal sepal erect; petals generally narrower, spreading; lip saccate, rarely split down the front; ovary 1-celled, with 3 parietal placentæ.—Species about 30, in the north temperate zone. For the greenhouse species formerly included here, see *Paphiopedilum*, and *Phragmipedium*.



A. Lvs. 2, opposite: lip split in front.

**acaule**, Ait.

Lvs. flat on the ground, ovate to oblong-oval: scape with 1 fl.; upper sepal and petals brownish, lanceolate; labellum pink-purple, darker veined. May, June. Newfoundland to N. C., west to Ind., Mich. and Minn. A.G. 13:514; 14:405. Gng. 4:263. A.F. 11:1049. G.C. III. 46:209.

**japonicum**, Thunb. Lvs. above the ground roundish, undulately plicate; bract longer than the ovary; fl. terminating the scape; sepals and petals lanceolate, acuminate, greenish, dotted with red; labellum white-pink. April, May. Japan. G.C. III. 33:355.

AA. Lvs. several, alternate: lip not split.

B. Lateral sepals free.

**arietinum**, R. Br. Plant about 6 in. high, slender: lvs. lanceolate: fls. small, resembling a ram's head, terminal, solitary; upper sepal ovate-lanceolate, brownish green; petals linear; labellum tapering at the apex, white veined with reddish purple, clothed with white, woolly hairs near the aperture. May. Maine to N. Y., Mich. and Minn., and northward. B. M. 1569. L.B.C. 13:1240. F.S. 20:2095.

BB. Lateral sepals united nearly or to the apex.

c. Fls. yellow.

**pubescens**, Willd. Fig. 1196. Lvs. oval, acute: petals usually twisted, much narrower than the ovate-lanceolate sepals;

labellum pale yellow; staminodium triangular. Same range as the next. May, June. B.M. 911 (as *C. parviflorum*). A.G. 13:513. Mn. 7, p. 5. G.C. III. 33:379; 47:369.—The rhizomes and rootlets are employed in medicine for their antispasmodic and nervine properties. Perhaps a form of the next.

**parviflorum**, Salisb. Lvs. ovate, acute: fls. smaller than in *C. pubescens*; labellum flattened from above and below, not laterally, bright yellow; staminodium triangular. May, June. Newfoundland to Ga., west to Minn. and E. Kans. A.G. 13:515. G.C. III. 46:227.—Same medicinal uses as *C. pubescens*.

cc. Fls. white or greenish.

d. Number of fls. 1-3.

**candidum**, Muhl. Lvs. oblong-lanceolate: fls. terminal, solitary; sepals broader than the petals, ovate-lanceolate; petals spreading like the sepals, greenish; labellum white, striped inside with purple; staminodium lanceolate. May, June. N. Y., Pa., Minn., Mo. and Ky.

**reginae**, Walt. Fig. 1197. Plants stout: lvs. oval, acute: sepals ovate, rather roundish, white; petals oblong, white; labellum white or pale pink-purple; staminodium oval-cordate. June. Maine, W. New England to Minn. and Mo., Mts. of N. C. R.H. 1868: 410. Gn. 53, p. 77; 61, p. 191; 65, p. 447. R.B. 20, p. 198. A.F. 11:1048. Gng. 4:262, 327. G.C. III. 29:21; 47:370; 50:315. Known also as *C. hirsutum* and *C. spectabile*.

**montanum**, Douglas. One to 2 ft., leafy, pubescent: lvs. ovate to broad-lanceolate, 4-6 in. long: fls. 1-3, short-pedicelled, the wavy-twisted petals brownish, the inch-long lip dull white veined with purple: caps. erect or nearly so. Calif. to Wash. B.M. 7319.—Fragrant. Grows in clumps. Handsome.

dd. Number of fls. 6-12.

**californicum**, Gray. Fig. 1198. Plants either slender or stout, varying in height, sometimes exceeding 2 ft.: lvs. ovate-alternate: floral bracts very large, becoming narrowly ovate: fls. small, from 6-12 open at the same time, an inch or more apart on the st.; labellum whitish; sepals oval, yellowish green; petals narrowly oblong, colored like the sepals. Calif. B.M. 7188. G.F. 1:281 (adapted in Fig. 1198). G.C. III. 41:418; 46:211.

*C. Calceolus*, Linn. Fls. single: sepals and petals deep brown; lip yellow, slightly compressed. Eu. R.H. 1892, p. 392. R.B. 21, 210. G.C. III. 46:210.—*C. debile*, Reichb. f. Lvs. 2, opposite: fls. small, the sepals and petals pale green with a dark brown basal blotch, sometimes brown-striped, the lateral sepals united; lip white, brown-streaked about the mouth. China and Japan. B.M. 8183.—*C. elegans*, Reichb. f. Sts. 4 in. tall: lvs. opposite: fl. single, the sepals and petals brown-veined, the lateral sepals united; lip brownish, corrugated. Tibet.—*C. guttatum*, Swartz. Lvs. 2, alternate: fls. single, white, blotched with purple. N.E. Eu. to N.W. Amer. B.M. 7746.—*C. himalaicum*, Rolfe. Sts. up to a foot tall: lvs. 3: sepals and petals brownish, deeper veined; lip brown-purple, many-nerved. Bhotan.—*C. trapezium*, Llav. & Lex. Lvs. ovate-lanceolate: fls. several, large, pale yellow, the large lip with some scarlet spots about the mouth. Mex.—*C. macranthon*, Swartz. Fls. purple, the lip contracted at the mouth. Siberia and N. Asia. R.H. 1877:310. B.M. 2938. G.C. III. 46:212.—*C. speciosum*, Rolfe. St. leafy: fls. whitish or flesh-colored, veined with rose; lip subglobose. Japan. B.M. 8386.—*C. Thunbergii*, Blume. Fls. pale purple. G.C. III. 46:228.—*C. tibeticum*, King. Fls. 3-4 in. across: sepals and petals white, light yellow at apex, veined with maroon-purple; lip maroon-purple. E. Tibet and W. China. B.M. 8070. G.C. III. 39:347; 46:420; 49:403, 410.—*C. ventricosum*, Hort. Said to be a natural hybrid between *C. Calceolus* and *C. macranthon*. G.C. III. 46:229.

GEORGE V. NASH.

**CYRILLA** (after Dominico Cyrillo, professor of medicine at Naples, 1734-1799). *Cyrollaceae*. Woody or nearly tree-like, rarely cultivated for its handsome bright green foliage and white flowers in slender racemes.

Leaves alternate, without stipules, short-petioled, entire, glabrous, deciduous or nearly persistent: fls. small, white, in narrow slender racemes, 5-merous; stamens 5-10; ovary superior with 2 short styles: fr. a small indehiscent 2-celled caps. with 2 seeds.—Probably one variable species from N. C. to Fla. west to Texas, and in W. India and S. Amer. Plant with handsome bright green foliage, and graceful racemes of white fls., hardy north to N. Y. Thrives best in humid sandy soil and shady position. Prop. by seeds and cuttings under glass, with slight bottom heat.

**racemiflora**, Linn.

**LEATHERWOOD.**

Shrub, occasionally tree to 30 ft.: lvs. cuneate, oblong or oblanceolate, usually obtuse, reticulate-veined, 2-3 in. long, bright green, turning orange and scarlet in fall, but in tropical climates evergreen: racemes 4-6 in. long, erect, at length nodding. B.M. 2456. S.S. 2:51. G.C. III. 30:198. J.H. III. 43:197.—The variety from W. Indies has been described as *C. antillana*, Michx., that of Brazil as *C. racemifera*, Vandelli, and a small-lvd. form from Fla. and La. as *C. parvifolia*, Raf.

ALFRED REHDER.



1198. *Cypridium californicum*. ( $\times \frac{1}{2}$ )

1197. *Cypridium spectabile*. ( $\times \frac{1}{2}$ )





**CYRTÁNDRA** (name refers to the curved stamens). *Gesneriaceæ*. A large group of tropical shrubs and trees, two or three of which are more or less known in cult. for their fls.; akin to *Trichosporum* (*Æschynanthus*); warmhouse subjects. Lvs. opposite, or alternate by failure of one of the pair, membranaceous, or fleshy or leathery: fls. usually white or yellowish, in fascicles, heads or cymes; corolla-tube cylindrical, the limb more or less 2-lipped; perfect stamens 2, and 2 or 3 small staminodia. Nearly 200 species in the islands of the Indian and Pacific oceans and in China. *C. pendula*, Blume. Short and stout: lvs. long-petioled, elliptic or lance-elliptic, acute, gray-blotched above: fls. white with brown calyx,  $1\frac{1}{2}$  in. long, the corolla inflated, and purple-dotted on lower side. Java. *C. Pritchardii*, Seem. Lvs. petioled, elliptic, obtusely toothed, acute: fls. small, white, in 3-fl. cymes. Fiji Isls.

**CYRTANTHÈRA**: *Jacobinia*.

L. H. B.

**CYRTÁNTHUS** (Greek, *curved flowers*; from their pendulous habit). *Amaryllidaceæ*. Tender bulbs from South Africa, known only in a few American greenhouses.

Flowers umbellate, pendulous or erect, usually red or white with green stripes; stamens inserted in the tube of the corolla; ovary 3-celled, crowded with numerous ovules, the seeds flat.—Species 20. Their cult. is like that of *hemanthus* and many other bulbs from the same region. They are suitable for pot culture, or for planting out in summer. The following analytical key gives an idea of the group, and its 3 subgenera.

A. Fls. many in an umbel, pendulous.

B. Lvs. strap-shaped. (*Cyrtanthus proper*.)

**obliquus**, Ait. Bulb ovoid, 3–4 in. thick: lvs. 10–12, strap-shaped, distichous, produced after the fls.,  $1\frac{1}{2}$ –2 ft. long: scape 1–2 ft. long, stout, mottled; fls. 10–12 in an umbel, entirely drooping, odorless, bright red, with more or less yellow, and greenish tips 2–3 in. long; pedicels  $\frac{1}{2}$ –1 in. long; style not exserted. Cape Colony. B. M. 1133. L.B.C. 10:947.

BB. Lvs. linear. (*Monella*.)

**Máckenii**, Hook. f. Bulb  $1\frac{1}{2}$  in. thick: lvs. 2–6, appearing with the fls., linear, 1 ft. long: scape slender, slightly glaucous; fls. 4–10 in an umbel, pure white, 2 in. long; style exserted. Natal. G.C. 1869:641. Gn. 50, p. 63.

AA. Fls. single, or few in an umbel, erect or slightly curved downward. (*Gastronema*.)

**sanguineus**, Hook. Bulb 2 in. thick: lvs. 3–4, appearing with the fls., lanceolate, petioled, 1 ft. long: scape slender, 6–9 in. long; fls. 1–3, bright red, 3–4½ in. long, wider funnel-shaped than in the 2 preceding species, with a throat 1 in. across. Caffraria, Natal. B.M. 5218. Var. **glaucophyllus**, Hort. A form with somewhat glaucous foliage and orange-red fls.

*C. Huttonii*, Baker, belongs to *Cyrtanthus proper*, but its lvs. appear with the fls., and it has 6–8 or even 12 pale red fls. about 1 in. long and a much shorter style than in *C. obliquus*. Cape Col ny. B.M. 7488. Gn. 50:62.—*C. inaequalis*, O'Brien. Fls. erect, coral-red, borne in umbels on scapes 1 ft. high; upper segms. of perianth overhanging. Cape Colony. G.C. III. 37:261.—*C. Jimodii*, Beauverd. Umbel 6–9-fl.; fls. cinnabar, yellow at apex, pendulous. Transvaal.

N. TAYLOR.†

**CYRTOCÁRPA** (Greek, *curved fruit*). *TAPIRA*. *Anacardiaceæ*. One or two Mexican trees, one of which bears a small fruit, likened to a cherry by the natives of Lower Calif.

Leaves alternate, compound: fls. axillary or terminal, paniculate, polygamous: fr. an oblique drupe, 1-seeded. Intro. into S. Calif. by Franceschi. Sometimes united with *Tapiria* (or *Tapirira*), from which it differs in its straight embryo and other characters.

**procèra**, HBK. Very tall tree, with slender, terete, dark purplish, resinous branches: lvs. alternate, odd-pinnate; lfts. 5–7 or 9, oblong, entire, with a very slight silkiness, especially below, very shortly stalked, 1 in. or more long, half as wide: fls. white, inconspicuous, in panicles 1–2 in. long; calyx 5-parted, villous, persistent; segms. roundish; petals 5, elliptic; stamens 10; style 1: fr. the size of an olive, edible. Mex. HBK. 6, t. 609.

**CYRTOCÈRAS**: *Hoya*.

**CYRTOCHÏLUM**: *Oncidium*.

**CYRTODÈIRA**: *Episcia*.

**CYRTÔMIUM** (Greek, *a bow*). *Polypodiaceæ*. Asiatic half-hardy or greenhouse ferns of rigid habit.

Leaves simply pinnate, anastomosing veins and firm indusia fixed by the depressed center. It differs from *Polystichum* mainly in venation.—Three or four species known.

Culture as for *Polystichum*, to which it is closely allied.

A. Margins of pinnae entire or slightly undulate.

**falcatum**, J. Smith. Fig. 1199. HOLLY FERN. Pinnae glossy, ovate, falcate; the lower rounded or

obliquely truncate at the base, 4–6 in. long, 1–2 in. wide. Japan, India.—The large thick glossy foliage makes it an excellent fern for decorations. One of the species used in fern-dishes and one of the few species which can be made to thrive under ordinary house conditions. Plants from the temperate parts of Japan will do well out-

1199. *Cyrtomium falcatum*. (Leaf  $\times \frac{1}{4}$ )

of-doors in the northeastern states if given slight winter protection. For another illustration, see article on ferns. *C. Bütterfeldii*, Hort., is a form of this species differing in having the pinnae deeply serrate. *C. Rochfordianum*, Hort., recently advertised, is a variety of *C. falcatum* with fimbriated lfts. Superficially these two forms resemble *C. caryotideum* somewhat, but the species are entirely distinct. It has begun to replace the original form in the dealers' stocks.

**Fórtunei**, J. Smith. Pinnae dull, lanceolate, opaque, 2–4 in. long,  $\frac{1}{2}$ –1 in. wide. Japan.

AA. Margins of pinnae toothed or sometimes lobed.

**caryotideum**, J. Smith. Pinnae larger, 5–7 in. long,  $1\frac{1}{2}$ –2½ in. wide, often auricled on both sides at the base, sharply toothed. India. R. C. BENEDICT.†

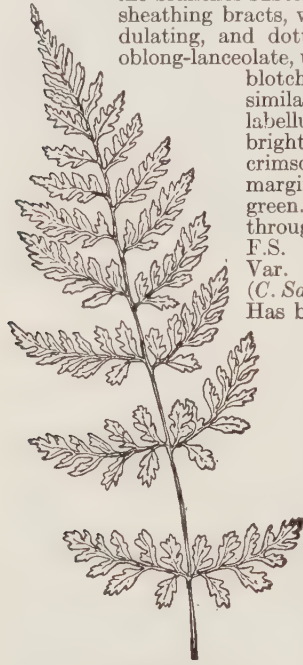
**CYRTOPÈRA**: *Eulophia*.

**CYRTOPÒDIUM** (Greek for *curved foot*, from shape of lip). *Orchidaceæ*. Epiphytes, grown in warmhouses. Stems fusiform, bearing plicate lvs.: scapes radical, bearing numerous fls., pure yellow or spotted with crimson; sepals and petals equal, free; column semi-

terete; pollinia 2, caudicle short; gland ovate.—Species 3 or 4 in the tropics. They are large-growing plants, with large and showy fls. They need a rich, fibrous soil with manure. Grow in a warm or tropical house.

**Andersonii**, R. Br. Sts. 5 ft. high: lvs. long, lanceolate, sheathing at the base: scape often 3 ft. high, branching, bearing many yellow fls.; sepals and petals broad, bright yellow, the labellum brighter, front lobe slightly concave. Specimens with over 100 fls. have been recorded. Trop. Amer. B.M. 1800.

**punctatum**, Lindl. Habit as above: scape from 2–3 ft. high, branching about midway, dotted with dull purple, the branches subtended by membranaceous sheathing bracts, which are lanceolate, undulating, and dotted with crimson; sepals oblong-lanceolate, undulate, greenish yellow blotched with crimson; petals similar, spotted at the base; labellum  $\frac{1}{2}$  in. long, fleshy, bright yellow, lateral lobes crimson, midlobe spotted and margined with crimson; column green. Extensively distributed through S. Amer. B.M. 3507. F.S. 22:2352. R.B. 30:158. Var. **Saintlegerianum**, Hort. (*C. Saintlegerianum*, Reich. f.). Has brighter markings on the bracts and fls. J.H. III. 50:91.



1200. *Cystopteris fragilis*. ( $\times \frac{1}{2}$ )

many-fl. fls. about 1 in. across, lemon-colored, spotted rose-pink. Brazil. B.M. 7807.

*C. palmifrons*, Reichb. f. & Warm. Sts. about 2 ft. tall, clothed with the lemon-yellow, purple-margined sheaths: lvs. 6–8 in. long; panicle 12–15 in. long, purple-colored, spotted rose-pink.

OAKES AMES.

GEORGE V. NASH.†

**CYRTOSPÉRMA** (Greek, *curved seed*). *Aracææ*. A handsome warmhouse tuberous foliage plant, with large, hastate red-veined leaves resembling an alocasia, but easily distinguished by its spiny stems.

Herbs with tubers or long rhizomes: lf.- and fl.-stalks often spiny or warty: lvs. hastate or sagittate; petioles long, sheathing at the base.—*Cyrtosperma* has 10–12 species, remarkably scattered in the tropics. Cult. presumably same as alocasia.

**Johnstonii**, N. E. Br. (*Alocasia Johnstonii*, Hort.). Tuberous: petiole 2–2 $\frac{3}{4}$  ft. long, olive-green, spotted rose, covered with fleshy, spine-like warts: lvs. sagittate, depressed in the middle, 1 $\frac{1}{2}$ –2 ft. long, olive-green, with prominent and beautiful red veins above. I.H. 27:395. G.W. 15, p. 340.—Intro. from the Solomon Isls. as *Alocasia Johnstonii*, but when it flowered it became evident that the plant is a *Cyrtosperma*.

*C. ferox*, Lind. & N. E. Br., is a second species of this genus, figured in I. H. 39:153, but not known to be in the American trade. It has narrow-sagittate lvs. on slender, very prickly petioles: spathe rather large, reflexed, greenish white. Borneo.

GEORGE V. NASH.†

**CYRTÓSTACHYS** (Greek for a *curved spike*). *Palmææ*, tribe *Aracææ*. Three or four palms of the Malayan region of stately habit, but little known in this country.

Stem spineless, slender and tall, crowned by a graceful cluster of pinnately divided lvs.: lfts. narrowly lanceolate, a little oblique, at the apex somewhat bifid: spadix short-peduncled, the branches more or less compressed, alternate, sometimes pendulous; fls. monœcious, the two kinds in 1 spadix; stamens 6, rarely 12 or 15: fr. small, elongate-ovoid, tipped by the persistent stigma. For cult., see *Areca*. The small and young lvs. of *C. Renda* are effective but old plants are not very attractive and scarcely known. G.C. II. 24:362.

**Rénda**, Blume. Height 25–30 ft.: lfts. linear or ensiform, obtuse but somewhat obliquely bifid, delicate gray beneath, the petioles dark, brownish red: spadix 3–4 ft. long, the branches nearly alternate, about 18 in. long. Sumatra. Var. **Duvivierianum**, Pynart. Lf.-stalks brightly colored. Malay Archipelago.

**Lákka**, Becc. Petioles green, not over 4 in. long: lvs. broad, boldly arched, 3 $\frac{1}{2}$ –4 $\frac{1}{2}$  ft. long, the lfts. nearly 18 in. long, 1 $\frac{1}{2}$  in. wide, obliquely bifid at the apex, pale beneath. Borneo.

N. TAYLOR.

**CYSTACÁNTHUS** (Greek for *bladder Acanthus*, because the flowers are inflated). *Acanthææ*. Evergreen herbs of Burma and Cochinchina, with showy, sessile fls. in the axils of bracts, the entire infl. more or less crowded into a terminal panicle or thyrs. Corolla-limb spreading, unequally 5-lobed, the lobes short-rotund; stamens 2; style filiform, the stigma 2-toothed: lvs. entire: caps. long and narrow, almost 4-sided, many-seeded. Doubtfully distinct from *Phlogacanthus*.—One species is cult. This is *C. turgida*, Nichols. B.M. 6043 (as *Meninia turgida*). It comes from Cochinchina: 2 ft. or less high, with prominently jointed sts. and opposite, elliptic-lanceolate lvs.: fls. white, yellow in the throat and pink-reticulated on the lobes. April. Cult. as other warmhouse acanthads. (See *Aphelandra* for example.) Prop. by cuttings of young wood. There are 4 or 5 species of *Cystacanthus* in farther India.

**CYSTÓPTERIS** (Greek, *bladder-fern*). *Polypodiææ*. Native ferns, with delicate foliage; deserve to be planted in the hardy fern garden.

Sori round, covered by a delicate indusium which is attached under one side and opens at the other, becoming hood-like in appearance and finally disappearing. The 5 species are native in the north temperate zone. Of easy cult. in shady, rich borders.

**bulbifera**, Bernh. Lvs. 8–24 in long, dark green, 3–5 in. wide, widest at the base, long tapering, tripinnatifid, bearing on the under surface of the rachis a series of bulb-like bodies, which germinate and prop. new plants. Canada to N. C.—Thrives best on lime-bearing rocks. Exceptionally useful and attractive on damp rocky banks.

**fragilis**, Bernh. Fig. 1200. Lvs. clustered, gray-green, 4–8 in. long besides the slender stalks, tripinnatifid, widest above the base. Widely distributed over the world at all altitudes.

L. M. UNDERWOOD.

**CÝTISUS** (Greek name for a kind of clover). *Leguminosææ*. Broom. Woody subjects, chiefly grown for their profusely produced yellow or sometimes white or purple flowers.

Mostly low shrubs, rarely small trees: lvs. trifoliate, sometimes unifoliate, rather small, alternate, deciduous or persistent, sometimes few and minute and branches almost leafless: fls. papilionaceous, axillary or in terminal heads or racemes, yellow, white or purple; stamens 10, connate; style curved: pod flat, dehiscent, with few or many seeds; seeds with a callose appendage at the base.—About 50 species in S. and Cent. Eu., Canary Isls., N. Afr. and W. Asia. For a monograph of the genus see Briquet, *Etude sur les Cytisides des Alpes Maritimes* (1894).

The brooms are ornamental free-flowering shrubs,



blooming most in early spring and summer. Nearly hardy North are *C. hirsutus*, *C. supinus*, *C. scoparius*, *C. nigricans*, *C. leucanthus*, while the evergreen species *C. canariensis*, *C. monspessulanus*, *C. filipes* are hardy only South. Most of the species are well adapted for borders of shrubberies, and thrive in almost any well-drained soil and in sunny position; they naturalize themselves often very quickly in dry, gravelly soil, where few other plants will grow; *C. scoparius* especially does so. The cytisus ought to be transplanted carefully and when young, as they do not bear transplanting well as older plants. Some dwarf species, like *C. Ardoinii*, *C. kewensis*, *C. emeriflorus*, *C. purpureus* and *C. leucanthus* are very handsome for rockeries. The evergreen *C. canariensis* and *C. racemosus* are much grown in the North as greenhouse shrubs, blooming profusely in early spring; also the white *C. multiflorus* and *C. filipes* make handsome pot-plants, and may be had in bloom in February with gentle forcing. For pot-plants, a light sandy loam with peat added forms a suitable compost. After flowering the plants should be cut back and repotted as soon as they start into new growth. After repotting, they are kept close and often syringed until they are established; then they ought to have plenty of air and only slight shade. When the new growth has been finished they may be put in the open air until frost is threatening. During the winter they should be kept in a cool greenhouse with plenty of light and carefully and moderately watered. From January they may be transferred gradually in a warmer house for forcing. Cuttings started in early spring, transplanted several times and then gradually hardened off, can be grown into flowering specimens for the following spring. Propagated by seeds sown in spring and by greenwood cuttings under glass; they are also sometimes increased by layers or by grafting. As stock *C. nigricans* is much used, or *Laburnum vulgare* for small standard trees; for plants grown in the greenhouse or South, *C. canariensis* is a good stock.

Of cytisus, the young growths root readily in December and January in the ordinary way. They should be shifted on as they grow. Good-sized plants can be produced if shifting and pinching is not neglected. By the following winter, the winter-propagated plants should be in 5-inch pots, in which size they are most useful. Keep very cool during winter, and withhold any forcing. They flower in March, or, if kept at a night temperature of 45°, as late as April. Syringe at all times to prevent red spider. To produce good-sized plants in one year, it is best to keep them plunged on a bench under the glass the entire summer, with little shade. Older plants can be plunged out-of-doors during July, August and September. (William Scott.)

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A. Calyx tubular, much longer than wide: lvs. always 3-foliolate: branches terete. (*Tubocytisus*.)

B. Fls. in terminal heads with bracts at the base, yellow to white.

1. *supinus*, Linn. (*C. capitatus*, Scop.). Shrub to 3 ft., with erect, or sometimes decumbent, villous branches: lfts. obovate or oblong-obovate, sparingly appressed pubescent above, villous pubescent beneath,

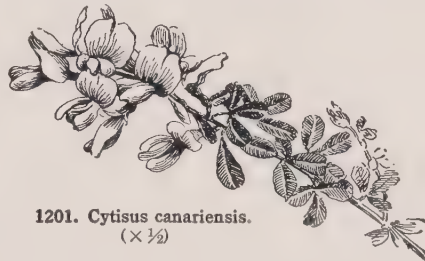
$\frac{3}{4}$ –1 in. long: fls. yellow, brownish when fading, nearly 1 in. long; standard pubescent outside or nearly glabrous: pod villous, 1–1½ in. long. July, Aug. Cent. and S. Eu. L.B.C. 5:497. J.H.III. 31:161 (as *Genista*).

2. *leucanthus*, Waldst. & Kit. (*C. albus*, Hacq.). Upright shrub, to 3 ft., with villous branches: lfts. 3. oblong-obovate, obtuse or acutish, appressed pubescent, sometimes glabrous above, ciliate,  $\frac{1}{8}$ – $\frac{3}{4}$  in. long: fls. 3–6, yellowish white; calyx appressed-villous; standard pubescent outside: pod about 1 in. long, appressed pubescent. June, July. S. E. Eu. Var. *pallidus*, Schrad. (*C. pallidus*, Kerner). Fls. pale yellow. Var. *schipkaensis*, Dipp. Low shrub, about 1 ft. high: fls. white. Bulgaria.—The oldest name for this species is *C. albus*, but as the same combination has been used by many writers for *C. multiflorus*, the name *C. leucanthus* is here used to avoid possible confusion.

BB. Fls. axillary, distributed along the branches.

c. Color of fls. yellow.

3. *hirsutus*, Linn. (*C. elongatus*, Hort., not Waldst. & Kit. *C. polytrichus*, Bieb. *C. ruthenicus*, Hort., not Fisch.). Shrub, to 3 ft., with erect or procumbent, villous, terete branches: lfts. obovate or obovate-oblong, villous pubescent beneath,  $\frac{1}{2}$ – $\frac{3}{4}$  in. long: fls.



1201. *Cytisus canariensis*.  
( $\times \frac{1}{2}$ )

2–3, short-petioled; calyx villous pubescent; standard glabrous on back: pod 1 in. long, villous. May, June. Cent. and S. Eu. Orient. B.M. 6819 (lfts. erroneously shown as serrate). L.B.C. 6:520 (as *C. falcatus*). B.R. 14:1191 (as *C. multiflorus*).

cc. Color of fls. white or purple.

4. *proliferus*, Linn. Shrub, to 12 ft., with long and slender pubescent branches: lfts. oblanceolate, silky pubescent beneath, green and sparsely pubescent above, 1–1¼ in. long: fls. white, 3–8; pedicels rather long, tomentose; calyx tomentose; standard pubescent outside: pod densely tomentose-villous, 1½–2 in. long. May, June. Canary Is. B.R. 2:121. L.B.C. 8:761. G. 32:291.—Recommended as a fodder plant for Calif.

5. *purpureus*, Scop. Procumbent or erect shrub, to 2 ft., quite glabrous: lvs. rather long-petioled; lfts. oval or obovate, dark green above,  $\frac{1}{2}$ –1 in. long: fls. 1–3, purple; calyx reddish: pod black, 1–1½ in. long. May, June. S. Austria, N. Italy. B.M. 1176. L.B.C. 9:892. G.C. III. 36:217; 50:163. Gn. 21, p. 421. J.H. III. 49:399. Var. *albus*, Kirchn. Fls. white. G. 6:433. Var. *albo-carneus*, Kirchn. (var. *carneus*, Hort.). Fls. light pink. Var. *atropurpureus*, Dipp. Fls. dark purple. Var. *elongatus*, André (var. *pendulus*, Dipp.), with slender, pendulous branches and purple fls., is sometimes grafted high on *Laburnum*. There exists an interesting graft hybrid of this species and *Laburnum vulgare*, for which see *Laburnum Adamii*.

AA. Calyx campanulate, as long or only slightly longer than wide: branches grooved or angled.

B. Fls. axillary along the branches.

C. Lvs. simple: fls. yellow: procumbent shrubs. (*Coro-thamnus*.)

6. *decumbens*, Spach. Prostrate shrub, 4–8 in. high: branchlets 5-angled, glabrescent: lvs. oblong-obovate,

obtuse or acutish, pilose on both surfaces, ciliate,  $\frac{1}{3}$ – $\frac{3}{4}$  in. long: fls. yellow, 1–3; calyx sparingly pilose; standard broadly obovate,  $\frac{1}{2}$  in. broad: pod  $\frac{1}{2}$ – $\frac{3}{4}$  in. long, pilose, with 3–4 seeds. May, June. S. Eu. B.M. 8230. L.B.C. 8:718.

cc. *Lvs. 3-foliate (in Nos. 9 and 10 partly simple).*

d. *Plant a prostrate shrub: fls. yellow or yellowish white. (Trianthocytisus.)*

7. **Ardoinii**, Fournier. Prostrate shrub, about 1 ft. high: branchlets grooved, pubescent: lvs. long-petioled; lfts. 3, linear-oblong, acute, covered with spreading hairs,  $\frac{1}{4}$ – $\frac{1}{2}$  in. long: fls. golden yellow, 1–3, crowded at the end of short lateral branchlets, nearly  $\frac{1}{2}$  in. long: pod very villous,  $\frac{3}{4}$  in. long. April, May. S. France. Moggridge, Flora of Mentone 58.—Very handsome, but tender.

8. **kewénsis**, Bean (*C. Ardoinii*  $\times$  *C. multiflorus*). Prostrate shrub: lfts. 3, linear-oblong, clothed with short soft pubescence,  $\frac{1}{3}$ – $\frac{1}{2}$  in. long: fls. yellowish white, 1–3, along slender branches,  $\frac{1}{2}$  in. long. May. Originated at Kew. Gn. 60, p. 348; 69, p. 282; 73, p. 228; 75, p. 273. G.M. 44:579; 51:355. G.W. 16, p. 610.—Like the preceding well adapted for rockeries or for forming a close covering to the ground.

dd. *Plant an upright shrub: foliage scarce.*

e. *Style slightly curved, shorter than keel: fls. white or yellowish white. (Spartothamnus.)*

9. **multiflorus**, Sweet (*C. albus*, Link, *C. Linkii*, Janka. *Spartium multiflorum*, Ait.). Shrub, to 3 ft., with slender, erect, grooved branches pubescent at first: lvs. short-petioled, 1- to 3-foliate; lfts. obovate-oblong to linear-oblong,  $\frac{1}{4}$ – $\frac{1}{2}$  in. long, sparingly appressed-pubescent: fls. axillary, 1–3, white,  $\frac{1}{3}$ – $\frac{1}{2}$  in. long: pod appressed-pubescent, usually 2-seeded. May, June. Spain, N. Afr. Gn. 64, p. 251; 69, p. 92; 72, p. 276. G.M. 49:579. G.W. 5, p. 111. Var. **incarnatus**, Sweet. Fls. white, slightly blushed. L.B.C. 11:1052 (as *Spartium*).

10. **præcox**, Bean (*C. multiflorus*  $\times$  *C. purgans*). Shrub, to 10 ft., with slender upright or arching branches: branchlets grooved, pubescent at first: lfts. usually 1, sometimes 3, short-petioled, oblanceolate or linear-spatulate, silky pubescent,  $\frac{1}{3}$ – $\frac{3}{4}$  in. long: fls. 1–2, yellowish white, very numerous along the slender branches, nearly  $\frac{1}{2}$  in. long: pod appressed-pubescent, about 1 in. long, usually 2-seeded. May. Of garden origin. G.C. III. 29:41. Gn. 56, p. 37; 65, p. 438; 69, p. 318. G.M. 44:581; 52:183. M.D.G. 1903:265. G.W. 3, p. 221. Var. **albus**, Smith. Dwarfier, more pendulous: fls. white. Gn. 75, p. 192. Var. **luteus**, Smith. Dwarf: fls. yellow.—This hybrid is one of the most floriferous of all brooms.

11. **filipes**, Webb (*Spartocytisus filipes*, Webb). Shrub, with slender, angulate, thread-like branches: lvs. slender-petioled, 3-foliate, nearly glabrous; lfts. linear-lanceolate: fls. axillary, 1–2, fragrant, pure white; wings much longer than the keel. Feb.–May. Teneriffa.—As *C. palmensis*, Hort., in the American trade.

EE. *Style longer than keel, spirally incurved: fls. bright yellow or partly crimson, rarely pale, large. (Sarthamnus.)*

12. **scoparius**, Link (*Sarthamnus scoparius*, Wimm. *Spartium scoparium*, Linn.). SCOTCH BROOM. Shrub, to 10 ft., with erect, slender branches: lvs. short-petioled, 1–3-foliate; lfts. obovate or oblanceolate, sparingly appressed-pubescent,  $\frac{1}{4}$ – $\frac{1}{2}$  in. long: fls. usually solitary,  $\frac{3}{4}$  in. long; calyx and pedicels nearly glabrous; pod brownish black, glabrous, villous only at the margin. May, June. Cent. and S. Eu. G. 25:169.—The tops are used for their sedative and diuretic properties. In Germany the fls. also are used medicinally. Var. **Andreanus**, Dipp. (*Genista Andreana*, Puissant).

Fls. yellow with dark crimson wings. R.H. 1886:373. Gt. 40:1342. R.B. 19:129. J.H. III. 32:462.—A beautiful and striking variety. Var. **albus**, Loud. (var. **pallidus**, Hort. var. **ochroleucus**, Zabel., var. **sulphureus**, Arb. Kew). With yellowish white or pale yellow fls. Gn. 61, p. 299; 65, p. 375. G.M. 44:580. Var. **pendulus**, Arb. Kew (*C. grandiflorus*, Hort., not DC. *C. cantabricus*, Hort., not Willd.). With slender pendulous branches. There is also a variety with double fls.—All the vars. are more tender than the type. The Scotch broom, *C. scoparius*, has become established in this country, as a naturalized plant, in waste places from Nova Scotia to Va.; and it is also reported from Vancouver Isl. It is also recommended by landscape gardeners for covering raw and broken places. Its yellow fls. and nearly bare sts. make a unique combination in the American landscape. Even when it kills to the ground in winter, it throws up its sts. again in the spring.

BB. *Fls. in terminal racemes, sometimes umbel-like, yellow: branches very leafy.*

c. *Foliage deciduous: branches terete: racemes very long and slender. (Phyllocytisus.)*

13. **nigricans**, Linn. (*Lembotropis nigricans*, Griseb.). Shrub, 2–4 ft., with erect, appressed-pubescent branches: lvs. long-petioled; lfts. obovate or oblong-obovate, glabrous above, appressed-pubescent beneath,  $\frac{1}{2}$ –1 in. long: racemes very long and slender, 3–8 in. long. June, July. Germany, N. Italy, Hungary. L.B.C. 6:570. B.R. 10:802. B.M. 8479. R.B. 26:3. Var. **elongatus**, Borkh. (var. **longespiciatus**, Hort.). Blooming again in fall at the top of the elongated fruiting racemes. R.H. 1891, p. 149 (as var. *Carlieri*).

cc. *Foliage persistent: branches grooved. (Telina.)*

d. *Lvs. distinctly petioled, obovate or obovate-oblong.*

e. *Racemes nearly capitate, 3–9-fl., at the end of short lateral branchlets.*

14. **monspessulanus**, Linn. (*C. candicans*, DC. *Genista candicans*, Linn.). Shrub, to 10 ft.: branches villous-pubescent when young: lvs. short-petioled, usually glabrous above, pubescent beneath; lfts. obovate or obovate-oblong, mucronulate,  $\frac{1}{3}$ – $\frac{3}{4}$  in. long: racemes 3–9-fl., short, leafy at the base; fls. fragrant, bright yellow: pod rufous-villous. May, June. Mediterranean, Canary Is. W.D.B. 1:80 (not good).

EE. *Racemes longer, 6- to many-fl., second, terminal and lateral.*

f. *Petioles  $\frac{1}{2}$  in. long or shorter; lfts. usually obovate, less than  $\frac{1}{2}$  in. long.*

15. **canariensis**, Kuntze (*Genista canariensis*, Linn.). GENISTA of florists. Fig. 1201. Much-branched shrub, to 6 ft., with villous-pubescent branches: lfts. cuneate, obovate or oblong-obovate, rounded at the apex, pubescent on both sides,  $\frac{1}{4}$ – $\frac{1}{2}$  in. long: racemes usually many-fl., dense and rather short; fls. fragrant, bright yellow. May–July. Canary Is. A.F. 6:802. R.B. 26:229. Var. **ramosissimus**, Briquet (*C. ramosissimus*, Poir. *C. Attheyanus*, Hort.). Lfts. very small, glabrous above: racemes short, but numerous. L.B.C. 13:1201. B.R. 3:217.

16. **racemosa**, Nichols., not Marn. (*Genista formosa*, Hort.). Fig. 1202. Shrub, to 6 ft.: branches pubescent: lvs. rather long-petioled; lfts. oblong-obovate, mucronulate,  $\frac{1}{2}$ – $\frac{3}{4}$  in. long, silky pubescent on both sides: racemes elongated, many-fl., second and rather loose, 2–4 in. long. Probably of garden origin and hybrid between *C. canariensis* and *C. maderensis* var. **magnifoliosus**. A. F. 6:802; 13:1136. F-E. 9:431.—Better florists' plant than the last; much grown as a pot-plant and forced for early spring and Easter. Var. **Everestianus**, Rehd. Fls. of a deeper shade of yellow, very free-flowering. R.H. 1873:300.



FF. Petioles  $\frac{1}{2}$  in. long or longer; lfts. oblong-obovate, about  $\frac{1}{2}$  in. long or longer.

17. *maderénsis*, Masferrer (*Teline maderénsis*, Webb). Shrub or small tree, to 20 ft.: lvs. slender-petioled, crowded; lfts. oblong-obovate, silky pubescent on both sides, or smooth above, acute or acutish,  $\frac{1}{8}$ – $\frac{3}{4}$  in. long; racemes 6–12-fld., rather short, fulvous or silky pubescent; fls. bright yellow, slightly fragrant; pod 5–7-seeded. May, June. Madera. Var. *magnifoliósus*, Briquet (*Teline stenopétala*, Webb. *C. stenopétalus*, Christ. *C. racemósus*, Marnock). Lvs. larger,  $\frac{1}{2}$ – $1\frac{1}{2}$  in. long; racemes elongated, 10–20-fld. Madera. Marnock, Floricult. Mag. 2:19. B.R. 26:23 (as *Genista bracteolata*). Webb & Berthelot, Phytogr. Canar. 45.— Sometimes cult. as *C. splendens*, but less desirable as a greenhouse plant than the two preceding species.

DD. Lvs. nearly sessile, linear or linear-lanceolate.

18. *linifolius*, Lam. Shrub, to 3 ft., with erect, appressed-silky tomentose branches: lfts. linear or linear-lanceolate, acute, revolute at the margin, nearly glabrous and shining above, silvery pubescent beneath,  $\frac{1}{2}$ –1 in. long; racemes short and compact; fls. bright yellow; pod torulose. April–June. Spain, N. Afr., Canary Isls. B.M. 442.

*C. Adamii*, Poir.—*Laburnum Adamii*.—*C. alpinus*, Mill.—*Laburnum alpinum*.—*C. austriacus*, Linn. Allied to *C. supinus*. Lfts. narrow, oblanceolate, silky pubescent on both sides; fls. yellow; calyx densely villous. S.E. Eu., Caucasus.—*C. Bearii*, Nichols. (*C. Ardoinii*  $\times$  *C. purgans*). Low shrub with golden yellow fls., and narrow mostly simple lvs. G. 30:207.—*C. biflorus*, L'Her. = *C. ratibonensis*.—*C. cantabricus*, Willd. Allied to *C. scoparius*.

but prostrate, with silky lvs. and large bright yellow fls.: pod villous. May. Spain.—*C. congestus*, Ball (*Teline congesta*, Webb). Allied to *C. linifolius*. Densely villous-tomentose, small-lvd.: lvs. short-petioled; racemes short. Teneriffa.—*C. Dallimòrei*, Rolfe (*C. multiflorus*  $\times$  *C. scoparius* var. *Andreanus*). Upright shrub with pale purple fls. G.C. III. 51:198. Gn. 74, p. 291. G.M. 55:11. B.M. 8482. There are forms with sulfur-yellow and one with orange-yellow fls.—*C. elongato-purpureus*, Hort. = *C. versicolor*.—*C. elongatus*, Waldst. & Kit. = *C. ratibonensis* var. *elongatus*.—*C. emeriflorus*, Reichb. (*C. glabrescens*, Sartor. not Schrank). Allied to *C. Ardoinii*: Sparingly appressed-pubescent; branchlets angled; fls. yellow; pod glabrous. N. Italy. G.W. 15, p. 557.—*C. fragrans*, Lam. Allied to *C. filipes*. Petioles short; lfts. densely pubescent; fls. fragrant, white. Spring. Teneriffa. J.H. III. 50:448.—*C. glabrescens*, Sartor., not Schrank = *C. emeriflorus*.—*C. handsworthensis*, Paul & Sons. "A white-fld. plant suitable for the rockery."—*C. Hillebrandtii*, Briquet (*Genista Hillebrandtii*, Christ). A suffruticose species, with long, slender hairy sts. and trifoliate hairy lvs. Canary Isls.—*C. incarnatus*, Hort. = *C. versicolor*.—*C. Laburnum*, Linn. = *Laburnum vulgare*.—*C. nubigenus*, Link = *C. fragrans*.—*C. purgans*, Willd. Shrub, to 3 ft., appressed-pubescent; branches striped; lvs. 1–3-foliate, oblong or linear-lanceolate; fls. axillary, yellow, fragrant; pod glabrous. May–July. Spain, S. France.—*C. ramentaceus*, Sieb. = *Petteria ramentacea*.—*C. ratibonensis*, Schaeff. Allied to *C. hirsutus*. To 3 ft.: branches slender, appressed-pubescent; lfts. glabrous above, silky beneath; fls. 1–2, yellow; calyx with appressed, yellowish, silky hairs. April–June. M. Eu., W. Asia. Var. *elongatus*, Koch. More erect; fls. larger, 3–5; calyx with somewhat spreading hairs. B.R. 4:308 (as *C. biflorus*).—*C. sessilifolius*, Linn. Allied to *C. nigricans*. Quite glabrous; lvs. nearly sessile, with roundish-obovate lfts.: racemes short, 4–11-fld. May, June. S. Eu. B.M. 255.—*C. Spachianus*, Kuntze (*Genista Spachiana*, Webb). Closely related to *C. canariensis*. Taller: lfts. obovate, acuminate; racemes somewhat elongated. Canary Isls. B.M. 4195.—*C. triflorus*, L'Her. Similar to *C. hirsutus*. Fls. long-pedicelled, yellow; calyx-tube short, not tubular. April, May. S. Eu., N. Afr. Tender. F.C. 3:102.—*C. versicolor*, Dipp. (*C. hirsutus*  $\times$  *C. purpureus*). Low shrub, with sparingly villous lvs.: fls. yellowish white and pale purple. Sometimes cult. as *C. incarnatus*.—*C. Weldenii*, Vis. = *Petteria ramentacea*.

ALFRED REHDER.



1202. *Cytisus racemosus*.  
( $\times \frac{1}{2}$ )

# D

**DABŒCIA** (after its Irish name, St. Dabeoc's Heath). More commonly spelled Daboëcia, and sometimes Dabeocia. Syn., *Borëta. Ericacææ*. Shrub cultivated for its purple flowers appearing in summer.

Low evergreen with alternate entire lvs. and drooping pedicelled fls. in long terminal racemes: corolla ovoid, contracted at the mouth and shortly 4-lobed, with recurved lobes; stamens 8, included; caps. 4-celled, dehiscent.—One species in W. Eu.

This is a very pretty heath-like plant, with purple or white flowers in elegant loose racemes, well adapted for rockeries or borders of evergreen shrubberies. Requires protection North during the winter, and thrives best in a peaty, sandy soil. Propagated by seeds treated like those of *Erica*, and by cuttings of half-ripened wood under glass.

**cantábrica**, Koch (*D. polifolia*, Don. *Borëta cantábrica*, Kuntze. *Menziësia polifolia*, Juss.). IRISH HEATH. To 2 ft.: branchlets glandular pubescent: lvs. elliptic, the uppermost narrower, revolute at the margin, whitish tomentose beneath, shining and dark green above,  $\frac{1}{4}$ – $\frac{1}{2}$  in. long: racemes many-fl.; corolla  $\frac{1}{8}$ – $\frac{1}{2}$  in. long, purple in the type. June–Oct. Ireland, W. France, N. Spain, Azores. Gn. 52:344; 71, p. 442; 76, p. 490. Gn. M. 3:336. R.B. 3:121. Gt. 47:1450. S.B.F.G. 2:276.—There are many varieties, as *alba*, Dipp., with white fls. (Gn. 22, p. 302); *bicolor*, Dipp. (var. *striata*, Hort.), with white- and purple-striped fls.; *rosea*, Rehd. (*Borëta cantábrica rosea*, Koopmann), with pink fls.; *atropurpurea*, Dipp., with dark purple fls.; *nana*, Rehd. (*Menziësia polifolia nana*, Lodd. *M. polifolia pygmæa*, Arb. Kew). Dwarf; with small and narrow lvs. L.B.C. 20:1907.

ALFRED REHDER.

**DACRÝDIUM** (Greek-made name, referring to the tear-like exudations). *Taxacææ*. About 16 species of New Zeal., Austral., Malaya and Chile, being trees or shrubs with closely imbricated scale-like lvs. on old trees and linear or linear-subulate spreading lvs. on young trees and lower branches, none apparently in the trade in this country but more or less grown in European arboreta; allied to *Podocarpus*, from which it differs in having dimorphic lvs., peduncle of fr. dry or fleshy (fleshy and enlarged in *Podocarpus*), and the ovule becoming erect; and to *Phyllocladus*, which differs in having cladophylla and the true lvs. reduced to minute scales. *Dacrydium* is dioecious or rarely monœcious, the fls. not in cone-like structures; male fls. solitary at tips of branchlets and with the uppermost lvs., females nearly or quite terminal under the lf.-like scales: seeds nut-like, ovoid, borne in a cup-like fleshy or thin aril.—These more or less spruce-like trees sometimes attain a height in their native

regions of 75–100 ft. Some of the species may be expected to thrive in the southern areas.

**DÁCTYLIS** (Greek *daktulos*, a finger). *Graminææ*. A perennial tufted grass with flat blades, thin prominent ligules and sheaths closed nearly to the throat, grown for forage and one form for ornament.

Panicles glomerate; spikelets 2–5-fl., nearly sessile in dense 1-sided fascicles, these arranged in a panicle; lemmas hispid-ciliate on the keels, awn-tipped, compressed.—Species 1, north temperate regions of the Old World.

**glomerata**, Linn. ORCHARD-GRASS. Fig. 1203. A coarse grass, 2–3 ft., forming large tussocks: panicle a few stiff branches, expanding in fl., afterwards appressed. Dept. Agric., Div. Agrost. 20:145.—Commonly cult. as a pasture and meadow grass and useful for lawns under trees. Var. *variegata*, Hort., is a dwarf form of compact habit with foliage variegated silver and green; used for borders. Prop. by division; of easy cultivation.

A. S. HITCHCOCK.

**DACTYLOCTËNIUM** (Greek, *daktulos*, finger, and *ktenion*, a little comb). *Graminææ*. FINGER-COMB GRASS. Annual grasses with spreading or creeping stems, one of which has been offered as an ornamental subject.

Spikelets several-fl., sessile, crowded in 2–6 digitate 1-sided, rather broad, flattened spikes; axis of spike extending beyond the spikelets as a naked point. Species 2, warm regions of the Old World. One species, *D. ægyptium*, Richt. (*D. ægyptiacum*, Willd. *Eleusine ægyptica*, Desf. *Cynosurus ægyptius*, Linn.), Crow-Foot, is a common weed in Trop. Amer. The 3–5 short spikes are divaricate at the summit of the culms, about 2 in. long.—It has been offered as an ornamental grass for garden cult., but has little value. Mojave Indians of S. Calif. use the grain for food. In Afr. a decoction is prepared from the seeds for inflammation of the kidneys.

A. S. HITCHCOCK.

**DÆDALACÁNTHUS** (Greek words, signifying an *acanthad* of curious structure). *Acanthacææ*. Tropical shrubs or sub-shrubs, with blue or rose-colored flowers, sometimes grown under glass and in the open in warm countries.

Leaves entire or scarcely dentate: fls. in bracted spikes which are sometimes paniculate, the bracts usually much exceeding the calyx; calyx deeply 5-lobed or -parted; corolla-tube elongated and slender, more or less curved, bearing an oblique spreading 5-lobed limb; perfect stamens 2, affixed in the throat, included; style slender and recurved: fr. an ovate or oblong caps., the seeds 4 or fewer.—Some 15 to 20 species in E. India and Malay Archipelago; by some authors the name *Eranthemum* is applied to these plants



1203. Orchard-grass.—*Dactylis glomerata*. (plant  $\times \frac{1}{2}$ )



and what are known as *Eranthemum* in this work then become *Pseuderanthemum*.

This genus contains some tender shrubs of rather difficult culture under glass, but great favorites in the tropics, particularly in India. *D. nervosus* is a popular winter- and spring-blooming shrub in southern Florida. It has blue flowers an inch across, five-lobed, and shaded purple at the mouth of the tube. For culture, see *Justicia*.

**nervosus**, T. Anders. (*Eránthemum nervosum*, R. Br. *E. pulchellum*, Andr., and some dealers, while that of others is *E. bicolor*, and that of Roxburgh is *D. purpurascens*). Fig. 1204. Glabrous or very nearly so: lvs. ovate or elliptical, acuminate at both ends, somewhat crenate or entire: spikes axillary, opposite, overlapping and interrupted: bracts elliptical, acute, nervose: limb of the corolla as wide as the tube is long. India. B.M. 1358 (as *Justicia nervosa*). Gn. 51:352. G.C. II. 21:415.—A very pretty shrub for the warm-house, 2-6 ft., its fls. being of a color that is not very common in winter-blooming plants. It is an easy subject to manage, requiring a light, rich soil, full sunlight and plenty of water. Cuttings of young growth root readily in a warmhouse.

**macrophyllus**, T. Anders. St. pubescent toward top: lvs. elliptic-lanceolate, ovate-acuminate, attenuate at base: spikes linear, somewhat interrupted: bracts elliptic, rather obtuse, nervose: fls. pale violet-blue. India. B.M. 6686.—Differs from *D. nervosus* in laxer infl., hairy lvs. which are scabrid-pubescent on the nerves beneath, and more pubescent shoots.

**Wáttii**, Bedd. (*D. párvus*, C. B. Clarke). Slender, 2 ft.: lvs. deep green with a light metallic shade, very broad-ovate: fls. 1 in. across, blue or violet-blue, the corolla-lobes broad-obovate and narrowed abruptly to a point, the white stigma protruding from the narrow throat. India. G.M. 44:645. G.C. III. 32:311. A.F. 17:382.—A good dwarf species with fls. in dense clusters, blooming in pots when 1 ft. high and flowering in Sept. Requires a warmhouse treatment; grows well in sandy loam; prop. by cuttings. L. H. B.†

**DÆMÓNOROPS** (probably means *God-like*, of *divine appearance*). *Palmææ*, tribe *Lepidocárpeæ*. Slender pinnate palms grown for their graceful foliage, but little known in Amer. outside of botanic gardens. Differs from *Calamus* (with which it is by some united) only in having the outer sheaths or spathes boat-shaped, deciduous, at first inclosing the inner sheaths; its more longly stalked fls. also separate it from *Calamus*.—About 85 species, all Trop. Asiatic. Only a very few are in cult. Treatment and general cultural conditions of *Calamus*. *D. Draco* produces some of the "dragon's blood" of commerce. See page 3568.

A. *Young lvs. green.*

B. *Sts. erect or climbing, sometimes both in one plant.*

**calicárpus**, Mart. (*Calamus calicárpus*, Griff.). St. erect or climbing, 1 in. diam.: lvs. 6-8 ft. long, upper small with long flagella; lfts. numerous, 12-13 in. long,  $\frac{1}{3}$ - $\frac{1}{2}$  in. wide; petiole 1 ft., the base not gibbous or puckered: fr. about  $\frac{3}{4}$  in. diam., tawny. Malacca.

**melanochætēs**, Blume. St. erect: lvs. pinnate, 10-12 ft. long in nature, the pinnae long and narrow, dark green and drooping, furnished with many cirrhi, the petioles sharp-spined at the sheathing base: fr. yellow-green. Malaya.—Very decorative. A small form is var. *microcárpus*. Little known in U. S.

BB. *Sts. always climbing.*

**Lewisianus**, Mart. (*Calamus Lewisianus*, Griff.). St. climbing, 1 in. diam.: petiole 1 ft., base much swollen, armed below with scattered, short, deflexed spines, and above with straight and hooked spines  $1\frac{1}{4}$  in. long; lfts. 13-15 in. long,  $\frac{3}{4}$ -1 in. wide; sheath

armed with solitary or seriate flat-back spines: fr. pale yellowish. Penang.

**intermèdeus**, Mart. St. 15-20 ft.,  $\frac{3}{4}$  in. diam.: lvs. long-petioled, 4-6 ft. long; lfts. opposite or scattered, 18-20 in. long, 1-1 $\frac{1}{2}$  in. wide, linear-lanceolate, acuminate, margins and 3-5 costæ bristly above and below;



1204. *Dædalacanthus nervosus*. (× $\frac{1}{3}$ )

rachis semi-cylindrical, sparingly armed; petiole 1 ft. long, with flattened spines. Malaya.

AA. *Young lvs. brownish or straw-colored.*

**palembánicus**, Blume. St. erect: lvs. pinnate, broadly ovate, bright cinnamon-brown when young, and lfts. many, long, narrow, 1 $\frac{1}{2}$  ft. long, about  $\frac{1}{2}$  in. wide; petioles erect, with stout spines on the back, which are deflexed and not thickened at the base and are arranged singly or in series. Sumatra. F. 1873, p. 136.

**periacánthus**, Miq. Height 15 ft.: resembles *D. palembanicus*, but the young lvs. are nearly straw-colored, and the spines are placed in irregular rings. Sumatra.—A most graceful species.

*D. plumosus*, Hort. Graceful plume-like lvs., with pinnae 4 ft. or less long; petioles with rigid black spines with white bases. India. F. 1871, p. 39.—Not in cult. in N. Amer.

JARED G. SMITH.  
N. TAYLOR.†

DAFFODIL: *Narcissus*. Daffodil, Sea: *Pancratium*.

**DÁHLIA** (named after Professor Andreas Dahl, a Swedish pupil of Linnæus, and author of "Observationes Botanicae"). Syn. *Georgina*. *Compósitæ*. Stout perennial herbs, sometimes somewhat woody, much grown out-of-doors for the rich and profuse autumn bloom. Plate XXXIV.

Tuberous-rooted (Fig. 1205): st. mostly erect, branching, glabrous or scabrous: lvs. opposite, 1-3-pinnate: heads long-peduncled, large, with yellow disk and rays in a single series and mostly in shades of red and purple and also in white (in cult.); ray-fls. neutral or pistillate, disk-fls. perfect and fertile; involucre double, the inner series of thin scales that are slightly united at base, the exterior series smaller and somewhat leafy;

receptacle plane, bearing chaffy scales; rays spreading, entire or minutely 3-5-dentate; fr. oblong or obovate, strongly compressed on the back, rounded at the apex, obscurely 2-toothed or entirely bald.—Probably 10 or 12 species, in the higher parts of Mex., some of them now much modified by cult., and the domesticated forms often difficult of systematic study. The nomenclature of the group is confused because systematists are not agreed on the rank to be given to forms that have received independent names. Voss (*Blumengärtneri*) combines the three species of Cavanilles, *D. pinnata*, *D. coccinea*, and *D. rosea*, all under the name *D. pinnata*. His arrangement is as follows: *D. pinnata*, Cav.; var. *coccinea*, Voss (*D. coccinea*, Cav. *D. rosea*, Cav., in part. *D. frustanea*, DC. *D. crocea*, Poir. *D. bidentifolia* and *D. mexicana*, Hort.); var. *gracilis*, Voss (*D. gracilis*, Ort.); var. *Cervantesii*, Voss (*D. Cervantesii*, Lag.); var. *variabilis*, Voss (*D. variabilis*, Desf. *D. rosea*, Cav., in part. *D. sambucifolia*, Salisb. *D. superflua*, Ait. *D. purpurea*, Poir.). It seems to be well, however, to keep *D. rosea* and *D. coccinea* distinct, and perhaps also *D. pinnata*; and this is the method adopted for the present treatment. Of the three Cavanillesian names, *D. pinnata* has priority.

A. Plant very tall, tree-like.

B. Fls. nodding, bell-shaped.

*imperiælis*, Roezl. Height 6-18 ft.: sts. usually many from one base, mostly unbranched, knotty, 4-6-angled, usually dying to the ground in winter in S. Calif.: lvs. 2-3-pinnately parted; lfts. ovate, narrowed at the base, acuminate, toothed, with a few short scattered soft hairs; fls. nodding, 4-7 in. across, white, more or less tinged with blood-red, especially at the base; rays sterile or pistillate, lanceolate, sharp-pointed, not 3-toothed at the apex. Gt. 1863:407; 56, p. 22. G.C. 1870:459; II. 12:437; III. 34:178. B.M. 5813. Gn. 12:352; 33, p. 527; 61, p. 40. R.H. 1872:170; 1911, pp. 62-3. A.G. 15:313. Mn. 8, p. 61.—As few conservatories can make room for so large a plant, it is common to graft this species on dwarf varieties of *D. rosea*. The inflated and pointed fl.-buds (3-4 in. long) are very characteristic. It is not known whether the original plant collected by Roezl was found in wild or cult. surroundings. This species and the next are mostly cult. under glass if cult. at the N., but this species thrives in the open in Cent. Calif.; the others are grown outdoors in summer, and the roots stored in winter. Hybrids are reported between this species and *D. excelsa*.

BB. Fls. erect, not bell-shaped, but opening out flat.

*excelsa*, Benth. (*D. arborea*, Regel). Height to 20 ft. or more: sts. several from same base, usually



1205. Clustered roots of the garden dahlia.

beneath, with a few short scattered hairs or none; fls. 4½ in. across, dilute purple, crimson-pink. G.C. II. 19:80; III. 27:85.—This species was described from a cult. plant with 8 rays in a single row, but with considerably elongated disk-fls. It was almost an anemone-fl. type, and all the florets were sterile. *D.*

*arborea* has never been sufficiently described as a botanical species, but plants have been cult. for many years under this name. Var. *anemonæflora*, Hort. Disk of lilac or yellow tubular florets; rays flat.

AA. Plant medium, averaging 3 ft., commonly from 2-5 ft., rarely exceeding these extremes.

B. Lvs. once pinnate: st. not branching from the base: habit erect.

c. St. usually not glaucous: rays fertile.

D. Rays of the single fls. not recurved at the margins; of the double fls. never flat, but cupped.

*rosea*, Cav. (*D. variabilis*, Desf. *D. Barkeriæ* and *D. Royleana*, Knowl. & Westc.? *D. superflua*, Ait.



1206. *Dahlia rosea* (or *D. variabilis*). (× ½)

*D. purpurea*, Poir. *D. nana*, Andr. *D. crocata*, Lag. *D. coronata*, Hort.). Fig. 1206. Lvs. typically once pinnate, sometimes bipinnate; lfts. ovate, toothed, broader and coarser than in the other species. B.R. 55. B.M. 1885.—The original of practically all the old-fashioned dahlias, particularly the Single, Pompon, Show and Fancy types. It is therefore the parent of the vast majority of the horticultural varieties. This is a wonderfully variable species. Some plants are densely hairy, others scarcely at all. The lvs. are sometimes bipinnate in parts of plants or throughout an entire plant. In double forms the rays usually have abortive pistils. Many garden forms have glaucous sts. Some authors have doubted whether this species is distinct from *D. coccinea*, but the two types are very different in the garden, although there are intermediate forms in nature.

DD. Rays of the single fls. with recurved margins; of the double fls. not cupped, but long, flat and pointed, and some at least with recurved margins.

Juarézii, Hort. (*D. Yuarézii*, Hort.). CACTUS DAHLIA. Fig. 1207. Distinct in the bloom: heads bril-







XXXIV. Dahlia.—Jeanne Charmet, one of the most beautiful Decorative dahlias.



liant scarlet; fls. irregular in length and overlapping, the rays narrow. The Cactus dahlias all originated from one plant, which was flowered in Eu. for the first time in 1864, and first pictured in G.C. II. 12:433 (1879). F.M. 1879:383. Gn. 18, p. 589; 19:742; 56, p. 236. G.Z. 26:49.

cc. *St. glaucous*: rays not fertile.

**coccinea**, Cav. (*D. bidentifolia*, Salisb. *D. Cervantesii*, Lag. *D. Crœcea*, Poir.). Fig. 1208, redrawn from B.M. 762 (1804). Always more slender than *D. rosea*, with narrower lfts., and in the wild, at least, dwarfer than that species. The color range is much smaller, and does not include white or any shade of purple or crimson. The colors vary from scarlet, through orange to yellow. There are no double forms, and it has been said that this species will not hybridize with *D. rosea*. The named varieties pictured in I.H. 31:515 and 533 (1881), which are emphatically declared to be varieties of *D. coccinea*, are probably garden forms of *D. rosea*. The only characters that certainly distinguish *D. coccinea* from *D. rosea* are the glaucous sts. and infertile rays of the former, but these characters break down in garden forms. B.M. 762. Gn. 19:154. G.C. II. 12:525.

BB. *Lvs. twice pinnate*: sts. branched from the base: habit spreading.

**Mérckii**, Lehm. (*D. glabrata*, Lindl.). Fig. 1209, redrawn from B.M. 3878 (1841). Height 2-3 ft.: roots much more slender than those of *D. rosea*: st. and lvs. wholly devoid of hairs; lvs. bipinnate: floral bracts linear; fls. typically lilac; rays pistillate; outer involucre bracts linear. B.R. 26:29 (1840). Gn. 19:154 (1881).—This is a very distinct garden dahlia, and is worth growing merely as a foliage plant. The fine-cut character of the foliage makes it more attractive than the coarse foliage of most of the varieties of *D. rosea*. The plants are much dwarfer and wider spreading than most florists' dahlias, and show no st. while growing. The branched flowering sts. are remarkably long, slender and wiry, often rising 2-3 ft. above the foliage. The rays are very short and often roundish, with a short sharp point instead of 3 minute teeth. There are no red, yellow or white forms in nature. The roots of this and *D. coccinea*, being slenderer than those of *D. rosea*, must be preserved with greater care in winter.

*D. gracilis*, Ort. Lvs. bipinnate and ternately divided, glabrous, the lfts. small, ovate and coarsely toothed; fls. brilliant orange-scarlet; outer bracts of involucre almost orbicular: 4-5 ft., making a dense bush with very slender growths, bearing heads 2½-3 in. across. Apparently not in general cult.—*D. pinnata*, Cav. Plant scarcely 3 ft. high, glabrous: lvs. 5-foliate; lfts. ovate, crenate-dentate, glaucous beneath, sessile; rachis winged: fls. large, solitary; female corolla large, blue-red, exterior involucre with 6-7 bracts, ovate, narrowed toward the base, spreading and reflexed-incurved, the interior with coriaceous lobes. The plate of Cavanilles shows semi-double fls., i.e. with several rows of rays, with the rays incurved at the margin and becoming at the base nearly tubular.—*D. Zimapanii*, Roelz, is by some retained in Dahlia and by others referred to Bidens; in this work it is described under Cosmos (*C. diversifolius*).

WILHELM MILLER.  
L. H. B.†

### Types and varieties of the dahlia.

Practically all of the named varieties of dahlias have come from one immensely variable species, usually known as *D. variabilis*, but more properly as *D. rosea*. For garden purposes, however, a second form of great importance, *D. Jaurezii*, the parent of the Cactus forms, must be kept distinct. There are other species cultivated to a slight extent. It is curious that these showy plants should be closely related to a common weed, the beggar's tick, of the genus *Bidens*; but other species of Dahlia have leaves whose forms pass gradually into those of *Bidens*. Other close allies are *Cosmos* and *Coreopsis*. *Cosmos* flowers are some shade of purple, rarely white in wild nature, and only one species has yellow flowers; *Coreopsis* has yellow flowers

only; *Bidens*, yellow or white; and none of these genera has produced double-flowered forms of the first importance. Dahlia has all these colors and more, being far richer in bright reds, and lacking only sky-blue and its closely related hues, which are seen to perfection in the China asters.

Although dahlias are popular plants, especially in old gardens, they are destined to still greater popularity from the new "Cactus," "Decorative," "Peony-flowered," and "Collarette" types. There exists a prejudice against dahlias in many localities in which these new types have never been seen. This prejudice is part of a reaction against formal and artificial flowers in general. The old-time dahlias were round hard and stiff like a ball. The new-time dahlias are flatter, and tend toward loose, free, fluffy chrysanthemum-like forms. The dahlia has now become immensely variable.

Of the important and very variable florists' flowers, the dahlia was one of the latest to come into cultivation. The first break of considerable importance in the wild type occurred about 1814. Up to that time there were perhaps a dozen well-marked colors in good single-flowered varieties. Dahlias had been cultivated in Europe since 1789, and it is a curious fact that they showed signs of doubling the very first year of their European residence; but it was not until twenty-five years later that a marked gain in doubling was made. The dahlia seemed to be undeveloped until 1814, when the era of doubling began. Before another twenty-five years had passed, the dahlia had sprung into the front ranks of garden plants. In 1826 there were already sixty varieties cultivated by the Royal Horticultural Society. In 1841, one English dealer had over 1,200 varieties. Today it is not uncommon for the leading tradesmen to keep 500 to 1,000 distinct varieties. In the absence of good records, it is conjectured that over 3,000 different names of varieties have been published in the catalogues. Most of the varieties are the Show and Fancy types, which are as spherical and regular as possible, and differ only in color. At first the distinction between the two types



1207. The original Cactus dahlia.—*D. Jaurezii*.  
Reduced from the Gardeners' Chronicle, where  
it was first pictured

seems to have been the same as that between "self-colored" and "variegated" flowers in general. Lately, for purposes of exhibition in prize competitions, the following arbitrary distinction has been adopted: A Show dahlia (Fig. 1210) is often of one color; but if the edges of the rays are darker than the ground-color, the variety may be exhibited in the Show section. A Fancy dahlia (Fig. 1211) always has two or more colors, and if the rays are striped or if the edges are lighter than the ground-color, the variety must be exhibited in the Fancy section. The two types reached full perfection certainly by 1840, and after that date the improvements were mostly in matters of secondary importance. Most of the longest-lived varieties belong to the Show and Fancy type. These types held full popularity until about 1879, when the first Cactus dahlia appeared in England with a promise of new and freer forms. This form is the one which is perhaps farthest removed from nature, and it is probably so highly esteemed largely because the most work has been spent on it.



1208. *Dahlia coccinea*.  
Redrawn from the Botanical  
Magazine for 1804.

A reaction against formalism in all departments of life and thought set in about the time of the American Civil War. It was in the sixties that the Japanese chrysanthemums did much to emancipate the floral world. With dahlias the reaction came much later and has proceeded more slowly. The first Cactus dahlia was so called because of its resemblance in form, but chiefly in color, to the brilliant crimson-flowered *Cereus speciosissimus*, a well-known garden plant (which is known in the present work as *Heliocerus speciosus*). The name is now highly inappropriate because the color range of the pure Cactus type has been extended to include all of the important well-defined colors of which the dahlia seems capable. The original Cactus dahlia was named *Dahlia Juarezii*, after President Juarez, the "Washington of Mexico." It was pictured for the first time in the *Gardeners' Chronicle* for 1879, and this interesting picture is here reproduced in a reduced size in Fig. 1207. The type is still cultivated under the same name and in all essentials seems to be unchanged. Forms of the Cactus dahlia are shown in Figs. 1212, 1213.

The origin of the Cactus type, as of all the other types of dahlias, is uncertain, and our efforts to secure full and definite information upon some of the most interesting points may perhaps always be baffled.

A Dutch dealer secured a root from Mexico that produced one plant which is the parent of all the Cactus forms. It is not known whether the seed which may have produced the original root came from a wild or a cultivated flower. It has been said that seedlings of *D. Juarezii* have produced in cultivation forms approaching the Show type of *D. rosea*. The reverse process is also said to have taken place, but full, authoritative and convincing statements are wanting. In the garden, *D. Juarezii* is exceedingly distinct from the florists' forms of *D. rosea*. It is usually a slenderer, taller and longer-jointed plant, with much handsomer and more delicate foliage, the leaves being narrower than in the coarse and almost ugly foliage of the old forms. It has another peculiarity of growth, which is still one of the most serious defects in the true Cactus type: the plants tend to hide some of the flowers beneath their foliage. This comes about in a curious way. At a node between two young leaves there commonly appear, at about the same time three new growths; the middle one develops into a flower with a naked stalk only 2 or 3 inches long, while the side shoots quickly overtop it and repeat the same threefold arrangement. The other most serious objection to the true Cactus type is that it does not stand shipment well and does not last so long as a cut-flower as the Show dahlias.

The Decorative or Cactus Hybrid types are numerous, and their popularity is more modern. They have been largely seedlings from show flowers. Their rays are rarely, if ever, recurved at the margins. All the other types of dahlias are well defined, and a single picture of each one will represent its type with sufficient exactness. No one picture, however, can give any conception of the great variety of forms included in this more or less open horticultural section. The name Cactus Hybrid means practically "miscellaneous," and is analogous to the "Japanese" section of chrysanthemums. It is on this section and the pure Cactus type that the greatest hopes for the future of the dahlia are based.

Dahlias considered to be of true Decorative type are those possessing broad flat and nearly straight petals, arranged somewhat irregularly; but the flowers are not spherical in shape like the Show dahlia, but are inclined to be flat and massive, and are always full to the center. Dahlias of this character score a greater number of points at exhibitions.

The Colossal dahlia is the basis of much discussion, especially at exhibitions, the cause of debate being that these dahlias are in reality not classified; that is, the same variety is exhibited in one display as a Show dahlia, and in the next as a Decorative dahlia; but in reality there should be a Colossal class for this type of dahlia. This type, if it may be so called, has large cupped but not quilled rays or petals; the flowers are 5 inches and over in diameter, and spherical in shape; they therefore partake of both types, but are sufficiently different to spoil the harmony, when exhibited in either the Show or Decorative class. "Le Colosse" is the first of this type of dahlia, and hybridization has given a large number of seedlings, which are almost identical in form, shape, and size, the most prominent being at present American Beauty, Giant Purple or Royal Purple, J. K. Alexander, Surpasse Colosse, and Janne (Yellow) Colosse.

The Pompon type is a small form of the Show and Fancy types. It has the same colors and the same form, but the flowers are smaller and more abundant. As a rule, the smaller the flowers the prettier and more individual they are. The larger they are, the more they suffer by comparison with the Show type. Perhaps their greatest point is their productiveness. When profusion is the main idea, not great size and quality, the Pompons are the favorite type of dahlia for cut-flowers.



The Single dahlias may be freely produced, but they are not so lasting for cut-flowers. The Single type has had many ups and downs. In the reaction against formalism, it came to the front about 1881, and for several years thereafter several hundred forms were kept distinct and they were made the chief feature of

the European shows. When the dahlia first came into cultivation, its rays were relatively long, slender, acuminate, notched at the end, and with such wide spaces between the tips of the rays as to give the flower a stellate appearance. In the course of the evolution of the single type, the gardeners retained the most regular and symmetrical forms. Single dahlias with always and only eight rays were preserved. The rays of dahlias became broader and rounder, as in



1209. *Dahlia Merckii*.

Redrawn from the Botanical Magazine, for 1841.

Fig. 1214, until finally in pedigree varieties the vacant spaces were closed up. The same mental ideals have produced the rose-petaled geraniums and the shouldered tulips. In a high-bred single dahlia there are no minute teeth or notches at the tips of the rays.

Most of the single dahlias of high pedigree have rays of uniform coloration with no secondary color at the base, but a few have a distinct ring of color at the base, often called an "eye or crown," which is sometimes yellow and rarely red or some other color. Usually the rays of a single dahlia are spread out horizontally, sometimes they bend back, and rarely they bend inwards and form a cup-shaped flower. These three forms can doubtless be separated and fixed during those periods when the interest in the Single type warrants it. Semi-double forms are frequent (Fig. 1215).

Single dahlias are likely to lose some of their rays after a day or two in a vase. In cutting them it is well to choose the younger flowers. A vigorous shake often makes the older ones drop their rays. It is an easy matter to keep the seeds from forming, simply by removing the flowers as they mature, and by so doing save the strength of the plant for the production of flowers.

There are three other dahlia types of minor importance,—the Single Cactus, the Pompon Cactus and Tom Thumb. The Single Cactus type differs from the common Single type in having rays with recurved margins, which give a free and spirited appearance to the flowers. Instead of spreading out horizontally, the rays often curve inward, forming a cup-shaped flower. This type originated with E. J. Lowe, Chepstow, England, was developed by Dobbie & Co. about 1891, and was first disseminated in 1894. The Single Cactus dahlias are very interesting and pretty. The Tom Thumb type is a miniature race of round-rayed single dahlias, which grow from 12 to 18 inches high, and are used for bedding. The type originated in

England with T. W. Girdlestone, and was developed and introduced by Cheal & Sons.

The "green" dahlia (*Dahlia viridiflora*, Hort.) is an interesting abnormal form in which the rays are partially or wholly suppressed, and the chief feature of interest is a confused mass of green, not resembling petals at all, but evidently a multiplication of the outer involucre scales, which, in the dahlia, are green, leafy bracts. The "green" dahlia is not unhealthy; it is as strong and vigorous as any of the other forms, but very unstable and variable, producing flowers of solid green color, others of green with small cup-shaped crimson-scarlet petals intermingled, and others of solid crimson-scarlet color, and all on the same plant. This freak was pictured as long ago as 1845 in G.C., p. 626; and again in G.C. III. 30: 294.

Another interesting variation which hardly ranks in present importance with the eleven types contrasted below is the lacinated form, which makes a very pretty though rather formal effect. Examples are Germania Nova, Mrs. A. W. Tait and its yellow variety among large double forms, and White Aster among the Pompons. In these cases, the notches at the tips of the rays, instead of being minute and inconspicuous, are deepened so much that they give the lacinated effect. At present this form is available in a very narrow range of colors. It is not probable that it will be an important factor in producing chrysanthemum-like forms.

Another form which baffles description, but is nevertheless very distinct, is that of Grand Duke Alexis. It is nearer the Show type than any other, but is perhaps best classed with the Cactus Hybrid section, simply because it seems advisable to keep the Show type the most sharply defined of all. It is a very flat flower, and the rays are remarkably folded, leaving a round hole at the top of each one. Up to 1909 the variety of colors of the type of Grand Duke Alexis has been increased, including the varieties Dreer White, Mrs. Roosevelt, Purple Duke, Pythias, W. W. Rawson, and Yellow Duke.

About midway between Grand Duke Alexis and the Show or cupped type is an interesting form, the "quilled" dahlia, a name which is perhaps necessary, though unfortunate. In A. D. Livoni the rays are rather tightly folded for about two-thirds of their length, leaving a round hole at the tip as in Grand Duke Alexis, but giving a peculiar whorled effect, which plainly shows the spiral arrangement of the successive tiers of rays. Among Pompons, Blumenfalter is an example of this rosette-like or quilled form, and many colors are procurable. However, the word "quilled" usually suggests a long tube with a flared opening, whereas in the form described above the margins of the ray are merely rolled tightly together, but not grown together into a thin seamless tube. Perhaps the most important variation that has not yet appeared in the dahlia is the wonderful elongation of the disk florets



1210. A Show dahlia.

into long, thin, variously colored tubes which have produced such charming effects in the China aster and have culminated in the marvelous grace of many chrysanthemums. The dahlia may not be denied such possibilities, for in G.C. III. 20:339 (1896) a new dahlia was described in which the quills are really tubes for two-thirds of their length.

The Collarette dahlia is a very novel and distinct type. The flowers are single, with an additional row of short petals around the disk, which forms a frill or collar usually of a different color from the remainder of the flower. The same method obtained in the development of the Collarette dahlia as in the development of the Single dahlia. Varieties having only eight rays or petals, with the additional collar, and presenting a symmetrical and concentrated impression, were preserved. The collar consists principally of three or four smaller and more gracefully curved rays, produced at the disk, at the center of each of the eight larger rays or petals, and taking the same direction as the large rays, thus showing distinctly the golden yellow center, so pronounced in the Single dahlia. The first Collarette dahlia was President Viger, and was originated at Parc de la Tete d'Or, or in the gardens of the City of Lyons, France, then under the supervision of Professor Gerard, who was succeeded by M. Chabannes. President Viger was first shown in 1900 at the Universal Exposition, and offered for sale in 1901 by Rivorie Pere & Fils of Lyon. In 1902 appeared the variety Joseph Goujon also obtained at the Parc de la Tete d'Or, Lyon; then in 1903 Rivorie offered Etendard de Lyon and Gallia, which figured with honor for that firm. During the next ten years, from 1903 until 1913, all the known varieties of the Collarette dahlia were developed by Rivorie Pere & Fils, and appeared in the following order: 1903, Etendard de Lyon, and Gallia; 1904, Mme. LePage Viger, La Fusee, Duchesse J. Melsi D'Ehril-Barbo, Prince Galitzine, Comte Cheremeteff, and Maurice Rivoire; 1905, Exposition de Lyon Orphee, and Prince de Venosa;



1211. A Fancy dahlia of the Pompon type. ( $\times \frac{1}{2}$ )

1906, Merveille de Lyon, Mme. Georges Bernard, Comte Nodler, Deuil de Brazza, Princesse Olga Altieri, Corbeille de Feu, and Signorina Rosa Esen-grini; 1907, Comtesse Dugon, Ami Cachat, and Volcan; 1908, Jupiter, Pluton, Pan, Etoile de Moidiere, and Mme. Chamrion; 1909, M. Mery de Montigny;



1212. A Cactus dahlia. ( $\times \frac{1}{3}$ )

1910, Abbe Hugonnard, Comte de Vezet, Mme. Pile, Souvenir de Bel-Accueil, and Vicomtesse des Mons; 1911, General de Sonis, and Deuil du Docteur Ogier; 1912, Cocarde Espagnole, Etincelant, and Stella; 1913, Geant de Lyon, Maroc, and Etoile de Mon-plaisir. In 1912, J. K. Alexander, a dahlia specialist in East Bridgewater, Massachusetts, succeeded in developing the first Collarette dahlia of American origin, the variety Champion; this added the red and yellow coloring to the type. Previous to 1912, three other foreign varieties, Directeur Rene Gerard, Mme. E. Poirier, and Souv. de Chabanne, found their way to America, and were offered the following year in the leading seedsmen's catalogues. The year 1913 gave a collection of nearly fifty distinct named varieties of the Collarette dahlia, including every known color in the dahlia world.

The Holland Peony-flowered dahlia is now the most popular dahlia, possessing an entirely original form, resembling the semi-double peonies; the flowers are broad, flat, somewhat irregular in form, and are produced with remarkable freedom on long stems. This type of dahlia has proved the most satisfactory for garden purposes, the plants being covered with flowers the entire season. The origin of the Holland Peony-flowered dahlia, like all other types, is uncertain, and all efforts to secure full and definite information are unfruitful. Originally the Holland Peony-flowered dahlia was grown for some years in Germany in a mixture known as "Half-double Giant Dahlias." A Dutch grower, H. Hornsveld of Baarn, Holland, was



the first to note their possibilities, and selected from these "mixed dahlias" the best varieties, from which he propagated; then he drew the attention of the public to his new varieties, which he named and offered for sale. Other growers in Holland followed his example with great success. The Holland Peony-flowered

dahlia was imported to America in 1908, and simultaneously appeared in the catalogues of the leading growers and seedmen. The number increased rapidly, and in 1910 appeared new varieties of American origin, notably the new varieties originated by the W. W. Rawson Co., of Boston, Massachusetts. The most prominent varieties are the following: Andrew Carnegie (1908), Bertha Von Suttner (1908), Caesar (1911), Cecilia (1911), Dr. K. W. van Gorkum (1906), Dr. Peary (1911), Duke Henry (1906), Geisha (1908), Germania (1906), Glory of Baarn (1906),

1213. Single cactus dahlia. ( $\times \frac{1}{2}$ )

Glory of Groenekan (1907), H. Hornsveld (1907), Hugo de Vries (1907), H. J. Lovink (1911), Kaiserin Augusta Victoria (1907), King Edward (1909), King Leopold (1906), La Rainte (1907), Mannheim (1908), Merveille (1907), Miss Gladys Dawson (1908), Paul Kruger (1906), P. W. Jansen (1907), Queen Alexandra (1909), Queen Emma (1906), Queen Wilhelmina (1906), Snow Queen (1907), and Sherlock Holmes (1912).

The fragrant dahlia is the pride of the true Peony-flowered type, possessing a pleasing and agreeable odor, so long desired. The fragrant dahlia was first detected by J. Herbert Alexander, in the year 1912, on the trial-grounds of J. K. Alexander of East Bridgewater, Massachusetts; hybridization and propagation was begun immediately with the new variety, and in 1913 a collection of five fragrant dahlias appeared in Alexander's catalogue.

The main types of dahlias may perhaps be distinguished more clearly by the following scheme:

A. Plants very dwarf.

1. THE TOM THUMB TYPES.

AA. Plants not very dwarf.

B. Fls. single.

c. Rays flat, not recurved at the margins.

2. THE SINGLE TYPE. Fig. 1214.

CC. Rays with recurved margins.

3. THE SINGLE CACTUS TYPE. Fig. 1213.

BB. Fls. double.

C. Size of fls. small, 1-2 in. across.

D. Rays cupped.

4. THE POMPON TYPE. Fig. 1211. Also called "Bouquet" and "Lilliputian."

DD. Rays flat.

5. THE POMPON CACTUS TYPE.

CC. Size of fls. large, 3-5 in. across, averaging 4 in.

D. Rays cupped.

E. Colors single, or the edges darker than the ground-color.

6. THE SHOW TYPE. Fig. 1210.

EE. Colors 2 or more, striped, or with edges lighter than the ground-color.

7. THE FANCY TYPE.

DD. Rays not cupped, but long and flat, or with recurved margins.

8. THE CACTUS TYPE. Figs. 1207, 1212.

DDD. Rays various in form.

9. THE DECORATIVE TYPE.

10. THE COLLARETTE TYPE.

11. THE PEONY-FLOWERED TYPE; including the fragrant dahlia. Fig. 1215.

Useful dahlias for various purposes, as they exist in North America in 1913:

*Cactus dahlias, for cut-flower purposes.*—Alexander, Alight, Alfred Vasey, Clara G. Stedwick, Countess of Lonsdale, Dainty, Effective, Eureka, Floradora, Forbes Robertson, Flame, Glory of Wilts, Golden Gem, Gazelle, Gabriel, Gen. Buller, Helene, Henri Cayenx Hereward, Ivernia, Jeannette, J. H. Jackson, J. Weir Fife, Killarney, Lightship Lady Fair, Lady Colin Campbell, Lord of the Manor, Mary Service, Mrs. Deluca, Mrs. H. L. Brouson, Mrs. Winchester, Mrs. Mortimer, Mrs. Geo. Caselton, Mme. Henri Cayeux, Mrs. MacMullan, Reine Cayeux, Rosa Starr, Reliable, Stella, Sirus, Sandy, Thomas Wilson, and Yonne Cayeux.

*Cactus dahlias for exhibition purposes.*—Amazon, Clincher, Diavolo, Master Carl, Mercury, Mrs. S. T. Wright, Rev. Dr. Baker, Rev. T. W. Jamieson, Royal Scarlet, Schneewitchen, Snowstorm, T. G. Baker, Wellington, Whirlwind, White Swan, Wm. Marshall, W. B. Childs.

*Decorative dahlias for cut-flower purposes.*—Delice, Himmlische, Jack Rose, Jeanne Charmet, John R. Baldwin, Minos, Maid of Kent, Mme. A. Lumiere, Mme. Victor Vassier, Mme. Van den Dael, Perle de la Tete D'or, Reggie, Souv. de Gustave Douzon, Wilhelm Miller.

*Decorative dahlias for exhibition purposes.*—American Beauty, A. E. Johnson, Blue Oban, Gigantea, Grand Duke Alexis, Gettysburg, Le Grand Manito, Le Mont Blanc, Les Allices, Mme. Helene Charvet, Mme. Augusta Lumiere, Mademoiselle Galy Miquel, Madame Devinat, Mme. Marze, Morocco, Peerless, Perle de Ocean, Papa Charmet, Ville de Lyon, Yellow Colosse.

*Peony-flowered dahlias for cut-flower purposes.*—Admiration, Bertha Von Suttner, Goddess of Fame, Geisha, Marie Studholme, Mrs. A. Platt, Mrs. Jacques Futrelle, Queen Wilhelmina, and Sunrise.

*Peony-flowered dahlias for exhibition purposes.*—Hampton Court, King Leopold, Priscilla, Snow Queen, Solfatara, Duke Henry, and Hollandia.

*Collarette dahlias for massing.*—Exposition de Lyon, Maurice Rivoire, and President Viger.

*Show dahlias for exhibition purposes.*—Acquisition, Alice Emily, Acme of Perfection, Brown Bess, Dreer's White, Dr. Keynes, David Johnson, Emperor, Ivanhoe, Harrison Weir, Mrs. Susan Wilson, Mme. Heine Furtado, Mme. Marika Anagnostaki, Mme. Alfred Mareau, Merlin, Muriel, Norma, Nugget, Queen of Autumn, Rosebud, Stradella, Standard, W. P. Laird, and Wm. Dodds.

*Among the Show dahlias that are the best for flowering are:* A. D. Livoni, Arabella, Ansonia, Dr. J. P. Kirkland or Cuban Giant, Dorothy Peacock, Imperial, Miss Fox, Perfection, Storm King, and White Queen.

*Show dahlia for bedding purposes.*—White Bedder.

*Fancy dahlias of merit.*—Chorister, Chas. Turner, Dazzler, Dorothy, Distinction, Duchess of Albany, English Dandy, Eric Fisher, Gloire de Guiscard, Frank Smith, Frederick Smith, General Grant, Gold Medal, Goldsmith, Geo. Barnes, Hercules, Les Amours de Madame, Lucy Faucett, Mme. Lily Large, Polly Sandall, Rebecca, Rev. J. B. McCamm, S. Mortimer, Sunset, and Wizard.

*Pompon dahlias for borders or hedges.*—Achilles, Crusoe, Darkness, Fascination, Mabel, Pure Love, Rosalie, Red Indian, Snow Clad, Vivid, and Winifred.

*Pompon dahlias for exhibition purposes.*—Amber Queen, Ideal, Harry, Little Mary, Rosebud, Shalii, and Spy.

*Pompon dahlias for flowering purposes.*—Klein Domitea, Darkest of All, Fairy Queen, Star of the East, and Spy.

*Societies and shows.*

—The dahlia is one of about a dozen



1214. A broad-rayed single dahlia. ( $\times \frac{1}{2}$ )

genera of plants whose horticultural value has been attested by permanently successful special societies. There are national dahlia societies in England and America. Dahlia shows are usually held the second or third week in September. On December 21, 1906, the New England Dahlia Society was chartered; this Society led to great advancement in the dahlia, holding an annual exhibition in Boston, and issuing monthly a paper known as the "Dahlia News." Great interest was fostered, and in 1913 its membership list included nearly every state in the Union, and six foreign countries. At the present date of writing the New England Dahlia Society is considering the adoption of a new charter, whereby it can become the National Society. Other societies devoted to the welfare of the dahlia have been recently formed; principally "The Dahlia Association of Seattle," "Tacoma Dahlia Society," "Inter-town Dahlia Association" in Connecticut.

*Literature.*—As in many other cases, the magazine literature of the dahlia is the most bulky, and, in some respects, more important than the books on the subject. C. Harman Payne published a bibliography in G.C. III. 21:329 (1897). There had been about twenty-five books devoted to the dahlia, many of them pamphlets and cheap cultural manuals. These books were mostly published from 1828 to 1857, with none in North America for nearly forty years after that date until 1896, when Lawrence K. Peacock's book, "The Dahlia," appeared. The first American treatise was by E. Sayers, published at Boston, 1839. Many interesting facts came out in 1889, the centennial year of the dahlia. A report of the National Dahlia Conference is reprinted from the Journal of the Royal Horticultural Society for 1890, but Shirley Hibberd's statements therein regarding the botany of the dahlia agree very poorly with Hemsley's revision of the genus in G.C. II. 12:437, 524, 557 (1879). In 1906 W. W. Wilmore published "The Dahlia," a handsomely illustrated American manual, valuable to both amateur and professional. The annual catalogues of the leading dahlia specialists furnish much valuable matter, and cultural hints, and are the most up-to-date issues in the dahlia line.

WILHELM MILLER.  
J. K. ALEXANDER.

### Cultivation of the dahlia.

The dahlia has no very special or particular requirements, and yet many growers fail of the best success because the few demands are not well met.

#### *Propagation.*

There are four methods by which dahlias are propagated: by cuttings (the commercial method), by division of roots (the amateur's method), by grafting to perpetuate rare kinds, and by seeds, to produce new varieties.

*Cuttings.*—Propagation by cuttings is employed mainly by commercial growers, and though the amateur may propagate plants successfully, the attention a few cuttings would probably require is so great that it would be cheaper to buy plants. The roots are planted closely in benches in the greenhouse early in January, and cuttings are made from the young shoots as fast as they form the third or fourth set of leaves. These cuttings are carefully trimmed and placed in pure sand in the propagating-bench, using a dibble and putting the cuttings in rows about 3 inches apart and  $\frac{1}{2}$ –1 inch between the cuttings.

The propagating-bench is made by running a flue, hot-water or steam pipes beneath an ordinary bench, and boarding up the side to confine the heat. Although there may be a difference of opinion among propagators, yet a bottom of sand heat of 65°, with the temperature of the house from 5° to 10° less, will give the best practical results. With this temperature, the cut-

tings will root in about two weeks, and will be far stronger than if rooted in less time with greater heat. As soon as cuttings are rooted, they are potted off into small pots and grown in a cool greenhouse until danger of frost is over, when they are planted out in the open ground. Cuttings made too far below a joint, or too late in summer, will produce flowering plants but no tubers.

*Division of roots.*—This is the easiest and most satisfactory way for amateurs. As the eyes are not on the tubers, but on the crown to which the tubers are attached, care must be taken that each division has at least one eye, otherwise the roots will never grow. It is, therefore, best to start the eyes by placing the roots in a warm, moist place a short time before dividing. The roots are sometimes placed in a hotbed, and shoots grown to considerable size, then set out as plants; but this plan has many drawbacks, and is not advised.

*Grafting.*—A very interesting, though not profitable mode of propagation is by means of grafting. The top of the tuber is cut slantingly upward, and the cutting slantingly downward, placed together and tied with raffia or any soft, handy material. They are then planted in a pot deep enough to cover the lower part of the graft with earth, and they will soon adhere if placed under a hand-glass or in a frame. Grafting is practised only for the preservation of rare and weak-growing sorts.

*Seeds.*—The chief use of seeds is the production of new varieties. Seeds are also used by those who chiefly desire a mass of color, and are not particularly desirous of finely formed blooms. If planted early enough indoors and transplanted to the open as soon as safe, fine masses of color can be secured before frost, and the roots of the more desirable kinds can be saved, and will give even better results the next season.

#### *Field or garden requirements.*

Dahlias are easily destroyed by high winds unless they are given a protected position, and they need plenty of air and sunlight for best results. In shaded, close, airless quarters the growth is sappy, and the flowers are poorly colored.

The soil is not so important, except in its ability to hold moisture during severe droughts. Any rich soil that will grow corn will also grow dahlias to perfection, if all other conditions are favorable. They will grow equally well in clear sand, clay or gravel, if the proper kinds and quantities of plant-food are added and well and thoroughly worked in. It is, however, unreasonable to expect dahlias or any garden plants to succeed in a hard clay, devoid of humus, easily baked and never tilled.

*Feeding.*—It is always best to broadcast the manure and plow or spade it into the soil; thorough spading is absolutely necessary if the manure is not well decomposed. On heavy clay or gravelly soils, loose coarse manure may be used, but on light or sandy soils, manure should always be fine and well rotted. Commercial fertilizers are also largely used, and are most valuable when used in connection with manure. Any good fertilizer, rich in ammonia and phosphoric acid, with a liberal amount of potash, will answer at the time of planting, but as a top-dressing later, nothing equals pure bone-meal and nitrate of soda, four parts bone-meal to one part soda.

*Kinds of stock.*—Dahlias are offered in five forms: large clumps, ordinary field-roots, pot-roots, green plants and seeds. The clumps give the best satisfaction the first year, but are entirely too large and unwieldy for anything but a local trade and exchange among amateurs. The ordinary field-roots are the most valuable, as they can be handled easily and safely, and always give satisfactory results. Pot-roots are largely used in the mailing trade, and, while they will not give as good results the first year, are valuable for shipping



long distances where larger roots could not be profitably used, owing to heavy transportation charges. Green plants are mainly used to make up any deficiency in the field-crops, owing to unfavorable seasons, or an unusual demand for certain varieties.

*Planting.*—There is diversity of opinion as to the proper time to plant dahlias, but the writer has always found it best to plant early, and would advise planting large strong roots about two weeks before danger of frost is over. This would be, in the vicinity of Philadelphia, about April 15; and as it requires from two to three weeks for the plants to get up through the ground, there will be no danger, while the plants will bloom that much earlier. It is best, however, not to plant small roots or green plants until danger of frost is over—in the vicinity of Philadelphia, about May 1 to 10, according to the season. A good rule to follow everywhere would be to plant small roots and green plants as soon as danger of frost is past, and large roots about three weeks earlier.

*Tillage.*—The first requisite of successful garden cultivation is thoroughly to stir the soil to considerable depth and enrich it, if it is not already rich, by broad-casting and plowing or spading in a good coat of well-rotted manure. Too much stress cannot be placed upon the thorough preparation of the land, as it not only allows the roots to go down deep after the moisture more readily during dry weather, but affords good drainage during excessive rains. Having prepared the land as above, mark out rows 4 feet apart and 6 to 8 inches deep, and plant the roots from 18 inches to 3 feet apart in the row, according as solid rows or specimen plants are desired.

In its early stage of development, the dahlia grows very rapidly, and should be kept thoroughly tilled. But while deep tillage is beneficial during its early stages of development, it is almost fatal to the production of flowers if practised after the plants come into bloom. Therefore, when the plants begin to bloom, cease deep tillage, and stir the soil to the depth of 1 to 3 inches only, but stir it often, and never allow the surface to become hard and baked. This will not only prevent excessive evaporation of moisture and keep the under soil cool and moist, but will also prevent the destruction of immense quantities of feeding-roots.

As long as the roots supply more nourishment than is needed to support the plant, both the plant and the flowers increase in size and beauty; but as the supply gradually becomes exhausted, the plants cease growing and the flowers become much smaller. This condition is what is generally called "bloomed out," but what is really "starved out," and can easily be prevented if the proper attention is given to the plants. As soon as the flowers begin to grow smaller, broadcast around each plant a small handful of pure bone-meal, and nitrate of soda, in proportion of four parts bone to one part soda, and carefully work it into the soil.

*Watering.*—This is a debatable subject, and, although a judicious application of water during a severe dry spell is very beneficial, yet in nine cases out of every ten in which water is applied, a thorough stirring of the surface soil would give better results.

Many persons think Dahlias should be watered every evening, and as soon as they are up begin watering them daily unless it rains. This practice is very injurious, as it causes a rapid but soft growth, and as

the soil is seldom stirred, the roots become so enfeebled that they are unable to supply the needs of the plant; as a consequence, but few buds are formed, and they generally blast before developing into flowers. In other cases, as the enthusiasm wears off, watering is stopped, probably right at the beginning of a severe drought, and the weak, pampered plants are fortunate to survive, much less bloom.

If large, strong roots are planted and the soil is kept thoroughly stirred, there will be little need of artificial watering until after the plants come out in full bloom. However, if it should become hot and dry after the dahlias come into bloom, it would be very beneficial to give them a thorough watering once each week or ten days during the continuance of the drought. But care should be taken to stir the soil to the depth of 1 to 2 inches the next day, carefully pulverizing it later in order to break the natural capillarity by which the moisture is evaporated.

The best rule to follow is not to allow the plants to suffer for want of moisture, not to water them except when they need it, but to water them thoroughly when necessary, and not to allow excessive evaporation for want of frequent stirring of the soil.

*Training.*—In planting the roots or tubers, place them on their sides with the eye as near the bottom as possible, and cover only 2 to 3 inches deep. As soon as the shoots appear, remove all but the strongest one, and pinch out the center of that one as soon as two or three pairs of leaves have formed, thus forcing it to branch below the level of the ground. As the plants develop, the soil is filled in gradually by subsequent hoeings. By this method the entire strength of the root and the soil is concentrated on the one shoot, causing it to grow vigorously; while the pinching

back not only causes it to branch below the surface of the soil, and thus brace it against all storms, but also removes all of those imperfect, short-stemmed flowers that appear on some varieties. If the plants are pinched back low, as described, there is no danger of the branches splitting down, as the soil around them will hold them securely in place. However, when they branch above ground and are inclined to split down, drive a short stout stake near the stem and tie the branches to it. These short stakes are not to hold the plants up, but to prevent the branches splitting down when the above directions have not been followed closely.

By this method it is possible to grow dahlia blooms on stems from 18 inches to 2 feet long. It has always been thought necessary to tie dahlias to stakes to prevent them from being blown down by heavy winds. The system of staking is not only unsightly during the early stage of their growth, but is attended with considerable labor and expense. Staking, however, is unnecessary, if the directions already given are followed, as the plants will branch out below the surface of the ground, and the stems will become so heavy as to resist the strongest winds. The plants are one-third dwarfer, compact and regular in form, and produce much finer flowers on long stems well supplied with buds and foliage.

*Storing the roots.*—As soon as the plants are killed by frost, lift the roots, and, after removing all the soil possible from them, allow them to dry in the air for a few hours, when they should be stored in the cellar or



1215. A semi-double form of dahlia.

some other cool place secure from frost. If the cellar is very dry or is not frostproof, put the roots in a barrel or box and cover completely with dry sand or some other suitable and convenient material, such as sawdust or tanbark, to prevent freezing or loss of vitality by drying or shriveling. LAWRENCE K. PEACOCK.

**DAHOON HOLLY:** *Ilex Dahoon*.

**DÀIS** (Greek, *pine torch*; application not obvious). *Thymelæacæ*. Contains a woody plant that yields a strong fiber, and is also rarely cultivated for ornament, especially in Florida and southern California, and possibly in a few northern conservatories.

Tender deciduous shrubs: lvs. opposite, often crowded at the ends of branches: fls. in terminal heads; perianth-tube cylindrical, often curved; stamens 10, in a double series, the alternate ones shorter, upper or all exerted; style exerted. The plants are prop. with difficulty by cuttings of half-ripened wood. The single cult. species has lvs. resembling the smoke tree, or *Cotinus*, and bears long-stalked umbel-like heads of starry pink fls., with floral parts in 5's. The genus has 2 species, 1 from S. Afr. and 1 from Madagascar.

**cotinifolia**, Linn. Lvs. opposite and alternate, oblong or obovate, acute at both ends: involucre a half shorter than the fls.: head about 15-flid.; fls.  $\frac{1}{2}$  in. across, fragrant. S. Afr. B.M. 147. G.W. 8, p. 313.—Said to bloom profusely at Santa Barbara but not to produce seed.

L. H. B.

**DAISY** (i. e., *day's eye*, in allusion to the sun-like form of the flower). A name applied to the flowers of many *Compositæ*, but it properly belongs to the *Bellis perennis* of Europe, a low early-flowering plant, which, in its double forms (Fig. 535, Vol. I), is widely known as a garden subject (see *Bellis*). The American congener is *B. integrifolia*, Michx., an annual or biennial, very like the Old World species, ranging southward from Kentucky; it is not domesticated. In North America, the word daisy is applied to many field composites, particularly to those of comparatively low growth and large flower-heads. Unqualified, the word is commonly understood to mean *Chrysanthemum Leucanthemum* (Fig. 937), an Old World plant that has become an abundant field weed in the eastern part of the country.

This plant is also frequently known as the ox-eye daisy, although in parts of New England it is called whiteweed, and the term ox-eye is applied to *Rubdeckia hirta*, which has a yellow-rayed head. Kin to the *Chrysanthemum Leucanthemum* are the Paris daisies, or marguerites, of the conservatories (see *Chrysanthemum*). The wild asters (Fig. 1216) are called daisies, especially Michaelmas daisies, in many parts of the country, particularly west of New York. Spring-flowering erigerons also are called daisies. The Swan River daisy is *Brachycome iberidifolia* (Figs. 621, 622, Vol. I). The African daisy of gardens is *Dimorphotheca*.

L. H. B.

**DALBÉRGIA** (N. Dalberg, a Swedish botanist, 1730 to 1820). *Leguminosæ*. Nearly 100 species of trees, shrubs, or climbers, belonging to tropical regions all over the world, a few of which have been introduced to North America, one for timber.

Leaves alternate, odd-pinnate (rarely 1-foliate) without stipules: fls. small, numerous, purple, violet or white, in forking cymes or irregular cyme-like

panicles, which are axillary or terminal, papilionaceous, with ovate or orbicular standard: fr. an indehiscent narrow pod, 1-seeded at middle and with few seeds toward the ends, the seeds compressed and reniform.

**Sissoo**, Roxbg. A good-sized tree, 80 ft. high in India: lvs. pinnate; lfts. 5, alternate, stalked, obovate, abruptly acuminate, pubescent beneath: fls. white, in short, axillary panicles.—In India considered one of the best timbers, whenever elasticity and durability are required. Intro. at Santa Barbara, where it is hardy but growth said to be very slow. The Sissoo tree is worth trial in nearly frostless districts, especially along sandy river banks. It improves sterile lands. Experiments in Egypt have shown its most remarkable property of standing severe droughts, as well as submersion for a long period. The wood is very elastic, seasons well, does not warp or split, is easily worked, and takes a fine polish. It is also a durable wood for boats. The tree is raised easily from seeds or cuttings, and is of quick growth. Other species of *Dalbergia* are of economic value and have been sparingly planted.

**DÀLEA** (Samuel Dale, 1659–1739, English botanist and author on pharmacology). Syn. *Parosela*. *Leguminosæ*. More than 100 herbs and small shrubs bearing purple, blue, white or even yellow fls. in terminal or lateral spikes or heads, odd-pinnate lvs., and usually glandular-dotted, a very few of which have been cult.; probably none is now in the American trade. Fls. papilionaceous, the standard mostly cordate or eared and clawed and attached in the bottom of the calyx, the wings and keel attached or adnate to the stamens and usually exceeding the standard; stamens 10 or 9, monadelphous: fr. a small usually 1-seeded mostly indehiscent pod inclosed in the calyx. The species occur from the N. U. S. to Chile and the Galapagos Isls. They grow in the U. S., mostly on prairies and in dry soil; some of these species might make acceptable border plants. Those that have received most attention are tropical species, as *D. mutabilis*, Willd., of Mex., with fls. white changing to violet, (B. M. 2486) and *D. Mutisii*, Kunth (properly *Psoralea Mutisii*, HBK.), of the northern Andes, with deep blue fls. in cylindrical heads; these are to be regarded as greenhouse perennials.

L. H. B.

**DALECHÁMPIA** (from J. Dalechamps, French savant of sixteenth century). *Euphorbiacæ*. Climbing or rarely erect tropical shrubs; one rarely cultivated in warmhouses for its ornamental bracts.

Leaves alternate, simple; stipules large: fls. small, monœcious, apetalous, in dense clusters, with 2 conspicuous, colored involucre bracts; calyx valvate; styles united; ovules 1 in each of the 3–4 cells.—About 60 species scattered through the tropics. Plukenetia, a related genus, is without the large involucre.

*Dalechampia Roetziana* was described by Hooker in 1867 as one of the noblest plants introduced for many years, comparable with the bougainvilleas and surpassing them in size of bracts and brilliancy of color. It is not so fine a florists' plant as the poinsettia, but is worth trial in the finer conservatories. It requires well-drained sandy, peat soil, and is propagated by cuttings.

**Roetzliana**, Muell. Arg. (var. *rosea*, Authors). Erect shrub, 3–4 ft. high, much branched, leafy: lvs. 6 in. long, sessile, obovate-oblongeolate, acuminate, entire, or with coarse, obtuse teeth above the middle, narrowed to a small cordate base: bracts 2–2½ in. long, broadly cordate, nearly sessile, toothed, membranaceous, distinctly nerved, rose-red, other smaller bracts among the small yellow fls.; stamens united. Mex. B.M. 5640. H.F. II. 11:234, pl. 8. Gt. 16:532. F.W. 1867, p. 318. F.M. 7:373, 374. F.S. 16:1701–2. G.C. 1867:236, desc. Var. *álba*, Hort., has white bracts.

J. B. S. NORTON.



1216. Wild aster, or Michaelmas daisy. ( $\times \frac{1}{2}$ )



**DALIBÁRDA** (after Thomas François Dalibard, French botanist). *Rosaceæ*. A low-growing native hardy herbaceous perennial, with foliage resembling violet and flowers like those of a strawberry, sometimes grown in borders and rock-gardens.

This monotypic genus has lately been referred to *Rubus*, but it differs in habit, in the carpels being usually well defined instead of indefinite and the achenes dry instead of drupaceous: fls. 1 or 2 on a scape-like peduncle, white, and also others that are



cleistogamous and apetalous on short curved peduncles; calyx 5-6-parted, 3 of the parts larger; petals 5; stamens many; ovaries 5-10.

**repens**, Linn. (*Rubus Dalibarda*, Linn.). Fig. 1217. Tufted, creeping: lvs. heart-shaped, wavy-toothed: fls. white, 1 or 2 on each scape; calyx 5-6-parted, 3 of the divisions larger and toothed; petals 5; stamens numerous; pistils 5-10. Common in woods in New Brunswick, Ont. and south and west to N. J., Pa., Ohio and Minn.—It blooms June-Aug. It is a slow-growing plant, thriving in a deep fibrous soil and sheltered position; little grown. In Fig. 1217, *a* shows the perfect flower; *b*, *c*, achenes of the cleistogamous fls.

L. H. B.

**DAMASK ROSE:** *Rosa Damascena*.

**DAMASK VIOLET:** *Hesperis matronalis*.

**DAME'S ROCKET and DAME'S VIOLET:** *Hesperis matronalis*.

**DAMMÁRA:** *Agathis*.

**DAMNACÁNTHUS** (Greek, referring to the powerful spines). *Rubiaceæ*. A tender evergreen shrub, chiefly valued for its coral-red berries, which remain on the bush until the flowers of the next season are produced.

Divaricately branched, strongly spiny woody plants: lvs. small, opposite, leathery, nearly sessile, broadly ovate, acuminate: fls. small, axillary, in 1's or 2's, white, fragrant; calyx-tube obovoid, limb 4-5-cut; corolla funnel-shaped. Prop. by cuttings; sometimes grown in greenhouses and perhaps adaptable for planting in the southern parts.

**índicus**, Gaertn. Described above, being the only species as understood by some authors; but others keep *D. mājor*, Sieb. & Zucc. (which is sometimes nearly spineless), distinct, distinguishing it by the 2-3-times larger lvs. and the larger fls.; others combine the two as species and variety, as *D. índicus* var. *mājor*, Makino. Gt. 17:570. The species occurs from E. India to Japan, the var. *mājor* being Japanese. The species is a low thick bush, densely dichotomously branched: lvs. ovate-acute, shining green above, light green beneath, in var. *mājor* 1½ in. long. The shining lvs. and showy berries commend the plant to cult. L. H. B.

**DAMPING-OFF.** A gardeners' phrase for a disastrous rotting of plants, especially of seedlings and cuttings, and commonly at the surface of the ground. It is usually associated with excessive moisture in the soil and air, with high and close temperatures, and sometimes poor light. Such conditions weaken the plants and allow them to fall a prey to the minute parasitic fungi which live upon the decaying vegetable matter in the soil, and can remain alive for months, even if the soil is thoroughly dry or frozen. A whole bench of cuttings may be ruined in a night. The skilful propagator takes every possible precaution. His benches have perfect drainage, he uses fresh sharp sand, and sometimes sterilizes it with steam heat for several hours. Damping-off is one of the most trying experiences of the beginner, and nothing can prevent it but a thorough grasp of the principles of greenhouse management in general, and watering in particular. (Consult articles on these subjects.) As soon as the disease is noticed, the healthy plants should be removed to fresh soil, as the disease spreads rapidly. If the disease appears in the entire bed, the organisms causing the trouble almost certainly are distributed generally in the sand, and sterilization either with formaldehyde solution (40 per cent strength diluted one part to fifty parts water) or with steam should be employed in all future work. If only a spot here and there shows the trouble, saturate the affected area at once with formaldehyde solution, as above, or with copper-sulfate solution (one part by weight to one hundred parts of water). One of the commonest occasions of damping-off is the sudden flooding of a bed or bench after leaving it too dry for a long time.

The terms damping-off and burning are also used for ruined flowers. Burning is often caused by sunlight or by imperfections in glass, but a flower spoiled by dripping cold water, or by some unknown cause, is said to have a burned look.

D. REDDICK.†

**DAMSON:** *Plum*.

**DÀNÆ** (name of a daughter of King Acrisius of Argos). *Liliaceæ*. ALEXANDRIAN LAUREL. An evergreen erect much-branched shrub with thick unarmed alternate cladophylla and terminal racemes of small whitish fls., often referred to *Ruscus*. It is one of the *Asparagus* tribe of the lily family: fls. nearly globular, the lobes short and erect, with a crown at the throat; stamens affixed in the tube beneath the crown, the filaments united, the anthers 6: fr. a pulpy indehiscent red berry. *D. racemōsa*, Moench (*Ruscus racemōsus*, Linn. *D. Laurus*, Medikus), occurs from Greece to Persia, making a bush 4 ft. high, with ovate-lanceolate, nearly sessile, about 5-7-nerved leaf-like cladodes. Recently intro. in S. Calif., but is little known in this country. Ornamental for porches, vases, and similar uses.

L. H. B.

**DANÆA** (a personal name). *Marattiaceæ*. A small genus of tropical American fern-like plants, with synangia sessile, arranged in rows, and covering the entire under surface of the leaf. They are apparently not in cultivation in America.

**DANDELION** (i. e., *dent de lion*, French for lion's tooth; referring to the teeth on the lvs.). The vernacular of *Taraxacum officinale*, Weber, a stemless perennial or biennial plant of the *Compositæ*, a common weed, much collected in spring for "greens" and in improved forms sometimes grown for that purpose.

Dandelion is native to Europe and Asia, but is naturalized in all temperate countries. On the Rocky Mountains and in the high North are forms that are apparently indigenous. A floret from the head of a dandelion is shown in Fig. 1218. The ovary is at *e*; pappus (answering to calyx) at *a*; ray of corolla at *c*; ring of anthers at *b*; styles at *d*. The constricted part

at *e* elongates in fruit, raising the pappus on a long stalk, as shown in Fig. 1219; and thus is the balloon of the dandelion formed. A dandelion plant, with its scattering fruits, is shown in Fig. 1220. Another species of dandelion is also naturalized in this country, but is not so common; it is the red-seeded dandelion (*T. erythrospermum*, Andr.), with red fruits, not reflexed involucre scales, and shorter beak.



1218. Floret of Dandelion.

The dandelion is much prized for "greens." For this purpose it is cultivated in parts of Europe; also about Boston and in some other localities in this country. There are several improved large-leaved varieties, mostly of French origin. Some of these named forms have beautiful curled leaves. Seeds are sown in the spring, and the crop is gathered the same fall or the following spring,—usually in the spring in this country. Commonly the seeds are sown where the plants are to stand, although the plantlets may be transplanted. The plants should stand about 1 foot apart each way, and a good crop will cover the land completely when a year old. Sandy or light loamy soil is preferred. The crop is harvested and marketed like spinach. The leaves or heads are often blanched by tying them up, covering with sand or a flower-pot. The plants are sometimes grown more closely in beds, and frames are put over them to force them. Roots are sometimes removed from the field to the hotbed or house for forcing. When treated like chicory (which see), the roots will produce a winter salad very like *barbe de capucin*. Roots of dandelion dug in fall and dried are sold for medicinal purposes in drug-stores under the name of *Taraxacum*.

L. H. B.

**DANGLEBERRY:** *Gaylussacia frondosa*.

**DÁPHNE** (Greek name of *Laurus nobilis*). *Thymelæaceæ*. Ornamental woody plants, chiefly grown for their handsome foliage and sweet-scented, white, purple, lilac or rarely greenish flowers, which, with some species, in warmer climates, often appear in the winter.

Low deciduous or evergreen shrubs: lvs. alternate, rarely opposite, entire, short-petioled; fls. in clusters, short racemes or umbels, apetalous, mostly fragrant; calyx-tube cylindric or campanulate, 4-lobed, corolla-like, usually clothed with silky hairs outside; stamens 8, in two rows, included; stigma capitate, sessile or nearly so; fr. a fleshy or leathery 1-seeded drupe. —About 50 species in Eu. and Asia. For a monograph of the section *Daphnantes* see Keissler in Engler Bot. Jahrb. 25:29-124 (1898); see also Nitsche, Beiträge zur Kenntnis der Gattung Daphne (1907).

Only *D. Mezereum*, with very early lilac fragrant flowers and decorative scarlet fruit, and some low evergreen species, like *D. Cneorum* and *D. Blagayana*, are hardy North, while most of the evergreen species can be recommended only for warmer climates. *D. Genkwa* with lilac flowers appearing before the leaves, and *D. pontica* and *D. Laureola*, with large evergreen leaves, are hardy as far north as New York. *D. odora* is fairly hardy in Washington, D. C.

In California, according to Franceschi, the species most commonly grown is *D. odora*, the plants being mostly imported from Japan. Many plants are also sent from Japan for eastern greenhouse culture. A decoction

of the bark of *D. Mezereum* is sold in drug-stores under the name of *mezereum*. It is stimulant and diuretic. It is also known as olive spurge.

Daphnes thrive best in a well-drained light soil and in a partly shaded position, but some, as *D. Cneorum* and *D. Blagayana*, which are exceedingly pretty plants for rockeries, do better in sunny situations. In the North, *D. odora* and its varieties are often grown in pots for their sweet-scented and handsome flowers appearing during the winter. A sandy compost of peat and loam in equal proportions will suit them; they require a good drainage and careful watering during the winter, and pots not larger than just necessary should be given; they may also be planted out in a cool greenhouse and trained as a wall plant. *D. Genkwa*, with abundant lilac flowers before the leaves, is sometimes forced.

Propagation is by seeds, sown after maturity or stratified, but germinating very slowly; also by layers put down in spring and taken off the following year. The evergreen species may be increased by cuttings of mature wood in fall under glass, and kept in a cool greenhouse during the winter. If gentle bottom heat can be given in early spring, it will be of advantage to the development of the roots; softwood cuttings taken from forced plants may also be used. *D. odora* is often veneer-grafted on seedling stock of *D. Laureola* in winter, or on roots of *D. Mezereum*; also other species are grafted on roots of *D. Mezereum*. *D. Cneorum* and probably its allies are readily increased in spring by removing the earth around the plant, pegging down the branches and filling with fine compost almost to the tops of the branches. Next spring, if the compost is carefully removed, a large number of little buds, each supplied with a white root, are found along the branches; they are easily detached and planted in pans or boxes.



1220.  
The Dandelion.  
( $\times \frac{3}{4}$ )

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A. *Foliage deciduous: fls. axillary along the branches of the previous year, appearing before the lvs.*

B. *Lvs. alternate, glabrous. (Mezereum.)*

1. **Mezereum**, Linn. Erect shrub, with stout branches, to 4 ft.: lvs. alternate, cuneate, oblong or oblanceolate, glabrous, grayish beneath, 1-3 in. long: fls. usually 3, sessile, silky outside, fragrant, lilac-purple, appearing long before the lvs.: fr. roundish ovoid, scarlet. Feb.-April. Eu. to Altai and Caucasus. Gn. 29:602; 33, p. 514; 69, p. 131. V. 2:206. Var. *alba*, Ait., has white fls. and yellow fr. Gn. 29:602; 69, p. 131; 74, p. 255. G.C. III. 21:183, 185; 38:153. R.H. 1905, p. 532. Var. *plena*, Schneid. (var. *alba-plena*, Hort.), has double white fls. Gn. 29:602. Var. *grandiflora*, Dipp. (var. *autumnalis*, Hort.). With larger brighter purple very early fls., sometimes blooming in fall.

2. **Houtteana**, Planch. (*D. Mezereum* var. *atropurpurea*, Dipp.). Shrub, to 4 ft., with erect, stout branches: lvs. alternate, cuneate, oblong-lanceolate, glabrous, coriaceous and often persistent, purple: fls. appearing before the lvs., lilac-violet, 2-4, in short-peduncled clusters. April. F.S. 6:592.—Of garden origin, supposed to be a hybrid between *D. Laureola* and *D. Mezereum*.

BB. *Lvs. opposite, silky below. (Genkwa.)*

3. **Genkwa**, Sieb. & Zucc. (*D. Jénkwa*, Hort.). Shrub, to 3 ft., with slender branches: lvs. opposite, oblong-elliptic, appressed-pubescent on the veins beneath,  $1\frac{1}{4}$ -2 in. long: fls. lilac, 3-7, in short-stalked clusters, scentless, densely silky-villous outside. March, April. Japan. S.Z. 75. Gt. 15:499. F.S. 3:208. G.M. 35:292. Gn. 42:91; 76, p. 105. R.B. 10:73. Var. **Fórtunei**, Franch. (*D. Fórtunei*, Lindl.), has larger fls. and larger less regularly opposite lvs.

AA. *Foliage evergreen, alternate (see also No. 2).*  
(*Daphnantes.*)

B. *Fls. in terminal heads, rarely axillary and pinkish.*

c. *Habit low, procumbent or trailing.*

4. **Cneorum**, Linn. Fig. 1221. With long, trailing, pubescent branches: lvs. crowded, cuneate, oblanceolate, mucronulate, finally glabrous, dark green and glossy above, glaucescent beneath,  $\frac{1}{2}$ -1 in. long: fls. in sessile, many-flid. heads, pink, fragrant. Apr., May, and often again in summer. Mts. of Cent. Eu. B.M. 313. L.B.C. 18:1800. Gn. 33, p. 514; 45, p. 237; 62, p. 83. G.C. III. 47:21. G.M. 47:117. M.D.G. 1900:417, 418; 1906:75. G.W. 14, p. 625. V. 2:342; 4:168. Var. **máior**, Dipp. Of more vigorous growth, with larger fls. Gn. 51, p. 358; 65, p. 457. Var. **Vérlotii**, Meissn. (*D. Vérlotii*, Gren. & Godr.). Lvs. longer, mucronate: fls. 2 weeks later than the type. R. H. 1901, pp. 304, 305; 1902:552. Var. **máximus** of European nurseries = *D. neapolitana*.

5. **Blagayana**, Freyer. Branches often ascending, glabrous: lvs. cuneate, obovate or oblong, glabrous, 1-1 $\frac{1}{2}$  in. long: heads many-flid.; fls. white or yellowish white, fragrant, nearly glabrous outside, almost 1 in. long. April, May. Mts. of S. E. Eu. B.M. 7579. F.S. 22:2313. Gt. 29:1020. Gn. 14:200; 35, p. 540; 42, p. 95; 50, p. 26; 67, pp. 287; 71, pp. 7, 247; 73, p. 241. G.C. II. 13:245; 17:505; III. 11:491; 32:300, 301; 38:171.

cc. *Habit erect, 1-4 ft. high.*

D. *Lvs. less than 2 in. long, usually pubescent: perianth densely pubescent outside.*

E. *Lobes of perianth lanceolate, acute; heads without bracts.*

6. **oleoides**, Schreb. (*D. buxifolia*, Vahl). Shrub, to 3 ft.: branches pubescent: lvs. obovate-elliptic to obovate-lanceolate, usually mucronulate or acute, villous-pubescent on both sides or finally glabrous above, punctulate with whitish dots, 1-1 $\frac{1}{2}$  in. long: fls. in few-flid. heads without bracts, white or pale lilac, with

ovate-lanceolate, pointed lobes,  $\frac{1}{2}$  in. long. S. E. Eu. L.B.C. 3:299. B.M. 1917.—Very variable in shape and pubescence of lvs. Var. **Fioniàna**, Hort., with obovate-lanceolate, obtuse lvs. and lilac fls., is said to be a hybrid between this species and *D. collina*.

EE. *Lobes of perianth ovate, obtusish; heads with bracts at the base.*

7. **collina**, Smith (*D. australis*, Cyrill. *D. sericea*, Hort., not Vahl). Shrub, 1-3 ft.: branchlets villous: lvs. scattered, oblong-ovate to oblanceolate, obtusish, glabrous and shining above, tomentose below, 1-1 $\frac{3}{4}$  in. long: fls. rosy purple, fragrant,  $\frac{3}{4}$  in. long, in 10-15-flid. heads, lobes broad-ovate, obtuse, about as long as tube; bracts broadly oval, tomentose, about half as long as the fls., persistent for some time. April-June. Italy, Crete, Asia Minor. B.M. 428. B.R. 24:56. Var. **neapolitana**, Lindl. (*D. neapolitana*, Lodd. *D. Delahayana*, Hort.). Lvs. glabrous or nearly so. L.B. C. 8:719. B.R. 822. By some supposed to be a hybrid of *D. collina* and *D. Cneorum*.

8. **sericea**, Vahl (*D. oleifolia*, Lam.). Shrub, 1-2 ft.: branchlets short, puberulous or nearly glabrous: lvs. crowded at the end of the branchlets, lanceolate or oblanceolate, acute or acuminate, glabrous above, appressed pubescent beneath, sometimes nearly glabrous,  $\frac{1}{2}$ - $\frac{3}{4}$  in. long: fls. in 3-8-flid. heads, rose-colored,  $\frac{3}{4}$  in. long, lobes broadly ovate, obtuse, a third shorter than tube: bracts obovate, silky, soon drooping. May, June. Sicily, Crete, Asia Minor. Ann. Mus. Hist. Nat. Paris 10: 20.—Rare in cult.; usually confused with the preceding species.

DD. *Lvs. usually longer than 2 in., glabrous (or slightly pubescent beneath in No. 9); perianth glabrous or pubescent.*

E. *Apex of lvs. obtuse or acutish.*

F. *Heads of fls. all terminal, usually many-flid.; bracts persistent.*



1221. *Daphne Cneorum*.

9. **hýbrida**, Lindl. (*D. Dauphinii*, Hort. *D. Delphinii*, Lodd.). Garden hybrid of *D. collina*  $\times$  *D. odora*. Similar to *D. odora*, but hardier. Erect shrub, to 4 ft.: lvs. cuneate, oblong-elliptic, dark green and shining above, glabrous or slightly hairy along the veins beneath when young, 2-3 in. long: fls. reddish purple, pubescent outside, very fragrant, rather large, in few-flid. heads. B.R. 1177.

10. **odora**, Thunbg. (*D. sinensis*, Lam. *D. indica*, Loisel., not Linn.). Shrub, to 4 ft., with glabrous branches: lvs. oblong-elliptic, acute at both ends, bluntly pointed, glabrous, 2-3 in. long: fls. in dense, terminal heads, very fragrant, white to purple; ovary glabrous; bracts 6-10, lanceolate, persistent. Winter and spring. China, Japan. Gn. 28:8. J.H. III. 50:367. V. 4:318. Gng. 2:211. Var. *alba*, Hemsl. Fls. white. Gn. 28:8; 37, p. 10; 76, p. 240. G. 8:45; 22:9. Var. *punctata*, Hemsl. Fls. in dense heads, white, spotted outside with red. B.M. 1587. Var. *marginata*, Hort. Lvs. bordered yellow: fls. red. P.M. 8:175 and R.H. 1866:252 (as *D. japonica*). A.G. 22:843. Var. *rúbra*, Sweet. Fls. purple. S.B.F.G. II. 4:320. G.C. III. 21:173.—By some botanists *D. odora* and *D. sinensis*, Lam. (*D. indica*, Loisel.), are considered distinct species: *D. odora* has larger fls. about  $\frac{3}{4}$  in. long, glabrous outside, the bracts shorter than the fls., and

usually oval lvs., while *D. sinensis* has fls. about  $\frac{1}{2}$  in. long, slightly silky outside, the bracts longer than the fls., and usually oblong-elliptic lvs.; but it is doubtful whether these characters are constant.—*D. odorata*, Hort., is a common misprint in catalogues for *D. odora*. *D. odorata*, Lam. = *D. Cneorum*.

FF. Heads of fls. axillary and terminal, few-fl'd.; bracts caducous; perianth glabrous.

11. *japónica*, Sieb. & Zucc. (*D. Mazéliei*, Carr.). Shrub, to 4 ft.: branches glabrous: lvs. oblong-deltoid, gradually narrowed at the base, nearly sessile, 2–4 in. long: heads axillary and terminal short-peduncled, 3–4 fl'd.; fls. pink, short-pedicelled,  $\frac{1}{2}$  in. long; lobes ovate, obtuse, as long as tube; bracts ovate-lanceolate, ciliate, slightly shorter than fls.; peduncles and pedicels silky. Spring. Japan, China. Gn. 14:442.

EE. Apex of lvs. usually emarginate.

12. *retusa*, Hemsl. Shrub, 2–3 ft.: branchlets pubescent at first, soon glabrous: lvs. oblong or oblanceolate-oblong, obtuse and usually emarginate, narrowed at the base into a short petiole, glabrous, 1–3 in. long,  $\frac{1}{2}$ – $\frac{3}{4}$  in. wide: fls. white, tinged outside rose or violet, glabrous, fragrant,  $\frac{3}{4}$  in. long, in many-fl'd. terminal heads; lobes slightly shorter than tube; bracts 3–4, oval or obovate, ciliate, deciduous, shorter than fls.: fr. red. May. W. China. B.M. 8430.—Recently intro. and apparently fairly hardy; a very desirable plant.

BB. Fls. axillary, yellowish or greenish white, glabrous outside.

13. *Laurèola*, Linn. Shrub, to 4 ft.: lvs. cuneate, obovate-lanceolate, acute, shining and dark green above, glabrous, 2–3½ in. long: fls. in 5–10-fl'd., nearly sessile racemes, yellowish green, scentless: fr. black. March-May. S. Eu., W. Asia. Gn. 29, p. 602 (poor). Var. *Philippii*, Arb. Kew (*D. Philippii*, Gren. & Godr.). Lower: lvs. obovate: fls. often violet outside; bracts as long or longer than the fls. Pyrenees.—Var. *purpurea* of the Kew Arboretum = *D. Houtteana*.

14. *póntica*, Linn. Shrub, to 5 ft.: lvs. cuneate, obovate or obovate-lanceolate, acute, shining, glabrous, 2–3 in. long: fls. in long-peduncled, 1–3-fl'd. clusters, greenish yellow, fragrant, with linear-lanceolate lobes. April, May. S. E. Eu., W. Asia. B.M. 1282. G.C. II. 14:209. G.W. 5, p. 261.

*D. alpina*, Linn. Erect shrub, to 2 ft.: lvs. deciduous, cuneate-lanceolate, sparingly silky: fls. white or blushed, terminal, fragrant. May, June. S. Eu. L.B.C. 1:66. Gn. 29, p. 603.—*D. altaica*, Pall. Shrub, to 4 ft.: lvs. deciduous, cuneate, oblong-lanceolate, glabrous: fls. white, in terminal, 1–5-fl'd. heads, fragrant. May, June. Altai, Sogaria, Mongolia. B.M. 1875. L.B.C. 4:399.—*D. arbuscula*, Celak. Evergreen dwarf shrub: branchlets red: lvs. crowded at end of branchlets, linear-oblong-lanceolate, obtuse, pubescent or glabrous beneath,  $\frac{3}{4}$  in. long: fls. pink, in 3–8-fl'd. heads. June. Hungary.—*D. caucásica*, Pall. Allied to *D. altaica*. Lvs. narrower: fls. in 3–20-fl'd. heads. Caucasus. B.M. 7388.—*D. glomerata*, Lam. Allied to *D. pontica*. Low: fls. light pink, fragrant, the clusters crowded at the ends of the branches. May. W. Asia.—*D. Gnidium*, Linn. Evergreen shrub, to 2 ft.: lvs. linear-lanceolate, acute, glabrous: fls. yellowish white, fragrant, in terminal racemes or panicles. S. Eu. L.B.C. 2:150. Gn. 29, p. 603.—*D. jezoensis*, Maxim. Upright shrub, 2 ft.: lvs. oblong-obovate, persistent, obtuse,  $1\frac{1}{2}$ –3 in. long: fls. axillary, yellow. March, Apr. Gt. 15:496.—*D. kamschática*, Maxim. Low upright shrub, sparsely branched: lvs. oblong-lanceolate, acutish: fls. fascicled, yellowish. Kamchatka, Manchuria.—*D. papyrifera*, Sieb. = Edgeworthia papyrifera.—*D. petraea*, Leyb. Dwarf evergreen shrub: lvs. linear-lanceolate, small, obtuse: fls. light pink, in terminal, 3–6-fl'd. heads, fragrant. June, July. S. Tyrol. Gn. 69, p. 327.—*D. pseudo-mezereum*, Gray. Low, almost decumbent shrub: lvs. lanceolate-oblong, acutish: fls. fascicled, axillary, greenish yellow, scentless. March, Apr. Japan.—*D. rupéstris*, Fach. = *D. petraea*.—*D. salicifolia*, Lam. = *D. caucásica*.—*D. Sophia*, Kalen. Allied to *D. caucásica*: lvs. obovate-oblong, glaucous below: heads few-fl'd. S. Russia.—*D. striata*, Tratt. Dwarf evergreen shrub: lvs. small, cuneate, linear-lanceolate, glabrous: fls. in terminal, many-fl'd. heads, pink. June, July. Switzerland and Carpathian Mts.—*D. Vahlia*, Keissler. Allied to *D. collina*. Branchlets thick, puberulous: lvs. obovate or oblong-obovate, appressed-pubescent below: heads 8–10-fl'd.: bracts obovate, silky, deciduous. Crete, Asia Minor.—*D. jezoensis*, Hort. = *D. jezoensis*.

ALFRED REHDER.

DAPHNÍDIUM: *Benzoin*.

**DAPHNIPHYLLUM** (Greek, *laurel leaf*, from the similarity of the leaves). *Euphorbiaceæ*. Broad-leaved evergreen hardy or semi-tropical shrubs or small trees, sometimes cultivated for their handsome large foliage.

Leaves large, without stipules, leathery, smooth, more or less glaucous, alternate, entire, petioled, pinnately veined: fls. dioecious, in axillary racemes or panicles, apetalous; calyx 3–8-parted, small, imbricate; stamens 5–18; pistil 2-celled, 4-ovuled: fr. a small, olive-like drupe, usually 1-seeded.—Twelve to 20 species, mostly in Trop. Asia, etc. The one, or possibly two, species, rarely seen in cult. in Amer., are from Japan. The large evergreen lvs. distinguish it from other hardy euphorbiaceous shrubs. They are somewhat rhododendron- or laurel-like, hardy as far north as the Middle Atlantic States, and make very handsome broad-spreading shrubs with inconspicuous fls.

*Daphniphyllum* can be propagated by cuttings, but roots rather slowly, and if seed could be secured it would no doubt give better results. The plants need protection from frost in winter till well established. They are strong growers in rich soil.

*macrodonum*, Miq. (*D. glaucescens*, Hort.). A shrub or small tree, broad and compact, 5–10 ft. high, or more in native land, smooth, twigs red: lvs. oblong, 2 x 8 in., bluish glaucous below; petiole 1–2 in. long, red; lateral veins,  $\frac{3}{8}$ – $\frac{1}{2}$  in. apart: fls. small, in short racemes: fr. oblong, not over  $\frac{1}{2}$  in., black. Japan and China. G. 18:478; 31:16. S.I.F. 1:54.

Two other names, *D. glaucescens*, Blume, and *D. jezoense*, Hort., occur occasionally in horticultural literature. The first has scarcely glaucous lvs. with lateral veins  $\frac{1}{2}$ – $\frac{1}{2}$  in. apart and is probably not in cult.; the latter is a more dwarf form than the others.

J. B. S. NORTON.

DÁRBYA: *Nestronia*.

**DARLINGTONIA** (after William Darlington, of West Chester, Pa., author of "Memorials of John Bartram and Humphrey Marshall," and of "Florula Cestrica.") *Sarraceniacæ*. A monotypic genus of American pitcher-plants which, apart from their striking aspect and beautiful coloring, have acquired celebrity from their insectivorous habits.

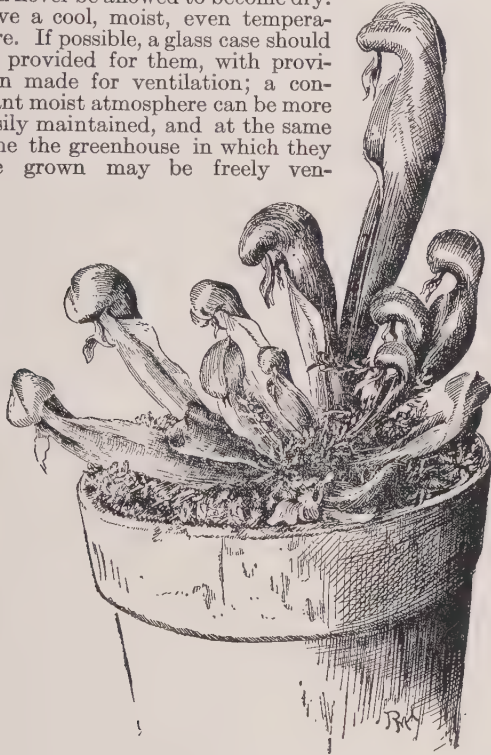
The short rhizomes grow in fine muddy soil, and produce annually a terminal rosette of lvs., all of which are modified into upright pitchers: each pitched lf. is 3–30 in. long by  $\frac{1}{2}$ –3 in. wide, is somewhat spirally twisted, hollow throughout and with a median crest or flap in front; the tube represents the hollowed lf.-midrib, the flap is formed by the fused halves of the lf. that have united by their upper faces in front of the midrib; the top part of the tube curves over in rounded fashion to form a down-directed pitcher orifice, from which depends a bilobed unusually crimson and green appendage of attractive aspect; the rounded top is also beautifully mottled by white translucent areas; the pitcher exterior and the appendage bear many honey-glands, the excretion from which tempts insects toward the orifice. The rounded hood is lighted within through the white areas, and bears many attractive honey-glands interspersed with down-directed hairs. Tempted by the former, and impelled by the latter, insects step or drop on to the upper interior of the tube. This is extremely smooth, affords no foothold, and so they soon tumble into the lower part. This is covered by down-directed hairs which prevent egress of the caught prey. Disintegration of the insects, amid a neutral liquid that is excreted by the pitcher-wall, then takes place and the products are gradually absorbed through thin areas of the lower cavity. Honey-secretion and insect-catching proceed most actively in May and June; by midsummer, therefore, each pitcher is filled to a depth of 4–8 in. by a decaying mass of insect-remains, amid which at times centipedes or a slug may be found. The genus is native from N. Cen. Calif. to S. Ore. It occurs there on the Sierras by the edge of mountain swamps or "deer-licks" at an elevation of 2,000–8,000



ft. Specimens were first hurriedly collected by W. D. Brackenridge of the Wilkes Exploring Expedition, on the southern slopes of Mt. Shasta, when the explorers were retreating before attacking Indians. The specimens were described and named by Torrey.

Darlingtonias have been grown outdoors in the East the year round in a few special localities. Edward Gillett at Southwick, Massachusetts, grows them in a favored spot without artificial protection. F. H. Horsford can preserve them at Charlotte, Vermont, with the aid of a winter mulch.

As greenhouse plants, darlingtonias require the same treatment as their allies, *sarracenias*, *dioneas* and *droseras*. A well-grown collection of these plants is not only very interesting and curious, but also very beautiful. To succeed, they must occupy a shaded position, and never be allowed to become dry. Give a cool, moist, even temperature. If possible, a glass case should be provided for them, with provision made for ventilation; a constant moist atmosphere can be more easily maintained, and at the same time the greenhouse in which they are grown may be freely ven-



1222. Young plant of *Darlingtonia*.

tilated without injury to these plants. The material in which they grow best is two-thirds fern-root fiber with the dust shaken out, and one-third chopped sphagnum moss and silver sand, with a few nodules of charcoal added. About the first week in July is perhaps the best time for potting, though one must be guided by the condition of the plants, choosing a time when they are the least active. When well established they will require potting only once in two years. The pots should be placed in pot-saucers as a safeguard against their ever becoming dry, and all the space between the pots should be filled with sphagnum moss up to the rims of the pots. A temperature of 40° to 45° during winter, with a gradual rise as the days lengthen in spring, will suit them admirably. During the summer they should be kept well shaded, or they may be removed to a well-shaded frame outside in some secluded position free from hot drying winds. Propagation of these plants is effected by division of the roots, or by seeds sown on live sphagnum moss in pans, the moss being made very even and the pans placed either under a bell-jar or glass case in a cool moist atmosphere. (Edward J. Canning.)

*californica*, Torr. Fig. 1222. Rootstock horizontal: lvs. 5-8 in annual rosettes, long-tubular, somewhat twisted, with median anterior flap, green below, green mottled with white over the arched hood, orifice down-directed with bilobed red and green appendage in front: fl.-stalk 10-30 in., bearing scattered bracts; fl. solitary, inverted; sepals 5, pale green; petals 5, yellowish to brown-red with red veins; stamens 15-12, inserted below ovary; ovary obconic with depressed apex, style 5-lobed with radial stigmas; caps. obovate, surrounded by the persistent sepals. Flowers from May to July, according to elevation. B.H. 5:113. F.S. 14:1440. F.M. 1869:457. B.M. 5920. I.H. 18:75. G.C. III. 7:84; 17:304; 24:339.—Intro. into cult. in 1861. Var. *rùbra*, Hort. Differs from type in being a reddish hue.

*D. Courtii* = *Sarracenia Courtii*.

J. M. MACFARLANE.

DARNEL: *Lolium perenne*.

**DARWÍNIA** (Dr. Erasmus Darwin, an English nature-student). *Myrtaceæ*. About 40 Australian evergreen shrubs, a very few of which are sometimes grown for the colored flower-like campanulate involucres that hold their condition 3-5 months; not in the American trade. Lvs. few and usually heath-like: fls. small, inclosed in petal-like bracts at the summit of the branches; calyx-lobes 5; petals 5; stamens 10, alternating with staminodia; ovary 1-celled, the fr. 1-seeded. The darwinias prop. from well-ripened tips of side shoots taken in early autumn or in spring. They require greenhouse or intermediate temperatures. *D. Hookeriàna*, Benth. (*Genetyllis fuchsioïdes*, Hort.). Lvs. linear-oblong, ½ in. long, scattered: sts. red: inner bracts of hanging involucre 1 in. long, bright red, the outer ones shorter and greenish and passing into the st.-lvs.: fls. small, greenish white, usually about 6 in each involucre. B.M. 4860 (as *Genetyllis macrostegia*). G.C. III. 43:243. F.S. 10; 1009. *D. macrostègia*, Benth. Lvs. elliptic-oblong, ¾ in. or less long, scattered: inner bracts 1½ in. long, creamy white with red splashes and stripes, the outer ones shorter and more colored, the lowest ones passing into the foliage. B.M. 4858 (as *Genetyllis tulipifera*). I.H. 2:73. F.S. 10:1064.

L. H. B.

**DASHEEN**. Edible crown-tubers of *Colocasia*, lately cult. in the U. S. to some extent. See p. 830; also *Taro*.

**DASYLÍRION** (Greek, *tufted lily*). *Liliacæ*. Stiff short-trunked desert plants, with crowded leaves and elevated panicles of small mostly white or whitish flowers.

Caudex or trunk erect and woody: lvs. numerous, near the top of the trunk, long and rigid, usually prickly-margined: fls. dioecious, in dense racemes which are crowded into a narrow compound panicle; perianth campanulate, the segms. toothed, distinct and nearly equal, obtuse; stamens 6, exserted, style short; stigmas 3: fr. dry and indehiscent, 3-winged, 1-celled and 1-seeded.—About 15 species. Mex., to Texas and Ariz. Monograph in Proc. Amer. Phil. Soc. 50, p. 404 (1911).

Dasyilirions are highly ornamental plants, well adapted for rockeries, for isolated specimens on lawns, decoration of conservatories, staircases and similar uses, and eminently suitable for terraces and vases, in the formal style of gardening. The leaves are in large number, inserted in a symmetrical way, so as to form a dome or globe-shaped, regular head, more or less serrulated, and in some species ending in a brush-like tuft of dried fibers. The tall panicles of numberless whitish green minute flowers are also a striking feature, standing far above the crest or crown of leaves. They are of the easiest possible culture, and will stand some degrees of frost, particularly if kept dry. Easily propagated from seeds and from cuttings of the branches when produced, as they do not sucker as a rule. These plants are inferior to *Yucca filamentosa*

in hardness, showiness and regularity of flowering, but they have an individuality of their own. They are especially esteemed in California, where the great flower-stalks, 8 to 10 feet high, give a strong impression of the desert. The individual flowers are not highly colored, but the spikes are several feet long. These and related plants have been the subject of recent revision. *Beaucarnea* is now considered to be distinct, and a new genus, *Calibanus*, is erected by Rose on *D. cespitosum*. These new treatments are explained under *Nolina*.

A. *Lvs. flat, prickly-margined.*

B. *Lvs. usually green, splitting into fibers at tip, narrow.*

**texanum**, Scheele. *Lvs.*  $\frac{1}{2}$  in. x 2-3 ft., glossy green: prickles yellow, turning brown: infl. 9-15 ft. high: fr. elliptical,  $\frac{3}{16}$  x  $\frac{1}{16}$  in., shallow-notched. S. Cent. Texas.

**acrótriche**, Zucc. (*D. acrótrichum*, Baker. *D. grácilis*, Planch. *Bonapártea grácilis*, Otto. *Roulinia grácilis*, Brongn. *Yucca grácilis*, Otto. *Y. acrótricha*, Schiede. *Barbacenia grácilis*, Brongn. *Littæa grácilis*, Hort.). *Lvs.* very narrow,  $\frac{3}{8}$  in. x 2-3 ft., sometimes dull or pale: prickles pale yellow, brown at tip: infl. 9-15 ft. high: fr. round-cordate,  $\frac{3}{16}$  x  $\frac{1}{4}$  in., shallow-notched. E. Cent. Mex. Abhandl. Akad. Muench. Cl. 2, 3:1. B.M. 5030. F.S. 1448; 7, p. 10. G.C. III. 19, p. 204.

**graminifolium**, Zucc. (*Yucca graminifolia*, Zucc.). *Lvs.*  $\frac{1}{2}$  in. x 3 ft., glossy green: prickles very short, yellowish white: fr. elliptical,  $\frac{1}{4}$  x  $\frac{3}{8}$  in. E. Cent. Mex. Abhandl. Akad. Muench., Cl. 2, 3:1. Allgem. Gartenz. 9:1.

BB. *Lvs. glaucous and dull.*

c. *The lvs. not shredded at tip, narrow.*

**glaucophyllum**, Hook. (*D. glaucum*, Carr. *Bonapártea glauca*, Hort.). *Lvs.*  $\frac{1}{2}$  in. x 3-4 ft: prickles yellowish white: infl. 12-18 ft. high: fr. elliptical,  $\frac{1}{4}$  x  $\frac{3}{8}$  in. E. Cent. Mex. B.M. 5041. G.C. II. 13, p. 205; III. 40, p. 247. Rep. Mo. Bot. Gard. 14, p. 12.

cc. *The lvs. splitting into fibers at tip, wider.*

**serratifolium**, Zucc. (*D. laxiflorum*, Baker. *Yucca serratifolia*, Schultes. *Roulinia serratifolia*, Brongn.). *Lvs.* 1-1½ in. x 2-3 ft., rough: prickles rather long, sometimes  $\frac{3}{4}$  in. apart. S. E. Mex. Abhandl. Akad. Muench., Cl. 2, 3:1.

**Wheeleri**, Wats. With distinct short trunk: lvs. nearly 1 in. x 2-3 ft., nearly smooth: prickles yellow, brown at tip: infl. 9-15 ft. high: fr. round obovate,  $\frac{1}{4}$  x  $\frac{5}{16}$  in., openly notched. S. E. Ariz. and adjacent region. Pl. World, 10, p. 254. Publ. Carnegie Inst. 99:58. Icones Sel. Hort. Thenensis, 225.

AA. *Lvs. 4-sided, neither prickly nor usually brush-tipped.*

**longissimum**, Lem. (*D. quadrangulatum*, Wats. *D. juncifolium*, Rehnelt). Trunk 3-6 ft. high: lvs. very numerous,  $\frac{1}{4}$  in. x 4-6 ft., dull green: infl. 6-18 ft. high: fr.  $\frac{5}{16}$  x  $\frac{3}{8}$  in., scarcely notched. E. Mex. B.M. 7749. G.F. 36, p. 280. Bull. Soc. Tosc. Ort. 9, p. 236; 35:6. Die Natur, 34, p. 340. R.H. 86, p. 66.

*D. Hookeri*, Lem.=*Calibanus Hookeri*, Trel. (see *Nolina*). —*D. juncum*, Zucc.=*Nolina Hartwegiana*. —*D. longifolium*, Zucc.=*Nolina longifolia*.

WILLIAM TRELEASE.†

**DATE.** A palm, *Phoenix dactylifera*, Linn., native to North Africa or Arabia and extensively planted in countries inhabited by Arabs, and having arid or desert conditions. Figs. 1223-1226. It is also grown to some extent in southern Asia and southern Europe and in other tropical and subtropical countries. It is of very ancient cultivation, having been grown along the Tigris and Euphrates Rivers for four thousand years or more. It has long been planted casually in parts of Mexico and the southwestern parts of the United

States, and is now becoming a fruit of commercial promise in some of these regions.

The date palm reaches a height of 100 feet, making a nearly straight, shaggy trunk, and it continues to bear for one or two centuries. It is dioecious, the males usually equaling the females in a batch of seedlings, this constituting one of the great disadvantages of raising seedling dates. The Arabs practise artificial pollination by tying male flowers on the pistillate clusters. The flowers are produced early in the spring, from six to twenty clusters appearing on a mature tree. The female or fertile clusters of good size will produce as much as twenty to forty pounds of dates. As with apples and other fruits, there are many varieties differing in quality; seedlings do not reproduce the variety, so that propagation of named varieties must be accomplished by other means.

The date is the fruit, being essentially a drupe, measuring 1 to 3 inches long. The date of commerce is the cured and dried natural fruit. The sweet nutritious pulp of the fruit constitutes one of the most important foods of the Arabs. The leaves and other parts of the plant afford materials for dwellings and many domestic uses. The wood or trunk is used for timber. The importation of dates into the United States amounts to about \$500,000 worth annually. No doubt the consumption will be greatly increased when a home-grown and clean-packed product is obtainable.

Aside from the direct uses of the plants and the fruits, the date palm is valuable as a cover for other crops in the hot and dry regions. Beneath the palms, other fruits, vegetables and many crops may be grown with more safety than in the open blazing sun. It is probable, therefore, that the date palm will become a feature of the farming in all the regions of the Southwest in which it thrives.

#### The general situation.

In Florida, California, and restricted areas of a few other states, the date has been grown for decorative purposes for more than a century. At the missions founded by the Spaniards at St. Augustine, and other places in Florida, and that long line of missions extending from far into Mexico northward and westward through southern New Mexico, Arizona and California, it is likely the date was planted wherever the climatic conditions were favorable to its growth. Within the borders of the United States the greater number of these early plantings were in Florida or along the coast of southern California, regions where the sum total of summer heat is not sufficient to develop the date fruit perfectly. The date, as a fruit-producer, being indigenous to a desert environment, does not take kindly to humid regions, even where it is not sufficiently cold to prohibit the growth of the tree. It is not only a question of maturing the tree or even of producing the fruit but also of bringing the fruit to perfect ripeness. For this reason the greater number of the early plantings in this country matured little fruit, while that produced was of poor quality, although in many instances the trees grew luxuriantly and to large size. In the more arid parts of Lower California and Sonora, where there is sufficient water for irrigation, the early plantings have been continued down to the present time, and dates of fair quality have been grown for many years. Moreover, each year the area devoted to dates is increasing, and with the recent studies of the life-history of the plant by Swingle and others the adaptation of regions is now better understood and undoubtedly the future plantings will be made with much better assurance of success. Modern date culture in this country may be said to have begun with the planting of imported Egyptian and Algerian palms and seedlings principally in Salt River Valley, Arizona, in the years 1890-1900. Toumey's studies of these early plantings resulted in Bulletin No. 29 of the



Arizona Station. Studies of conditions in the Saharan region and the importation of varieties by the United States Department of Agriculture, were made in 1899 and 1900. These results were set forth in Bulletin No. 53 of the Bureau of Plant Industry, by Swingle. Stations for testing the introductions were provided by Arizona in 1899, by California in 1904, and by Texas in 1907. Subsequent large importations were made by Fairchild and Kearney, as described in Bulletins Nos. 54 and 92 of the Bureau of Plant Industry of the national Department of Agriculture.

Dates unquestionably can be grown profitably in many of the hot dry irrigated valleys in the southwestern parts of the United States. The Salton Basin in southern California promises particularly well for date-culture because of the high temperature, and here even the famous Deglet Noor date of the Sahara will ripen fully, even in cool seasons. Considerable attention is also being given to dates in the newly developing Imperial Valley. In northern California, the date can undoubtedly be grown for home use in many regions, even north of San Francisco; it finds good conditions for commercial culture in parts of Arizona; and there are probably adaptable regions in Texas. The date can endure more alkali than any other profitable fruit crop, and this fact will extend the range of its usefulness. When once well established, brief temperatures as low as 10° F. do not do serious harm to date palms.

While date trees have been grown in the United States and Mexico for certainly more than a century, and while much fruit has been produced incidentally here and there, largely as a by-product, nevertheless date-growing on a commercial scale is yet a new and experimental industry in this country. Although it promises well, the business requires experience and skill, and it must be established only in those regions which are particularly adapted to it, especially those that have an extremely hot summer climate. As yet, the returns from date-culture are almost impossible of determination. As nearly always happens with new and promising industries, doubtful claims have been made for profits of date-culture by interested parties. It must be borne in mind that practically all the varieties now recommended for commercial cultivation in this country are of Old World origin. Although many seedlings are being raised, it is yet too early to designate any one of them as superior for general orchard planting. It is advisable that in the regions in California and Arizona, and elsewhere, that are adapted to dates, numbers of seedlings should be raised from the best varieties, care being taken that they have been pollinated from the best males; in this way the chance will be increased of originating varieties that are especially adapted to the region. The business must be developed by residents and those who study the conditions closely from year to year.

According to Swingle, at present less than a dozen varieties among the 200 or more on trial at the government date-gardens in the Southwest can be said to be well enough known to warrant planting on a commercial scale. The Deglet Noor and the Tazizaoot can be recommended for orchard planting in the Coachella and Imperial Valleys of California; the Halawy, the Khadrawy, the Maktoom, and the Hayany are promising for cooler regions, such as the Salt River Valley of Arizona, and may be planted in the California date regions on a scale not too large for the early markets; the Rhars is excellent for home use as a fresh date, but is of little commercial value; the Theory is a dry date of great promise, but it is as yet doubtful whether dry dates can be marketed advantageously on a large scale without an expensive publicity campaign. To plant other varieties that are new or inadequately tested, involves a considerable element of risk. The fact that they appear satisfactory in the Old World

deserts is no guarantee that they will grow, bear, and ripen fruit properly in the Southwest or that their fruit will prove acceptable to American buyers. Any planting of a variety on a large scale before it has been thoroughly tested must be considered as a speculation. It would be much safer for those who expect to grow dates on a commercial scale to limit themselves at first to those varieties that have been tested by public and private agencies, and to learn all phases of the culture, curing, packing, and marketing of the fruit of one or more of the standard varieties. This is the best possible preparation for the efficient culture of new sorts when they have been sufficiently tested in the government or other adequately supervised testing-gardens to render it desirable to test them on a commercial scale



1223. Young date palm, with growing suckers or offshoots.

in private culture. The government, through the Department of Agriculture, has taken special pains to safeguard the young industry.

#### *Propagation.*

It is always preferable to propagate dates from suckers unless one desires to originate new varieties, not only on account of the knowledge of the sex (it being hardly necessary to state that the sex of a sucker is the same as that of the plant from which it is taken), but on account of the ability to make a selection in the variety and quality of the fruit.

Dates are easily grown from seed if the ovules have been properly pollinated. Seeds may be planted in any month immediately after they are taken from the fruit, particularly in the mild climates of the Salton Basin, Lower Colorado Valley, and Salt River Valley. Unless the conditions are good, however, it is better to stratify them in a box between layers of moist sand and allow them to remain for three to six weeks in order that the seed-coats may be softened. It is important, however, that in the stratifying-box the seeds do not sprout, as they are easily damaged after sprouting takes place. The seed may be sown in nursery rows and the young seedlings transplanted after one, two or three years; or if the field is well prepared, and has good irrigation, the seed may be planted directly in the fields where the palms are permanently to remain. If they are placed directly in the field, it is well to plant them in rows 25 to 30 feet apart and to allow the young plants to stand

3 to 5 or 6 feet apart in the row. When the dates come into bearing, the undersirable ones and the males may be removed and the probability is that a sufficient number of good varieties will remain to make the row properly continuous; and the rows will be far enough apart for the regular or permanent plantation.

Suckers or offshoots are taken from the base of the young palm (Figs. 1223, 1224). One to several suckers may be removed each year, averaging two to four for the productive period, and when they are three to six years old and have begun to develop roots of their own. All species belonging to the genus *Phoenix* are difficult to transplant with uniform success. Frequently as high as 50 per cent of transplanted dates die even when watered daily and given the best of care. In planting suckers with the best of attention, a percentage die; while without care not one in a hundred will grow. It is due not so much to the lack of experience in removing the suckers as to lack of proper care after removal, that so large a percentage fail.

Suckers may be removed at any time during the spring or early summer, or even in the winter, if proper care be given them after removal. If they are to be planted in the open ground it is advisable to remove them in spring or early summer, April probably being the best month. In winter, when the plants are at a standstill, the suckers may be removed with comparatively small loss, if the "bulbs" or bottoms be not less than 4 inches in diameter. It is necessary, when suckers are removed at this season, to set them in rather small pots, so that the earth, which should be given a daily soaking, may have a chance to get warm quickly. The pots should be kept in a dry greenhouse, or, better yet, imbedded in a hotbed of manure, covered with the customary frame and glass. In all cases the leaves should be cut back to 6 to 12 inches in length, and sometimes they are removed. Transplant only when the ground is warm.

If proper attention can be given it is best to plant large suckers where they are to remain, as a second chance for loss occurs when they are transplanted from a nursery to the position that they are finally to occupy. An iron bar weighing thirty to forty pounds, and flattened to a 4-6-inch cutting end, may be used to cleave the offshoots from the tree. The leaf-stalks should be cut away, exposing the bulb of the sucker, care being taken not to injure the bulb in removing. One should cut in rather deeply at either side, not being afraid of injuring the old plant, cutting out a V-shaped portion extending from the base of the bulb downward for a few inches. Wounds may be painted with coal-

tar to prevent bleeding and evaporation. It is important, when planting the suckers in the field, to set them so high that the crown-bud will not be covered with water during irrigation, in order to avoid decay and death.

A successful method of rooting the suckers is to bank up earth about the base of the parent tree and above the base of the suckers, and keep moist by watering daily to induce formation of roots. Suckers may be partially severed from the old stock before the banking is done, or after the roots have started. When the roots are well grown, the suckers may be transplanted with little loss.

The suckers will grow perfectly well, however, if no roots are left attached. The offshoots may be cut away from the parent plant, with all the leaves removed, and leaving only the bud in the center or at the apex surrounded by the leaf-stalks. Such offshoots will stand very much exposure and may be shipped long distances without being packed in moist material, care being taken that the boxes are so filled with packing that they will not be jammed or bruised in transportation. After they are planted, they should be kept constantly moist about the bottom and should not be allowed to suffer any check. The Arabs apply water every day for thirty or forty days and then continue to irrigate each week until the following winter, care being taken not to water too much. If these precautions are taken and if the offshoots are planted in warm ground, there need be very little loss. They should never be set in the open ground when the soil is cold, as in fall or winter. If the offshoots are to be taken off at that time, they must be grown in pots or in some similar way, as described above.



1224. Deglet Noor date palm about eight years old, with offshoots and ripe fruit.

#### *The growing of dates.*

The date palm grows in nearly all kinds of soil, if only the climatic conditions are right. If it be sufficiently irrigated and have the requisite amount of heat, the soil seems to be a secondary consideration. In general it may be said, however, that sandy-loam soils of the desert, with a small percentage of clay and slightly charged with salts, are preferable to rich and heavy soils, suitable for growing ordinary crops. The question of water is of great importance in the culture of dates, as it is necessary that the roots of the date palm be in moist earth throughout the year. In general, the amount of water required for successful culture is considerable. If sufficient water cannot be supplied by natural methods, one must resort to irrigation. Water should be supplied at frequent intervals throughout the year. However, the most should be supplied in the spring before blooming, and in the fall prior to the ripening of



the fruit. The amount of water for each palm depends so much upon soil and local conditions that an estimate would be worthless. Care should be taken not to irrigate to excess at the time of blooming and immediately after, as it will militate against the successful setting of the



1225. An American seedling date.

fruit. The date seems to enjoy not only a high-atmospheric temperature, but a high temperature of the water supplied in irrigation as well. In irrigating small crops by flooding, it is necessary in midsummer to irrigate late in the afternoon or at night in order to prevent scalding. Care should be taken, in the hotter part of the year, that the date palm is not subjected to hot water about the roots, rising above the soil for a considerable length of time, and later left until the soil becomes exceedingly dry and baked by the sun. Such extremes sometimes seriously injure or destroy the tree.

The date palm comes into bearing early, examples being known in California of fruits being produced two years after the seeds were planted. It usually requires six to eight years, however, for seedlings to bear any

considerable quantity of dates. Under the best date-culture, seedlings are not used but the plants are propagated by means of suckers, as already explained; these suckers soon become established and will bear abundantly in five or six years afterwards. After ten or fifteen years, the palm may be considered to be in full bearing and should continue to produce indefinitely. It should yield 100 to 200 pounds of fruit annually, although there are cases of very much higher yields than this. To conserve the strength of the parent plant, the suckers should not be allowed to grow around the base in large numbers. Usually not more than three or four of these suckers or offshoots are allowed to remain at any one time. After the palm is in full bearing and has a trunk a few feet high, the offshoots cease to be produced. It is recommended, however, that one offshoot be left attached to the mother plant in order to replace the tree in case of an accident. If the date palm is allowed to grow as it will, it becomes a clump of many trunks, surrounded by a jungle of offshoots.

It is advised that the date palm be planted at distances of not less than 26 to 33 feet. Other crops can be grown between the trees till they come into bearing heavily, or even continuously.

Under proper cultivation, the date palm should produce from ten to fourteen leaves each year. A well-developed tree will have at one time from thirty to sixty leaves, the old ones dying away below while new ones are forming at the top. The different varieties show great variation in rapidity of growth, form and length of leaves, size of stem, and general aspect of plant. The stem of the date palm is very rigid. When the stem reaches a height of 5 or more feet it is frequently necessary to tie the growing bunches of dates securely to the lower leaf-stalks, that they be not broken and injured by the wind before maturity.

While it is possible to produce dates by depending on wind-pollination from male to female trees, this process is much too uncertain for commercial culture and requires a very large number of male trees. In commercial plantations, one male tree to 100 females is sufficient; but this requires that the pollinating shall be performed by hand. Small separate twigs or branchlets of the male inflorescence, from 4 to 6 inches long and bearing thirty to fifty flowers, are tied on the female cluster. Inasmuch as the flowers in the female

cluster mature at different times, it is necessary to repeat the operation of pollination. In old plantings, persons must climb the trees in order to perform this operation, but for the first ten or fifteen years of bearing the clusters are so near the ground that little if any climbing is required. Each female flower produces three ovaries. After pollination, two of these ovaries fail and one matures into the date. In case there is no pollination, all three of the ovaries will develop but will be seedless and the fruit will be inferior.

As with other fruits, it is often necessary to thin the dates on trees, particularly on young trees that tend to overbear. Even on old trees, best results are to be secured if only eight or ten bunches are left.

Usually the dates in an entire bunch do not ripen at the same time. Picking off the dates as they ripen is a practicable operation when labor is cheap. In general, however, it probably will be found the better plan to cut the entire bunch at once. This may require some special operation in the handling and curing. Some varieties require practically no special handling or curing and are ready to ship as soon as they have ripened naturally. Usually, however, the bunch must be ripened much as a bunch of bananas is cured, by being cut off and hung in a moist and warm place. It has been found that in Arizona the best varieties of dates may not ripen naturally on the tree. Freeman's experiments at the Arizona Experiment Station show that conditions favorable for the rapid ripening of the Deglet Noor may be produced artificially in an oven. The degree of moisture and temperature may be carefully regulated. In this ripening process, there is not only a

change in the sugar-content but the tissues of the date are softened, the tannin is precipitated and the astringency of the fruit is thereby relieved. Vinson found that dates may be ripened artificially by means of chemical reagents. Artificial ripening by means of heat, moisture, and chemical stimulation makes possible the production of commercial crops at altitudes too high and cool to mature many medium and late varieties. Losses by rain, insects, and birds are minimized, and greater cleanliness secured. Last year over half the crop from miscellaneous varieties at the Tempe Date Orchard (Arizona) would have been lost but for artificial methods of ripening. These methods are cheap and practicable. In connection with ripening operations, the fruit can be pasteurized at a temperature of 65° to 70° C (149°-158° F.) and then packed under

cheese-cloth to secure it from contamination by flies and other insects. Recent experiments by Drummond show that fumigation with carbon bisulfide kills insect eggs, and is preferable to pasteurization with varieties inclined to be sticky. In 1910, Swingle discovered the process now in use for ripening Deglet Noor dates by



1226. Fruit clusters of date, as grown in Arizona.

keeping them in moist atmosphere in closed packing-boxes which are kept warm at night and heated to 80° or 90° F. during the day. Deglet Noor dates ripen perfectly by this process and remain light-colored while those ripened by the rapid process are darkened. Freeman's rapid process will ripen greener dates, however.

For further discussion, see *Phoenix*; also the bulletins of the United States Department of Agriculture, and of the experiment stations of Arizona and California.

J. W. TOUMEY.

L. H. B.†

**DATÍSCA** (old Greek name, applied to some doubtful plant). *Datiscaceæ*. Tall perennial herbs, one of which is sometimes planted in gardens.

Glabrous branching hemp-like plants with pinnately compound or ternately divided alternate lvs., the lfts. or segms. lanceolate and usually serrate or toothed: fls. usually dioecious, the staminate fascicled in the axils and short-pedicelled, the pistillate racemose on axillary branchlets; stamens in sterile fl. 8-12-25, mostly opposite the calyx-lobes; stamens sometimes present in fertile fls. but few and perhaps alternate with calyx-lobes; ovary 3-angled at top, with 3 styles which are 2-parted: fr. a narrow ribbed many-seeded caps., opening between the styles at the top.—Species 2, one in S. E. Eu. and W. Asia, and the other in Calif. and Mex.; the former is in cult. abroad, requiring no special treatment; prop. by seeds and division.

The family *Datiscaceæ* is placed near *Begoniaceæ* and *Cactaceæ*. It comprises two other genera of tall trees, neither of which is recorded as in cultivation; these are *Octomeles*, with two species in the Malayan archipelago, and *Tetrameles*, with one species in East India to Java.

**cannabinā**, Linn. Three to 7 ft.: lvs. odd-pinnate; the lfts. of 3 pairs, 2 in. long, deeply serrate, long-acuminate: fls. small, yellow, the females in long and open racemes. Eu.—Attractive bushy plants with graceful foliage; both sexes should be grown, the female being the finer for ornament.

*D. glomerata*, Brew. & Wats., the American species, is apparently not in cult.: 2½-4 ft., stout, glabrous, the sts. clustered: lvs. ternately divided or lobed: staminate fls. in clusters of 3; pistillate fls. 4-7 together or scattered along short branchlets. It is the durango-root of the Coast ranges and Sierra Nevada.

L. H. B.



1227. A triple form of *Datura fastuosa*, commonly known as *D. cornucopia*.

**DATŪRA** (Arabic name). Syn. *Brugmānsia*. *Solanaceæ*. THORN-APPLE. Several large plants cultivated for their huge trumpet-like flowers, which have an odor that is very pleasant to some persons.

Annual or perennial herbs, shrubs, and trees: lvs. large, entire or wavy-toothed: fls. large, solitary, erect or pendulous, mostly white, with more or less violet, rarely red or yellow; calyx 5-toothed, sometimes breaking apart near the base or splitting lengthwise; corolla trumpet-shaped, with spreading 5-10-toothed

limb; stamens 5, all perfect, slightly or not at all exserted, the filaments slender; style long, the stigma 2-lobed: fr. a large 2-celled caps., mostly prickly or spiny, usually dry and 4-valved at top but sometimes fleshy and bursting irregularly, with large seeds.—Some 15 species, mostly strong-smelling, in the warmer parts of the globe, some of them weeds.

A few daturas are grown as flower-garden subjects, or the shrubby kinds under glass or as tub specimens. The most popular kind in northern gardens is commonly called *D. cornucopia* (Fig. 1227), which is especially interesting when its flowers develop two or three well-defined trumpets, one within another. Sometimes, however, these double flowers are a confused mass of petalage. Double and triple forms are likely to occur in any of the species described below. The horn-of-plenty has been especially popular in America since about 1895, when it was found in South America by an orchid collector of the United States Nursery Company, and soon became widely distributed in "yellow, white, blue and deep carmine," all double forms. Daturas contain strong narcotics. Large doses are poisonous, small doses medicinal. Separate preparations of *Stramonium* seed and leaves are commonly sold in the drugstores. *D. Stramonium* (Fig. 1228) is the thorn-apple or Jamestown weed, the latter name being corrupted into jimson weed. Its foul, rank herbage and large spiny fruits are often seen in rubbish heaps. At the first successful settlement in America—Jamestown, Virginia, 1607—it is said that the men ate these thorn-apples with curious results. Capt. John Smith's account of their mad antics is very entertaining. It has been conjectured that this same plant was used by the priests at Delphi to produce oracular ravings. The seeds of *D. sanguinea* are said to have been used by Peruvian priests that were believed to have prophetic power.

Daturas are of easy culture. Some are treated as tender annuals. In the North the woody species can be grown outdoors in summer, and stored in cellars during the winter; in the South and in southern California they are almost everblooming. They are sometimes kept in cool conservatories the year round, in which case they should be planted in the border, as they rarely flower well in pots, their roots being large and spreading and requiring a constant supply of moisture. This method produces great quantities of bloom in spring. After flowering, the plants should be cut in to the main limbs.

#### A. Fls. red.

**sanguinea**, Ruiz & Pav. Tree-like shrub, 4-12 ft. high: branches fragile, leafy at the apex: lvs. clustered, 5-7 from the same point, ovate-lanceolate, acuminate, almost 7 in. long, 2½-2¾ in. wide, pubescent on both sides, shining green above, paler beneath, the lower lvs. wavy or angled, upper one entire; petioles 2½ in. long, channeled, pubescent; peduncles terminal; fls. pendulous, brilliant orange-red, about 8 in. long; calyx ovate, 5-angled, variegated, inflated. Peru. B.R. 1739 (as *B. bicolor*). F.S. 18:1883.—All the other species are said to be easily raised from cuttings, but this is very slow to take root.

#### AA. Fls. yellow.

**chlorántha**, Hook. Shrub, glabrous throughout: lvs. broadly ovate, almost triangular; margin wavy, with short, rather sharp, very distinct teeth: peduncles axillary, very short; fls. pendulous, yellow; calyx tubular, with 5 nearly uniform, short, triangular teeth. Habitat unknown. B.M. 5128. Gn. 46:429; 49, p. 379.—*Datura* "Golden Queen" is presumably a horticultural variety of this species. While this species is horticulturally distinct by reason of its yellow fls., it is a doubtful species botanically, being founded on a very double garden form of unknown origin. In Vilmorin's



Blumengärtnerei, by Voss, it is referred to *D. humilis*, Desf., but *D. humilis*, in turn, is perhaps a form of *D. fastuosa*.

AAA. Fls. normally white (sometimes touched with violet) or purple.

B. Plants tall, 7–15 ft. high; blossoms pendulous.

c. Calyx tubular, with 5 obscure teeth.

*suaveolens*, Humb. & Bonpl. (*D. Gärdeni*, Hook.). ANGEL'S TRUMPET. Tree-like shrub, 10–15 ft. high; lvs. ovate-oblong, 6–12 in. long,  $2\frac{1}{4}$ –4 in. wide, entire, glabrous, petioled, often unequal at the base; fls. 9–12 in. long; calyx inflated, angled, glabrous, with 5 obscure teeth; corolla-tube plaited, the limb with 5 short lobes; anthers crowded together. Mex. G.C. III. 11:593; 23:71. S.H. 2:433.—The double form is much commoner in the gardens than the single. This is the plant which is usually cult. as *D. arborea*. It is said to be very distinct from the true *D. arborea* of Linn., but it can be separated with certainty by the calyx.

cc. Calyx spathe-like, not toothed.

*arborea*, Linn. (*Brugmansia arborea*, Steud.). ANGEL'S TRUMPET. Small tree: lvs. ovate-lanceolate, margin entire, never wavy or angled, pubescent, in pairs, one a third shorter than the other; petioles 1 in. or more long; fls. with a musk-like odor; calyx tubular, entire, spathe-like, acuminate; corolla-tube terete, the lobes of the limb very long; anthers distinct, not conglomerate. Peru and Chile. G.C. II. 11:141.—Most of the plants cult. under this name are presumably *D. suaveolens*. The extent to which the true *D. arborea* is cult. is undetermined.

BB. Plants less tall, only 2–5 ft. high.

c. Blossoms erect; calyx not spurred.

*fastuosa*, Linn. (*D. Hummātu*, Bernh. *D.* and *B. corracopia*, Hort.). Fig. 1227. Annual, 4–5 ft. high, herbaceous: lvs. ovate-lanceolate, acuminate, acute and unequal at the base, toothed or wavy, glabrous on both sides, solitary, upper ones in pairs one of which is larger, 7–8 in. long,  $2\frac{1}{2}$ – $3\frac{1}{2}$  in. wide; petioles  $1\frac{1}{2}$ – $2\frac{1}{2}$  in. long; fls.  $6\frac{1}{2}$ –7 in. long, violet outside, whitish within; calyx purple, angled, 2 in. long, 5-toothed, the teeth triangular lanceolate, acuminate, 5 lines long, 2–3 lines wide; caps. spiny, subglobose,  $1\frac{1}{4}$  in. diam. Native of India. Naturalized in the tropics of both worlds. F.S. 14:1457. Gn. 46:224. I.H. 42:25.—The commonest garden datura. Resembles the common *D. Stramonium*, but fls. larger. Var. *alba*, Clarke (*D. alba*, Nees), has fls. white or nearly so. (*D. alba* var. *africana*, Fedde, is distinguished by its larger lvs., longer calyx, and corolla glabrous outside. Italian Somaliland.) Var. *dubia*, Clarke (*D. dubia*, Don. *D. Nilhummatu*, Dunal), has spineless frs. Var. *Huberiana*, Hort., is a thick bushy cult. form with large fls. of several colors, running into yellowish, blue and red; it is said to be a hybrid with *D. chlorantha*.

*meteloides*, DC. (*D. Wrightii*, Hort.). Perennial (cult. as an annual N.), glaucescent and puberulent: branches slender, forked: lvs. unequally ovate, almost entire, acuminate, acute at both ends, upper lvs. often in pairs, the larger  $2\frac{1}{4}$  in. long, 8–9 lines wide; petioles thickened at the base, 4–5 lines wide; calyx tubular, the teeth mostly 5; corolla about 4–8 in. long, or twice as long as the calyx, 5-toothed, the teeth slender-subulate: caps. 2 in. diam., succulent, prickly. Texas to Calif. Gt. 1859:260. R.H. 1857, p. 571. F.S. 12:1266.—Fls. white, suffused with violet, fragrant. Occurs also in Northern Mex.

cc. Blossoms pendulous; calyx with a long spur.

*cornigera*, Hook. (*D.* and *B. Knightii*, Hort.). Height 3–4 ft.: branches downy: lvs. chiefly at the ends of branches, ovate, petioled, acuminate, margin entire, wavy or angled: fls. pendulous, white or creamy white,

very fragrant at night, striated, 5-lobed, the lobe terminated by a long awl-shaped spreading or recurved point; stamens included. Mex. B.M. 4252. *Brugmansia Knightii* seems to be a trade name for only the double form. Gn. 45, p. 549.

Weedy annual species of *Datura*, intro. from the tropics or warm countries and run free in this country, are: *D. Metel*, Linn. Pubescent: lvs. entire or slightly toothed; calyx tubular; corolla-limb 10-lobed, 4 in. across: caps. nodding, prickly: 3–5 ft.: fls. white.—*D. Stramonium*, Linn. Fig. 1228. The common stramonium or jimson-weed: glabrous, green-stemmed; lvs. ovate, sinuate or angled or even cut-toothed: caps. erect, with stout prickles: 2–4 ft.: fls. white. A very similar species but with a smooth and spineless caps. is *D. inermis*, Jacq.—*D. Tatula*, Linn. Differs from *C. Stramonium* in having purple sts., and violet-purple or lavender fls., and prickles of the caps. more nearly equal.



1228. Pods of *Datura Stramonium*. ( $\times\frac{1}{3}$ )

Other daturas more or less cult. abroad are: *D. ceratocaula*, Ort. Annual, 2 ft.: branches horn-shaped: lvs. broad-lanceolate: fls. very large, inside white or light violet, outside bluish, opening late in afternoon till middle of forenoon: fr. hanging, smooth. Trop. Amer. B.M. 3352.—*D. coccinea*, Hort.—*D. De Noteri*.—*D. colosseus aurea*, Hort. Garden hybrid, parentage not reported, with bright golden yellow fls.—*D. De Noteri*, Hort. Probably annual: 3 ft.: fls. fragrant, brilliant red, freely produced. S. Afr.—*D. ferox*, Linn. St. thick, glabrous, red at base but otherwise green or white-punctate: lvs. rhombic-ovate, angled-toothed: calyx 5-angled and about 5-parted; corolla light blue, the limb angulate: fr. unequally spiny, with 4 large spines at top. S. Eu.—*D. quercifolia*, HBK. Annual, with green sts., the young growth somewhat pubescent: lvs. deeply sinuate-pinnatifid: fls. as in *D. Tatula*: caps. bearing large and unequal flattened prickles that are sometimes  $\frac{1}{2}$  in. long. Mex.

WILHELM MILLER.  
L. H. B.†

DAUBENTONIA: *Sesbania*.

DAUCUS (ancient Greek name). *Umbelliferae*. Perhaps 60 annual and biennial herbs of very wide distribution. One or 2 species are native to N. Amer.; one species of *Daucus* is the common garden carrot, and the wild form of the same species is an abundant old-field weed in the northeastern states. Aside from the carrot, there are no horticultural members of the genus. *Daucus* comprises bristly or setose slender plants, with pinnately decomposed and often finely divided lvs., very small fls. in compound involucre umbels, and oblong mostly dorsally flattened frs. The species are mostly of the temperate regions of Eu., Afr. and Asia.

*Carda*, Linn. Figs. 821, 822. Bristly biennial, with twice- or thrice-pinnatifid lvs., the ultimate divisions cut and pointed: fls. crowded in umbels, mostly white but sometimes blush or even pale yellow, some of the marginal fls. larger; rays of umbel numerous; involucre of many elongated-subulate divisions: fr. (or "seed") small, greenish or brownish, somewhat convex on one side and plane on the opposite side

grooved, bristly, aromatic. Eu. Under cult., the root has been greatly developed into many edible forms.

Var. *Boissieri*, Schweinf., from Egypt and also in Spain, has blood-red or violet-colored roots. Gt. 1904:1527.

L. H. B.

**DAVALLIA** (a personal name). *Polypodiaceæ*. Ferns, some of them grown under glass, and the smaller species making good plants for hanging-baskets.

Tropical plants, usually with firm, somewhat finely divided foliage and coriaceous semi-cylindric indusia, which are attached at both the base and sides, opening toward the margin of the leaf.—Some twenty species, in many parts of the globe, some of them epiphytes.

The diverse habits of growth of the many different species of *davallias*, and their good lasting qualities, peculiarly fit them under ordinary care for decorative purposes, when delicate and graceful plants are desired. Among the many species, the following are most often seen and best adapted for commercial purposes: *D. bullata*, *D. parvula*, very dwarf; *D. pentaphylla*, young fronds of a dark bronzy green, and *D. Tyermanni* (Humata), are well adapted for hanging-baskets. *D. dissecta* and var. *elegans*, *D. concinna* (*Loxoscaphe*), *D. fijiensis* and vars. *plumosa* and *major*, *D. faniculacea* (*Loxoscaphe*), *D. solida*, *D. pallida* (syn. *Mooreana*) and *D. pyxidata* are adapted for large specimen plants. *D. tenuifolia* (*Odontosoria chinensis*) and vars. *stricta* and *Veitchiana* are desirable for fern-dishes, because of their dwarfish habit of growth and the ease with which they may be raised from spores.—Old plants of *davallia* may be cut into a number of smaller ones with a sharp knife. Planted firmly into shallow pans and placed in a temperature of 60° to 65° F., they soon develop into symmetrical plants. The rhizomes should be firmly fastened to soil by strong copper-wire staples, where they will root in a short time. To gain a large number of small plants, the rhizomes should be detached, cleaned from all soil and roots, laid on sand and thinly covered



with moss. Placed in a shaded position in a temperature of 65° to 70° F., and kept moderately moist, a number of small plants will develop from the dormant eyes, which may be separately potted as soon as of sufficient size. Spores of *davallia* should be sown on a fine compost of soil, leaf-mold or peat and sand in equal parts, and placed in a shaded position in a temperature of 60° to 65° F. All the operations of propagation of *davallias* will be most successful if conducted during the spring months. All *davallias* delight in a rich and open compost, an abundance of light and air, and moisture at their roots, a temperature of 60° to 65° F. and a thorough syringing every bright day. (N. N. Bruckner.)

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## A. Lvs. once pinnate, with few linear segms.

1. *pentaphylla*, Blume. Lvs. scattered, from a stout fibrillose rootstock, 1-pinnate, with 1 terminal and 4-6 pairs of lateral pinnæ, 4-6 in. long, ½ in. broad; sori in marginal rows. Java and Polynesia.

## AA. Lvs. tri- or quadri-pinnatifid, deltoid.

### B. Length of lvs. less than 1 ft.

2. *parvula*, Wall. A tiny fern with scaly creeping rootstocks, the lvs. sessile or with stalks 1-2 in. long, the blades ½-¾ in. long, ½ in. broad, triangular, 2-3 pinnatifid, the segms. threadlike, pointed. Singapore and Borneo.

3. *bullata*, Wall. Figs. 1229, 1230. Rootstock creeping, clothed with whitish or light brown hair-like scales: lvs. scattered, 6-10 in. long, 4-6 in. wide, quadri-pinnatifid, with deeply incised segms.; texture firm. India to Java and Japan. F.E. 11:543.—Often sold for house cult. in the form of a fern-ball.

4. *Mariesii*, Moore. Rootstock stout, with brownish scales, which are lanceolate from a broad dilated base: lvs. deltoid, 4-6 in. each way, with the pinnæ cut away at the lower side at base; segms. short-linear, 1-nerved; sori intramarginal. Japan. G.C. III. 13:571.

### BB. Length of lvs. 1-2 ft.

#### C. Foliage commonly tri-pinnatifid.

5. *denticulata*, Mett. (*D. elegans*, Swartz). Rootstock clothed with woolly fibers: lvs. 9-15 in. wide, with the main rachis slightly winged toward the apex; indusia several to a segm., with the sharp teeth projecting beyond the cups. Ceylon to Austral. and Polynesia.

6. *decurrens*, Hooker. Rootstock stout, creeping, fibrillose: lf.-blade 1-2 ft. long, 9-15 in. broad, triangular, the main rachis scarcely winged at the apex, 3-pinnate, the segms. linear-oblong, broadly toothed; sori inside the margin. Philippines. Var. *Mayi*, Hort. Graceful, much divided lvs.

7. *solida*, Swartz (*D. ornata*, Wall.). Rootstock clothed with appressed scales or fibers: lvs. 1-2 ft. long, 12-15 in. wide, the center of the apex broad and undivided; segms. broad and slightly cut; indusia marginal. Malaya. Var. *superba*, Hort. Lvs. flat, in young state tinted with red.

#### cc. Foliage commonly quadri-pinnatifid.

8. *canariensis*, Smith. Rootstock stout, densely clothed with pale brown linear scales: lf.-blades 12-18 in. long, triangular, with ovate-rhombic, deeply incised segms.; sori on entire segms., or with a horn outside. Spain, Canaries, N. Afr. Var. *elegans*, Hort. Lvs. finely divided.

9. *pyxidata*, Cav. Rootstock clothed with pale brown linear scales: lf.-blades tri-quadri-pinnatifid, 6-9 in. broad, with oblong segms.; sori with a broad space outside, which is extended into a horn-like projection. Austral.

10. *fijiensis*, Hook. Lvs. 6-12 in. broad, with the lower pinnæ deltoid and the segms. cut into narrow, linear divisions ½-¾ in. long; sori on the dilated apices of the segms. with no horn. Fiji Is. A.F. 6:900; 9:233. G.C. III. 23:323.—One of the finest species, with numerous varieties. Considered by some botanists to be a variety of *D. solida*. Var. *plumosa*, Bull. Distinct from the species by the gracefully drooping habit and feathery nature of the pendulous lvs. Var. *major*,



Moore. More robust: lvs. not so fine, lighter color than the species.

11. *dissécta*, J. Smith. Rootstock stout, with dense, rusty scales: lvs. 10-12 in. broad, on straw-colored stalks; segms. oblong, cuneate at base, with simple or bifid lobes; sori minute, often with 2 projecting horns. Java. Var. *élegans*, Hort. Similar to type but with more graceful habit.

BBB. Length of lvs. 2-3 ft.

12. *divaricâta*, Blume (*D. polyântha*, Hook.). Rootstock with linear rusty scales: lvs. tri-pinnatifid, sometimes 2 ft. broad, with deltoid segms. cut into linear-oblong lobes; sori at some distance from the edge. India to Java and Hong Kong.

13. *pállida*, Mett. (*D. Mooreana*, Mast.). Rootstock stout, with lanceolate dark brown scales: lvs. with straw-colored stalks 12-18 in. long, quadri-pinnatifid, with deltoid, stalked segms., the ultimate obovate-cuneate, bearing the sorus on the upper side at the base. Aneityum and Borneo. A.F. 6:901; 9:231. A. G. 13:143.

For *D. concinna* and *D. feniculacea*, see *Loxoscaphe*. *D. platyphylla*, see *Microlepia*; *D. stricta*, see *Stenoloma*; *D. tenuifolia*, see *Stenoloma*; *D. Tyermanni*, see *Humata*.

Several other ferns are in trade under the name *Davallia*, which are properly referred to other genera. Of these, disposition should be made as follows: *D. alpina*=*Humata repens*; *D. angustata*=*Humata heterophylla*; *D. brasiliensis*=*Saccoloma inaequale*; *D. retusa*=*Odontosoria retusa*; *D. tenuifolia*=*Odontosoria chinensis*. *D. amena* and *D. decora* are names of uncertain standing and application.

R. C. BENEDICT.†

**DAVÍDIA** (after Armand David, French missionary, botanized in China from 1862 to 1873). *Nyssaceæ*. Ornamental deciduous trees, cultivated for their handsome foliage and the large and showy white flowers.

Leaves alternate, slender-petioled, dentate, without stipules: fls. polygamous, in dense subglobose heads consisting of numerous staminate fls. and 1 bisexual fl., with 2 large bracts at the base; sepals and petals wanting; stamens 1-7, with slender filaments; ovary 6-10-celled, with rudimentary perianth and a circle of short stamens on top of the ovary at the base of the short and thick style, with spreading stigmas: fr. a drupe with a 3-5-seeded stone.—One species in W. China.

This is a handsome tree of pyramidal habit, with rather large and attractive bright green foliage, and an object of striking beauty when studded with the very large creamy white floral bracts. The tree has proved hardy in favorable positions as far north as Massachusetts; it seems to be somewhat tender only while young. Apparently it grows well in any good fresh soil. Propagation is by seeds sown in spring, which soon germinate, and by cuttings in summer of half-ripened wood under glass; also by layers.

*involutocrâta*, Baill. Pyramidal tree, to 60 ft., with upright or ascending branches: lvs. cordate-ovate, acuminate, coarsely serrate, strongly veined, bright green and finally glabrous above, densely silky pubescent below, 2¼-5 in. long; heads terminal, peduncled; bracts 2, opposite, rarely 3, ovate to oblong-obovate, entire or serrate, creamy white, of unequal size, the larger to 7 in. long and to 4¼ in. broad; drupe oblong-ovoid, brownish, punctulate, about 1½ in. long. May, June: fr. in Oct. W. China. Var. *Vilmoriniâna*, Hemsl. (*D. Vilmoriniâna*, Dode. *D. læta*, Dode). Lvs. glabrous and glaucescent below, or only sparingly pubescent while young. B.M. 8432. H.I. 20:1961. G.C. III. 33:235; 39:346. J.H.S. 1903:57; 37:129, fig. 113. R.H. 1906, pp. 297-9; 1907, p. 321. R.B. 34:230. This variety is better known in cult. than the type. It was intro. in 1897 by Farges who sent seeds

from which a single plant was raised by Vilmorin. Later E. H. Wilson sent seeds of the variety as well as the type, from which a large stock of plants was raised by Veitch.

ALFRED REHDER.

DAY FLOWER: *Commelina*.

DAY LILY: *Funkia* and *Hemerocallis*.

DEAD NETTLE: *Lamium*.

**DEBREGEASIA** (derivation unknown; probably named after a person). Syn., *Morocârpus*. *Urticaceæ*. Upright shrubs, grown for their handsome foliage and ornamental yellow or red fruits, which are edible.

Leaves alternate, short-petioled, serrulate, 3-nerved at the base, rugose above, tomentose beneath; stipules bifid: fls. monœcious or diœcious in unisexual globose clusters arranged in small axillary cymes; staminate fls. with usually 4-parted perianth, with 4 short stamens; pistillate with urceolate or obovate perianth much contracted at the mouth, with very short usually 4-toothed limb, adnate to the ovary; stigma penicillate, on a short style or sessile: fr. subglobose consisting of numerous small 1-seeded fleshy drupelets.—Five or 6 species in China, S. Asia and Abyssinia.

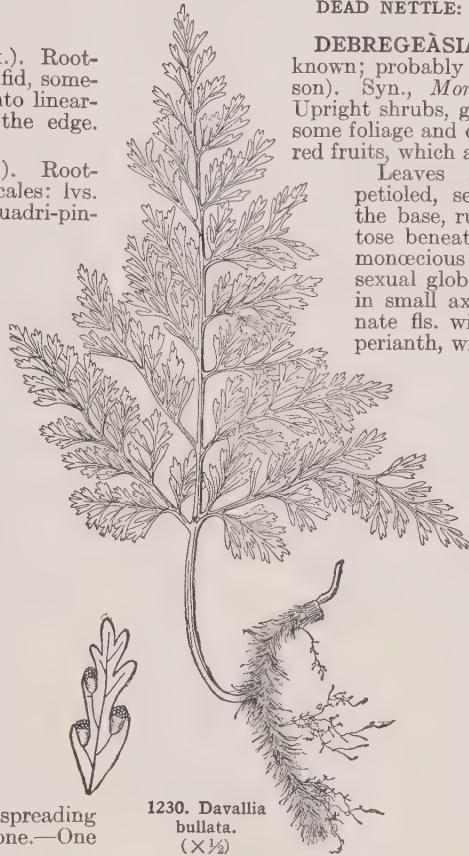
The two species in cultivation, neither of which is yet in trade, are spreading tender shrubs with handsome slender foliage, dark green above, whitish below,

and small usually orange-red fruits resembling in shape a small mulberry and produced profusely along last year's branches. *D. longifolia* is a stove-plant; *D. edulis* is hardier, and at the Arnold Arboretum survives the winter outdoors. It is, however, killed back nearly to the ground, but sends up numerous shoots, and although it does not flower and fruit, it is an attractive bush on account of the striking contrast of the dark green lustrous upper and the white lower surface of the leaves. Propagation is by seeds and by green-wood cuttings under glass.

*edulis*, Wedd. (*Morocârpus edulis*, Sieb. & Zucc.). Shrub, to 6 ft.: branchlets appressed-pubescent, soon glabrous: lvs. oblong-lanceolate to elliptic, acuminate, serrulate, rugose and smooth above, whitish tomentose below, 3-5 in. long; fr. orange-red, globose, about ½ in. across, in small dichotomous cymes in June. China, Japan.

*longifolia*, Wedd. (*D. velutina*, Gaud. *Conocéphalus niveus*, Wight). Shrub, to 8 ft.: branchlets villous: lvs. lanceolate to oblong-lanceolate, acuminate, serrulate, rugose and rough above, white-tomentose beneath, 4-7 in. long; fr. orange-yellow or red, ½ in. across, in small dichotomous cymes. Subtropical Himalaya to Java. R.H. 1896, p. 321. G.C. III. 39:232, suppl.

ALFRED REHDER.



DECABELONE: *Tavaresia*.

**DECAISNEA** (after Joseph Decaisne, French botanist, who wrote much on the botany of cultivated plants; 1809–1882). *Lardizabalaceæ*. Woody subjects grown for the large pinnate foliage and the conspicuous fruits.

Upright sparingly branched shrubs: lvs. odd-pinnate, large, with opposite entire lfts.: fls. polygamous, in axillary racemes, slender-pedicelled; sepals 6, petaloid, long-acuminate; petals wanting; stamens 6, the filaments in the staminate fl. connate into a column; pistils 3, growing into rather large oblong follicles with numerous seeds in two ranks imbedded in a white pulp.—Two species in E. Himalayas and in W. China.

These are distinct-looking shrubs, in habit resembling a large-leaved sumac, with long racemes of pendulous greenish flowers similar in shape to those of a yucca, but are smaller, and with conspicuous blue or yellow fruits which are edible, but insipid. The Chinese species has proved hardy at the Arnold Arboretum in sheltered position, while the Himalayan is tender. They prefer a sheltered situation of warm southern exposure and do not seem particular as to the soil. Propagation is by seeds.

**Fargesii**, Franch. Shrub, to 15 ft.: lvs. to 3 ft. long, glabrous; lfts. 13–25, elliptic, acuminate, short-petioled, bright green above, glaucescent below, 2–5 in. long: racemes upright, many-fld.; fls. nodding, campanulate, greenish, 1–1½ in. long; sepals lanceolate, long-acuminate, much longer than the stamens: fr. pendulous, oblong-cylindric, deep blue, 3–4 in. long, about 1 in. thick, with numerous black seeds about ½ in. long: April, May; fr. in Sept. W. China. B.M. 7848. R.H. 1900, pp. 270, 271, 273. M.D. 1912:197.

*D. insignis*, Hook. f. & Thoms. In habit, lvs. and fls., very little different from the preceding species, but fr. yellow, thicker, curved. E. Himalayas. B.M. 6731. F.S. 13:1335. I.H. 3:91.

ALFRED REHDER.

**DÉCODON** (Greek, *ten-toothed*). *Lythraceæ*. A hardy perennial herb sometimes offered by dealers in native plants. Decodon is sometimes considered a subgenus of *Nesaea*, but is latterly kept distinct as a monotypic genus. It is distinguished from *Lythrum* by having 5 (rarely 4) petals instead of 6, and 10 stamens while *Lythrum* has mostly 6 or 12. It has opposite or whorled lvs., the upper with axillary, short-stalked clusters of fls.

**verticillatus**, Ell. (*Nesaea verticillata*, HBK.). SWAMP LOOSE-STRIPE. WATER-WILLOW. Smooth or downy: sts. recurved, 2–8 ft. long, 4–6-sided: lvs. lanceolate, nearly sessile: petals 5, cuneate-lanceolate, rose-purple, ½ in. long; stamens 10, half of them shorter. Swampy grounds, N. E. to Fla., west to Minn. and La.—Desirable for colonizing about ponds and in very wet places. It runs into 2 or 3 varieties.

**DECUMARIA** (Latin, *decumus*, tenth, referring to the number of the parts of the flower). *Saxifragaceæ*. Climbing shrubs, cultivated for their handsome glossy foliage and clusters of attractive white flowers.

Climbing by aerial rootlets: lvs. deciduous, opposite, petioled: fls. in terminal peduncled corymbs, small, white, perfect; sepals and petals 7–10; stamens 20–30: fr. a 5–10-celled ribbed caps. opening between the ribs, with numerous minute seeds.—One species in E. N. Amer. and one in China.

These are ornamental climbing shrubs with handsome glossy foliage and fragrant white flowers, forming a corymb of feathery appearance, well adapted for covering walls, rocks, trellis work and trunks of trees; tender, but the American species survives in sheltered positions as far north as Massachusetts, while the Chinese is more tender. They thrive in almost any humid soil. Propagation is by greenwood cuttings in summer under glass, rarely by seeds.

**bárbara**, Linn. (*D. sarmentosa*, Bosc). Climbing to 30 ft., but usually less high: lvs. ovate, obtuse or acute, remotely denticulate or entire, glabrous and shining above, 2–4 in. long and 1–2 in. broad: corymbs 2–3 in. broad, semiglobose. May, June. Va. to Fla., west to La. B.B. (ed. 2) 2:233. Mn. 1:41. G.C. III. 46:242, suppl.

*D. sinensis*, Oliv. Very similar to the preceding; less high: lvs. generally oblong, obtuse or obtusish, 1½–3 in. long and ½–1 in. broad: pedicels appressed-pubescent. Cent. China. H.I. 18:1741.

ALFRED REHDER.

**DEERBERRY**: *Vaccinium stamineum*.

**DEERGRASS**: *Rhexia*.

**DEERÍNGIA** (Karl Deering, died 1749; born in Saxony, practicing physician in London and author of catalogue of plants of England). *Amarantaceæ*. About a half-dozen species of climbing herbs or sub-shrubs, from Madagascar to Austral., one of which is offered in Calif. Lvs. alternate: fls. dioecious or perfect, numerous and small, in terminal spiciferous panicles; parts of fl. 5, spreading under the succulent indehiscent fr.; stamens 5, united into a ring. **D. baccata**, Moq. (*D. celosioides*, R. Br.), in Austral., E. Indies and elsewhere, is a smooth woody climber, 10–12 ft.: lvs. ovate or ovate-lanceolate, acuminate, entire: fls. in slender interrupted spikes 1 ft. or less long, greenish white: berry red, nearly globular, ¼ in. or less diam. B.M. 2717. The plant offered as *D. variegata*, described as a slender-growing shrub that will climb if shoots are trained up, long spikes of white fls., and lvs. margined with white, is probably a form of this species, or it may be *Bosea Amherstiana* (*D. Amherstiana*, Wall.), which has a form with variegated lvs.

L. H. B.

**DEINÁNTHE** (Greek *extraordinary*, referring to the flowers being large for the group). *Saxifragaceæ*. Herbs or sub-shrubs of 2 species, 1 in Japan and 1 in China, at least the Chinese species having been offered in England. Of the *Hydrangea* tribe, allied to *Cardiandra*, but lvs. opposite rather than alternate and style 1–5-forked rather than 3 and separate. *D. cærulea*, Stapf, from China, is a perennial herb, 1–1½ ft. high, with horizontal stout rootstock, the solitary st. from the tip of the rootstock: lvs. about 4 at the top of the st., ovate or broad-elliptic, sharply toothed: fls. sterile and fertile, the former few, the fertile much larger and nodding, the petals bright blue, stamens blue, all constituting a terminal panicle. B.M. 8373. *D. bifida*, Maxim., has creamy white or pure white fls. with yellow stamens, a different infl. and lvs. deeply bifid at apex.

L. H. B.

**DELABÉCHEA RUPESTRIS**: *Sterculia rupestris*.

**DELÁRBREA** (after a French naturalist). *Araliaceæ*. Tall tender shrubs from New Caledonia, grown in hot-houses.

Leaves alternate, decomposed, gracefully arching, the lfts. leathery and entire or slightly cut: fls. falling very early, in large umbellate-paniculate clusters, not very showy. Distinguished from *Aralia* by its round, not angled frs.—Two species. Cult. same as *Aralia*.

**spectabilis**, Lind. & André (*Arália concinna*, Nichols.). St. ashy gray, with brown, warty spots: lvs. odd-pinnate; lfts. in 8–10 pairs, each lft. entire or 3-toothed or twice cut, sometimes so deeply cut as to make 3 entirely free segms. I.H. 25:314.—Under the name of *Aralia spectabilis*, two different plants have been sold. One is *Aralia filicifolia*. The two plants can be distinguished at a glance. The primary division of the lf. in *A. filicifolia* is long and narrow, thrice as long as in *D. spectabilis*, and tapering to a long point, while in *D. spectabilis* the primary division of the lf. is short and has 3 well-marked segms. In *A. filicifolia* the secondary divisions are deeply and irregu-



larly cut; in *D. spectabilis* they are merely serrate. The two plants are also immediately distinguished by the black spots on the st. of *D. spectabilis*.

N. TAYLOR.†

**DELAVÀYA** (after J. M. Delavay, French missionary, who explored the flora of S. W. China). *Sapindaceæ*. A tree from S. W. China, allied to *Xanthoceras*, but differing chiefly in its 3-foliate lvs. and in the much smaller fls. with a cupular disk. The only species, *D. toxocarpa*, Franch. (*D. yunnanensis*, Franch.), is a small tree, to 25 ft.: lfts. lanceolate, serrate, glabrous, to 7 in. long; fls. about  $\frac{1}{2}$  in. across, white; fr. a 2-3-lobed woody caps. with large brownish black seeds. Reported as recently intro. but probably hardy in warmer temperate regions only. ALFRED REHDER.

**DELPHINIUM** (Greek, a dolphin, from the resemblance of the flower). *Ranunculaceæ*. LARKSPUR. A group of beautiful hardy plants grown in borders for their handsome spikes of flowers and stately stems of foliage. They are of great value for cut-flower purposes as the blooms keep well.

Annual or perennial, erect, branching herbs; lvs. palmately lobed or divided; fls. large, irregular, in a showy raceme or panicle; sepals 5, petal-like, the posterior one prolonged into a spur; petals 2 or 4, small, the posterior ones spurred, the lateral ones small, if present; the few carpels always sessile, forming many-seeded follicles. Full double forms are very common in a number of the species (compare Figs. 1232, 1233). A. Gray, An attempt to distinguish between the American Delphiniums, Bot. Gaz. 12:49-54, 1887. E. Huth, Monographie der Gattung Delphinium, in Eng. Bot. Jahrb. 20:322-499, 1895. There are about 60 species, native of the north temperate zone, four of which are of much greater popularity than the others: the annual, *D. Ajacis*, and the perennials, *D. grandiflorum*, *D. hybridum* and *D. formosum*. The last three have been especially prolific in named garden varieties. See page 3568.

Some of the garden varieties of delphiniums are as follows: King of Delphiniums, semi-double, and Duke of Connaught, distinguished by a deep intense blue and conspicuous white center of the large singular flowers; Mme. Violet Geslin and Julia, cornflower-blue varieties with white eye; Amos Perry, a combination of rich rosy mauve, flushed with sky-blue; Lizzie and Rev. J. J. Stubbs, spikes of vivid azure around deep brown centers. Combinations of sky-blue, pink and lavender are striking characteristics of Diademe, Excelsior, Grille, Hallgarten, Libelle, Minerva, Niederwald and Seidenspinner, distinguished from each other by white, brown or black centers. The petals of Carmen are of deep gentian-blue and pink, surrounding a brown center; those of Lamartine and Musea, lavender-blue; and Felicite, sky-blue.—Of the perpetual-flowering Belladonna class, the trade offers the following named hybrids: Capri, clear sky-blue; Moerheimeii, pure white; Nassau, Mr. Brunton and Persimmon variations in sky-blue and azure; while the light graceful spikes of Semiplenum and Grandiflora show a clear intense cornflower-blue.—Perfect double-flowering delphiniums, though very handsome, are shy seeders and a small percentage come true to color and variety. They do not seem to share in the great popularity of the singles. Of the latter the old species *D. chinense*, *D. Davidii*, and the rather hard to handle but otherwise beautiful yellow *D. Zaili*, are well worth cultivating. (R. Rothe.)

Rocket and Candelabrum are names used to designate the forms of inflorescence in the two annual species. The "Rocket" or spike-like form is more com-

monly found in the Ajacis type, and the "Candelabrum," with a number of short spike-like heads of different heights, is found more often in *Consolida*.

Delphiniums thrive in any good garden soil, but are improved by a deep, rich sandy loam, exposed to the sun. Deep preparation of the soil is very important. The annuals are propagated from seed, which are very slow in germinating. In the warmer latitudes they may be sown in early fall and will then produce flowers early the next season; or they may be started indoors.

The perennials, may be propagated: (1) By root-division in the fall or spring. The large strong-growing species may be divided into a number of plants after growing in the flower-bed for several years. (2) By cuttings, about which J. B. Keller says: "Take a few cuttings from each plant in early spring, when growth is about 3 or 4 inches long, or else use the second growth, which has come after the flower-stems have been removed. Cuttings root readily in a shaded frame, no bottom heat being required, but an occasional sprinkling during dry

and hot weather is necessary. When rooted they are treated like seedlings." (3) By seeds, started in the greenhouse or hotbed in March or even earlier. The young seedlings should be given plenty of room by transplanting as they grow, and may be set in the open garden by June. If started thus early they flower the first autumn. The seed may be planted in late spring or summer, care being taken to water well during dry weather, and flowers will come the next summer. To get the best results, the perennials should be transplanted every 2 or 3 years. Two good crops of blossoms may be secured in one season by cutting away the flower-stems of the first crop as soon as the flowers have faded; of



1231. *Delphinium Ajacis*. ( $\times \frac{1}{2}$ )

course no seeds will be produced in this way.

In most climates where they are grown the roots of the perennials are left unprotected, in the open garden, during the winter. This plan can be improved by giving the bed or border a good dressing of barnyard manure about the time the ground begins to freeze in the fall. This will greatly enrich the soil and also protect the underground buds during winter. A much better show of flowers will be the result. Because of their ability to use much fertility, it is well to spade in the manure instead of removing it in the spring. A top-dressing of manure near the plants in midsummer is used to aid in forcing the "fall" or second crop of flowers. This dressing conserves the soil-moisture, prevents weeds, and adds plant-food. Such applications of manure will make the plants more vigorous throughout. They will flower more profusely and, if desired, the roots can be divided much more freely.

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*Walkeri*, 10.  
*Zalil*, 6.

## A. Annuals: petals only 2, united: follicle 1.

1. *Ajacis*, Linn. Fig. 1231. An erect annual, about 18 in. high, with a few spreading branches: lvs. of st. sessile, deeply cut into fine, linear segms.; root-lvs. similar, but short-petioled: fls. showy, blue or violet, varying to white, more numerous than in *D. Consolida*, in a spicate raceme; petals 2, united; calyx-spur about equaling the rest of the fl.: follicle only 1, pubescent; seeds with wrinkled, broken ridges. May–Aug. Eu. R.H. 1893, p. 228. Same figure in S.H. 2:282.—The season of flowering is governed largely by the time of sowing the seeds. If sown in the fall, as may be done in warm climates, the plants will produce fls. by May or June. But if the seeds be sown in spring no fls. should be expected before July or Aug.

2. *Consolida*, Linn. (*Consolida arvensis*, Opiz). An erect, hairy annual, 1–1½ ft. high: lvs. similar to *D. Ajacis*: fls. few, loosely paniced, pedicels shorter than the bracts, blue or violet or white; petals 2, united: follicle 1, glabrous; seeds with broken, transverse ridges. June–Aug. Eu. Baxter Brit. Bot. 4, t. 297. R.H. 1893, p. 228 (var. *ornatum Candelabrum*). G.Z. 15:81. Var. *imperialis*, Hort. (*D. imperialis fl. pl.*, Hort.). Fls. double. From the English gardens.—See above species for sowing of seeds.

## AA. Perennials, pure species: petals 4: follicles 3–5 (Nos. 3–27).

## B. Sepals red.

3. *nudicaule*, Torr. & Gray. St. 1–1½ ft. high, glabrous, branched, few-lyd.: lvs. rather succulent, 1–3 in. across, lobed to the middle or farther 3–7 times, the secondary lobes rounded and often mucronate; petioles 3–5 in. long, dilated at the base: fls. paniced; sepals bright orange-red, obtuse, scarcely spreading, shorter than the stout spur; petals yellow, nearly as long as sepals; follicles 3, spreading and recurved, soon becoming glabrous; seeds thin-winged. Apr.–July. Along mountain streams, N. Calif. B.M. 5819. F.S. 19:1949. R.H. 1893, p. 259.—A good perennial in the E.



1232. Single larkspur.  
 —*D. grandiflorum*.

4. *cardinale*, Hook. St. erect, 2–3½ ft. high and much higher under favorable conditions, partly pubescent: lvs. smooth, fleshy, deeply 5-parted, the parts cut into long, linear lobes: raceme elongated, many-fl.; fls. bright red, with petal-limbs yellow: follicles glabrous, usually 3; seeds smooth. July, Aug. S. Calif. B.M. 4887. Gt. 6:328. F.S. 11:1105. R.B. 6:101. Gn. 19:234.

## BB. Sepals clear yellow or tipped with blue.

5. *Przewalskii*, Huth (*D. Przewalskianum*, Hort.). Nearly glabrous, often branched at base, erect, varying much in height: lvs. 3–5 times deeply parted, parts

divided into narrow, obtuse lobes: fls. clear yellow, or sometimes tipped with blue; spur equaling the sepals: follicles 3, densely hairy. July, Aug. Asia.—Intro. 1892.

6. *Zalil*, Aitch. & Hemsl. (*D. sulphureum*, Hort. *D. hybridum* var. *sulphureum*, Hort.). St. nearly simple, erect, 1–2 ft. high, rather glabrous, or becoming so: lvs. of several narrow, linear lobes, dark green; petioles not dilating at the base: fls. large, light yellow, in long racemes: follicles 3, longitudinally furrowed and ribbed; seeds with transverse, fibrous plates. June, July. Persia. Intro. 1892. B.M. 7049. Gn. 50:434; 54, p. 347; 71, p. 285. G.C. III. 20:247.—Seedlings from tubers and plants die down as if dead; but they make a second growth after a short period of rest.



1233. Double larkspur.—  
*D. grandiflorum*.

## BBB. Sepals blue or varying to white.

## c. Height 1½ ft. or less.

## D. Petioles dilating at the base.

7. *bicolor*, Nutt. Erect, rather stout, ½–1 ft. high, from fascicled roots: lvs. small, thick, deeply parted and divisions cleft, except perhaps in the upper lvs.; segms. linear and obtuse: raceme rather few-fl., the lower pedicels ascending 1–2 in.; spur and sepals nearly equal, ½ in. long or more, blue; upper petals pale yellow or white, blue-veined; lower petals blue: follicles glabrous or becoming so. May–Aug. Dry woods, Colo., west and north to Alaska.

8. *Brunonianum*, Royle. MUSK LARKSPUR. Sts. erect, ½–1½ ft. high: plant somewhat pubescent: upper lvs. 3-parted, lower ones reniform, 5-parted; segms. deeply cut, musk-scented: fls. large, light blue with purple margins, center black; spur very short; sepals 1 in. long, membranous and often clinging until the fr. is mature: follicles 3 or 4, villose. June, July. China. B.M. 5461. R.B. 1863:34.

9. *decorum*, Fisch. & Mey. St. slender and weak, ½–1½ ft. high, smooth or nearly so: lvs. few, bright green; upper ones small, 3–5-parted into narrow lobes; lower and radical ones somewhat reniform in outline and deeply 3–5-parted, lobes often differing widely: fls. in a loose raceme, or somewhat paniced; sepals blue, ½ in. long, equaling the spurs; upper petals at least tinged with yellow: follicles 3, thickish, glabrous. Spring. Calif. Intro. 1881 B.R. 26:64.

## DD. Petioles hardly dilating at the base.

## E. Upper petals never yellow.

10. *cashmerianum*, Royle. Plant pubescent, not very leafy: st. simple, erect, slender, 10–18 in. high: root-lvs. orbicular, 2–3 in. diam., 5–7-lobed, coarsely, acutely toothed and cut; petiole 5–8 in. long; sts.-lvs. short-petioled, 3–5-lobed, cut like the radical ones, all rather thick, and bright green: infl. corymbose, the branches rather spreading; fls. 2 in. long, deep azure-blue; spur broad, obtuse, inflated, decurved, little over half as long as sepals; upper petals almost black, 2-lobed, lateral ones greenish: follicles 3–5, hairy. July–Sept. Himalayas. B.M. 6189. Gt. 32:1105. Gn. 18:568. R.H. 1893, p. 259.—Hardy in Mass., and choice.

Var. *Walkeri*, Hook. St. very short, leafy, many-fl.; upper lvs. less lobed or almost entire, small, long-petioled: fls. very large, light blue with yellow petals. Suited to rockwork. B.M. 6830.

## EE. Upper petals yellow or striped with yellow.

11. *tricorné*, Michx. St. succulent, about 1 ft. high: lvs. 3–5-parted, with 3–5-cleft linear lobes; petioles smooth, hardly dilating at the base: fls. large, blue, rarely whitish; upper petals sometimes yellow, with blue



veins, lower ones white-bearded; sepals nearly equaling the spur: follicles 3-4, very long, becoming glabrous, strongly diverging; seeds smooth. May. Northern states. L.B.C. 4:306.—Very beautiful and much used. Best for rockwork. The foliage dies down in midsummer and the plant appears as if dead.

12. *Ménziesii*, DC. Plant sparingly pubescent: st. simple, slender,  $\frac{1}{2}$ -1 $\frac{1}{2}$  ft. high, few-ld.: lvs. small, 3-5-parted, the divisions mainly cleft into linear or lanceolate lobes; petioles hardly dilating at the base: fls. in simple, conical racemes; sepals blue, somewhat pubescent outside, nearly equaling the spurs in length; upper petals yellowish: follicles 3, pubescent, or sometimes glabrous; seeds black, winged on the outer angles. Apr.-June. On hills, Calif. and northward to Alaska. B.R. 1192.

13. *pauciflorum*, Nutt. Roots oblong or fusiform, fasciculate-tuberos: sts. slender, nearly glabrous,  $\frac{1}{2}$ -1 ft. high: lvs. small, parted into narrow, linear lobes; petioles not dilating at base: fls. and fr. similar to those of *D. Menziesii*, but on shorter pedicels. May, June. Colo. to Wash. and Calif. Intro. 1892.

cc. Height usually more than 1 $\frac{1}{2}$  ft.

d. Seeds wrinkled or smooth, not winged nor scaly.

e. Follicles always 3.

14. *altissimum*, Wall. Plant shaggy-hairy above: st. tall and slender, branched: lvs. palmately 5-parted, the divisions 3-lobed and toothed: bracts long-lanceolate: fls. blue or purple, in long, branching racemes; spur straight or slightly incurved, equaling the sepals; petals 2-lobed: follicles 3, erect; seeds not winged or scaly. Aug., Sept. Himalayas.

15. *exaltatum*, Ait. St. stout, 2-4 ft. high, smoothish: lvs. flat, nearly glabrous, deeply cleft into 3-7 wedge-shaped lobes, which are often trifid; petioles usually not dilated at the base: fls. blue, with yellow on the upper petals, medium in size, on long, crowded, erect, pyramidal racemes; sepals nearly equaling the spur in length: follicles 3, pubescent or smooth; seed-coats irregularly wrinkled. June-Aug. Borders of woods, Ala. to Minn.

16. *elatum*, Linn. (*D. alpinum*, Waldst. & Kit. *D. pyramidale*, Royle). BEE LARKSPUR. Glabrous, 2-6 ft. high: lvs. somewhat pubescent, 5-7-parted, part rather narrow, cut-lobed; upper lvs. 3-5-parted, petioles not dilated at the base: raceme much like *D. exaltatum* or more spike-like; fls. blue, with dark violet petals; sepals ovate, glabrous, nearly equaling the spurs: follicles 3; seeds transversely wrinkled, not scaly. June-Aug. B.R. 1963 (as *D. intermedium*). F.S. 12:1287. (var. *fl.-pl.*). R.H. 1859, p. 529; 1893, p. 258.—A polymorphous and complex species of Eu. It is probable that all or nearly all the plants sold here under this name should be called *D. exaltatum*, which is a closely allied species.

17. *grandiflorum*, Linn. (*D. sinense*, Fisch.). Figs. 1232, 1233. St. rather slender, 2-3 ft. high: lvs. rather small, many times parted into nearly distinct, narrow, linear lobes: fls. large, blue, varying to white, the spur and lower petals often violet, upper petals often yellow; spurs long and taper pointed: follicles 3, pubescent; seeds triangular, coats wrinkled, not scaly. Blooms in midsummer. Siberia. Intro. 1880. B.M. 1686. Gn. 46: 484. Var. *album*, Hort. Fls. pure white. Var. *albo-pleno*, Hort. Fls. double and pure white. Var. *flöre-pleno*, Hort. (var. *hybridum fl.-pl.*, Hort.). Fls. double, blue, very pretty. R.H. 1893, p. 259; 1895, p. 379 (same).—This group includes the most common and the most beautiful of the perennial delphiniums. *Grandiflorum* is also one of the most stately. Its striking foliage remains beautiful throughout the growing season. It is usually planted well back in the hardy border because of its height, smaller plants

being in front. They may be massed as close as 2 ft. or less but produce a fine effect when 4 ft. apart.

Var. *chinense*, Fisch. St. very slender, not much branched: lvs. and fls. like the type, but fls. more numerous. China. L.B.C. 1:71.—A favorite garden form. The double blue form has been known as *D. Brückii*, Hort.

EE. Follicles varying from 3-5.

18. *carolinianum*, Walt. (*D. azureum*, Michx. *D. virescens*, Nutt.). Plant somewhat pubescent: st.  $1\frac{1}{2}$ -2 $\frac{1}{2}$  ft. high, not much branched: lvs. 3-5-parted, the divisions 3-5-cleft into usually linear lobes: racemes spicate, usually many-flid.; fls. azure-blue, but varying to whitish or white; sepals often with a brownish spot: follicles 3-5, oblong, erect; seeds transversely wrinkled. July. N. C. to Ill., west and south. P.M. 16:258. Var. *album*, Hort. (var. *albidum*, Hort.). Sts. 2-3 ft. high: lvs. larger than the type and with border divisions: fls. creamy white.—The double form of this is not much used.

Var. *vimineum*, Gray. St. 2-4 ft. high, sometimes branched, broader-ld., looser-flid.: fls. violet or white. Texas. B.M. 3593. B.R. 1999 (as *D. azureum*).

19. *mesoleucum*, Link. St. 3 ft. high, pubescent above: lvs. 3-5-parted, the segms. wedge-shaped and deeply serrated; petioles somewhat dilated at the base: fls. blue, with pale yellow or whitish petals: seeds not seen. June. Nativity not known.

DD. Seeds winged.

E. Upper petals never yellow.

20. *trolliifolium*, Gray. St. 2-5 ft., leafy, often reclining: lvs. thinnish, large, often reniform at base, 3-7-parted; lobes wedge-shaped, incised: racemes in larger plants 1-2 ft. long and very loose; fls. blue, with upper petals white; spur and sepals each  $\frac{3}{4}$  in. long: follicles glabrous; seeds with thin wing or crown at the end. April. Moist grounds, Columbia River. Intro. 1881.

EE. Upper petals often yellow.

21. *simplex*, Douglas. St. nearly simple, 2-3 ft. high, soft-pubescent throughout: lvs. many-parted, into linear divisions and lobes: racemes dense, little branched; fls. pale blue, with upper petals yellow, lower petals white-bearded; sepals equaling the spur: follicles 3, pubescent; seeds dark, with margins white-winged. June. Mts. of Idaho and Ore. Intro. 1881.

22. *Nuttallii*, Gray (*D. columbianum*, Greene). St. erect, simple, nearly glabrous, leafy,  $1\frac{1}{2}$ -2 $\frac{1}{2}$  ft.: lvs. thinnish, 3-5-parted, parts divided into many linear-oblong lobes: racemes long, many-flid.; sepals deep blue, ovate, sparingly pubescent, shorter than the spur; petals blue or upper ones yellow, lower ones white-bearded: follicles 3, pubescent, rather erect; seeds thin, dark, with yellow wings. Summer. Low, open woods, Columbia River. Intro. 1892.

23. *scopulorum*, Gray. St. 2-5 ft., glabrous, at least below: lvs. 5-7-parted, the upper ones the more narrowly cleft; petioles dilating at the base: racemes simple, densely many-flid.; fls. blue or purple, rarely white, upper petals often yellow; spur  $\frac{1}{2}$  in. long, equaling the sepals: follicles 3, pubescent; seeds large-winged. Aug., Sept. Moist ground, west of Rockies.—A polymorphous species.

Var. *subalpinum*, Gray (*D. occidentale*, Wats.). A smaller plant, pubescent above: broader divisions of lvs., shorter racemes, larger and deeper-colored fls.: follicles glabrous. Wasatch Mts.

24. *cheilanthum*, Fisch. St. erect, simple or branched, 2-3 ft.: lvs. glabrous or slightly pubescent, 5-parted, the lobes pointed, sub-trifid, and somewhat toothed: fls. dark blue, the upper petals sometimes pale yellow, the lower ones inflexed, ovate, entire; spur

rather long, straight or somewhat curved; foliicles 3, either glabrous or pubescent; seeds 3-cornered, 3-winged, not scaly. June, July. Siberia. B.R. 473. J.F. 1, pl. 49. Gt. 13:253. P.M. 16:258 (as *D. magnificum*).

DDD. *Seeds scaly.*

25. *formosum*, Boiss. & Huet. Fig. 1234. St. strong, 2-3 ft., hairy below, rather glabrous above: lower lvs. 5-7-parted, long-petioled; upper ones 3-5-parted, short-petioled or sessile, all alternate: racemes many-fl.; fls. blue, with indigo margins; spur long, violet, bifid at the tip: foliicles 3, pubescent; seeds scaly. June, July. Asia Minor perhaps, but the origin of it is disputed. F.S. 12:1185. R.H. 1859, p. 528. G.Z. 1:144. H.F. 8:99.—The most permanent form for naturalizing, because it is so hardy. If given rich soil and good cult., it is one of the most effective for use in the permanent fl.-border. Var. *coelestinum*, Hort. Fls. light blue.

26. *Maackianum*, Regel. Erect, 3 ft. high, pubescent or glabrous, branched above: lvs. pubescent on both sides, base often truncate or reniform, 3-5-parted, the parts serrate; petioles dilated at the base: peduncles yellow-hairy, with the bracts often inserted above the base; fls. in loose panicles; sepals blue, half as long as the spurs; petals dark violet: foliicles often glabrous,  $\frac{3}{4}$  in. long; seeds small, distinctly scaly. July. Siberia.

27. *hybridum*, Steph. St. 3-4 ft., pubescent above: root somewhat bulbous: lvs. 5-many-parted; lobes linear; petioles dilated and sheathing at the base: racemes dense; fls. blue, lower limbs white-bearded; spur straight, longer than the sepals: foliicles 3, hairy; seeds ovate, with transverse scales. June-Aug. Mts. of Asia. R.H. 1893, p. 258; same cut in S.H. 2:282.—There are many double and semi-double varieties of this type. This is the tallest and most robust of the popular species of Delphinium. It will respond well to fertilizer and cult. When the clumps become large and strong they are usually set about 4 ft. apart. Young plants may be set 2 ft. apart and thinned a year or two later.

Var. *Bárlowii*, Paxt. Very large, semi-double fls., deep blue, with brownish center. A supposed hybrid with *D. grandiflorum*. B.R. 1944. Intro. 1892.

AAA. *Perennial, garden hybrids.*

28. *cultorum*, Voss (*D. hybridum*, Hort., not Steph.). The general mixed and more or less undefinable hybrid delphiniums, constituting some of the choicest garden and border plants of many colors, single, semi-double and double.



1234. *Delphinium formosum*. ( $\times \frac{1}{2}$ )

*D. carulescens*, Freyn. A fine Asiatic species, with single and double forms. P.M. 16:258.—*D. candidum*, Hemsl. A dwarf perennial: fls. pure white. Uganda. B.M. 8170.—*D. cardiopetalum*, DC., is a pretty annual, branching very low, the outer branches very short, giving a pyramidal form when covered with blue fls. R.H. 1893, p. 228.—*D. caucasicum*, C. A. Mey. (*D. speciosum* var. *caucasicum*, Huth.). Similar to *D. cashmerianum*.—*D. Davidii*, Franch. Hairy: lvs. 3-parted almost to the base: fls. light blue. China.—*D. divaricatum*, Ledeb. Allied to *D. consolida*, but taller, more branched, with smaller more abundant fls. Caucasus and Caspian region. R.H. 1912, p. 513.—*D. macrocentron*, Oliv. Perennial, hairy in nearly all parts: fls. blue and green or yellow and green. E. Trop. Afr. B. M. 8151.—*D. Moerhousii*, Hort. A garden hybrid.—*D. Pardonii*, Craib. Fls. blue in somewhat lax raceme. China.—*D. Ráryi*, Gray, is also listed in the trade, and is closely allied to *D. consolida*.—*D. Wheelerii* is listed in the trade and is doubtless a variety of *D. speciosum*, Bieb., from E. Asia. Many other species may be expected in the lists of collectors and fanciers.

K. C. DAVIS.

DEMAZÈRIA: *Desmazeria*.

DEMERARA ALMOND: *Terminalia*.

DÉNDRIUM: *Leiorhynchum*.

DENDROBIUM (*tree and life*; they are epiphytic). *Orchidaceæ*. Epiphytic orchids of great horticultural merit, grown in hothouses and greenhouses.

Pseudobulbs (sts.), tufted or arising at intervals from a creeping st. sometimes very short and thick, more commonly elongated and often thickened at or near the base, naked or leafy at time of flowering: fls. usually showy, rarely small, in terminal or lateral racemes which are long and lax or short and dense, sometimes of a few fls., or sometimes reduced to 1 or 2; sepals about equal, the dorsal free, the lateral adnate obliquely to the foot of the column, forming either a short sac-like or long spur-like foot or mentum; petals usually resembling the dorsal sepal, either broader or narrower; lip jointed or adnate to foot of column, 3-lobed or entire; pollinia 4.—A large genus of about 600 species, ranging from India and Ceylon to Austral., New Zeal., Japan, and the Pacific Isls., being especially numerous in the Malay Archipelago. There are numerous hybrids, artificially produced.

There are two well-marked sections in this genus for the guide of the cultivator, the evergreen and the deciduous. The first named should not be allowed to become dry at the roots at any period, or loss of vigor will result. Among these, also, are some that need warm-house treatment all the time, such as *D. Phalænopsis*, *D. bigibbum*, *D. Bensoniæ*, *D. Brymerianum*, *D. Dearei*, and others. There are, in fact, but few among the evergreen species that need a coolhouse, and of these *D. formosum*, *D. infundibulum* and its variety *Jamesianum* are conspicuous. Apart from these, the evergreen dendrobies should be kept in a warmhouse during winter where 60° F. may be maintained.—All the deciduous species (typified by *D. Nobile*, *D. Wardianum* and *D. Pierardii*) need a marked resting period, easily determined by the finishing up of the growth in autumn, and the swelling of the nodes for flowering in spring. When at rest, it does not hurt the plants to be subjected to a low temperature of 45°, and it may be done to retard plants for later blooming, allowing the day heat to be regulated by the sun, with plenty of ventilation on favorable days. After the pseudobulbs have flowered, they cease to be of value to the plants, and should be cut out; if there are portions that have not produced flower-buds, these may be used for propagation, cutting the pieces into lengths of several joints or nodes, and laying them on moss in a warm propagating-house or -case, when they will soon produce growths. The above also applies to the hybrids, now so numerous, that have been raised from the deciduous Indian species.—Another section that requires warmth in winter, and now very much grown for cut bloom, is represented by *D. Phalænopsis* and *D. bigibbum*. These are Australian, quite distinct in growth, and usually short-lived in cultivation. The flowers are produced freely for a





XXXV. *Dendrobium superbum* as grown in the American tropics.





few years, are very decorative, and the plants may be increased by taking off the young plants that often appear on the stems. These often can be grown on to strong flowering specimens, and thus the stock maintained. When wintered in a temperature less than 60°, the plants suffer, and great care is necessary at the time the young growths appear in spring to prevent damping off. Small pots or pans are best, and always keep the plants suspended near the sun and air. The evergreen tropical species, as *D. densiflorum*, *D. thysiflorum*, *D. aggregatum*, *D. Farmeri*, *D. moschatum*, *D. fimbriatum* and *D. Dalhousieanum*, also need warmth in winter and must not be dried severely during the resting-period or loss of vigor will ensue at the price of blooming. This section of the genus produces flowers from the old stems for many years. It frequently happens that growths made in India will bloom long after the plants have become established in gardens. It is thus unwise to cut old growths unless they become withered or dead. Enough water may be given to keep the plants plump, and the flowers will be produced freely in their season. In some species, growth begins before or at the time of bloom. This is usually a sign of extra vigor and should not be discouraged. The proper time to repot with all plants of flowering age, is when they begin to recuperate in early summer after the bloom is past; young roots will be seen pushing out at the base of the stems, and if this is anticipated by a week or two, the new material is soon taken to by the roots and no check is experienced. Good sound osmundine is the best material, always using small receptacles rather than large, and if larger than a 6-inch pot or pan, use perforated ones. The roots do not like exposure, but the material will be kept in a sweet healthy condition. Moss is best avoided in most cases; it often fails to grow, and is inimical to the welfare of the plants; when it does grow, it holds too much moisture about the roots. (E. O. Orpet.)

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## GENERAL KEY TO SECTIONS.

A. *Lvs. equitant.* SECTION I. Species 1 and 2.

AA. *Lvs. not equitant.* SECTION II. Species 3-10.  
 B. *Lf.-sheaths black-hairy.*

BB. *Lf.-sheaths not black-hairy.* SECTION III. Species 11-14.  
 C. *Pseudobulbs not thickened at base.*  
 D. *Mentum or chin of fls. elongated.*

DD. *Mentum or chin of fls. short (rather long in D. ramosum).*  
 E. *Fls. usually in pairs, rarely 1 or 3 or more.*  
 F. *The pseudobulbs leafless at flowering time.* SECTION IV. Species 15-44

FF. *The pseudobulbs leafy at flowering time.* SECTION V. Species 45-55.

EE. *Fls. in 3- to many-fl. racemes (single in D. Jenkinsii).*  
 F. *The pseudobulbs 1-lvd., short, fusiform.* SECTION VI. Species 56 and 57.

FF. *The pseudobulbs several-lvd.*  
 G. *Racemes very short, glomerate.* SECTION VII. Species 58.

GG. *Racemes usually long, not glomerate.*  
 H. *Sepals and petals hairy externally; lateral lobes larger than middle lobe of lip.* SECTION VIII. Species 59.

HH. *Sepals and petals glabrous externally.*  
 I. *Pseudobulbs gradually attenuated from a thick bulbous base.* SECTION IX. Species 60.

II. *Pseudobulbs not bulbous at base.*  
 J. *Fls., at least the lip, purple or red.* SECTION X. Species 61-63.

JJ. *Fls. white or yellow.* SECTION XI. Species 64-75.

CC. *Pseudobulbs fusiform-thickened above base, attenuated beyond.* SECTION XII. Species 76.

## SECTION I.

A. *Pseudobulbs leafy at base, naked above.* 1. **Macfarlanei**  
 AA. *Pseudobulbs leafy throughout.*..... 2. **anceps**

1. **Macfarlanei**, Reichb. Pseudobulbs erect, nearly cylindric, up to 9 in. tall, 2-3-lvd.: lvs. 3-4 in. long: racemes 8-15-fl.; fls. 4-5 in. across, white, except the purple markings on lateral and middle lobes of lip. New Guinea.

2. **anceps**, Lindl. Pseudobulbs tufted, compressed, 5-8 in. long: lvs. up to 3 in. long, fleshy, laterally compressed: fls. axillary, solitary or in very short racemes, lemon-yellow at maturity. Trop. Himalayas. B.R. 1239. B.M. 3608 and L.B.C. 19:1895 (as *Aporum anceps*).

## SECTION II.

- A. *Raceme 1-2-, rarely 3-fld.*  
 B. *Mentum of fls. very short; sepals and petals green, yellow-margined.* . . . . 3. *cruentum*  
 BB. *Mentum of fls. long, extinguisher-shaped.*  
 C. *Sepals and petals white, not keeled.*  
 D. *Fls. 1½-2 in. across; lateral lobes of lip manifest.*  
 E. *Middle lobe yellow, reflexed; lateral lobes yellowish green.* 4. *scabrilingue*  
 EE. *Middle lobe white, yellow-marked, fimbriate.* . . . . 5. *longicornu*  
 DD. *Fls. 3 in. across; lateral lobes of lip indistinct.* . . . . 6. *infundibulum*  
 CC. *Sepals yellowish white, keeled.* . . . . 7. *cariniferum*  
 AA. *Raceme 3-8-fld.*  
 B. *Fls. yellow.* . . . . 8. *Lowii*  
 BB. *Fls. white.*  
 C. *Petals broad, oval or obovate.* . . . . 9. *formosum*  
 CC. *Petals oblong-lanceolate, narrow.* . . . . 10. *draconis*

3. *cruentum*, Reichb. Pseudobulbs erect, 10-12 in. tall; fls. 1½-2 in. across; sepals triangular-ovate, keeled; petals linear; lip 3-lobed, the lateral lobes scarlet, the middle lobe pale green, red-margined. Malay Penins. G.C. III. 18:91.

4. *scabrilingue*, Lindl. Pseudobulbs erect, 8-14 in. tall; fls. about 1½ in. across; sepals and petals similar, ovate-lanceolate, white; lip 3-lobed, the lateral lobes yellow-green, the middle lobe reflexed, yellow with orange-yellow lines. Burma. B.M. 5515 (as *D. hedyosmum*).



1235. *Dendrobium Dearei*.  
(×½)

5. *longicornu*, Lindl. Pseudobulbs 8-14 in. tall, slender; fls. 2-3 in. across, white except a central orange or yellow band on lip; sepals and petals similar, elliptic-oblong; lip fimbriate; spur slender. Burma. B.R. 1315.

6. *infundibulum*, Lindl. Pseudobulbs up to 2 ft. long, cylindric, slender; fls. about 3 in. across, white except the yellow blotch on the lip; sepals oblong-elliptic, less than half as broad as the nearly rhomboid petals; lip resembling a wide-mouthed funnel. Burma. B.M. 5446. I.H. 21:172. C.O. 6. Var. *Jamesianum*, Hort. (*D. Jamesianum*, Reichb.). Pseudobulbs stouter and stiffer; lateral lobes of lip roughened on the inner surface; disk cinnabar. Gn. W. 9:485.

7. *cariniferum*, Reichb. Pseudobulbs 6-10 in. tall, nearly cylindric; fls. about 1½ in. across; sepals yellowish white, fading white, narrower than the ovate white petals; lip 3-lobed, the triangular lateral lobes red-

orange, the middle lobe hairy, red-orange at the base, the front part white or pale orange; spur long, obtuse. Burma.

8. *Lowii*, Lindl. Pseudobulbs 8-15 in. tall, slender; fls. 1½-2 in. across, buff-yellow; sepals narrower than the undulate petals; lip distinctly 3-lobed, the lateral lobes tipped with red, the oblong middle lobe reflexed, marked with 6 lines of red hairs. Borneo. B.M. 5303. F.S. 23:2395. C.O. 30.

9. *formosum*, Roxbg. Pseudobulbs up to 1½ ft. tall, cylindric; fls. 3-4 in. across, white except the yellow mark on lip; sepals oblong-elliptic, about half as broad as the obovate petals; lip retuse, erose. Khasia Hills. B.R. 25:64. F.S. 3:226. P.M. 6:49. C.O. 8. O.R. 15: frontispiece. Var. *giganteum*, Hort. Fls. 4-5 in. across. G.C. III. 24:471. Gng. 1:118-9. F.E. 10:1240. F.S. 16:1633-4. G. 25:385.

10. *draconis*, Reichb. Pseudobulbs up to 1½ ft. tall; fls. about 1½ in. across, white except for some orange-red stripes at base of lip; sepals narrower than the petals; lip 3-lobed, the lateral lobes small, the oblong-oval middle lobe crisped and minutely toothed. Burma. B.M. 5459 (as *D. eburneum*).

## SECTION III.

- A. *Raceme secund.* . . . . 11. *secundum*  
 AA. *Raceme not secund.*  
 B. *Bracts small; racemes not capitate.*  
 C. *Fls. rosy purple, about 1 in. across.* . . . . 12. *cumulatum*  
 CC. *Fls. white, about 2½ in. across.* . . . . 13. *Dearei*  
 BB. *Bracts large, colored; racemes capitate* 14. *Bullenianum*

11. *secundum*, Wall. Pseudobulbs up to 2 ft. tall, cylindric; fls. narrow, less than 1 in. long, rosy purple, on one side of the raceme; lip with an apical orange blotch. Sumatra. B.R. 1291. B.M. 4352. C.O. 35. Var. *niveum*, Hort. Fls. white.

12. *cumulatum*, Lindl. Pseudobulbs up to 2 ft. long, pendulous; fls. rosy purple, in short racemes with a purple axis; sepals and petals similar, oblong; lip oblong-obovate; spur obtuse, slightly curved. Burma. B.M. 5703.

13. *Dearei*, Reichb. Fig. 1235. Pseudobulbs up to 3 ft. long; fls. white, 2-2½ in. across, in 5-7-fld. racemes; sepals lanceolate, acuminate, about one-third as broad as the oval petals; lip oblong, obscurely 3-lobed, a pale yellowish green band across the middle; spur funnel-shaped, elongated. Philippines. V.O. 3:37. G.W. 1:225. O. 1912:18. C.O. 36.

14. *Bullenianum*, Reichb. f. (*D. salaccense*, Hort., not Lindl. *D. erythroxanthum*, Reichb. f.). Pseudobulbs 10-18 in. tall; racemes densely fld.; fls. yellow, striped with purple; dorsal sepal and petals oblong; lateral sepals oblong, acute, about as long as the obtuse spur; lip oblong, from a long linear base, acute. Philippines.

## SECTION IV.

- A. *Sepals and petals not yellow.*  
 B. *Lip deeply fimbriate.* . . . . 15. *Devonianum*  
 BB. *Lip entire or minutely fimbriate.*  
 C. *Nodes of pseudobulb much thickened.*  
 D. *Pseudobulbs thick.*  
 E. *Internodes abruptly depressed-globose, thickened at apex.* . . . . 16. *pendulum*  
 EE. *Internodes gradually thickened toward apex.*  
 F. *Front lobe of lip ovate, reflexed, purple.* . . . . 17. *Linawianum*  
 FF. *Front lobe of lip orbicular-ovate, yellow.* . . . . 18. *Findlayanum*  
 DD. *Pseudobulbs wand-like, slender.* . . . . 19. *Falconeri*  
 CC. *Nodes not thickened, or but slightly so.*  
 D. *Internodes usually more than 5 times longer than broad.*



- E. *Lip curved like a trumpet; sepals and petals purple*....20. *lituiflorum*  
 EE. *Lip not curved.*  
 F. *Fls. white*.....21. *monile*.  
 FF. *Fls. with sepals and petals white, tips colored.*  
 G. *Throat of lip yellow.*  
 H. *Middle lobe violet, white-margined*.....22. *amœnum*  
 HH. *Middle lobe yellow, tip rose*.....23. *crystallinum*  
 GG. *Throat of lip purple*.....24. *transparens*  
 FFF. *Fls. with sepals and petals mauve, lip primrose*.....25. *Pierardii*  
 DD. *Internodes usually less than 5 times longer than broad.*  
 E. *Fls. 2½ in. across or less.*  
 F. *Color violet-purple*.....26. *Parishii*  
 FF. *Color white or lilac.*  
 G. *Lip primrose-yellow; sepals and petals lilac*.....27. *primulinum*  
 GG. *Lip with ground color white, a large light or dark yellow blotch in center.*  
 H. *Blotch not marked; base plaited*.....28. *crepidatum*  
 HH. *Blotch marked.*  
 I. *With 2 basal purple spots*.....29. *Bensoniæ*  
 II. *With reddish orange lines.*  
 J. *Shape of lip obtuse; blotch light yellow*.....30. *cretaceum*  
 JJ. *Shape of lip acute; blotch deep yellow*.....31. *gratiosissimum*  
 EE. *Fls. exceeding 2½ in. across.*  
 F. *Ground-color of sepals and petals white.*  
 G. *Throat deep purple*.....32. *nobile*  
 GG. *Throat yellow, with 2 purple spots*.....33. *Wardianum*  
 FF. *Ground-color of sepals and petals rose.*  
 G. *Front lobe of lip rose, the throat yellow*.....34. *regium*  
 GG. *Front lobe of lip white-margined, the throat with 2 dark spots*.....35. *rhodopterygium*  
 AA. *Sepals and petals yellow.*  
 B. *Lip deeply pectinate-fringed*.....36. *Brymerianum*  
 BB. *Lip not fringed.*  
 C. *Disk pilose; 2 large purple fringed spots at base of lip*.....37. *Dalhousieanum*  
 CC. *Disk not pilose, nor with fringed spots*  
 D. *The lip slipper-shaped*.....38. *moschatum*  
 DD. *The lip not slipper-shaped.*  
 E. *Unicolored, yellow.*  
 F. *Shape of sepals and petals acute; lip minutely serrate* 39. *dixanthum*  
 FF. *Shape of sepals and petals obtuse; lip fimbriate*.....40. *fimbriatum*  
 EE. *Bi-colored, yellow with purple markings.*  
 F. *Apex of lip acute; sepals and petals pale yellow.*  
 G. *Front lobe nearly rhomboid, cream-margined*...41. *Aphrodite*  
 GG. *Front lobe ovate, red-lined, the apex recurved*.....42. *aureum*  
 FF. *Apex of lip rounded; sepals and petals rich yellow.*  
 G. *Fls. 2½ in. or more across; lip with a single large spot.*  
 H. *Lip serrate or shortly fimbriate; floral bracts large*.....43. *clavatum*  
 HH. *Lip fimbriate, the divisions branched; floral bracts small*.....40. *var. oculatum*  
 GG. *Fls. about 2 in. across; lip with 2 spots*.....44. *Gibsonii*

15. *Devoniænum*, Paxt. Pseudobulbs up to 3 ft. long, round, pendulous: fls. single or in pairs, about 2 in. across; sepals and petals white tinted amethyst at the apex, the sepals about half as broad as petals, lanceolate, the petals ovate, acute, ciliate; lip white, fringed, the apex purple, and 2 orange blotches in the throat. N. India to S. China. B.M. 4429. J.H. III. 34:197; 52:317. G.C. III. 7:680. C.O. 23. O.R. 4:177; 12:152.

16. *péndulum*, Roxbg. Pseudobulbs abruptly swollen at the nodes, up to 2 ft. long, somewhat pendulous: fls. solitary or 2 or 3 together, 2-2½ in. long; sepals and petals white, purple-tipped, acute, the petals broader than sepals; lip white, ciliate, pubescent on upper surface, the center yellow, the front margin purple. Moulmein. B.M. 5766 (as *D. crassinode*). C.O. 19. O.R. 2:177; 8:177. Var. *Barberiænum*, Hort. Fls. brighter, the apical spots larger and deeper.

17. *Linawiænum*, Reichb. (*D. moniliforme*, Lindl., not Swartz). Pseudobulbs with internodes gradually thickened toward apex, up to 1½ ft. long, clavate: fls. in pairs or 3's, about 2 in. across; sepals and petals rosy purple above, white below, the sepals half as broad as petals; lip obscurely 3-lobed, small, the front lobe purple, the lower part white with 2 purple spots on disk. China and Japan. B. M. 4153. P.M. 3:77.

18. *Findlayænum*, Par. & Reichb. Pseudobulbs with internodes gradually thickened toward apex, up to 1½ ft. long: fls. in pairs, 2-3 in. across; sepals and petals pale lilac, the sepals much narrower than the petals; lip yellow, white-margined. Burma. B.M. 6438. Gn. 49:446. G.M. 44:373 (var. *roseum*). O.R. 8:169.

19. *Falconeri*, Hook. Pseudobulbs slender, up to 1½ ft. long: fls. solitary, 2-3 in. across; sepals and petals white, purple-tipped, the former tinged with pale rose, the petals broader than sepals; lip obscurely 3-lobed, the throat deep purple, with an orange spot on each side and a white band in front, the acute apex purple. N. India. B.M. 4944. I.H. 23:243. F.M. 1876:226. G.Z. 31:145. Var. *gigantæum*, Hort. Pseudobulbs larger: fls. larger and lasting longer.

20. *lituiflorum*, Lindl. Pseudobulbs up to 2 ft. long, pendulous: fls. in pairs, rarely more, 2-2½ in. across; sepals and petals amethyst, the former paler at base, the latter the more richly colored, the sepals much narrower than the petals; lip curved like a trumpet, the opening turned up, the throat purple, surrounded by a white zone, the margin purple. Burma. B.M. 6050. Var. *candidum*, Reichb. Fls. larger, the sepals and petals white, the lip sulfur-yellow. Var. *Freëmanii*, Hort. Sepals and petals deeper in color, the lip with a sulfur-yellow zone.

21. *monile*, Kränzl (*D. japonicum*, Lindl.). Pseudobulbs up to 1 ft. long, slender-clavate: fls. solitary or in pairs, fragrant, white except for a few purple spots on the lip; sepals narrower than petals, both acute; lip acuminate, reflexed at apex. S. Japan. B.M. 5482.

22. *amœnum*, Lindl. Pseudobulbs up to 1½ ft. long, slender: fls. solitary, or sometimes in 2's or 3's, about 2 in. across; sepals and petals white, amethyst-tipped; lip with the front lobe ovate, amethyst margined with white. Nepal. B.M. 6199. G.C. II. 16:625.

23. *crystallinum*, Reichb. f. Pseudobulbs up to 2 ft. long, somewhat pendulous: fls. solitary, or sometimes in 2's or 3's, about 2 in. across; sepals and petals white, tipped with amethyst, or this sometimes lacking in the sepals which are much narrower than the petals; lip with a yellow middle lobe margined white. Burma. B.M. 6319. Var. *álbens*, Hort. Sepals and petals pure white; lip rich yellow tipped with white.

24. *transparens*, Wall. Pseudobulbs up to 20 in. long, slender: fls. in pairs or 3's, about 1½ in. across, white, the sepals, petals and lip tipped pale mauve; sepals lanceolate; petals oblong-elliptic; lip recurved

at the obtuse apex, the disk with a large purple spot. India. B.M. 4663. J.F. 1:68. C.O. 27.

25. *Pierárdii*, Roxbg. (*D. cucullatum*, R. Br.). Pseudobulbs up to 3 ft. long, slender, pendulous: fls. commonly in pairs, up to 2 in. across; sepals and petals pale rosy mauve, acute, the sepals lanceolate, much narrower than the elliptic-oblong petals; lip obscurely 3-lobed, pale primrose-yellow, pubescent on the upper surface, purple-streaked at base. India. B.R. 548 (as *D. cucullatum*); 1756. Gn. 55, p. 405. F.S. 9:955. L.B.C. 8:750. C.O. pl. 26. B.M. 2242 (as *D. cucullatum*); 2584. Var. *latifolium*, Hort. Lvs. broader.

26. *Párishii*, Reichb. f. Pseudobulbs up to 15 in. long, curved, rather stout: fls. solitary, or in 2's or 3's, amethyst-purple with 2 maroon spots on each side of the throat of lip; sepals oblong-lanceolate, narrower than the oval-oblong petals; lip downy, apiculate. Moulmein. B.M. 5488.

27. *primulinum*, Lindl. Pseudobulbs up to 20 in. long, erect or nearly so, rather stout: fls. solitary or in pairs, 2-3 in. across; sepals and petals pale mauve-lilac, oblong, obtuse; lip pale primrose-yellow, purple-streaked at base, the middle lobe very broad. Nepal and Sikkim. Gt. 1861:326. J.H. III. 50:377. B.M. 5003 (as *D. nobile*, var.). Var. *giganteum*, Hort. Pseudobulbs pendulous, more slender: fls. larger, the lip sometimes veined with pale rose.

28. *crepidatum*, Lindl. Pseudobulbs up to 1½ ft. long, nearly erect, rather stout, longitudinally marked with white lines: fls. in 2's or 3's, about 1½ in. across; sepals and petals white, tinted lilac, obtuse, the sepals oblong, narrower than the petals; lip white tinted lilac, sometimes downy, the front lobe obtuse or retuse, the middle orange-yellow. Assam. B.M. 4993, 5011. C.O. 40. Var. *roseum*, Hort. Fls. darker. Var. *album*, Hort. Fls. white.

29. *Bénsoniæ*, Reichb. f. (*D. Dartoisianum*, De Wild. *D. signatum*, Reichb. f.). Pseudobulbs up to 32 in. long, erect, rather slender: fls. solitary, or in 2's or 3's, 2-2½ in. across, white, the disk of the lip yellow with 2 maroon spots; sepals oblong, obtuse, much narrower than the petals; lip with the front lobe orbicular, denticulate, downy on the upper surface. British Burma. B.M. 5679, 8352. O.R. 11:241; 16:68. F.M. 355. Var. *majus*, Hort. Fls. larger.

30. *cretaceum*, Lindl. Pseudobulbs up to 15 in. long, rather stout, curved, pendulous: fls. solitary, about 1½ in. across, cream-white, with a large light yellow spot on lip streaked with orange-red; sepals and petals lanceolate, obtuse; lip with the front lobe orbicular-ovate, obtuse, downy. Khasia Hills. B.R. 33:62. B.M. 4686. F.S. 8:818. J.F. 4:344.

31. *gratiosissimum*, Reichb. f. (*D. Buxallii*, Reichb. f. *D. Bullerianum*, Batem.). Pseudobulbs up to 1½ ft. long, somewhat thickened from a slender base: fls. in 2's and 3's, 2-2½ in. across, white, the sepals, petals and lip tipped with rose-purple; sepals oblong-lanceolate, narrower than the ovate-lanceolate petals; lip with the front lobe broadly ovate, acute, a large yellow orange-streaked blotch in the center. Burma and Moulmein. B.M. 5652. F.M. 315. G.W. 1, p. 227.

32. *nobile*, Lindl. Fig. 1236. Pseudobulbs up to 2 ft. long, erect or nearly so, tufted, nearly round: fls. in 2's or 3's, 2½-3 in. across; sepals and petals white, the upper portion, varying in extent, amethyst-purple, the sepals ligulate, the petals broader, oblong-oval, wavy-margined; lip with a broad nearly orbicular blade, downy, a large rich maroon spot in the center, inclosed by a cream-white zone, the apex amethyst-purple. Himalayas to China. P.M. 7:7. C.O. 1. O.R. 5:209; 9:73. G.M. 47:425. J.H. III. 48:511; 56:511. Var. *albiflorum*, Hort. Fls. white, with a black-purple spot on the lip. O.R. 2:113; 9:73. Var. *album*, Hort. Fls. pure white. Var. *Amesiæ*, Hort. Similar to the preceding,

but fls. larger. Var. *Armstrongiæ*, Hort. Sepals and petals pure white, of great size; lip very dark maroon-purple. Var. *Ashworthianum*, Hort. Fls. pure white, except the green mouth of the lip. Var. *Ballianum*, O'Brien. Sepals and petals white; lip yellowish white or white with 2 crimson spots. C.O. 1 b. Var. *cærulescens*, Reichb. (*D. cærulescens*, Lindl.). Shorter and more slender pseudobulbs: fls. smaller and of a deeper color, and the lip-blade more oval. Var. *Colmanianum*, Hort. A large, pure white variety with a sulfur-yellow disk to the lip. Var. *Cooksonianum*, Reichb. f. Petals concave, approaching the lip in form, erect, with a large basal maroon blotch. C.O. 1a. O.R. 2:113; 9:73. Var. *elegans*, Hort. Fls. larger and more symmetrical; petals broader, the base white; a pale sulfur-yellow zone inclosing the maroon spot on lip, which has a rose-purple apex. Var. *formosanum*, Reichb. f. Pseudobulbs somewhat longer,



1236. *Dendrobium nobile*. (×¼)

pendulous: fls. with longer pedicels, the tips of the petals and lip only purple, the mouth and mentum green. Var. *jaspidium*, Hort. Fls. very showy; apex of segms. red variegated with purple. Var. *murrhianum*, Hort. Like var. *Ballianum*, but finer: sepals and petals slightly tinged violet; disk rich violet, finely veined with rose-violet. Var. *nobilius*, Reichb. f. Fls. larger, the sepals and petals, except at the base, deep purple; lip large, rose-tipped, deep purple in the mouth. C.O. 1c. G.M. 46:193. O.R. 2:113; 9:73. Var. *Owenianum*, Hort. Var. *Rajah*, Hort. Like var. *albiflorum*, but sepals and petals broader and flushed with delicate pink. Var. *Rothwellianum*, Hort. Var. *Sanderianum*, Reichb. f. Resembles var. *nobilius* but fls. smaller, the color more intense, the sepals and petals broader, the lip with a large black purple spot, the surrounding white zone larger. R. 58. O.R. 2:113; 9:73. Var. *Schneiderianum*, Reichb. f. Lip suffused with yellow, and with a deep purple spot. Var. *Schroederianum*, Hort. Larger fls. with broader segms., the sepals and petals white, sometimes tipped with amethyst; lip with an almost black spot, bordered with pale yellow, passing into white. Var. *summitense*, Hort. Var. *Tollianum*, Reichb. f. Pedicels twisted, the



fls. therefore appearing inverted; fls. not fully opening. Var. *virginale*, Hort. Fls. pure white, except a pale primrose tinge on the lip. G.C. III. 35:357. G.M. 52:394. O.R. 5:145; 8:121.

33. *Wardi anum*, Warner. Pseudobulbs up to 3 ft. long, round, pendulous: fls. in 2's or 3's, 3-4 in. across; sepals and petals white, oblong, usually tipped with amethyst, about half as wide as the white oval petals which are amethyst-tipped; lip white with an amethyst apical blotch, the throat yellow, with a maroon spot on each side. B.M. 5058. I.H. 24:277. F.R. 1:231. Gn. 47, p. 84. R.B. 23:25. J.H. III. 30:454; 32:237; 42:211. G.M. 45:744. C.O. 5. O.R. 2:177; 8:177; 9:frontispiece. R. 9. Var. *album*, Williams. Fls. white, except the yellow throat with 2 purple-crimson spots. C.O. 5a. Var. *aureum*, Hort. Sepals and petals light yellow. Var. *Fowleri*, Hort. Lateral sepals with yellow markings and purple blotch as in the lip. G.C. III. 31:125. Var. *xantholeucum*, Hort. Fls. pure white, with a large orange-yellow disk to the lip.

34. *regium*, Prain. Pseudobulbs up to 1 ft. long, cylindric: fls. in 2's or 3's, nearly 3 in. across; sepals and petals purple-rose, darker veined, obtuse, the sepals oblong, narrower than the ovate or oval petals; lip with the limb nearly orbicular, purple-rose, the throat yellow, surrounded by a cream-white zone. India. B.M. 8003. G.C. III. 42:122.

35. *rhodopterigium*, Reichb. f. Pseudobulbs up to 2 ft. long, erect, cylindric: fls. about 2½ in. across; sepals and petals rosy purple, mottled with white; sepals oblong-lanceolate; petals oblong-ovate; lip crimson-purple, striated, white-margined, denticulate, with a central pale longitudinal band. Burma and Moulmein.

36. *Brymerianum*, Reichb. f. Pseudobulbs up to 2 ft. long, rather stout, a little enlarged at the middle: fls. solitary or in few-fl. racemes, about 3 in. across, golden yellow; sepals broadly lanceolate, acutish, a little broader than the linear-oblong obtuse petals; lip with lateral lobes erect, fimbriated with short ciliate flexuous divisions, the middle lobe ovate, fimbriate with very long branched ciliate divisions; disk papillose. Burma. B.M. 6383. A.F. 6:609. G.C. II. 11:475; 16:689. F.M. n. s. 459. R. 92. Lind. 4:183. G.Z. 30:121. O.R. 12:249; 16:24.

37. *Dalhousie anum*, Wall. Pseudobulbs 2-4 ft. long, round, rather slender: racemes pendulous, 6-10-fl.; fls. 4-5 in. across; sepals and petals pale yellow, tinted and veined with rose, the sepals ovate-lanceolate, much narrower than the ovate petals; lip concave, hairy in front, with 2 large fringed purple spots near the base. Burma. B.R. 32:10. I.H. 28:423. Gn. 48:222. G.C. III. 21:157. P.M. 11:145. F.S. 7:698. C.O. 7. Var. *luteum*, Hort. Fls. tinted sulfur-yellow, with crimson disks at base of lip.

38. *moschatum*, Wall. Pseudobulbs up to 6 ft. tall, cylindric: racemes 5-15-fl.; fls. 3-4 in. across, faintly fragrant of musk; sepals and petals pale yellow, tinted pale rose at apex, veined and reticulated, the sepals much narrower than petals; lip slipper-shaped, pale yellow, with 2 large maroon spots encircled with orange, the front part hairy. India. B.M. 3837. B.R. 1779 (as *D. cupreum*). P.M. 2:241. Var. *Calceolaria*, Veitch Man. Fls. smaller, orange-yellow, with deeper veins and reticulation, and deeper spots on lip. C.O. 13.

39. *dixanthum*, Reichb. f. Pseudobulbs up to 3 ft. tall, erect, somewhat clavate: racemes 2-6-fl.; fls. yellow, with an orange mark on lip; sepals and petals acute, the former lanceolate, narrower than the oblong, serrulate petals; lip serrulate, the blade nearly orbicular. Moulmein and Tenasserim. B.M. 5564.

40. *fimbriatum*, Hook. Pseudobulbs 3-5 ft. tall, cylindric: racemes 6-12-fl., pendulous; fls. 2-3 in. across; sepals and petals bright orange-yellow, the former oblong-elliptic, narrower than the oblong-oval,

ciliate petals; lip bright yellow, with an orange spot on the orbicular fimbriate blade, Nepal. P.M. 2:172. J.F. 3:314. G.C. III. 25:305. C.O. 9. Var. *oculatum*, Hook. Pseudobulbs shorter, more slender, the smaller fls. with a maroon spot on the lip. B.M. 4160. I.H. 1:15. C.O. 9a. P.M. 6:169 (as *D. Paxtoni*). F.S. 7:725 (as *D. Paxtoni*).

41. *Aphrodite*, Reichb. f. (*D. noctatum*, Lindl.). Pseudobulbs up to 1 ft. long, slender, branched: fls. solitary or in pairs, 2-3 in. across; sepals and petals cream-colored, the former lanceolate, narrower than the ovate petals; lip cream-colored, with a large saffron-yellow spot in the middle, and 2 maroon spots at base, the front lobe nearly rhomboid, acute. Moulmein and Tenasserim. B.M. 5470. F.S. 15:1582.

42. *aureum*, Wall. (*D. heterocarpum*, Wall. *D. rhomboideum*, Lindl.). Pseudobulbs up to 1½ ft. tall, erect, somewhat clavate: fls. in 2's and 3's, fragrant, 2-2½ in. across; sepals and petals cream-colored, acute, the former oblong-lanceolate, a little narrower than the oblong-ovate petals; lip yellow, streaked with reddish purple, the front lobe ovate, acuminate, recurved, the disk velvety. Trop. Himalayas to Philippines. B.M. 4708. F.S. 8:842. P.M. 14, p. 68, desc. J.F. 4:386. C.O. 10. R. 63. B.R. 29:17. J.H. III. 52:405; 57:3. O.R. 8:41, 169. Var. *sulphureum*, Hort. Fls. sulfur-yellow, with the usual orange-colored markings.

43. *clavatum*, Wall. Pseudobulbs up to 3 ft. long, cylindric, pendulous: racemes 4-6-fl.; fls. 2-3 in. across; sepals and petals orange-yellow, the former oval-oblong, about half as wide as the nearly orbicular petals; lip bright yellow, with a maroon blotch in center, the front lobe orbicular, denticulate, the upper surface pubescent. Trop. Himalayas to S. China. B.M. 6993.

44. *Gibsonii*, Lindl. (*D. fuscatum*, Lindl.). Pseudobulbs up to 3 ft. tall, a little enlarged in the middle, slender: racemes 5-10-fl., pendulous; fls. about 2 in. across, golden yellow, with 2 maroon spots on the lip; sepals and petals oval-oblong, obtuse, about the same width; lip with the limb a little broader than long, rounded at apex, fimbriate, villous on the upper surface. Trop. Himalayas to S. China and Java. P.M. 5:169. B.M. 6226.

## SECTION V.

- A. Sepals and petals white.
- B. Without markings.
  - c. Middle lobe of lip quadrate, emarginate, undulate; spur short, sacate.....45. *lasioglossum*
  - cc. Middle lobe of lip triangular, acute, ciliate; spur long, conic.....46. *aqueum*
- BB. With purple or mauve at apex.....32. *nobile*
- AA. Sepals and petals purple, mauve or lilac.
  - B. Base of lip inclosing column; sepals and petals widely spreading.
    - c. Lip fringed; disk yellow.....47. *Loddigesii*
    - cc. Lip denticulate; throat deep purple 48. *superbum*
  - BB. Base of lip not inclosing column; sepals and petals ascending.....49. *MacCarthyæ*
- AAA. Sepals and petals yellow.
  - B. Color pale.
    - c. Fls. buff-yellow; lip clawed, with 2 purple spots.....50. *albo-san-guineum*
    - cc. Fls. primrose-yellow; lip at base convolute around column.
      - d. Middle lobe of lip oblong, emarginate; petals larger than sepals 51. *luteolum*
      - dd. Middle lobe of lip nearly orbicular, reflexed, much undulated.. 52. *ramosum*
  - BB. Color bright.
    - c. Lip with a single large maroon blotch.....53. *ochreatum*
    - cc. Lip with 2 purple spots.
      - d. Margin of lip denticulate.....54. *chrysanthum*
      - dd. Margin of lip fimbriate, the divisions long and bearded... 55. *Hookerianum*

45. *lasioglóssum*, Reichb. f. Pseudobulbs up to  $1\frac{1}{2}$  ft. long, slender, pendulous, a little enlarged at the middle: fls. in 2's or 3's, white, except the reddish lines on the side lobes of the lip; sepals ovate, a little narrower than the petals; lip 3-lobed, the lateral lobes rounded, denticulate, the middle lobe nearly quadrate, undulate, reflexed, the disk with a tuft of orange-yellow hairs. Burma. B.M. 5825.

46. *aqueum*, Lindl. (*D. album*, Wight.). Pseudobulbs up to 2 ft. long, rather stout, decumbent: fls. about 2 in. across, solitary or in pairs, cream-white, except a yellow spot on the lip; sepals and petals similar, broadly ovate, acute; lip obscurely 3-lobed, the middle lobe triangular, deflexed, ciliate, the upper surface pubescent. Neilgherry Hills. B.R. 29:54. B.M. 4640. J.F. 3:262.

47. *Lóddigesii*, Rolfe (*D. pulchellum*, Lodd., not Roxbg. *D. Seidelianum*, Reichb. f.). Dwarf: pseudobulbs 3-4 in. long: fls. solitary, about  $1\frac{1}{2}$  in. across; sepals and petals lilac, the sepals oblong, much narrower than the ovate petals; lip orbicular fringed, the center orange-yellow, the margin pale lilac. China. L.B.C. 20:1935. B.M. 5037.

48. *supérbum*, Reichb. f. (*D. macrophyllum*, Lindl. Plate XXXV. *D. Scottéchinii*, Hook. *D. macranthum*, Hook.). Pseudobulbs up to 3 or 4 ft. long, cylindric, pendulous: fls. in pairs, 3-5 in. across, with the odor of rhubarb; sepals and petals purple-lilac, acute, the former oblong-lanceolate, about half as wide as the oblong-ovate petals; lip with the tube a deep red-purple, this color appearing as 2 large spots in the throat, the front lobe acuminate, reflexed, denticulate, the upper surface pubescent. Philippines. B.M. 3970. C.O. 20. P.M. 8:97. F.S. 8:757. O.R. 14:78; 20:144. Var. *anósmum*, Reichb. f. (*D. anósmum*, Lindl. *D. macrophyllum* Dayanum, Hort.). Pseudobulbs shorter: fls. usually solitary, nearly odorless, smaller, the sepals and petals shorter and broader. Lind. 6:264. P.M. 15:97. Var. *gigantéum*, Reichb. f. Fls. larger. Var. *Huttonii*, Reichb. f. Fls. white, except the base of the lip and 2 spots on it which are purple. Malay Archipelago. Var. *Richardii*, Hort. Medium-sized very fleshy fls. set on long bristled pedicels.

49. *MacCárthiaë*, Thwaites. Pseudobulbs up to 2 ft. long: fls. in 2-3-fld. pendulous racemes; sepals and petals ascending, the fl. not opening wide, pale rosy mauve, acute, the former lanceolate, narrower than the oblong-ovate petals which are sometimes purple-striped; lip pale purple, striped with deep purple and with a maroon spot surrounded by a white zone. Ceylon. B.M. 4886. G.W. 14, p. 408.

50. *álbo-sanguíneum*, Lindl. Pseudobulbs up to 15 in. long, stout, cylindric, erect: racemes 2-7-fld.; fls. 2-3 in. across, buff-yellow, with 2 purple spots on lip; sepals oblong-lanceolate, acute, about half as broad as the oblong-oval petals which sometimes have a few red streaks at the base; lip broadly clawed, the blade broadly obovate or nearly orbicular, undulate. Moulmein and Tenasserim. B.M. 5130. F.S. 7:721. J.F. 2:203.

51. *lutèolum*, Batem. Pseudobulbs up to  $1\frac{1}{2}$  ft. tall, furrowed, cylindric: fls. 2-4, in lateral racemes, 2-2 $\frac{1}{2}$  in. across, primrose-yellow; sepals oblong-elliptic, narrower than the oval petals; lip with a few reddish streaks, slightly 3-lobed, the middle lobe oblong, emarginate, a tuft of yellow hairs below the tomentose disk. Moulmein. B.M. 5441. F.S. 23:2395 (as *D. Lowii*). J.H. III. 32:143; 51:519; 54:137. V.O. 57. Var. *chlorocéntrum*, Reichb. Fls. a little larger with greenish hairs on the lip. G.C. II. 19:340.

52. *ramòsum*, Lindl. (*D. Rückeri*, Lindl.). Pseudobulbs up to  $1\frac{1}{2}$  ft. tall, slender: fls. solitary or in pairs, about  $1\frac{1}{2}$  in. across; sepals and petals pale primrose-yellow, the dorsal sepal oblong, the lateral triangular, the petals narrower than dorsal sepal; lip 3-lobed, the lateral lobes white, rose-streaked, the middle lobe nearly orbicular, reflexed, deeper yellow than petals, much undulate. Trop. Himalayas. B.R. 29:60.

53. *ochreàtum*, Lindl. (*D. cambridgeanum*, Paxt.). Pseudobulbs up to 10 in. long, stout, curved, cylindric, decumbent: fls. in pairs, 2-3 in. across, rich golden yellow, except the maroon blotch on lip; sepals and petals oblong, acute, similar; lip with the concave blade orbicular, recurved on the margin, the upper surface downy. Trop. Himalayas. B.M. 4450. C.O. 16. Var. *luteum*, Hort. Fls. lemon-yellow, with blotch on lip of much lighter purple than in type.

54. *chrysánthum*, Wall. (*D. Paxtonii*, Lindl.). Pseudobulbs up to 6 ft. long, slender, furrowed, pendulous: fls. about 2 in. across, in racemes of 4-6, golden, except the 2 maroon spots on the lip; sepals oblong-oval; petals broadly obovate; lip denticulate, the middle lobe orbicular. Tropical Himalayas to Burma and southern China. B.R. 1299. Lind. 5:194. C.O. 2. G.C. III. 15:565; 40:374. Var. *anoph-tálmum*, Reichb. f. Lip. not spotted. Var. *microph-tálmum*, Reichb. f. Petals serrate, and the spots on the lip smaller.

55. *Hookerianum*, Lindl. (*D. chrysòtis*, Reichb. f.). Pseudobulbs up to 8 ft. long, pendulous: fls. 3-4 in. across, in pendulous racemes of 10-15, golden, except the 2 maroon spots on the lip; sepals and petals oblong,

acute, similar; lip with the blade broadly oval, velvety on upper surface, fimbriate, the divisions long and bearded. Trop. Himalayas and Bengal. B.M. 6013. Lind. 16:730. I.H. 20:155. J.H. III. 33:221. Var. *brachy-stachyum*, Kränzl. Fls. a little larger, fewer, in shorter racemes. Khasia Hills.

#### SECTION VI.

A. Fls. usually single.

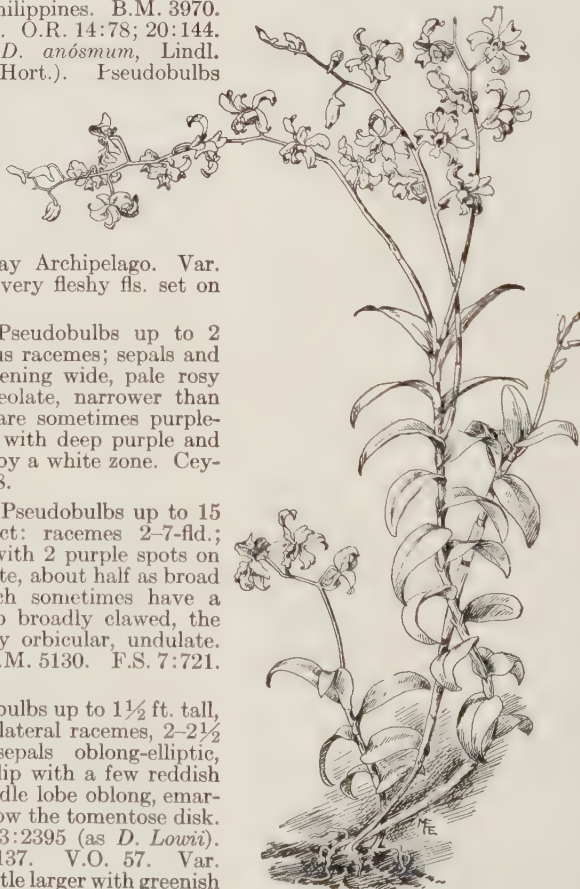
56. *Jenkinsii*

AA. Fls. in racemes.

57. *aggregatum*

56. *Jenkinsii*, Wall. Dwarf: pseudobulbs up to  $1\frac{1}{2}$  in. long, crowded, oblong, compressed, 1-lvd.: lvs. oblong, oval, 1-2 in. long: fls. solitary, about  $1\frac{1}{2}$  in. across, orange-yellow, with the disk on the lip darker; sepals oval, much narrower than the rhomboid petals, the lip downy above. Assam and Burma. B.R. 25:37.

57. *aggregatum*, Roxbg. Pseudobulbs ovate-fusiform, up to 2 in. long, crowded, 1-lvd.: lvs. 2-3 in.



1237. *Dendrobium superbiens*. ( $\times\frac{1}{7}$ )



long, oblong-oval: racemes pendulous, 6-12-fld.; fls. becoming orange-yellow with age, the disk deeper; sepals ovate, about half as broad as the nearly orbicular petals; lip with a pubescent disk. Burma and China. B.R. 1695. B.M. 3643. G.C. III. 50:82. C.O. 33.

## SECTION VII.

58. *bicameratum*, Lindl. (*D. breviflorum*, Lindl. *D. callibotrys*, Ridley). Pseudobulbs tufted, fusiform, up to 16 in. long: racemes short, fasciated, on the old pseudobulbs; fls. yellow, the sepals and petals marked with red spots in lines; lip cuneate, 3-lobed, the lateral lobes small acute, the middle lobe retuse, the callus fleshy, papillate. Trop. Himalayas.

## SECTION VIII.

59. *macrophyllum*, A. Rich. (*D. Veitchianum*, Lindl. *D. macrophyllum Veitchianum*, Hook. f. *D. ferox*, Hassk.). Pseudobulbs stout, clavate, up to 2 ft. long, furrowed, narrowed below: lvs. up to 1 ft. long: racemes many-fld., erect; fls. about 2 in. across; sepals oblong-ovate, hairy externally, pale yellowish green, larger than the whitish spatulate petals; lip 3-lobed, the lateral lobes round, purple-streaked, the middle lobe broader than long, with radiating purple lines. New Guinea, Java, Trinos, Philippines. B.M. 5649. H.F. 2:132. Var. *stenopterum*, Reichb. f. Fls. smaller, the mentum much reduced, the sepals and petals ochre, copiously dotted inside, marked outside with large brown spots.

## SECTION IX.

60. *Kingianum*, Lindl. Dwarf: pseudobulbs 2-3 in. long, attenuated upwards from a bulbous base, 2-5-lvd.: racemes few-fld.; fls. nearly 1 in. across; sepals and petals purple, the acute ovate sepals broader than the petals; lip white, marked with purple, 3-lobed, the lateral lobes obtuse, the middle lobe reniform, apiculate; spur yellow-tipped. Queensland. B.R. 31:61. B.M. 4527. J.F. 2:143. C.O. 38.

## SECTION X.

- A. *Sepals and petals undulate; ovary same color as fls.* ..... 61. *superbiens*  
 AA. *Sepals and petals not undulate; ovary green*  
 B. *Fls. about 2 in. across; middle lobe of lip retuse; disk papillose.* ..... 62. *bigibbum*  
 BB. *Fls. 2½-4 in. across; middle lobe of lip acute; disk smooth.* ..... 63. *Phalænopsis*

61. *superbiens*, Reichb. f. (*D. Goldiei*, Reichb. f. *D. Fitzgéraldii*, F. Muell.). Fig. 1237. Pseudobulbs up to 2½ ft., cylindric, somewhat narrowed at both ends, leafy above: peduncle nearly terminal, bearing a nodding terminal raceme; fls. about 2 in. across, crimson-purple, the sepals and petals often white-bordered; sepals oblong, reflexed, undulate, narrower than the obovate petals; lip 3-lobed, the lateral lobes round, the middle lobe oblong, wavy, reflexed. Austral. F.M. 1878:294. R. 1:39. G. 34:117. G.W. 14, p. 29. G.C. III. 49:36. C.O. 15.

62. *bigibbum*, Lindl. Pseudobulbs cylindric, somewhat fusiform, slender, up to 1½ ft. long, leafy: peduncle nearly terminal, slender, with a terminal many-fld. raceme; fls. 1½-2 in. across, purple-magenta, the lip darker; sepal oblong, acute, much narrower than the nearly orbicular petals; lip 3-lobed, the lateral lobes oblong, incurved, the intermediate one oblong, reflexed; crest white, papillose. Austral. B.M. 4898. F.S. 11:1143. Gt. 49:1473. Var. *candidum*, Reichb. f. Fls. white.

63. *Phalænopsis*, Fitzgerald. Fig. 1238. Pseudobulbs slender, up to 2 ft. long, leafy above: peduncle terminal or nearly so, slender, bearing a terminal raceme of 8-15 fls. which are 2½-3½ in. across; sepals lanceo-

late, acute, white, flushed pale rose, narrower than the rhomboid orbicular mauve petals with deeper veins; lip 3-lobed, the lateral lobes round, curved over the column, maroon-purple, the middle lobe pale purple, deeper veined. Austral. G.F. 5:440 (adapted in Fig.

1238). A.F. 16:1442. B.M. 6817. C.O. 4. Var. *hololeucum*, Hort. Fls. white. G.C. III. 28:239. Var. *Lindenæ*, Hort. Fls. large, creamy white. Var. *Rothschildianum*, Kränzl. Fls. 4 in. across, the sepals and petals white, suffused rose, the lip rose, intensely veined. Var. *rubescens*, Hort. An exceptionally dark form. Var. *Schröderianum*, Hort. Sepals white, the petals and lip deep violet. G.C. III. 28:238. Var. *splendens*, Hort. Fls. bright magenta-rose, white at base of segms. Var. *Statterianum*, Sander. Fls. deep violet. Var. *thundersleyense*, Hort. A dark-colored form.



1238. *Dendrobium Phalænopsis*. (×¼)

## SECTION XI.

- A. *Sepals and petals not yellow.*  
 B. *Pseudobulbs clavate, few-jointed.*  
 C. *Fls. single or in racemes of 2 or 3; sepals and petals contorted.* ..... 64. *tortile*  
 CC. *Fls. in 6- to many-fld. racemes; sepals and petals not contorted.*  
 D. *Lip white with a yellow spot; racemes loosely fld.* ..... 65. *Palpebræ*  
 DD. *Lip entirely yellow; racemes densely fld.* ..... 66. *thyrsiflorum*  
 BB. *Pseudobulbs cylindric, many-jointed.*  
 C. *Lip white, colored at base; sepals and petals white.*  
 D. *Middle lobe of lip broadly obcordate, resembling the petals.* ..... 67. *Fytchianum*  
 DD. *Middle lobe of lip narrowly oblong, much different from petals.* ..... 68. *leucolophotum*  
 CC. *Lip rose with a large orange blotch; sepals and petals rose.* ..... 69. *Bronckartii*  
 AA. *Sepals and petals yellow.*  
 B. *Color pale straw-color, tinted with rose.* ..... 70. *Farmeri*  
 BB. *Color clear yellow, not tinted.*  
 C. *Raceme of 2-4 fls.* ..... 71. *capillipes*  
 CC. *Raceme 10- to many-fld.*  
 D. *Lip deeply fimbriate, the divisions ciliate.* ..... 72. *chrysotoxum*  
 DD. *Lip minutely fimbriate.*  
 E. *Throat of lip marked with purple radiating lines.* ..... 73. *sulcatum*  
 EE. *Throat not lined.*  
 F. *Petals about as wide as sepals.* ..... 74. *densiflorum*  
 FF. *Petals nearly twice as wide as sepals.* ..... 75. *Griffithianum*

64. *tortile*, Lindl. Pseudobulbs up to 1 ft. long, clavate, furrowed: fls. in 2's or 3's, sometimes solitary; sepals and petals narrowly oblong, twisted, pale lilac;

lip convolute at base, nearly orbicular, primrose-yellow, with a purple basal spot. Malay Penins. B.M. 4477. O.R. 8:201. Var. *Dartoisianum*, O'Brien (*D. Dartoisianum*, De Wild). Sepals and petals yellowish. French India.

65. *Pálpebræ*, Lindl. Pseudobulbs up to 10 in. long, clavate, 4-angled: racemes loosely 5-10-fl.; fls. white, except the orange-yellow disk on lip; sepals oblong, narrower than the oval petals; lip oblong, downy above, fringed near the base. Burma, Siam, China.

66. *thysiflorum*, Reichb. f. (*D. densiflorum albo-luteum*, Hook.). Pseudobulbs up to 2 ft. long, terete, leafy: racemes pendulous, many-fl., lateral; fls. 1½-2 in. across; sepals and petals white, nearly transparent, the sepals oblong-ovate, acute, narrower than the nearly orbicular denticulate petals; lip orange-yellow, downy, the blade nearly orbicular, fimbriate. Moulmein and Burma. O.R. 6:209. C.O. 18. Gn. 60, p. 282. Gt. 55, p. 98. J.H. III. 48:313. I.H. 22:207. G. 19:204. F.M. n. s. 449. Var. *Walkerianum*, Warner. Pseudobulbs longer: fls. larger in longer racemes.

67. *Fytchi anum*, Batem. (*D. barbatulum*, Batem., not Lindl.). Pseudobulbs up to 1½ ft. tall, slender, erect: racemes 10-15-fl.; fls. 1½-2 in. across, white, except the rosy tint on sides of lip; sepals lanceolate, about one-third as wide as the obovate petals; lip 3-lobed, the lateral lobes incurved, the middle lobe broadly obcordate, with basal tufts of yellowish hair. Burma. B.M. 5444. Var. *roseum*, Berkeley. Fls. rose.

68. *leucolophotum*, Reichb. f. Pseudobulbs up to 1½ ft. tall, rather stout: raceme nodding, many-fl., 1-sided, on a long peduncle; fls. about 1 in. across, white, except the pale green on the side lobes and base of lip; sepals oblong-linear, keeled, much narrower than the obovate petals; lip 3-lobed, the lateral lobes incurved, the midlobe narrowly oblong. Malay Archipelago.

69. *Brónckartii*, De Wild. Pseudobulbs up to 3 ft. long, furrowed, terete, leafy: racemes pendulous, laxly many-fl.; fls. about 2 in. across, pale rose, except an orange blotch on lip; sepals elliptic-oblong; petals elliptic-ovate; lip nearly orbicular, denticulate, the disk velvety. Annam. B.M. 8252. R.B. 33:369.

70. *Färmeri*, Paxt. (*D. Pálpebræ*, Hook. not Lindl.). Pseudobulbs up to 1½ ft. tall, 4-angled, clavate, leafy: racemes pendulous, laxly many-fl.; fls. about 2 in. across; sepals and petals pale straw-color, tinted rose, the sepals oblong, acute, narrower than the broadly oval petals; lip nearly orbicular, deep yellow, downy above. Sikkim to Nepal and Burma. B.M. 4659. F.S. 7:741. J.F. 307. C.O. 30. Var. *albiflorum*, Hort. Sepals and petals white. Var. *aureo-flavum*, Hook. Sepals and petals golden.

71. *capillipes*, Reichb. f. Dwarf: pseudobulbs 2-3 in. long, fusiform: racemes few-fl.; fls. about 1¼ in. across, golden yellow, with a deeper blotch on lip; sepals lanceolate, acute, much narrower than the broadly oval petals; lip with the blade about orbicular, emarginate. Burma. B.M. 7639. Var. *élegans*, Reichb. f. Pseudobulbs taller, and base of lip deeper yellow.

72. *chrysotóxum*, Lindl. Pseudobulbs up to 1½ ft. tall, clavate or fusiform: racemes drooping, many-fl.; fls. about 2 in. across, golden yellow, except the red-dish streaked orange-yellow disk on lip; sepals oblong-elliptic, about half as broad as the obovate-oblong petals; lip orbicular, fimbriate, pubescent on upper surface. Burma. G. 18:465; 30:275. B.M. 5053. I.H. 5:164. C.O. 11. Var. *suavissimum*, Hook. f. (*D. suavissimum*, Hook. f.). Differs in its shorter, thicker pseudobulbs, and the large chestnut spot on the lip. Burma. Gn. 13:166. C.O. 11a.

73. *scalcatum*, Lindl. Pseudobulbs up to 10 in. long, clavate, furrowed: racemes 10-15-fl., short, nodding; fls. yellow, the lip deeper and purple-streaked; sepals

oval-oblong, narrower than the ovate petals, lip broadly ovate. Khasia Hills. B.R. 24:65. B.M. 6962.

74. *densiflorum*, Wall. Pseudobulbs up to 1½ ft. tall, 4-angled, clavate, leafy: racemes pendulous, many-fl.; fls. about 2 in. across; sepals and petals orange-yellow, nearly transparent, the acute sepals oblong-ovate, narrower than the denticulate nearly orbicular petals; lip nearly orbicular, orange-yellow, downy above. Nepal. B.R. 1828. B.M. 3418. F.S. 14:1397. G.W. 1, p. 223. J.H. III. 51:123; 64:94. C.O. 14. Var. *Schröderi*, Hort. (*D. densiflorum Schröderi*, Hort. *D. densiflorum album*, Hort.). Fls. larger in looser, longer racemes, the sepals and petals white, the lip deep orange, shading at margin to pale yellow. F.M. 502. A.G. 20:5.

75. *Griffithianum*, Lindl. Pseudobulbs up to 1½ ft. tall, furrowed, attenuated below: racemes pendulous, many-fl.; fls. about 2 in. across; sepals and petals bright yellow, the sepals oblong-oval, narrower than the nearly orbicular petals; lip orbicular, fringed, papillose above. Burma. Var. *Guibértii*, Veitch (*D. Guibértii*, Carr.). Fls. larger and more intensely colored: pseudobulbs more abruptly narrowed below.

## SECTION XII.

76. *crumenatum*, Swartz. Pseudobulbs fusiform, thickened above base, then attenuated: fls. appearing successively in upper part of st., white, or suffused with pale rose; sepals acute, the petals oblong-lanceolate, acute; lip cuneate, the lateral lobes rounded, the middle lobe nearly orbicular, the disk with 5 keels. Malay Archipelago. B.R. 25:22. B.M. 4013.

*D. acuminatum*, Rolfe=Sarcopodium acuminatum.—*D. am-  
plum*, Lindl.=Sarcopodium amplum.—*D. annamense*, Rolfe. Fls. buff-yellow, rather membranous. Annam.—*D. arcuatum*, J. J. Smith. Fls. white, with stout spurs curved forward at the tip. Java.—*D. Ashworthiae*, O'Brien. Fls. cream-white, except a few purple streaks at base of lip, the sepals lanceolate or triangular, the petals clawed. New Guinea. B.M. 8141. G.C. III. 29:86. C.O. 39.—*D. atroviolaceum*, Rolfe. Racemes many-fl., the fls. about 3 in. across, the sepals and petals primrose-yellow, claret-spotted, the lip 3-lobed, the disks violet, white-striped, the middle lobe recurved, dark violet streaked white at base, the upper part yellow, claret-spotted. New Guinea. B.M. 7371. C.O. 12. O.R. 3:305; 9:152; 16:69. G.W. 14, p. 407. J.H. III. 50:355.—*D. bellatulum*, Rolfe. Dwarf, tufted: fls. 1 or 2, axillary, white with a vermilion lip. China. B.M. 7985. G.C. III. 36:114.—*D. bicaudatum*, Reinw. Sepals and petals whitish, changing to greenish yellow, with faint purple lines; lip elongated; white. Java.—*C. Brändtii*, Kränzl. Resembles *D. Phalenopsis*. Fls. more fleshy, mauve-purple with silvery crests to the lip; sepals and petals twisted or curled.—*D. capituliflorum*, Rolfe. Fls. in dense axillary heads, greenish white, with column and disk of lip bright green. New Guinea.—*D. chidatum*, Parish. Sepals and petals yellowish green, the lip yellow, purple-lined. Moulmein. B.M. 5430. G.W. 11, p. 340. Var. *annamense*, Hort. A white-fl. form with fringed lip, purple at the base. Annam.—*D. Calogyne*, Reichb. f.=Sarcopodium Calogyne. C.O. 32.—*D. compactum*, Rolfe. A small-growing species: sepals and petals pure white, linear, acuminate; lip nearly as long as sepals, light green. China.—*D. convolutum*, Rolfe. Sepals and petals light green, with a few small dark brown markings at the base; lip green and dark brown. New Guinea.—*D. criniferum*, Lindl. "Fls. lasting only a single day, whitish, with a 3-lobed lip which breaks up in front into a fringe of long spreading yellow filaments." Malaya. G.C. III. 43:194.—*D. cucumerinum*, M'Leay. Dwarf: lvs. oblong, terete, with tubercles arranged in lines: fls. 3-5, white or yellowish, purple-streaked. New S. Wales. J.F. 4:358. B.M. 4619.—*D. delicatum*, Kränzl.—*D. subacaulis*.—*D. delicatum*, Bailey. Sepals and petals milky white the lip white, violet-lined, the callus golden, minutely violet-dotted. New Guinea. G. 34:245.—*D. epidendropsis*, Kränzl. Resembling an epidendrum: fls. greenish or yellow outside, yellow inside, about 1½ in. long. Philippines.—*D. Paulhaberianum*, Schltr. Fls. violet-rose; lateral sepals forming a mentum scarcely ½ in. long. Hainan.—*D. fusiiforme*, Bailey.—*D. speciosum* fusiforme.—*D. glomeratum*, Rolfe. Fls. rose-purple, in few-fl. fascicles, the lip golden carmine. Molucca. Gn. 65, p. 123.—*D. Goldschmidtianum*, Kränzl. Over a foot high: racemes short, about 12-fl.; fls. deep rose-purple. Formosa.—*D. Hildebrandtii*, Rolfe. Racemes axillary, 3-4-fl.; sepals and petals white, the lip primrose-yellow, the tube pubescent externally. Burma. B.M. 7453. O.R. 3:49; 12:153; 16:26.—*D. Hodgkinsonii*, Rolfe. Raceme 5-7-fl., terminal; fls. pale green, the lip purple-nerved. New Guinea. B.M. 7724.—*D. Imthurnii*, Rolfe. Probably the most robust of all dendrobiums in cult.: racemes axillary, many-fl.; fls. of medium size, white, with lilac streaks on lateral lobes of lip. New Hebrides. B.M. 8452.—*D. inaequale*, Rolfe. Flowering pseudobulbs separate from leafy ones, clavate, the fls. second, arising alternately from the margin of the internodes; sepals and petals white, the lip tubular, pale yellow, purple-streaked inside.



New Guinea. B.M. 7745.—*D. Jeraonidum*, Wight= *D. nutans*.—*D. kardense*, Schlecht. Fls. solitary in axil of lf. at apex of the st., small, white. A curious species. New Guinea.—*D. Madonnæ*, Rolfe= *D. rhodostictum*.—*D. monophyllum*, F. Muell. In habit resembling a bulbophyllum: racemes with 9-15 greenish yellow fls. Austral.—*D. Mörtii*, F. Muell. Fls. solitary; sepals and petals light yellow; lip whitish, marked with lilac with 3 undulate green keels on disk. New S. Wales.—*D. muricatum munificum*, Finet.= *Inobulbon munificum*.—*D. nutans*, Lindl. Fls. short, in few-fld. racemes, golden; sheaths hispidulous. Malabar. B.M. 7741. C.O. 28 (as *D. Jerdonianum*).—*D. punicum*, Rolfe. Fls. in racemes, light rose-pink, with light yellow tips to the sepals and petals. New Guinea.—*D. quinarius*, Rolfe. "Fls. light yellow with several light brown nerves in front of lip." New Guinea.—*D. rhodostictum*, F. Muell. Fls. white, with a few purple spots on margins of lateral lobes of lip. New Guinea. B.M. 7900 (as *D. Madonnæ*). G.C. III. 43:162.—*D. rosellum*, Ridley. Fls. rose-colored. Borneo.—*D. roseo-nervatum*, Schlecht. Fls. pale rose, borne at the summits of the sts. Sumatra.—*D. Sanderæ*, Rolfe. Pseudobulbs up to 3 ft. long, leafy: racemes lateral, 3-4-fld.; fls. large, white, the lip with purple stripes on the disk and lateral lobes, the middle lobe obovate, truncate, crenulate. S. E. Asia. B.M. 8351. G.C. III. 45:374. G.M. 52:621. O.R. 17:209.—*D. Schinzii*, Rolfe. Fls. pale green, very fugacious. Sumatra.—*D. Schurzei*, Rolfe. Fls. very large, white. A new species of the *D. Nearii* group.—*D. senile*, Pav. & Reichb. f. Pseudobulbs fusiform, hairy, as are the lvs.: fls. in pairs or solitary, fleshy, rich yellow, with a few orange streaks on lip. Burma, Tenasserim. Moulmein. B.M. 5520. G.W. 9, p. 422.—*D. spathaceum*, Lindl. A small species with slender pseudobulbs: fls. white. Sikkim.—*D. speciosum fusiforme*, Bailey. Pseudobulbs fusiform: fls. pale sulfur or straw-color to nearly white, the lip white, marked with violet. Austral. G. 33:361. G.C. III. 41:337.—*D. spectabile*, Miq. Pseudobulbs up to 2 ft., clavate, grooved: fls. 3 in. across, white, streaked and spotted with dark purple, the sepals and petals undulate, recurved, the former triangular-lanceolate, the petals much narrower; lip undulate, narrowly panduriform, the narrow lanceolate tip recurved. New Guinea and Solomon Is. B.M. 7747. C.O. 22. A.G. 21:239. G.M. 43:53. Var. *Simmondsii*, Hort. Lip much longer than in the type, white, veined with dark purple.—*D. spirium*, J. J. Smith. Fls. solitary; sepals and petals white. A distinct and singular species. Java, Borneo.—*D. striatum*, Hort. "Sepals and petals narrow and nearly equal; labellum as long as petals, narrow, with sides folded back, whitish tinged with rose." Philippines.—*D. subacule*, Reinw. Fls. fragrant, white speckled with purple on lip; lip with very short apiculate middle lobe. Queensland.—*D. taurinum*, Lindl. Pseudobulbs cylindric: racemes many-fld.; fls. large, the sepals white, the petals and lip pale rose, intensely striated. Philippines. G.C. III. 31:90. B.R. 29:28.—*D. tonkinense*, De Wild. Lip entire, furnished with crests, the median one very prominent. Tonquin.—*D. Treacherianum*, Reichb. f. = *Sarcopodium Treacherianum*.—*D. triflorum*, Lindl. = *Sarcopodium cymbioides*.—*D. undulatum* var. *Broomfieldii*, Fitzgerald. Fls. pale greenish yellow. N. Austral.—*D. Victoriæ-reginæ*, Lohr. Racemes few-fld.; sepals and petals white at the base, violet-purple above, the lip golden at the base, violet-purple above, marked with black-purple lines of papillæ. Philippines. G.M. 51:610; 54:556. Gn. 75, p. 370. C.O. 21. O.R. 20:17.—*D. Williamsii*, Day & Reichb. f. Pseudobulbs up to 1 ft. tall, hairy, as well as the lvs.: fls. usually in pairs, 2½-3 in. across, ivory-white or yellowish, the throat of lip bright orange-red. N. E. India. B.M. 7974. G.C. III. 35:341.—*D. Wilsonii*, Rolfe. Racemes 2- or 3-fld.; fls. delicate pink or nearly white, with small yellow blotch on disk of lip. W. China.—*D. Wolterianum*, Schltr. Racemes many-fld.; fls. rose-colored. New Guinea.

The following are some of the hybrid forms: *D. Ainsworthii*, Moore (*D. aureum* × *D. nobile*). Fls. white, more or less suffused with rose, the lip with a feathered purple spot. C.O. 1. Gn. 51, p. 338. G.C. II. 16:624. J.H. III. 62:281.—*D. Apolló grandiflorum* = *D. rubens*.—*D. Artemis* = *D. aureum* × *D. Ainsworthii*. O.R. 14:72.—*D. Aspasia* = *D. aureum* × *D. Wardianum*. O.R. 1:137.—*D. burfordiense* = *D. aureum* × *D. Linawianum*. G. 29:35.—*D. Cassiope* = *D. moniliforme* × *D. nobile*. C.O. 2.—*D. chrysodiscus* = *D. Ainsworthii* × *D. Findlayanum*.—*D. Curtissii* = *D. aureum* × *D. Cassiope*. Gn. 69, p. 145. O.R. 14:73.—*D. Dalhousii-nobile* = *D. nobile* × *D. pulchellum*. G.C. III. 27:379.—*D. dominyanum* = *D. nobile* × *D. Linawianum*.—*D. dulce* = *D. aureum* × *D. Linawianum*.—*D. Edithæ* = *D. nobile nobilis* × *D. aureum*.—*D. endocharis* = *D. aureum* × *D. monileforme*. G. 32:293. G.Z. 36, p. 195.—*D. eudsmum* = *D. endocharis* × *D. nobile*.—*D. Leechianum* = *D. aureum* × *D. nobile*. R.H. 1904:280. C.O. 1a.—*D. melanodiscus gloriosa* = *D. Ainsworthii* × *D. Findlayanum*. G.C. III. 35:219.—*D. melanodiscus pallens* = *D. Ainsworthii* × *D. Findlayanum*. J.H. III. 50:25.—*D. Rablingianum* = *D. nobile* × *D. ramosum*. Gn. 59, p. 198, desc.—*D. Rolfæ* = *D. nobile* × *D. primulinum*.—*D. Rolfæ roseum* = *D. nobile* × *D. primulinum*. Gn. W. 18:541.—*D. rubens grandiflorum* = *D. Ainsworthii* × *D. Findlayanum*.—*D. splendens* = *D. Ainsworthii* × *D. aureum*. G.M. 43:179. G.M. 65, p. 140.—*D. Thwaitesæ* = *D. Ainsworthii* × *D. Wiganisæ*. G.M. 47:273.—*D. Venus* = *D. nobile* × *D. Falconeri*. G.M. 51:459. C.O. 3.—*D. Wiganisæ* = *D. nobile* × *D. signatum*.—*D. Wiganisæ xanthochilum* = *D. nobile* × *D. signatum*. Gn. W. 20:161.—*D. Wiganisæ* = *D. Hildebrandii* × *D. nobile*. G.M. 44:167.—*D. xanthoocentrum* = *D. Wardianum* × *D. Linawianum*.

GEORGE V. NASH.

**DENDROCÁLAMUS:** A few large bamboos of the East Indies and China; see *Bamboo*.

**DENDROCHILUM:** *Platycinis*.

**DENDROMÈCON** (Greek *dendron*, tree; *mecon*, poppy). *Papaveraceæ*. An outdoor shrub in California, with bright yellow flowers; sparingly grown elsewhere.

Smooth low branching plant with rigid alternate mostly entire lvs.: fls. golden yellow, 1-3 in. across, single on short pedicels; petals 4, large; sepals 2; stamens many, short; fr. a linear curved grooved caps. 2-4 in. long.—Long considered to comprise a single species, but lately redefined by Fedde into 20 species, but only one species-name appears to be in the trade. The division into species is largely on foliage characters. It is not unlikely that some of the cult. material represents one or more of these segregates.

**rigida**, Benth. Rigid, very leafy, 2-10 ft. high: sts. up to 2 in. thick; bark whitish; branches stiff, erect: lvs. lanceolate or ovate-lanceolate, coriaceous, reticulately veined, very acute and mucronate: fls. on pedicels, 1-4 in. long: seeds black, almost globular. Dry parts of Coast ranges and in the Sierras. B.M. 5134. F.S. 14:1411. Gn. 50:292. J.H. III. 29:92.—Spring-flowering. In England it is somewhat tender, requiring some protection in winter. Prop. from seeds,

that take very long to germinate. Considerable variation in size of fls. appears to depend on the conditions in which plants are growing. Evergreen, but in hard winters in Calif., loses most of its lvs. by Feb., when, becoming scraggly, it may be cut back to ground for renewal. L. H. B.†



1239. Tip of leaf of *Dennstædtia punctilobula*. (× ¼)



1240. Fruiting lobe of *Dennstædtia punctilobula*.

**DENDRÓPANAX** (Greek, *tree Panax*). *Araliaceæ*. Unarmed trees and shrubs from Trop. Amer. and Asia, also China and Japan. Fls. hermaphrodite, rarely polygamous. Species about 20. *D. japonicum*, Seem. (*Hedera japonica*, Jungh.), may be secured from dealers in Japanese plants. The lvs. have been compared to *Fatsia japonica*, but are smaller and mostly 3-lobed but simple. The floral parts are in 5's: infl. umbellate, terminal nearly simple and not showy; berry globose. Cult in temperate house. N. TAYLOR.†

**DENDROPHYLAX:** *Polymrhiæ*.

**DENNSTÆDTIA** (August Wilhelm Dennstedt, early German botanist). *Polypodiaceæ*. Hardy or greenhouse ferns of wide distribution, often referred to *Dicksonia* but belonging to a different family from the tree ferns of the latter genus from the antarctic or southern hemisphere. Indusium inferior cup-shaped, open at top and adherent on outer side to a reflexed toothlet: lvs. 2-3-pinnatifid, from erect or creeping rootstocks. Species about 30; of simple cultural requirements.

**punctilobula**, Moore (*Dicksonia pilosiuscula*, Willd.). Figs. 1239, 1240. Rootstock slender, creeping, underground: lvs. light green, 1-2½ ft. long, 5-9 in. wide, usually tri-pinnatifid, under surface minutely

glandular, giving the dried lvs. a somewhat pleasant fragrance; sori minute, on small, recurved teeth. Canada to Tenn.—Sometimes called hay-scented fern, and boulder fern. Likes light porous soil and semi-shaded places. Variable.

**Smithii**, Moore. Lvs. thick, the under surface almost woolly, glandular, tripinnate; lower pinnae 9–12 in. long, 3–4 in. wide; sori 2–8 to each segm. Philippines.

**dissécta**, Moore. From the W. Indies, often 6–7 ft. high, with broad (2–4 ft.) lvs.—Sometimes seen in cult. and is well worth a place in the trade.

L. M. UNDERWOOD.

**DENTÀRIA** (Latin, *dens*, tooth; referring to the toothed rootstocks). *Cruciferae*. TOOTHWORT. Small early-flowering herbs, sometimes offered by dealers in native plants.

Hardy herbaceous perennials, usually with pleasant-tasting rootstocks, 2 or 3 lvs., mostly with 3 parts, and corymbs or racemes of large white or purplish fls. in spring; sts. mostly unbranched and not leafy below: lvs. palmately 3-divided or lacinate: petals surpassing the sepals; stamens 6; style slender: fr. a very narrow flat silique dehiscent from the base.—Probably 20 species in Eu., Asia and in N. Amer. The European and E. American species are readily told from Cardamine by habit and many obvious differences, but the W. American representatives of the 2 genera converge so that some botanists have merged Dentaria into Cardamine. (See E. L. Greene, *Pittonia*, 3:117–124.)

Several species are cultivated in Old World rockeries. They are of easy culture in light rich soil, and moist shady positions. Usually propagated by division, as seeds are not abundant.

A. Rootstock continuous, not tuberous.

**diphylla**, Michx. PEPPER-ROOT. Fig. 1241. Eight to 16 in.: rootstock several inches long, often branched, strongly toothed at the many nodes: st.-lvs. 2, similar to the root-lvs., close together; segms. 3, ovate or oblong-ovate, coarsely crenate, the teeth abruptly acute: petals white inside, pale purple or pinkish outside. Nova Scotia to S. C., west to Minn. and Ky. B.M. 1465.—Rootstocks 5–10 in. long, crisp, tasting like water-cress. Pretty spring fl.

AA. Rootstock tuberous or jointed.

B. Lvs. deeply 3-parted, but not into distinct lfts.

**laciniata**, Muhl. Eight to 16 in.: the st. pubescent above: tubers deep: st.-lvs. 3, with lateral segms. often 2-lobed, all oblong to linear, more or less sharply toothed: petals purplish to white. Que. to Minn., south to Fla. and La. Var. **integra**, Fern., has the lateral segms. entire or nearly so. *D. anómala*, Eames, is perhaps a hybrid with *D. diphylla*; Conn.

**macrocarpa**, Nutt. (*C. gemmata*, Greene). St. simple, 4–15 in.: lvs. 1–3, palmately or pinnately 3–5-parted, or divided; segms. linear to oblong, entire: fls. purple or rose: tubers with joints about 1 in. long. N. Calif. to Brit. Col.

BB. Lvs. of st. cut into 3 distinct lfts. (except sometimes in *D. californica*).

**tenélla**, Pursh. Six to 12 in.: tubers small, irregular: basal lvs. simple and round-cordate, crenate or sinuate; st.-lvs. 1 or 2, nearly sessile, sometimes bulbiferous; lfts. linear-oblong or linear, obtuse, entire: petals rose. Ore., Wash.

**californica**, Nutt. Tubers mostly small: st.  $\frac{1}{2}$ –2 ft. high: lvs. very variable; st.-lvs. 2–4, mostly short-petiolate, and above the middle of the st. with 3–5 lfts., rarely simple or lobed; lfts. mostly short-petiolulate, ovate to lanceolate or linear, entire or toothed: petals white or rose. Mountains and streams of Calif. and Ore.

**máxima**, Nutt. Ten to 16 in.: tubers near the surface, jointed, strongly tubercled: st.-lvs. 2 or 3, usually alternate; lfts. ovate or oblong-ovate, coarsely toothed and somewhat cleft or lobed, with petiolules: fls. white or purple-tinged. Maine to Mich. and Pa.

L. H. B.†

DEODAR: *Cedrus Deodara*.

**DEPÀRIA** (Greek, *depas*, a beaker or chalice; referring to the form of the involucre). *Polypodiaceae*. A small genus of Hawaiian and South American ferns related to *Dennstædtia*, rarely seen in cultivation in America. The sori are marginal and usually on stalked projections from the margin of the leaf.

**DÉRRIS** (Greek, *a leather covering*). Syn. *Dequèlia*. *Leguminosae*. Tropical, tall woody climbers (sometimes trees), one of which has been offered in S. Calif., but is now apparently out of cult. there. Lvs. alternate; lfts. opposite, the odd one distant; stipules none: fls. violet, purple or white, never yellow, in racemes or panicles or fascicles, papilionaceous, standard broad and rounded; wings oblique: pod indehiscent; 1- to several-seeded.—About 40 species, of little horticultural significance.

**scándens**, Benth. Climbing: lfts. 9–18, 1–2 in. long, oblong, obtuse, or acute, glabrous or minutely pilose beneath: fls. pale rose, in very long racemes: pod long, lanceolate, acute at both ends, narrowly winged at the base; ovules 6–8. S. Asia

and Indian Archipelago to Austral.—It has been offered in this country, but has not been successfully cult.

*D. alboribra*, Hemsl., from China, has been flowered at Kew in the palm house "where it covered some square yards of the roof:" fls. white, fragrant, with red calyx, in long panicles: lfts. coriaceous, glabrous, ovate-oblong: a climbing evergreen shrub: once confused with *D. Fordii*, Oliver. B.M. 8008.

L. H. B.

**DESCHAMPSIA** (for Deslongchamps, a French botanist, 1774–1849). *Gramineae*. Tufted perennials with shining spikelets in narrow or loose panicles, sometimes grown for dry bouquets.

Spikelets mostly 2-flid., with a hairy prolongation of the rachilla; glumes about as long as the florets; lemmas toothed, bearing a dorsal awn.—Species about 20, in the cooler regions of the northern hemisphere.

**cæspitosa**, Beauv. (*Aira cæspitosa*, Linn.). TUFTED HAIR-GRASS. HASSOCK-GRASS. Growing in tufts 1–3 ft.: blades firm, narrow; panicle open, the branches slender. G.M. 54:916. Common in N. U.S., extending



1241. *Dentaria diphylla*. ( $\times \frac{1}{2}$ )



south in the mountains.—In England, it is sometimes used by the farmers to make door-mats.

*flexuosa*, Trin. (*Aira flexuosa*, Linn.). WOOD HAIR-GRASS. Culms slender, 1-2 ft.: blades numerous, capillary; panicle open, the flexuous branches spikelet-bearing near the ends. Dept. Agric., Div. Agrost. 7:173. Open woods N. E. U. S.—Of some value for woodland pastures, as it will grow well in the shade. Also used for ornament. A form with yellow-striped foliage is sold under the name *Aira foliis variegatis*.

A. S. HITCHCOCK.

**DESIGN, FLORAL.** An important feature of the work of a retail florist is the making of floral designs or "set pieces." Fig. 1242. This work is directly opposed to the informal arrangement of flowers which is so much admired at the present time. See *Bouquets*, Vol. I. By artistic arrangement, however, these designs are now made less formal than in the earlier history of the retailer's work. These designs lend themselves well to the working out of various inscriptions and legends in flowers; therefore, these are most frequently

As has been stated, the present-day tendency in the arrangement of flowers in designs is to get as far away as possible from a stiff, set formality. A design must, of necessity, be distinct in outline, but by a careful and free use of ferns and other florists' "green," the effect may be made somewhat informal and pleasing. Various forms of the "shower" wreath illustrate this, as well as a loose arrangement of flowers, and even foliage and flowering plants about the base of a standing emblem.

The most common forms of floral designs in use at the present time are flat and standing wreaths, pillows, casket-covers, crosses, anchors, and the emblems of various fraternal orders, such as the Masonic square and compass, and the Odd Fellows' three links.

The flowers, of which these designs are made, vary in different stores. The price which is to be paid for the design usually governs the species and varieties used. Orchids, lilies, lilies-of-the-valley, roses and *Farleyense* ferns compose the most expensive designs; while carnations, stevia, Roman white hyacinths and other more common flowers, with asparagus fern, comprise the cheaper designs. Usually the florist determines the price the customer wishes to pay and selects the flowers in accordance with this. Within recent years there has come to be a demand for unusual material in designs, and boxwood, galax, leucothoe and magnolia leaves, ericas and other woody plants have been much used.

In making these designs, the arrangement must necessarily be quite formal; therefore, wire frames are used. These are made in large quantities by various

wire-working firms and are sold at wholesale at a comparatively low figure. In order to emphasize the particular formal outline and to hold the flowers permanently in place, the flower-stems are usually removed and the flowers then wired with 9- or 12-inch, No. 22 or No. 24 wire. The wire forms are first filled with sphagnum moss, which is moistened so that the flowers will retain their freshness, and the wired stems of the flowers are inserted in this moss. The wiring is an art, and the design-worker becomes so proficient in this that many flowers may be wired in a short period of time. This is necessary when many designs must be made quickly, as is so frequently the case in a flower-shop at the time of the funeral of a distinguished person.

Design work usually brings the retailer a substantial remuneration. In many instances, flowers of a lower quality may be used in designs than are demanded by persons buying cut-flowers. They must always be fresh, however; but, when roses are used, those having short stems are just as desirable as long-stemmed flowers. In carnations, many having a split calyx may be used when they would be salable in no other way.

If Roman hyacinths are used, the main truss may be sold as cut-flowers, and the secondary trusses used in designs.

The green elements in the design, which are used to emphasize the beauty of the flowers, vary much in different stores. Each designer has his own ideas regarding the uses of this material, but often he is compelled to use what is available at the precise moment when it is needed. Because of its excellent keeping qualities, the "dagger," or Christmas fern, is frequently used; but, when this is plainly visible in the finished design, it has a coarse appearance which cheapens the effectiveness of the piece. It may, however, be used as a cover for the frame and moss, with excellent effects. The "fancy dagger," or spinulose wood fern, is more



1242. A floral design.

attractive than the common dagger fern. One of the earlier greens used was smilax, but this has inferior keeping qualities to other kinds and is not so popular at the present time. It does not lend itself readily to a loose, formal arrangement. Both *Asparagus plumosus* and *A. Sprengeri* make excellent backgrounds for all design work. For softening effects to be worked among the flowers, nothing adds value to the design so much as a few sprays of *Adiantum Croweanum* or *A. Farleyense*. Often the foliage of the plants from which the flowers come adds a more pleasing effect than does the green of any other species. This is especially true when roses or lilies-of-the-valley are used.

Of the many designs made by the retailer of flowers, wreaths are probably the most in demand. They exhibit good taste, and many have excellent keeping qualities. One of the earlier forms was made of English ivy, and the effect was pleasing. This was especially so when the wreath was enriched with a large bunch of violets, arranged in a loose, artistic manner. Because of the difficulty of getting a sufficient quantity of these leaves, the ivy wreath has been largely replaced by that made of galax leaves. These have excellent



keeping qualities and are obtained in large quantities by wholesale dealers from the mountains of North and South Carolina. Both bronze and green galax may be secured, but the green is most satisfactory as it makes a more pleasing contrast with a larger number of colors of flowers. It is customary to make these in rather large sizes, a 16-inch frame, or even larger, being used. Usually the right-hand side of the wreath is decorated with roses, lilies-of-the-valley, or other flowers. A standing galax wreath, with a base of galax leaves, cocos palms, white roses and "valley," and the wreath itself decorated with white roses, lilies-of-the-valley, with shower sprays of "valley" and maidenhair ferns on dainty narrow ribbon, makes an effective design. If a single spray of cattleyas is placed among the roses and "valley," the effect is enriched wonderfully. Magnolia and leucothoë leaves are also used extensively for wreaths, but this foliage is heavier and less pleasing than galax. However, the buying public is tiring of the galax, and the retailer is searching the continents for something to replace it. Boxwood also makes a rich and attractive wreath. Wreaths made principally of flowers are often in demand, and when varieties are carefully selected, the results are pleasing. Fig. 1242 (redrawn from American Florist).

In selecting the flowers for any design, certain rules must be observed. In the first place, a designer must realize that, as in all other flower-arrangement, a lavish use of material is not essential to good effects. A flower has an individuality of its own, and this should be just as pronounced in a design as in a loose vase arrangement. At no time should the material be crowded. When an inscription is to be placed over the flowers, as, for example, in a pillow when carnations are to be the background, even then each carnation should show its form and the background should not be a mass of petals without definite shape. As a general thing, it is best to place the flowers in position first, after having covered the mossed frame with green, and then to work the foliage among the flowers where it is needed for the best effects. This method requires fewer flowers, and the effect is more artistic. In making a design, it must be remembered that there may be contrast of forms as well as colors. As a rule, there should not be over three contrasts of forms and two contrasts of colors, although there may be variations to this rule in special cases. As regards shapes and forms, it is quite essential that larger, heavier blooms, such as lilies and roses, should be contrasted with sprays of a light and graceful character, like lilies-of-the-valley and Roman hyacinths. The larger flowers are to be placed low in the arrangement, and the finer sprays higher. Often the center of a design is made of one particular species, as, for example, pink roses with their foliage; and the borders of the design are filled with sprays of lighter flowers, like lilies-of-the-valley with their foliage or that of the maidenhair fern. If in the arrangement of the larger flowers a few buds of the species used are added, the effectiveness of form is increased.

In selecting colors for designs, the lighter shades are the most desired, although in recent years there has come to be a freer use of darker colors. For example, a large wreath of Richmond or other red roses contrasted with lilies-of-the-valley or white Roman hyacinths, is very effective and is not considered out of place for a funeral design. The amateur should, however, avoid striking contrasts or to endeavor to harmonize unusual forms in flowers. The experienced designer may bring these together with pleasing effects, but this ability comes only after years of study and experience. Large designs are more easily arranged than small ones, and in them may be used a wider range of colors. The most striking colors are, however, widely separated, and between these the flowers should be of such tints that they assist in blending.

Flowers with a strong fragrance should not be used in designs if they can be avoided. They are especially objectionable if they are to be used in a dwelling-house where the rooms are often crowded. In a church or other large room, the fragrance is less noticeable. Polyanthus narcissi, tuberoses and freesias are especially objectionable. The more delicate odors of violets, lilies-of-the-valley and Roman hyacinths are less so.

The funeral designs most frequently ordered by the immediate family are pillows and casket-covers. Both of these demand careful treatment in making, the pillow being especially difficult. The smaller the pillow, the harder it is to produce a pleasing result. The flowers should be of a rich character, and it shows better judgment to select a less expensive wreath as a floral tribute than to purchase a pillow made of cheap flowers. Casket-covers should also be made of expensive flowers. These covers are not lasting, for they must of necessity be light in character; and moss, which is so necessary to retain moisture and freshness in the flowers, cannot well be used. Light wire of a fine mesh, such as mosquito netting, is cut of the desired size and the flowers which are usually of one species, like Easter lilies or roses, are wired to this with sufficient foliage or other green to cover the wire. A flower of some contrasting color may be used for a border; or a rich outline of smilax is effective.

The construction of many fraternal emblems in a pleasing, artistic way, demands all the fine points of the professional designer's skill. Often all rules of flower-arrangement have to be disregarded. Special emblems have to be made of special colors; and when an emblem must be made which calls for definite parts to be blue, others to be yellow, red, white and green, the problem to harmonize these is a serious one. The designer has no choice in such a case, and can meet this demand only with an attempt to reduce to the minimum these clashing contrasts in color.

As has been stated, formal designs in the arrangement of cut-flowers are a necessity, and for these there will probably always be a demand. The designer should have in mind, however, that it is possible to arrange flowers in a pleasing way and still emphasize the formal lines. Artists in this line of work are just as truly "born, not made," as in any other branch of art; and unless one has a genuine love for flowers and the artist's skill in their arrangement, the making of formal designs should not be attempted.

E. A. WHITE.



1243. *Desmanthus sicularis*. ( $\times \frac{1}{2}$ )

**DESMANTHUS** (name refers to flowers being in bundles). Syn. *Acuan*. *Leguminosæ*. About 10 herbs or shrubs in subtropical N. Amer., and 1 in the tropics of the Old World, a few of the American species reaching well north in the U. S.; probably not regularly cult., but now and then transferred to the garden for the effect of their bipinnate lvs. and small greenish white fls., in axillary peduncled heads or spikes. The genus is one of the Mimosa tribe, and the fls. are not papilionaceous: petals 5, distinct or very nearly so; calyx bell-shaped, 5-toothed; stamens 5 or 10, distinct, usually exserted: pod flat, narrow, straight or curved, several-seeded. *D. illinoensis*, MacM. (*Mimosa illinoensis*, Michx. *Acuan illinoensis*, Kuntze), occurs in prairies and river borders from Ind. west and south: 1-5 ft., nearly glabrous, perennial erect



herb: lfts. 20–30 pairs, obtusish. *D. leptolobus*, Torr. & Gray, occurs on prairies from Kans. to Texas: lfts. mostly fewer and acute, and peduncles much shorter (1 in. or less long).

**DESMAZÈRIA** (in honor of Desmazieres, a French botanist). *Gramineæ*. Plants resembling *Eragrostis*, sometimes grown as ornamental grasses.

Spikelets many-flid., strongly compressed, the lemmas keeled and coriaceous but faintly 3- or rarely 5-nerved, awnless: infl. several closely imbricated spikelets, arranged in a linear, dense, nearly simple spike-like panicle.—Species 4, 1 in Medit. region, and 3 in S. Afr.

**sicula**, Dum. (*Brizopyrum siculum*, Link). **SPIKE-GRASS**. Fig. 1243. Annual, 8–12 in.: spikelets  $\frac{1}{2}$  in., in a nearly simple spike. Eu.—Cult. for ornament and frequently used for edging. A. S. HITCHCOCK.

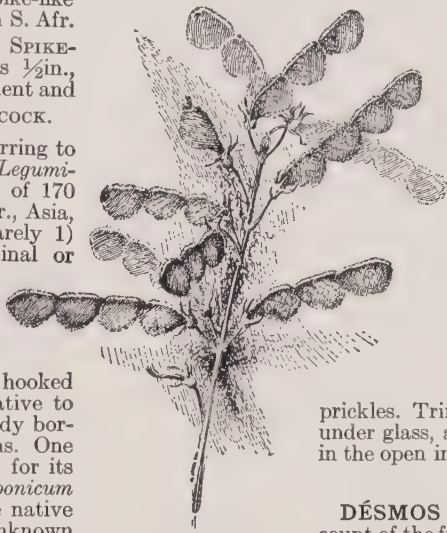
**DESMÔDIUM** (Greek, a *band* or *chain*; referring to the jointed pods). By some called *Meibomia*. *Leguminosæ*. **TICK TREFOIL**. Mostly herbs, upwards of 170 species, in temperate and warm regions of Amer., Asia, Afr. and Austral. Lvs. pinnate, with 3–5 (rarely 1) lfts.: fls. small and papilionaceous, in terminal or axillary racemes in summer, mostly purple; calyx with a short tube, more or less 2-lipped; standard broad; wings joined to the keel: pod flat, deeply lobed or jointed, the joints often breaking apart and adhering to clothing and to animals by means of small hooked hairs. Fig. 1244. A number of species are native to N. Amer., and are sometimes grown in the hardy border, where they thrive under ordinary conditions. One hothouse species, *D. gyrans*, is sometimes cult. for its odd moving lfts. *D. penduliflorum* and *D. japonicum* will be found under *Lepedeza*. Several of the native species are worthy of cult., but are practically unknown in the trade. The following have been offered by collectors: *D. canadense*, DC. (Fig. 1244); *D. cuspidatum*, Hook.; *D. Dillenii*, Darl.; *D. marilandicum*, Boott; *D. nudiflorum*, DC.; *D. paniculatum*, DC.; *D. pauciflorum*, DC.; *D. sessilifolium*, Torr. & Gray. The Florida beggarweed is *Desmodium tortuosum*, DC., of the W. Indies. It is coming into prominence in the S. as a forage plant (see *Cyclo. Amer. Agric.*, Vol. II, p. 214).

Two Chinese shrubby species have recently been intro. to Eu.: *D. amethystinum*, Dunn, growing 3–5 ft.: lvs. 3-foliate, the lfts. elliptic, 4–7 in. long: fls. amethystine,  $\frac{1}{2}$  in. long, in a terminal panicle. *D. cinerascens*, Franch., not Gray: broad bush, 3 ft. high, densely leafy: lvs. large, the lfts. lozenge-shaped: fls. rosy lilac to violet, in many racemes, produced in June and again in Sept.

The greenhouse species, *D. gyrans*, is of tolerably easy culture. It requires stove temperature, and, although a perennial, it is best treated as an annual. The best method of propagation is by seeds. These should be sown in February in a light, sandy soil, in 4-inch pots, and placed in a warm, close atmosphere, where they will soon germinate. The seedlings should be potted singly into small pots as soon as large enough to handle and grown on as rapidly as possible, using a mixture of good, fibrous loam and leaf soil in about equal proportions. By midsummer they will be good bushy plants, and, though not showy, they are very interesting. (Edward J. Canning.)

**gyrans**, DC. **TELEGRAPH PLANT**. Undershrub, 2–4 ft. high, with 3 oblong or elliptic lfts., the small lateral ones (which are almost linear) moving in various directions when the temperature is congenial, and especially in the sunshine: fls. purple or violet, in racemes and terminal racemose panicles. Ceylon to the Himalayas and the Philippines.—Grown occasionally as a curiosity, particularly in botanical collections. See Darwin's "Power of Movement in Plants," and various botanical treatises, for fuller accounts. L. H. B.

**DESMÓNCUS** (*band and hook*, referring to hook-like points on the lvs.). *Palmaceæ*. About 25 palms of U. S., S. Mex. to Bolivia and Brazil, differing from *Bactris* in the long slender climbing, caudex and technical characters. They are gregarious plants, with spines or hooks by means of which they climb or are elevated on growing trees, the sts. usually thin and flexuose and annular: lvs. scattered along the st., pinnate or pinnatisect, the parts or segms. opposite or alternate, the rachis produced into a long hook-bearing climbing organ: fls. greenish, in solitary spadices with 2 spathe-lvs.: fr. small, pea-shaped, red. *D. major*, Crueg., st. becoming very long and clinging to supports by the modified retrorse opposite segms. on the prolonged rachis: lvs. pinnate; lfts. 20 pairs, linear-acuminate and usually clustered; rachis spiny, dark-tomentose: spathe covered with brown prickles. Trinidad. Little known under glass, and reported as cult. in the open in S. Fla. and S. Calif. L. H. B.



1244. *Desmodium canadense* pods. (Nearly natural size.)

**DÉSMOS** (Greek, *chain*, on account of the fruit resembling nodes chained together). *Annonaceæ*. A genus established in 1790 by Loureiro and based upon *Desmos cochinchinensis* (Unona *Desmos*, Dunal, 1817; *Unona cochinchinensis*, DC., 1824). The flowers are composed of 3 sepals and 6 petals in 2 series, the latter valvate, nearly equal, and flat; stamens numerous, tetragonal-oblong or cuneate, the connective expanded above the dorsal oblong or linear-oblong pollen-sacs into a truncate hood-like process; receptacle, or torus, slightly raised, usually truncate or somewhat concave at the apex; carpels indefinite; ovules several, usually forming a single column, but sometimes sub-biseriate; style ovoid or oblong, recurved; ripe carpels indefinite, either elongate and chain-like from constrictions between the seeds, or baccate and spheroid. *D. cochinchinensis*, Lour., is a shrub with an erect or climbing st. and weak reclinate branches, lanceolate lvs., fragrant yellowish green pendulous fls., and reddish green moniliform frs. *D. chinensis*, Lour. (*Unona discolor*, Vahl), is a small tree of the E. Indies, with ovate-oblong lvs. glaucous beneath and extra-axillary sweet-scented aromatic fls., for the sake of which it is often cult. The greenish yellow corolla resembles that of *Canarium odoratum*, but the moniliform fr. consists of several joints, each containing a pea-like seed. It is used when green by the Chinese at Hongkong, who make from it a fine purple dye. *D. elegans*, Safford (*Unona elegans*, Thwaites), remarkable for its fr., which resembles strings of beads, and the very closely allied *D. zeylanicus*, Safford (*U. zeylanica*, Hook. f. & Thoms.), are endemic in the moist forests of Ceylon. Many species of *Desmos* have been erroneously referred to the genus *Unona*, based upon a S. American plant (*Unona discreta*, Linn. f.) not congeneric with the Asiatic genus above described, but more closely allied, if not to be identified with the genus *Xylopia*. See Safford, W. E., Bull. Torrey Bot. Club. 39:501–8 (1912). W. E. SAFFORD.

**DEUTZIA** (named by Thunberg in honor of his friend and patron, Johann van der Deutz). *Sarifragaceæ*. Very ornamental shrubs grown for their showy white or bluish flowers appearing in spring or early summer.

Upright; lvs. deciduous, rarely persistent, opposite, petioled, serrate, usually with rough stellate pubescence: fls. in panicles, rarely in racemes or in corymbs, white, sometimes purplish, epigynous; calyx-teeth 5; petals 5; stamens 10, rarely more, shorter than the petals; filaments usually winged and toothed at the apex; styles 3-5, distinct: caps. 3-5-celled, with numerous minute seeds.—About 50 species in E. Asia and Himalayas and 1 in Mex. Monograph by Schneider in M.D. 1904:172-188, and a hort. monograph by Lemoine in J.H.F. 1902:298-314; see also Rehder in Sargent, Plant. Wilson. 1:14-24 for Chinese species.

The deutzias belong to our most beautiful and most popular ornamental shrubs; they are very floriferous and of easy cultivation. *D. parviflora* and *D. grandiflora* are the hardiest, and also *D. gracilis*, *D. Sieboldiana* and *D. scabra* are hardy as far north as Massachusetts; the recently introduced *D. longifolia*, *D. Schneideriana*, *D. discolor*, and *D. Wilsonii* have proved fairly hardy with slight protection or in sheltered positions at the Arnold Arboretum. One of the most tender is *D. purpurascens*. Of the hybrids, *D. Lemoinei* is the hardiest, while *D. rosea* has proved about as hardy as *D. gracilis*; *D. kalmiaeflora*, *D. myriantha* and others are tender. Most of the deutzias have white flowers, but *D. rosea*, *D. purpurascens*, *D. longifolia*, *D. myriantha*, *D. kalmiaeflora* and some varieties of *D. scabra*, have the flowers carmine outside or pinkish. They flower most profusely if pruned as little as possible, although an occasional thinning out of the old wood soon after flowering will be of advantage.

The deutzias thrive in almost any well-drained soil, and are well adapted for borders of shrubberies. Potted plants forced with a temperature not exceeding 50° develop into beautiful specimens for the decoration of greenhouses and conservatories, especially *D. Lemoinei*, *D. gracilis* and *D. discolor*. The same plants cannot be forced again. Propagate readily by greenwood and hardwood cuttings, also by seeds sown in pans or boxes in spring.

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## A. Petals valvate in the bud.

## B. Fls. in panicles or racemes; calyx-teeth short (except in the hybrids).

## C. Lvs. glabrous below or nearly so.

1. *gracilis*, Sieb. & Zucc. Fig. 1245. Shrub, to 3 ft., with slender, often arching branches: lvs. oblong-lanceolate, acuminate, sharply serrate, with sparse stellate hairs above, nearly glabrous beneath, bright green, 1-2 in. long: fls. pure white, in racemes; petals erect or somewhat spreading, oblong; stamens much shorter than the petals; calyx-teeth persistent. May, June. Japan. S.Z. 8. P.F.G. 2, p. 7. F.S. 6:611. R.H. 1891, p. 203. G.M. 50:563. Gn. 39, p. 200. G.W. 12, p. 534. Gt. 1897:384. H.F. 1:48. J.F. 1:44. V. 7:217. Var. *aurea*, Schelle. Lvs. yellow. Var. *albo-marmorata*, Lemoine. Lvs. sprinkled with white.

2. *rosea*, Rehd. (*D. gracilis* × *D. purpurascens*. *D. gracilis rosea* and *D. discolor rosea*, Lemoine). Lvs. ovate-oblong, acuminate, bright green, slightly paler below, very sparingly stellate-pubescent on both sides: fls. pink, campanulate, in panicles; calyx-lobes longer than the tube; filaments slightly toothed or subulate, but strongly toothed in all varieties except in var. *venusta* and var. *multiflora*. F.E. 30:423. G. 27:274. Var. *campanulata*, Rehd. With large white campanulate fls. G. 28:485. Var. *venusta*, Rehd. With white fls. G. 27:275. Var. *multiflora*, Rehd.

With white fls. Var. *eximia*, Rehd. With white fls. tinted pink outside, in upright panicles. Var. *carminea*, Rehd. With light pink fls. tinted carmine outside. Var. *floribunda*, Rehd. With white fls. tinted pink outside. J.H.F. 1902:312. Var. *grandiflora*, Rehd. With fls. of the same color, but larger. All these varieties were originally described by Lemoine as varieties of *D. gracilis* except the two last ones, which he has under *D. discolor*.

CC. Lvs. stellate-pubescent beneath.

D. Filaments all toothed at the apex.

E. Calyx-lobes shorter than the tube; petals upright.

3. *scabra*, Thunb. Shrub, to 6 ft.: lvs. all petioled, ovate to ovate-lanceolate, rounded at the base, crenate-dentate, with rough pubescence on both sides, dull green, 1-3 in. long: panicles erect, 2-4 in. long; fls. white or blushed, with erect petals;



1245. *Deutzia gracilis*. (× 1/2)



calyx-lobes deciduous. June, July. Japan, China. S.Z. 6. B.M. 3838. B.R. 1718. S.B.F.G. II. 4:393. Gn. 37, p. 315. F.E. 31:1163. H.U. 1, p. 106. Var. *angustifolia*, Voss. Branches reddish brown; lvs. ovate-lanceolate, rougher. Var. *crenata*, Voss (*D. crenata*, Sieb. & Zucc. *D. dentata*, Hort. *D. mitis*, Hort.). Branches brown; lvs. ovate or oblong-ovate, less rough. This variety is less common in cult. than the former. Var. *marmorata*, Rehd. (var. *aureo-variegata*, Schneid.). Lvs. spotted with yellowish white. Var. *punctata*, Arb. Kew (var. *albo-punctata*, Schneid.). Lvs. sprinkled with white dots. Var. *Förtunei*, Schneid. Fls. larger. F.E. 31:1071. Var. *Wátereri*, Rehd. (var. *punicea*, Schneid. *D. crenata* *Wátereri*, Lemoine). Fls. white, tinted carmine outside. G.C. III. 39:340. Var. *plena*, Rehd. (*D. crenata* var. *plena*, Maxim.). Fls. double, white, tinged with rose outside. R.H. 1867: 70. F.S. 17:1790; 18:1850. G. 21:263. F. 1863:153. G.F. 8:112; here belongs also *Pride of Rochester*, with very large fls., faintly tinged with rose outside. Gn. 33, p. 514. Var. *candidissima*, Rehd. (*D. scabra* var. *albo-plena*, Schneid. *D. crenata* *candidissima* *plena*, Carr. *D. Wellsii*, Hort.). Fls. double, pure white.

4. *Schneideriana*, Rehd. Shrub, to 6 ft.: lvs. elliptic-ovate to elliptic-oblong, short-acuminate, sharply serrulate, stellate-tomentose and whitish below,  $1\frac{1}{2}$ -3 in. long; panicles broadly pyramidal; fls. nearly  $\frac{1}{2}$  in. long, white; stamens nearly as long as the petals; calyx-lobes deciduous. Cent. China. Var. *laxiflora*, Rehd. Lvs. oblong-lanceolate, acuminate, remotely denticulate, rough-pubescent above, thinly stellate-pubescent beneath and light green; panicles broad and rather loose,  $2\frac{1}{2}$ - $3\frac{1}{2}$  in. long; fls. about  $\frac{1}{2}$  in. long. June. W. China.—Only the var. is in cult.; similar to *D. scabra*, but the panicles looser and more graceful.

EE. Calyx-lobes longer than the tube.

5. *magnifica*, Rehd. (*D. scabra*  $\times$  *D. Vilmdrinæ*. *D. crenata* *magnifica*, Lemoine). Lvs. ovate-oblong, acuminate, appressed-serrulate, rough above, stellate-tomentose and grayish green below,  $1\frac{1}{2}$ - $2\frac{1}{2}$  in. long; fls. in erect panicles, white, double; sepals ovate or ovate-oblong, about as long as calyx, acute. June. G.M. 53:108. F.E. 31:322. Var. *latiflora*, Rehd., with very large single fls.  $1\frac{1}{2}$  in. across. Var. *superba*, Rehd., with large single campanulate fls. Var. *eburnea*, with white single campanulate fls. in loose panicles; stamens slightly shorter than petals. Var. *erecta*, Rehd., with white fls. in dense panicles. Var. *formosa*, Rehd., with double white fls. in large panicles. These varieties were originally described as vars. of *D. crenata*.

DD. Filaments, at least the longer ones, subulate, without teeth.

6. *Sieboldiana*, Maxim. (*D. scabra*, Sieb. & Zucc., not Thunb.). Low shrub, to 2 ft.: lvs. short-petioled, the pair below the panicle nearly sessile, ovate or ovate-elliptic to oblong-ovate, rounded or cordate at the base, rough and rugose above, stellate-pubescent and light green beneath, 1-2 in. long; panicles erect, loose, 2-3 in. long with appressed stellate pubescence mixed with spreading simple hairs; fls. white, rather small, with spreading petals; the shorter filaments usually abruptly contracted or with very short teeth; calyx-lobes persistent. June. Japan. S.Z. 7. G.C. III. 36:244. Var. *Dippeliana*, Schneid. (*D. scabra* *vèra*, Hort.). Lvs. broader and smaller; panicle only with appressed pubescence; stamens all subulate.—Graceful low shrub, but less showy than most other species.

BR. Fls. in corymbs or cymes.

C. Infl. many- or several-fl'd.

D. Calyx-teeth shorter than tube; anthers attached to the inside of the broad filament.

7. *setchuenensis*, Franch. (*D. corymbiflora* *erecta*, Hort.). Shrub, to 6 ft.: lvs. ovate-lanceolate to lanceo-

late, denticulate, rough-pubescent above, grayish green below and densely covered with stellate and simple hairs, 2-4 in. long; corymbs few-fl'd.; fls. less than  $\frac{1}{2}$  in. across; filaments with large broad teeth about as long as the nearly sessile anther. Cent. China. Var. *corymbiflora*, Rehd. (*D. corymbiflora*, Lemoine). Lvs. elliptic-ovate to ovate-lanceolate, acuminate, sometimes slightly cordate at the base, 2-4 in. long; corymbs many-fl'd.; fls. with spreading petals,  $\frac{1}{2}$  in. across;



1246. *Deutzia purpurascens*.

stamens about one-third as long as the petals, upright and connivent; styles shorter than stamens. June, July. Cent. China. B.M. 8255. G.C. III. 24:267. R.H. 1897, pp. 466, 467 (as *D. corymbosa*); 1898, p. 402. M.D.G. 1913:9 (lower picture). A.F. 14:166. Gng. 7:2.—The variety is much handsomer than the type; the fls. are comparatively small, but very numerous. Tender.

DD. Calyx-teeth lanceolate, as long or longer than the tube.

E. Anthers of the inner stamens borne on the inner side of the petaloid filaments; fls. pink or purplish outside.

8. *purpurascens*, Rehd. (*D. discolor* var. *purpurascens*, Franch.). Fig. 1246. Shrub, to 3 ft., with slender arching branches; lvs. ovate to ovate-lanceolate, crenately and unequally serrate, usually rounded at the base, green and only sparingly stellate-pubescent on both sides,  $1\frac{1}{2}$ - $2\frac{1}{2}$  in. long; corymbs 5-10-fl'd.; fls. with spreading petals, about  $\frac{3}{4}$  in. across, white, outside purple; the inner filaments with the anther below the apex. May, June. S. W. China. B.M. 7708. G.C. III. 2:45; 26:45. G.F. 7:287 (adapted in Fig. 1246). G. 27:201. R.H. 1895:64.—Very handsome, but tender.

9. *longifolia*, Franch. Shrub, to 6 ft., with upright branches; lvs. oblong-lanceolate to narrow-lanceolate, long-acuminate, narrowed at the base, thickish, rough and somewhat rugose above, grayish white and densely tomentose below,  $2\frac{1}{2}$ -4 in. long; corymbs many-fl'd., loose or dense; fls. with spreading petals, more than  $\frac{3}{4}$  in. across; the shorter filaments lanceolate with the anther inside near the middle. June. W. China. G.C. III. 51:409. Gn. 76, p. 243. G.M. 55:353. Var.

*Veitchii*, Rehd. (*D. Veitchii*, Veitch) with somewhat larger fls. in dense many-fl. corymbs. G.C. III. 51: suppl. 19. M.D.G. 1913:17.—One of the handsomest deutzias, but has proved hardy only under protection at the Arnold Arboretum.

EE. Anthers borne at the end of the filaments.

F. Fls. usually pinkish outside (hybrids of *D. purpureascens*).

10. *myriantha*, Lemoine (*D. Lemoinei* × *D. purpureascens*). Lvs. oblong-ovate, acuminate, rounded or broadly cuneate at the base, serrulate with spreading teeth, rough above, slightly stellate-pubescent beneath, 1½–3 in. long; fls. in broad corymbs, white, with spreading petals, partly imbricate in bud; filaments strongly toothed; anthers short-stalked; styles shorter than stamens; sepals triangular-ovate, about as long as calyx-tube. G.C. III. 52:45. F.S.R. 3, p. 193. A.F. 31:100, 101. M.D.G. 1907:376, fig. 5; 377, fig. 8. G.W. 13, p. 614. Var. *Boule Rose* and var. *Fleur de Pommier* have the fls. pink outside.

11. *kalmiæflora*, Lemoine (*D. parviflora* × *D. purpureascens*). Lvs. oblong to ovate-oblong, short-acuminate, broadly cuneate at the base, serrulate, rough above, slightly stellate pubescent below, 1–2½ in. long; fls. in rather small corymbs, pinkish, white in the center, light carmine outside, cup-shaped, ¾ in. across; petals mostly imbricate in bud; stamens half as long as petals; filaments with large teeth, nearly as long as the anthers; styles shorter than stamens. M.D.G. 1913:25. G. 27:199. Gn. W. 17:627.—One of the handsomest hybrids.

FF. Fls. white.

G. Filaments toothed below the apex.

12. *discolor*, Hemsl. Upright shrub, to 6 ft.: lvs. oblong-lanceolate, acuminate, cuneate at the base, denticulate, sparingly stellate-hairy above, stellate-tomentose and whitish below, 2–4 in. long; corymbs dense, hemispherical; pedicels usually not exceeding ¼ in.; fls. white, with spreading elliptic petals, about ¾ in. across; stamens about half as long as petals; filaments with large teeth usually as long as the stalk of the anther, the anthers of the inner stamens sometimes inserted inside a little below the apex. June. Cent. China. Var. *major*, Veitch. Fls. about 1 in. across. G. 30:307. R.B. 32, p. 174. M.D.G. 1913:9 (upper picture).

13. *Vilmorinæ*, Lemoine. Shrub, to 5 ft.: lvs. oblong-lanceolate, acuminate, narrowed at the base, serrulate, thinly stellate-pubescent above, densely so below and grayish white, 2–3 in. long; corymbs loose and large; pedicels ½–½ in. long; fls. more than ½ in. across; larger stamens only slightly shorter than petals; the teeth of the filaments shorter than the stalks of the anthers; styles as long as stamens. May, June. Cent. China. R.H. 1895, pp. 266, 267. F.V. 126. A very graceful shrub with its large and loose corymbs of white fls.

gg. Filaments, at least the longer ones, gradually narrowed toward the apex, without teeth.

14. *Wilsonii*, Duthie. Shrub, to 6 ft.: lvs. elliptic-lanceolate to oblong-lanceolate, short-acuminate, rounded or narrowed at the base, rough-pubescent above, grayish white and tomentose below, 2–4 in. long; corymbs compact, many-fl.; fls. white, more than ¾ in. across; stamens a third shorter than the petals; the shorter filaments usually abruptly contracted or sometimes with short obtuse teeth; calyx-lobes oblong-ovate, about as long as tube. May, June. Cent. China. B.M. 8083. G. 30:373. G.M. 51:473. M.D.G. 1912:27; 1913:16.

cc. Infl. 1–3-fl.; filaments with long and slender recurved teeth.

15. *grandiflora*, Bunge. Shrub, to 6 ft.: lvs. ovate, acuminate, rounded at the base, unequally and closely denticulate, rough pubescent above, whitish stellate-tomentose below and reticulate, 1–2½ in. long. fls. white, nodding, with slightly spreading petals about ¾ in. long; stamens about half as long as petals; calyx-lobes lanceolate, twice as long as tube. April, May. N. China.—A very distinct species, the earliest of all to bloom, the fls. appearing with the lvs.; has proved perfectly hardy at the Arnold Arboretum.

AA. Petals imbricate in the bud (or partly imbricate in the hybrid); fls. white.

16. *parviflora*, Bunge. Shrub, to 6 ft., with erect branches: lvs. ovate or oblong-ovate, usually narrowed at the base, finely serrate, with stellate hairs on both sides, often grayish green beneath, 2–3 in. long; fls. in many-fl. corymbs; petals roundish obovate, spreading, imbricate in the bud; longer filaments without teeth. June. N. China, Mongolia. G. F. 1:365. Gt. 11:370; 43, p. 65; 46, p. 382. R.H. 1892, p. 223. G.C. III. 14:153. Gn. 44, p. 181. F.S.R. 3, p. 197. A.F. 15:1297. Gng. 8:305, 307. Var. *Musæi*, Lemoine. Of stronger growth: lvs. larger and more acuminate; fls. creamy white in denser corymbs.

17. *Lemoinei*, Hort. (*D. gracilis* × *D. parviflora*. *D. angustifolia*, Dipp.).

Fig. 1247. Spreading shrub, to 3 ft.: lvs. elliptic-lanceolate, finely serrate with appressed teeth, with sparse stellate hairs above, nearly glabrous beneath, 1½–3 in. long; fls. in large corymbs or broad panicles, pure white; petals broadly ovate, spreading, partially valvate and partially imbricate in the bud; filaments with large teeth. G.F. 9:285 (adapted in Fig. 1247). A.F. 11:457; 15:1296. Gt. 44, p. 567; 46, p. 383. Gng. 4:135; 8:307. J.H. III. 34:77. G.C. III. 18:389. Gn. 48, p. 317. G.M. 39:251; 51:962, 963. G. 16:223. F.E. 24:747; 31:1119. G.W. 2, p. 173. M.D.G. 1895:438, 439.—A very desirable shrub, more vigorous and with showier fls. than *D. gracilis*. Excellent for forcing.

Var. *compacta*, Lemoine. Dwarfier and of more compact habit. *D. Boule de Neige*, Lemoine, with creamy white fls. (Gng. 8:306) and *D. Avalanche*, Lemoine, with pure white fls., are exceedingly floriferous forms.

*D. Brunoniæ*, R. Br.—*D. staminea* var. *Brunoniæ*.—*D. candellabrum*, Rehd. (*D. gracilis* × *D. Sieboldiana*. *D. gracilis* var. *candellabrum*, Lemoine). Shrub with slender branches and large white fls. in dense elongated panicles. R.B. 33, p. 372. R.H. 1908, p. 174. M.D.G. 1907:378. Var. *erecta*, Rehd. (*D. gracilis* erecta, Lemoine). Fls. smaller and panicles shorter. Var. *fastuosa*, Rehd. (*D. gracilis* fastuosa, Lemoine). Fls. in elongated rather dense panicles.—*D. candida*, Rehd. (*D. Lemoinei* × *D. Sieboldiana*. *D. discolor* candida, Lemoine). Upright shrub with large white fls. in panicles. M.D.G. 1907:376, fig. 6.—*D. carnea*, Rehd. (*D. Sieboldiana* × *D. rosea* grandiflora. *D. discolor* carnea, Lemoine). Upright shrub with pink rather small fls. in upright loose panicles.



1247. *Deutzia Lemoinei*.



Var. *lacteæ*, Rehd., with white fls., var. *stellata*, Rehd., with narrow spreading petals, pale pink or carmine-pink, and var. *densiflora*, Rehd., with white fls. in dense upright panicles, petals narrow; all these varieties described by Lemoine as varieties of *D. discolor*.—*D. compacta*, Craib. Allied to *D. parviflora*. Lvs. lanceolate, sparingly pubescent on both sides,  $\frac{3}{4}$ –2 in. long; fls. white in dense corymbs; filaments strongly dentate. W. China.—*D. corymbosa*, R. Br. Allied to *D. parviflora*. Lvs. rounded at the base, crenate-serrate, long-acuminate; fls. larger; all filaments toothed. Himalayas.—*D. discolor* vars.—*D. candida*, *D. carnea*, *D. elegantissima*, *D. excellens*.—*D. elegantissima*, Rehd. (*D. purpurascens*  $\times$  *D. Sieboldiana*). *D. discolor* var. *elegantissima*, Lemoine). Shrub, with slender branches, with numerous corymbs of large white, open fls. slightly tinted with rose inside and outside. R.B. 36, p. 387. M.D.G. 1907:377, fig. 9. Var. *arcuata*, Rehd. (*D. discolor* var. *arcuata*, Lemoine), with white fls. Var. *fasciculata*, Rehd. (*D. discolor* var. *fasciculata*, Lemoine). Flat white fls. tinted with pink.—*D. excellens*, Rehd. (*D. Vilmoriniana*  $\times$  *D. rosea grandiflora*). *D. discolor* var. *excellens*, Lemoine). Shrub, with slender upright branches, with large loose corymbs of pure white fls.—*D. globosa*, Duthie. Similar to *D. Wilsonii*, but smaller in every part: fls. creamy white in dense corymbs; filaments abruptly contracted below the apex. Cent. China.—*D. glomeruliflora*, Franch. Similar to *D. discolor*. Shrub, to 6 ft.: lvs. smaller, grayish white and soft-pubescent below; fls. white in dense and small, but very numerous corymbs along the slender branches; stamens like those of *D. longifolia*. W. China. Handsome and fairly hardy.—*D. gracilis* vars.—*D. candelabrum*.—*D. mollis*, Duthie. Allied to *D. parviflora*. Shrub, to 6 ft., with upright branches: lvs. elliptic-ovate to elliptic-lanceolate, soft-pubescent below, 2–4 in. long; fls. small, creamy white or slightly pinkish in dense flat corymbs; filaments subulate. Cent. China.—*D. reflexa*, Duthie. Allied to *D. discolor*. Lvs. oblong-lanceolate, 2–3 in. long; fls. smaller in loose corymbs, petals with reflexed margin; filaments with short teeth or abruptly contracted. Cent. China.—*D. staminea*, R. Br. Shrub, to 3 ft.: lvs. ovate or ovate-lanceolate, with whitish stellate pubescence beneath: corymbs many-fld.; fls. white, fragrant; filaments with large teeth. Himalayas. B.R. 33:13. Var. *Brunoniæ*, Hook. f. & Thoms. Lvs. less densely pubescent: fls. larger. B.R. 26:5 (as *D. corymbosa*).

ALFRED REHDER.

DEVIL-IN-A-BUSH: *Nigella*.

**DEWBERRY.** A blackberry-like fruit of trailing and climbing habit, now considerably grown in North America.

The botanist makes no distinction between dewberries and blackberries. But to the fruit-grower, trailing blackberries are dewberries, distinguished further, and probably better separated, by the flower- and fruit-clusters. In the true dewberries, the center flowers open first and flowers and fruits are few and scattered; in true blackberries—there are hybrids between the two in which the distinguishing characters are confused—the lower and outer flowers open first and flower- and fruit-clusters are comparatively dense. In the method of propagation there is a further distinction. In nature or under cultivation, dewberries are usually propagated from the tips, while blackberries are naturally propagated from suckers and under cultivation from root-cuttings.

The dewberry is an American fruit but very recently domesticated—if, indeed, it can be said to be domesticated, for it is the most uncertain and the most unmanageable of the small fruits. Its history as a garden plant, according to Card (Card's "Bush-Fruits," page 132) at the most does not go back further than 1863, and dewberries were not generally cultivated until well toward the close of the nineteenth century. Undoubtedly, despite unmanageable habits of growth, uncertainty in fruiting, the necessity of cross-pollination between varieties, capriciousness as to soils and lack of hardiness in northerly climates, the several species and the rapidly increasing number of varieties of dewberries, fill a place not occupied by the better-known and longer domesticated blackberries; for, as a rule, they ripen earlier and, when well grown, give larger, handsomer and better, or at least, differently flavored fruits than the blackberry. Moreover, from the several species of dewberries are being derived greatly improved varieties and hybrids between them and species of blackberries, of which there are now several under cultivation, as Wilson Early and Wilson Junior, which are most promising. These qualities make certain the place of the dewberry in home and commercial plantations and presage for it even greater value in the future.

Of the thirty or more species of *Rubus* which all could agree in calling blackberries and dewberries, the fruit-grower would probably distinguish five as dewberries. Between these there are hybrid forms under cultivation, as probably there are in the wild, and since

1248. Lucretia dewberry. ( $\times \frac{1}{4}$ )

there are also hybrids between blackberries and dewberries, the group is one of great taxonomic difficulty. The five species of dewberries are: (1) *Rubus procumbens*, Muhl., found in dry open places from Maine westward and southward. The species is characterized by woody, stoutly armed stems, membranaceous leaves, villous beneath, flowers few to several in leafy racemes, and short cylindrical fruits with few to many large drupelets. Var. *roribaccus*, Bailey, is a well-marked subspecies from West Virginia of more vigor, with larger flowers with elongated pedicels, and larger fruits; much cultivated with the Lucretia as the best representative. (Figs. 1248, 1249). (2) *Rubus invisus*, Bailey, is similar but stouter, with canes less procumbent, leaves more coarsely toothed, pedicels longer, and with the sepals large and leaf-like. The species grows wild from New York to Kansas and southwest and is the parent of several cultivated dewberries of which Bartel (Fig. 1250, adapted from G.F. 4:19) is the type. (3) *Rubus trivialis*, Michx., the southern dewberry, is quite distinct from 1 and 2. This species is found near the coast from Virginia to Florida and westward to Texas. It is characterized by slender trailing stems armed with recurved prickles, evergreen, smooth, leathery leaves, corymbs 1–3-flowered, and cylindrical fruits with many drupelets. Of the few varieties of this species cultivated, Manatee is probably the oldest and best known. (4) *Rubus rubrisetus*, Rydb., found in sandy soils in Missouri and Louisiana, is similar to *R. trivialis* but with stems, petioles, and pedicels rough with reddish, purplish hairs; the flowers are smaller but the corymbs are 3–9-flowered. The species is locally cultivated and gives some promise for greater improvement. (5) *Rubus vitifolius*, Cham. & Schlecht, is the Pacific Coast dewberry characterized by trailing, slender, pubescent canes with weak, straight or recurved prickles, leaves various, flowers staminate or pistillate on different plants.



1249. Lucretia dewberry. (Nat. size).

fruit of medium size, round-oblong, sweet. Several varieties, of which possibly Aughinbaugh and Skagit Chief are the best known, are cultivated in the far West. The loganberry is said to be a hybrid between this species and *R. Idæus*, and several less well-known hybrids are recorded.

The dewberry should receive under cultivation much the same treatment given the more common blackberry. The culture of the two differs chiefly in the dewberries requiring more care in training and must usually be better protected for the winter. The plants are trained on trellises of two or three wires or tied to stakes, the former method giving better results, but the latter being more common. The object in either case is threefold,—namely, to regulate the amount of bearing wood, to keep the vine out of the way of the cultivator and to keep the fruit off the ground. The plants should be set 4 by 7 feet apart, these distances varying somewhat in accordance with the variety and



1250. Bartel dewberry.  
( $\times \frac{1}{2}$ )

the soil. Pruning is a simple matter, consisting of shortening back young plants to 4 or 5 feet the first season to keep them from sprawling too much, cutting out old canes at any time after fruiting, and heading-in long shoots and laterals in early summer. From four to six fruiting canes are allowed to the plant. In northern climates, the vines must be laid on the ground and protected in winter with straw or other material. The plants thrive on a somewhat lighter soil than the blackberry—in fact some sorts require such a soil. Varieties should be intermixed to secure cross-pollination and thereby insure a good set of fruits and avoid the formation of nubbins.

Of about thirty named varieties, Lucretia, Bartel, Austin and Premo are the best. Of these four, Lucretia is far most commonly grown, being adapted to the greatest diversity of soils and is in general best suited to varying environments. For history and botany, see Bailey, "Evolution of our Native Fruits," for culture, see Card's "Bush-Fruits," and Cornell Bulletins Nos. 34 and 117. Consult *Blackberry*, *Loganberry* and *Rubus*.

U. P. HEDRICK

DEYEUZIA: *Calamagrostis*.

**DIACATTLEYA** (compounded of *Diacrium* and *Cattleya*). *Orchidaceæ*. A genus established to include hybrids between the two genera, *Diacrium* and *Cattleya*. A hybrid between *Diacrium bicornutum* and *Cattleya Mendelii* is known as *Diacattleya Sanderæ*. It was raised by Sander & Sons. The fls. are pure white, the lip with a pale yellow disk and small rose markings. G.C. III. 49:290. *D. Còlmanix*, Hort. (*Diacrocattleya Còlmanix* is a hybrid between *Diacrium bicornutum* and *Cattleya intermedia* var. *nivea*. G.C. III. 43:114. J.H. 56:167. It resembles a slender plant of *Diacrium*

*bicornutum*: sepals and petals pure white, lip slightly tinged primrose-yellow. GEORGE V. NASH.

**DIACRIUM** (*through and point*; the sts. are surrounded by sheaths). *Orchidaceæ*. Four Trop. Amer. epiphytes, closely allied to *Epidendrum*, with which they have been included. It differs from that genus in the fact that the column and lip are not united. Fls. showy, in loose racemes: lvs. few, sheathing; pseudobulbs slender. Cult. of *Epidendrum* and *Cattleya*.

**bicornutum**, Benth. (*Epidendrum bicornutum*, Hook.). Pseudobulbs 1–2 ft. long, hollow, bearing dry sheaths: lvs. short and leathery: raceme slender, 3–12-fld.; fls. white, with small crimson spots on the 3-lobed lip, fragrant. B.M. 3332. G.C. III. 16:337. J.H. III. 33:29. O.R. 12:113; 16:81; 20:361.—A handsome orchid, requiring high temperature.

*D. bidentatum*, Hemsl. (*Epidendrum bidentatum*, Lindl.), of Mex., has been listed in trade catalogues, but it is practically unknown to cult., and is probably not now in the American trade.

L. H. B.

**DIALÆLIA** (Compounded of the genera *Diacrium* and *Lælia*). *Orchidaceæ*. *D. Velchii*, Hort., is a hybrid between *Diacrium bicornutum* and *Lælia cinnabarina*. Pseudobulbs fleshy: fls. 9 or 10, the segms. white suffused with lilac, also showing a bronze tint derived from the *Lælia* parent.

DIAMOND FLOWER: *Ionopsidium*.

**DIANDROLÏRA** (*two-stamened Olyra*). *Gramineæ*. A single species raised at Kew some 8 years ago from seed supplied by Sander but native country unknown: differs from *Olyra* in its twin spikelets and other characters, the upper one being male and the lower one female, the male fls. with 2 stamens. The species is *D. bicolor*, Stapf, a perennial densely tufted grass with erect culms bearing 1–3 lanceolate or lance-oblong lvs. that are dark green above and violet-purple beneath.

**DIANÉLLA** (diminutive of Diana, goddess of the hunt). *Liliaceæ*. Tender perennial rhizomatous plants, related to *Phormium*.

Leaves hard, linear, sheathing, grass-like, crowded at base of st., often 2–3 ft. long: fls. blue, in large loose panicles, on delicate pendent pedicels; perianth withering but not falling, with 6 distinct spreading segms.; stamens 6, with thickened filaments; ovary 3-celled, each cell several-ovuled, the style filiform and stigma very small: plant bearing great numbers of pretty blue berries, which remain attractive for several weeks, and are the chief charm of the plant.—There are about a dozen species in Trop. Asia, Austral. and Polynesia. They perhaps succeed best in the open border of a cool greenhouse. Prop. by division, or by seeds sown in spring in mild heat. They are little known in this country. They are spring and summer bloomers.

A. Lvs. radical or nearly so.

**tasmánica**, Hook. f. Height 4–5 ft.: lvs. numerous, in a rosette, broadly ensiform, 2–4 ft. long,  $\frac{3}{4}$ –1 in. wide, margined with small reddish brown spines that cut the hand if the lvs. are carelessly grasped: panicle very lax, surpassing the lvs. 1–2 ft., with as many as 60 fls.; fls. pale blue, nodding,  $\frac{1}{2}$ – $\frac{3}{4}$  in. across, segms. finally reflexed; anthers 1 line long: berries bright blue, on very slender pedicels. Tasmania and Austral. B.M. 5551. Var. *variegata*, Bull. Lvs. handsomely striped with light yellow. R.B. 29:61.

**lævis**, R. Br. Lvs. 1–1½ ft. long, 6–9 lines wide, less leathery and paler than in *D. cærulea* and at first slightly glaucous: panicle deltoid, the branches more compound than in *D. revoluta*, outer segms. of the perianth with 5 distant veins, inner ones densely 3-veined in the middle third; anthers 1½ lines long. Eastern temperate parts of Austral. B.R. 751. L.B.C. 12:1136 (both as *D. strumdsa*).



*revoluta*, R. Br. Height 2-3 ft.: lvs. in a rosette, 1-1½ ft. long, 3-4 lines wide, dark green, purplish at the base and margin, not spiny at the margin: panicle branches short, ascending; fls. later than *D. cærulea*; veins of the perianth-segms. crowded into a central space. W. and E. Austral. in temperate parts. Tasmania. B.R. 734 (as *D. longifolia*); 1120.

AA. Lvs. more or less scattered on sts. that often branch at base.

*cærulea*, Sims. Sub-shrubby, with a short st. in age, branching: lvs. about 6, clustered at the ends of branches, 9-12 in. long, 6-9 lines wide, dark green, rough on the back and margin: outer perianth-segms. with 5 distant veins, inner ones with 3 closer veins. E. Temp. Austral. B.M. 505.

*nemorosa*, Lam. (*C. ensifolia*, Red.) Caulescent 3-6 ft. high, the lvs. never in a rosette, numerous, hard, linear, 1-2 ft. long, 9-12 lines wide, lighter-colored on the keel and margin: fls. blue or greenish white. Trop. Asia, China, Austral., Hawaiian Isls. B.M. 1404.

WILHELM MILLER.

L. H. B.†

**DIANTHÈRA** (*double anther* referring to the separated anther-cells). *Acanthaceæ*. WATER-WILLOW. Herbs, mostly of greenhouses and warmhouses, and sometimes of open planting in mild climates.

Glabrous or pilose perennial herbs or sometimes somewhat woody, mostly of wet places, with opposite, mostly entire lvs.: fls. mostly purplish or whitish, irregular, usually in axillary spikes, heads or fascicles, or the clusters combined in a terminal thyrse; corolla slender-tubed, 2-lipped, the upper lip erect and more or less concave or arched and entire or 2-toothed, the lower lip 3-lobed or 3-crenate and spreading, and with a palate-like structure; anther-cells separated on a broadened connective, not parallel with each other: fr. an oblong or ovoid 2-celled caps., the seeds 4 or less: floral bractlets small or minute.—Probably more than 100 species, mostly in warm and tropical countries. Lindau in Engler & Prantl unites it with *Justicia* as a subgenus, and the number of species is estimated as more than 70 in Trop. Amer. The diantheras are little known in cult. *D. Pohiana* is to be found in Jacobinia. The treatment given Jacobinia and *Justicia* applies to these plants.

*americana*, Linn. St. angled, 1-3 ft.: lvs. narrow-lanceolate, 3-4 in. long, nearly sessile: fls. several in a close cluster with a peduncle mostly exceeding the lvs., pale violet or whitish, the corolla mostly less than ½ in. long, the tube shorter than the lips. In water, Quebec to Wis., Ga. and Texas.—Sometimes transferred to garden bogs and streams.

*secunda*, Griseb. (*Justicia secunda*, Vahl). Nearly glabrous, constricted at the nodes: lvs. ovate or ovate-lanceolate, acuminate: fls. crimson, short-pedicellate, in a usually 1-sided panicle; lower lip 3-crenate. W. Indies. B.M. 2060.

*pectorâlis*, Gmel. (*Justicia pectorâlis*, Jacq.). GARDEN BALSAM. St. slender, often woody, 1-3 ft.: lvs. lanceolate-acuminate or nearly oblong, to 4 in. long: fls. rosy or pale blue, with a parti-colored throat, rather distant in elongated branched mostly 1-sided spikes. W. Indies, Mex., Brazil.

*bullata*, N. E. Br. St. terete, purplish: lvs. elliptic, to 4½ in. long, short-stalked, cordate at base, bullate or puckered between the veins, dark green above and purple-veined beneath: fls. whitish, small, clustered. Borneo. I.H. 33:589.—A. handsome foliage subject, with the appearance of a rubiaceus plant.—*D. ciliata*, Benth. & Hook. (*Jacobinia ciliata*, Seem.). St. obscurely 4-angled, 2 ft.: lvs. ovate-lanceolate, 2-3 in. long, short-stalked: fls. violet with white palate, sessile, many in a short-peduncled fascicle; calyx ciliate; corolla-tube ¾ in. long, cylindrical; upper lip very small, 2-lobed, concave and recurved; lower lip very large and showy (¼ in. across), flat, with 3 large lobes. Costa Rica. Panama(?). B.M. 5888 (as *Beloperone ciliata*, Hook. f.).—Described as an annual. Perhaps not of this genus.

L. H. B.

**DIANTHUS** (Greek for *Jove's flower*). *Caryophyllacæ*. PINK. Small herbs, many of them prized for their rich and showy flowers in the open garden; and one is the carnation. Some of them are deliciously fragrant.

Mostly perennials forming tufts and with grass-like lvs., and jointed sts. with terminal fls. and opposite lvs. From kindred genera *Dianthus* is distinguished by the sepal-like bracts at the base of a cylindrical calyx (Figs. 802, 803); petals without a crown; styles 2: caps. opening by 4 valves. Mostly temperate-region plants, of S. Eu. and N. Afr., but occurring elsewhere, one of them (a form of *D. alpinus*) being native in N. Amer.; about 250 species are recognized. The fls. are usually pink or red, but in garden forms white and purple are frequent colors. Most of the cult. species are hardy in the N. and are easy of cult. The perennial species are excellent border plants. The chief care required in their cult. is to see that the grass does not run them out. Best results in flowering are secured usually from 2-year-old seedling plants. The genus abounds in attractive species, and other names than those in this article may be expected to appear in the catalogues. Numbers of species are likely to be grown by rock-garden specialists. Pinks are among the old-fashioned flowers, particularly *D. plumarius*, which was formerly common in edgings and in circle-beds. The sweet williams are always popular. All the species described in this article are perennial, but there are a few annuals in the genus but apparently not in cult. Two weedy annual species, *D. prolifer*, Linn., and *D. Armeria*, Linn., are naturalized in the eastern states, and two or three others have run wild more or less. See E. T. Cook, "Carnations, Picotees, and the Wild and Garden Pinks," London, 1905. See p. 3568.

*Dianthus* like a warm soil, and one that will not become too wet at any time, especially in winter, when the perennial kinds are grown, as they are often killed not so much from cold as from too much ice around them. Snow is the best possible protection, but ice is the reverse.—All *dianthus* are readily propagated from seeds sown in rich soil (usually beginning to bloom the second year), but the double kinds are reproduced from cuttings alone to be sure to have them true, and in the fall months cuttings are easily rooted if taken with a "heel" or a part of the old stem adhering to the base of the shoot; so that to make cuttings it is best to strip them off rather than to make them with a knife. It will be found, also, that cuttings made from plants growing in the open ground do not root readily but seem to dry up in the cutting-bench; if the plants to be increased are carefully lifted and potted, placed in a temperature of say 50° until young growth shows signs of starting, every cutting taken off at this stage will root easily. The transition from outdoors to the propagating-house should not be too abrupt. Another method of propagation is by layering, and with the garden pinks, or forms of *D. plumarius*, it is the easiest and surest. After hot weather is past, stir the soil round the parent plant, take the branches that have a portion of bare stem, make an incision half way through and along the stem for an inch, and peg this down in the soil without breaking off the shoot (Fig. 809). Roots will be formed and good strong plants be the result before winter. The layering method is specially suitable to such species as *D. plumarius*, *D. Caryophyllus* and double forms of others, such as sweet william.—Among the species are various pretty little alpine tufted sorts as *D. neglectus*, *D. glacialis* and *D. alpinus*, all of which are of dwarf close habit, not exceeding 3 inches high and having very large single flowers of brightest colors. These are suited only for rock-gardening, as on level ground they often become smothered with weeds or swamped with soil after a heavy rainstorm, and to these two causes are attributable the failures to cultivate them. (E. O. Orpet.)

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A. Fls. mostly in cymes or in heads, often densely aggregated, the cluster often subtended by involucre-like lvs.

B. Petals not bearing hairs or barbs: bracts dry.

1. *cinnabarinus*, Sprun. A foot high, woody at base, many-stemmed, the sts. simple and 4-angled, blooming in Aug. and Sept.: lvs. linear, sharp-pointed and rigid, 7-nerved: fls. few in heads; petals fiery red above, paler beneath, glandular; stamens included. Greece.— Handsome little species; useful for hardy border or rockery.

2. *Pancicii*, Velen. (*D. stenopetalus* var. *Pancicii*, Williams). Cespitose, glabrous, 2-3 ft., the sts. slender and 4-angled: lvs. linear-acuminate, soft, 3-nerved, in a dense grass-like basal tuft: fls. 5-15 in a paniculate cyme or head; calyx green; petals rose or crimson. Balkan region. Var. *grandiflorus*, Hort., has very stout sts., large clusters, and large purple-carmine fls.

BB. Petals with hairs or barbs on the lower part of the blade.

c. Plant glabrous but usually not glaucous.

3. *barbatus*, Linn. SWEET WILLIAM. Fig. 1251. Readily grown from seed and flowering well the second year: glabrous, the sts. 4-angled, 10-20 in. high, simple or branched only above: lvs. broad and flat or conduplicate, 5-nerved: fls. several to many in a round-topped dense cyme, the petals toothed and bearded, red, rose, purple or white and also varicolored in garden forms, the bracts subtending the calyx 4 and long-pointed. Russia to China and south to the Pyrenees. G. 1:372. Gn. M. 2:217; 14:55. F. E. 23:219.—The sweet william is one of



1251. Sweet William—*Dianthus barbatus*. ( $\times \frac{1}{2}$ )

the oldest garden fls. It is sure to be found in the old-fashioned gardens. The cult. forms run into many colors. Sometimes found along roadsides as an escape. There are double-fl. forms. R.H. 1894, p. 277. Some of the modern improved large-fl. forms are very showy, and produce their bloom over a long season. *D. Laucheanus*, Bolle, is a hybrid of *D. barbatus* and *D. deltoideus*. Gt. 53:1528.

4. *carthusianorum*, Linn. (*D. atrorubens*, Willd.). Hardy, glabrous, scarcely glaucous, 12-20 in. high, the st. angled: lvs. linear and pointed, without prominent nerves when fresh: fls. in a dense, 6-20-fl. head (sometimes the clusters very few-fl.), in shades of red, odorless, the petals sharply but not deeply toothed, the cluster subtended by very narrow or even awl-like lvs.; calyx-bracts 4, coriaceous, yellowish or straw-colored. Denmark to Portugal and Egypt. B.M. 1775, 2039.—Widely variable. Little planted in American gardens.

cc. Plant glabrous and glaucous.

5. *cruentus*, Griseb. (*D. atrococcineus*, Hort.). Cespitose, glaucous, glabrous: st. 1-2 ft., terete, forking: lvs. linear or lance-linear, sharp acuminate, spreading, 7-nerved, the cauline linear-appressed and 5-nerved: fls. deep blood-red, small, about 20 in a subglobose dense head, odorless; petals red-hairy towards the base. July. Greece and N.

6. *giganteus*, Urv. Cespitose, glabrous, glaucous, 2-3 ft. or more, simple: lvs. long-linear, 7-nerved, plane, spreading and acuminate: fls. 10-12 in a head, red, the petal-blade obovate-cuneate. Balkan region. Gn. 66, p. 122.

ccc. Plant woolly, glaucous.

7. *capitatus*, Balb. Plant glaucous, woolly, 12-16 in., simple, st. 4-angled: lvs. linear, acute, plane, spreading, 7-nerved, those on the st. 5-nerved: fls. 6-8 in a head, the petals purple-spotted. Siberia to Servia.

cccc. Plant viscid-pubescent.

8. *viscidus*, Bory & Chaub. Cespitose, pubescent and sticky, about 12 in., simple: lvs. linear, acuminate, soft, plane, 1-3-nerved: fls. 3-6 in a fascicle, the petals purple-spotted, the blade obovate-cuneate and few-toothed. Bulgaria, Greece, Turkey.—Runs into several marked forms.

AA. Fls. solitary, or loosely in 2's or 3's.

B. Calyx-bracts short and broad, mostly appressed.

C. Petals fimbriate.

D. Teeth of calyx mucronate.

9. *plumarius*, Linn. (*D. scoticus*, Hort.). COMMON GRASS OR GARDEN PINK. SCOTCH PINK. PHEASANT'S-EYE PINK. Low, tufty, 1 ft.: sts. simple or forked: plant blooming in spring and early summer, very fragrant: lvs. elongate-linear, keeled, spreading or recurved, thickish, 1-nerved, blue-glaucous: fls. medium size, rose-colored (varying in cult. to purple, white and variegated), the blade of the petal fringed a fourth or fifth of its depth; calyx cylindrical, with short broad-topped mucronate bracts. Austria to Siberia. Gn. 66, p. 260. F.E. 23:401.—A universal favorite. Hardy. Much used in old-fashioned gardens as edging for beds. There are double-fl. forms. A more continuous-blooming form is catalogued as var. *semperflorens*.

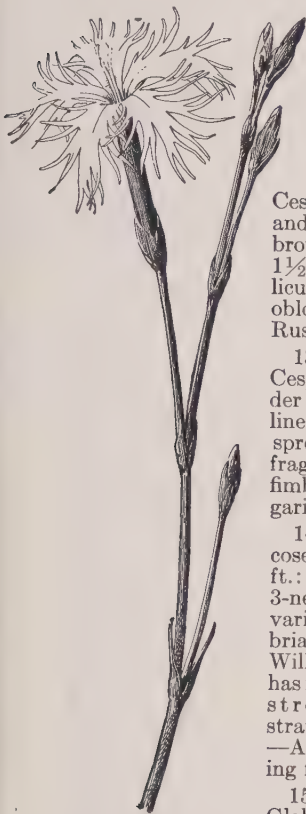
10. *arenarius*, Linn. Cespitose, glabrous, 1 ft. or less, the sts. simple or forked, slender, 1-3-fl.: lvs. elongate-linear, keeled, obtuse, fascicled, spreading: fls. white, fragrant; petals much cut beyond the middle; calyx purplish, the teeth ovate-lanceolate.



Dalmatia to Finland. G. 26:433.—Var. *glauus*, Blocki, connects this species with No. 9.

DD. *Teeth of calyx acuminate or attenuate.*

11. *monspessulanus*, Linn. Sts. terete, glabrous, branching, 12–20 in.: lvs. linear, acuminate, plane, spreading but strict, 5-nerved: fls. solitary or 2 or 3 together, showy, odorless; petals rose, rarely white, cut or fimbriate; calyx attenuated at top, the teeth 7-nerved. Spain to Caucasus.



1252. *Dianthus superbus*. ( $\times \frac{1}{2}$ )

lance-linear, acute, 3–5-nerved, rather soft, plane: fls. very fragrant, in a lax forked panicle; petals lilac, dissected below the middle. Norway to Japan and Spain. Variable. B.M. 297.—A handsome species; garden forms are sometimes offered.

cc. *Petals only dentate (except perhaps in some garden forms).*

16. *càsius*, Smith. CHEDDAR PINK. Cespitose, glabrous, glaucous: sts. 12 in. or less, simple, or forked above, 4-angled, 1–2-fld.: lvs. lance-linear, plane, 3-nerved, the cauline acute and keeled: fls. showy, fragrant, the petal-limb rose-colored, obovate-cuneate and irregularly toothed. Eu. G.C. III. 44:214. Gn. 64, p. 236.—Runs into several forms.

17. *sylvêstris*, Wulf. (*D. virgineus*, Hort.). Cespitose, slender, 1 ft. high, the st. simple or somewhat branched, angular-compressed and bearing 1–3 odorless fls.: lvs. tufted, linear and sharp-pointed, scabrous on the margins: fls. rather small, red, the petals obovate-cuneate and shallow-toothed. Spain to Greece and Austria.—Very variable. Pretty perennial border plant. Var. *frigidus*, Williams (*D. frigidus*, Kit.) is a dwarf Hungarian form.

18. *attenuatus*, Smith. Cespitose, glaucous, woody at base, the sts. diffuse and tortuose, 20 in.: lvs. linear, acute, plane, 3-nerved: fls. small, solitary or twin but disposed in a lax panicle, odorless, rose-colored; petal-limb oblong. Eu.

12. *squarrôsus*, Bieb. Cespitose: sts. terete, slender and squarrosely few-fld., glabrous, more or less branching,  $1\frac{1}{2}$ –2 ft.: lvs. linear, acute, canalliculate, recurved: fls. rose; petals oblong, pinnately many-parted. Russia, Siberia.

13. *petrêus*, Waldst. & Kit. Cespitose, glabrous, the sts. slender and simple, 1 ft. or less: lvs. linear-lanceolate, acute, keeled, spreading, 3-nerved: fls. white, fragrant; petal-limb obovate, fimbriate but not bearded. Bulgaria, Austria. B.M. 1204.

14. *fimbriatus*, Bieb. Suffruticose, glabrous, the sts. simple, 1 ft.: lvs. linear, acute, appressed, 3-nerved, plane or keeled: fls. variable, rose-colored, much fimbriate, bearded. Var. *orientâlis*, Williams (*D. orientâlis*, Donn), has fls. with linear-cuneate petals, strongly imbricate obovate straw-colored bracts. B.M. 1069.—A very variable species, ranging from Portugal to Thibet.

15. *supêrus*, Linn. Fig. 1252. Glabrous, light green: sts. 10–20 in., dichotomous and branched at top, terete and slender: lvs.

19. *Caryophyllus*, Linn. CARNATION. CLOVE PINK. PICOTEE. GRENADINE. Figs. 801–818. Plate XXII. Cespitose, glabrous, 1–3 ft., the sts. hard or almost woody below, the nodes or joints conspicuous: lvs. thick, long-linear, very glaucous, keeled, 5-nerved, stiffish at the ends: fls. mostly solitary, showy, very fragrant, rose, purple or white; calyx-bracts 4, very broad, abruptly pointed. B.M. 39 (Bizarre Carnation); 1622 (var. *imbricatus*); 2744 (Picotees).—Generally supposed to be native to the Medit. region, but Williams gives its geographical limits as “north and west Normandy” and “south and east Punjab” (northwestern Hindoostan). In Eu. it is largely grown as an outdoor pink, but in this country it is chiefly known as the greenhouse carnation. The American forcing type (which may be called var. *longicaulis*) is distinguished by very long stems and a continuous blooming habit; it is here the carnation of commerce. Garden varieties of *D. Caryophyllus* are numberless, and they often pass under Latinized names (*D. punctatus*, Hort., is one of these names). See *Carnation*. The carnation has been long in cult. The bloom is now very variable in size, form and color; originally probably pale lilac. Fragrant.

BB. *Calyx-bracts half the length of the calyx, mostly narrow-pointed, more or less spreading at the tips: lvs. short and spreading, the radical ones obtuse or nearly so.*

20. *deltoides*, Linn. MAIDEN PINK. Fig. 1253. Densely tufted, 6–10 in., blooming in spring and early summer, creeping: sts. ascending, forking, with solitary fls. on the branchlets: st.-lvs. an inch long, linear-lanceolate, sharp-pointed: fls. small ( $\frac{1}{2}$ – $\frac{3}{4}$  in. across), the petals toothed, deep red with a crimson eye, the petals bearing an inverted V-shaped pocket at their base (whence the name *deltoides*), fragrant. Scotland to Norway and Japan. Gn. 66, p. 224. G.M. 55:28. G.W. 14, p. 181.—One of the prettiest border pinks, making neat mats of foliage and bearing profusely of the little bright fls. There is a white-fld. variety.

21. *alpinus*, Linn. More or less cespitose, very dwarf, the 1-fld. slender sts. rarely reaching more than 3–4 in. high, more or less prostrate: foliage dark shining green, the lvs. linear or lance-linear, those on the st. keeled and strict: fl. 1 in. or more across, odorless, deep rose or purplish and crimson spotted, a darker ring around the eye. Russia to Greece and Swiss Alps. B.M. 1205. Gn. 26:184; 47, p. 292; 45, p. 53. Gt. 4:110. G.W. 8, p. 14.—One of the choicest of alpine and rock-work plants. Var. *repens*, Regel (*D. repens*, Willd.), of Siberia and Alaska, has a single root and procumbent sts. branched from near base: fls. purple; calyx somewhat inflated,  $\frac{1}{2}$  in. long. Apparently not cult. This is kept as a distinct species by some.

22. *versicolor*, Fisch. Glabrous, the sts. 10–12 in., terete, paniculately branched: lvs. narrow-linear, plane, those on the st. becoming scale-like: fls. loosely paniculate, the petal-limb obovate-cuneate, red-spotted above and greenish yellow beneath; calyx-teeth lanceolate, acute. Altai Mts., Siberia.

23. *callizônus*, Schott & Kotschy. Smooth and glaucous, the sts. terete, 1-fld., 12–16 in.: lvs. canalliculate, 3–5-nerved, the radical linear-lanceolate and acute, the cauline lance-linear and acuminate: petal-



1253. *Dianthus deltoides*.

limb obovate-cuneate, purple-spotted above, and with a zone at the center, rose-colored beneath; calyx purple, the teeth lanceolate-acuminate. S. E. Eu. Gn. 64, p. 298; 66, p. 54; 70, p. 275.

BBB. *Calyx-bracts leafy and spreading.*

24. *glaciâlis*, Haenke. Three to 4 in. high, the 4-angled sts. tufted and 1-2-fld.: lvs. green, linear-lanceolate, pointed, those on the st. linear-acute and strict or recurved, 3-nerved; fls. small and odorless, red-purple; the petals toothed, yellowish beneath, contiguous; bracts 2-4. Mts. of S. Eu. G.C. II. 21:809.—A pretty species, but difficult to establish. Grown among alpine plants. Var. *Frèynii*, Williams (*D. Frèynii*, Vandas). Lvs. rather soft, keeled, the lateral nerves obscure; sts. usually 1-fld.: calyx-teeth ciliate. Var. *neglectus*, Williams (*D. neglectus*, Loisel). Lvs. plane; fls. rarely twin; bracts 4: petals separate. G.C. III. 49:415. Gn. 76, p. 339. Gn.W. 20:711.

25. *chinensis*, Linn. (*D. sinensis*, Hort.).

Fig. 1254. Cespitose, glabrous, more or less creeping at base: st. forking, angled and more or less grooved, pubescent: lvs. broad and nearly flat or slightly trough-shaped, 3-5-nerved: fls. large, solitary or more or less clustered, pink or lilac; the petals (at least in the wild) barbed or hairy toward the base; calyx-bracts 4, in some cult. vars. short. China and Japan; but recent authorities consider a European pink to be but a form of it, and thereby extend its range west to Portugal. B.M. 25. The Amoor pink (*D. dentosus*, Fisch.) is a form known as var. *macrosepalus*, Franch.: it is a hardy border plant, 1 ft. high, with bright red fls. and a spot at base of each petal. Var. *âsper*, Koch (*D. Séguieri*, Auth.). has fls. in panicles, and the bracts squarrose-spreading: the European form of the species. *D. semperflorens*, Hort., is a hardy perennial form, 12-18 in., with silvery foliage and deep pink, red-eyed, fragrant fls. *D. chinensis* has given rise to a beautiful and variable race of garden pinks, var. *Heddewigii*, Regel (*D. Heddewigii*, Hort.). These are extensively grown from seeds, and are practically annuals, although plants may survive the winter and give a feeble bloom in the spring in mild climates. The fls. are scarcely odorous. They are single and double, of many vivid colors; and many of the garden forms have bizarre markings. Gt. 7:328. G. 2:537. In some forms, var. *laciniatus*, Regel (*D. laciniatus*, Hort.), the petals are slashed and cut. G. 2:538. G.Z. 6:1. *D. imperialis*, Hort., is a name applied to a strain with strong habit and rather

tall growth, mostly double. *D. diadematus*, Hort., is another garden strain. G. 2:538. *D. cinnamatus*, Lem., is a red form with shredded petals. I.H. 11:388. *D. hybridus*, Hort., is another set. This name (*D. hybridus*) is also applied to a *dentosus*-like form, which some regard as a hybrid of *D. dentosus* and some other species. A recent race of the garden pinks, with narrow petals and a star-like effect, is var. *stellaris*, (*D. stellaris*, Hort.). For portraits of garden pinks, see B.M. 5536. F.S. 11:1150; 12:1288-9; 13:1380-1. Gn. 49:82.—The garden pinks are of easy cult. Seeds may be sown in the open where the plants are to stand, but better results are obtained, at least in the N., if plants are started in the house. Plants bloom after the first fall frosts. They grow 10-16 in. high, and should be planted 6-8 in. apart. They are very valuable for borders and flower-gardens. Species-names now referred to *D. chinensis* are *D. caucasicus*, Sims, *D. ibericus*, Willd., *D. ruthenicus*, Roem., *D. montanus*, Bieb., *D. collinus*, Waldst. & Kit., representing the European extension of the species.

26. *latifolius*, Hort. Plant 6-12 in. high, of doubtful origin, but in habit intermediate between *D. chinensis* and *D. barbatus*. Fls. large, double, in close clusters or even heads, in good colors: lvs. oblong-lanceolate.—A good border plant; perhaps a hybrid.

*D. arboreus*, Linn. 3-4 ft., glabrous and glaucous, with a woody trunk, linear-acute canaliculate 3-nerved lvs., and showy rose-colored fragrant fls. in a dense corymb. S. E. Eu. G.C. III. 43:52. This species is one of the sub-shrubby group of *Dianthus*, comprising also *D. fruticosus*, Linn. (of the Grecian Archipelago), *D. Bisignani*, Tenore (of Tunis and Naples), and others. *D. suffruticosus*, Willd., probably belongs with the last.—*D. call-alpinus*, Hort. Hybrid of *D. callizonus* and *D. alpinus*. G.M. 47, p. 408.—*D. diutinus*, Kit. Allied to *D. barbatus*: glabrous: sts. simple, 12-18 in., 4-angled: fls. pale red, 6-8 together in a head, the petals barbed. Hungary, Servia. Rockery.—*D. fragrans*, Bieb. Cespitose, glabrous: sts. 10-16 in., simple, or branched above: lvs. elongated-linear, acuminate, 3-5-nerved: fls. fragrant, the limb white suffused with rose, petals beardless. Caucasasia, Algeria.—*D. gracilis*, Sibth. More or less woody at base, glabrous and glaucous, the sts. 14-18 in. and simple and slender: lvs. linear-acute, strict, 3-nerved: fls. rose, paler beneath, 2-3 in a cluster. Balkans.—*D. graniticus*, Jord. Sts. simple, scabrous below and glabrous above, slender, 4-angled, 6 in.: lvs. linear-acute, 3-nerved: fls. solitary or in pairs, purple. France, Rockery.—*D. japonicus*, Thunb. Glabrous perennial, with simple sts. 20 in.: lvs. ovate-lanceolate, acute, canaliculate, twisted at base: fls. 6-8 in a head, red. Japan, Manchuria.—*D. microlepis*, Boiss. Very dwarf, caespitose, glabrous: lvs. scale-like: fls. rose-colored (varying to white). Balkans. A marked little alpine.

L. H. B.



1254. *Dianthus chinensis*. (X $\frac{1}{2}$ )

**DIAPENSIA** (ancient name of obscure application). *Diapensiaceæ*. Two alpine-arctic species, one nearly circumpolar and one Himalayan, the former at least sometimes transferred to alpine gardens and rockeries. *Diapensias* are very small compact tufted evergreen more or less woody perennials, with small entire coriaceous crowded lvs.: corolla 5-lobed, bell-shaped; calyx inclosing the caps.; stamens 5, affixed in the corolla, the filaments broad; ovary 3-celled; fls. solitary on peduncles that project above the dense lf.-rosettes (or the peduncle projected, at least in fr.), white or rose-purple. *D. lappônica*, Linn., on mountain summits in New England and N. Y., and distributed northward to the arctic, forms dense cushion-like tufts, 1 or 2 in. high, with white fls. on peduncles that become 1 or 2 in. long; a very interesting alpine, but seldom grown. B.M. 1108. *D. himalaica*, Hook. f. & Thom. Densely tufted: lvs. somewhat acute, very short: fls. white or rose-red, subsessile, the corolla-tube twice the length of the calyx. Sikkim, 10,000-14,000 ft.

L. H. B.



**DIÁSCIA** (to adorn, Greek, having regard to the attractive flowers). *Scrophulariaceæ*. Low and slender herbs, mostly annual, one of which is recently grown in flower-gardens.

Leaves usually opposite: fls. mostly violet or rose-color in general effect, in racemes or fascicles at the end of the st. or branches; calyx 5-parted or -lobed; corollatube very short or none; limb 2-lipped, the upper lip 2-lobed and lower 3-lobed, all the lobes being broad and flat, 2 of the fauces being projected into spurs; stamens 4, didynamous; style filiform: fr. a globose or elongated dehiscent many-seeded caps.—Probably 25 or more species in S. Afr.

**Bárberæ**, Hook. f. Fig. 1255. Annual: st. erect, 1-1½ ft., square, green and glabrous: lvs. ovate, blunt, obtusely serrate, petioled or the upper ones sessile: fls. several to many in an erect terminal raceme, on slender glandular pedicels; calyx deeply 5-lobed; corolla ½ in. across, rose-pink with yellow green-dotted spot in throat, the 2 upper lobes small and nearly orbicular, the lateral twice larger, and the lower one much larger and obscurely 4-angled, the spurs cylindrical and about as long as lower lobe; filaments glandular. B.M. 5933. Gt. 50, p. 639.—A very attractive little plant, of simple cultural requirements, blooming freely in summer. It also makes a good pot-plant for indoor use. Half-hardy annual. Pink and orange shades are advertised.

L. H. B.

**DIASTÈMA** (two stamens). *Gesneriaceæ*. Dwarf warmhouse plants of Trop. Amer. (about 20 species), allied to *Dicyrta*, *Achimenes* and *Isoloma*, and requiring similar treatment; differs from former two in having 5 distinct glandular parts to the disk rather than annular, and from *Isoloma* in the narrower parts of the disk, plants weak, fls. pale, white or purplish, and in the short or nearly globular anther-cells, and other features: summer-flowering. *D. ochroleucum*, Hook., has yellowish white fls.; corolla somewhat swollen at base: lvs. ovate, acute, hairy, coarsely serrate, on hairy purplish erect sts. 1-2 ft. high. Colombia. B.M. 4254. *D. pictum* is offered abroad, but its identity is in doubt; see *Isoloma*.

L. H. B.

**DICÉNTRA** (Greek, *dis*, *kentron*, two-spurred, but originally misprinted *Diclytra*, and then supposed to be *Dielýtra*). *Fumariaceæ*; by some this family is combined with *Papaveraceæ*. Charming hardy perennial plants with much-cut foliage, and clustered attractive flowers of interesting structure.

Herbs of various habit, erect, diffuse or climbing, often stemless, with rhizome horizontal and branching or more or less bulbous: lvs. ternately compound or dissected: fls. rose-red, yellow or white in attractive

racemes, very irregular, with 4 petals cohering into a heart-shaped or 2-spurred apparently gamopetalous corolla (the 2 outer petals oblong with spreading tips and spurred or saccate at base, the inner 2 narrow and clawed and crested or winged and more or less united over the stigma); sepals 2, very small, scale-like; stamens 6, in sets of 3; pistil 1-celled, with a 2-4 crested and sometimes 2-4-horned stigma, ripening into an oblong or linear 2-valved caps. bearing crested seeds; pedicels 2-bracted.—About 15 species, in N. Amer., W. Asia and the Himalayas. The names *Bikukulla* (or *Bicuculla*) and *Capnorchis* are older than *Dicentra*, but are rejected by the "nomina conservanda" list of the Vienna code.

The squirrel-corn and dutchman's breeches are two of the daintiest native springtime flowers; and the bleeding-heart is one of the choicest memories of old-fashioned gardens: it is also the most widely cultivated of all the plants of this delightful order. Though long known to herbaria, plants of bleeding-heart were not introduced to western cultivation from Japan until the late forties of last century. Robert Fortune saw it on the Island of Chusan, where he also got *Diervilla rosea* and the "Chusan daisy," the parent of pompon chrysanthemums. The first live plants seen in England flowered in May, 1847. It rapidly spread into every garden in the land, and is now rich in home associations. It is an altogether lovely plant. The species of *Dicentra* may be classed as caulescent and acaulescent. The stemless kinds send up their short scapes directly from the ground, as *D. Cucullaria*, *D. canadensis*, *D. formosa*, *D. eximia*. The species with leaf-bearing stems are such as *D. chrysantha* and *D. spectabilis*. In the species here described the flowers are nodding except in *D. chrysantha*.

*Dicentras* are easily cultivated in borders and wild gardens. Two or three kinds can be readily secured from the woods in the East. Effort should be made to reproduce the natural conditions, especially the degree of shade. They like a rich light soil. Propagation is by dividing crowns or roots. The forcing of bleeding-hearts, though practically unknown in America, is said to be commoner in England than outdoor culture. The forcing must be very gentle and the plants kept as near the glass as possible. It is best to have fresh plants each year, and return the forced ones to the border. None of the species is much cultivated with the exception of the bleeding-heart (*D. spectabilis*).

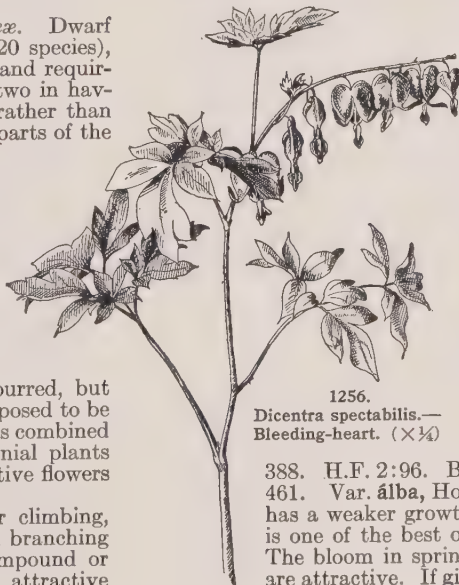
A. Fls. rose-purple.

B. Racemes simple.

*spectabilis*, Lem. (*Dielýtra spectabilis*, Don). BLEEDING-HEART. Fig. 1256. Height 1-2 ft.: lvs. and fls. broadest of the group, the ultimate segms. obovate or cuneate: fls. large, deep rosy red; corolla heart-shaped; inner petals white, protruding. Japan. F.S. 3: 258. Gn. 40:198; 60, p. 375; 70, p. 192. Gn.W. 23: suppl. July 14. G. 2:375; 26:142; 27:112. G.M. 49:718; 51:160. G.W. 5, p. 388. H.F. 2:96. B.M. 4458. R.H. 1847: 461. Var. *álba*, Hort., the white-fl. form, has a weaker growth. The bleeding-heart is one of the best of flowering perennials. The bloom in spring and also the foliage are attractive. If given room and moisture,



1255. *Diascia Barberæ*.  
(Plant  $\times \frac{1}{3}$ )



1256.  
*Dicentra spectabilis*.—  
Bleeding-heart. ( $\times \frac{1}{4}$ )

the plant will continue to be attractive as a foliage mass till late summer.

BB. *Racemes compound.*

**eximia**, Torr. Stemless, glabrous and somewhat glaucous, 1-2 ft., from a scaly rootstock: ultimate lvs. segms. broadly oblong or ovate, the lvs. being ternately parted: scape about equaling the lvs.; fls. rose or pink, heart-shaped, tapering to a neck, inner petals protruded. Rocks of W. N. Y. and mountains to Ga. Var. **multi-pinnata**, Hort., has lvs. more finely cut, making a very handsome foliage plant.

**formosa**, Walp. Fig. 1257. Stemless, with a fleshy and spreading rootstock: lvs. very long-stalked, biterminately compound, the segms. cleft or pinnatifid.: scapes about 2 ft., somewhat exceeding the lvs., naked; fls. in a terminal cluster of short and bracted racemes, rose-purple, the corolla ovate-cordate, the petals all united to above the middle, the inner petals scarcely protruding. Cent. Calif. to Brit. Col. A.F. 21:459. Mn. 8:17. B.M. 1335 (as *Fumaria formosa*).



1257. *Dicentra formosa*.  
( $\times \frac{1}{2}$ )

AA. *Fls. chiefly white.*

**canadensis**, Walp. (*Dielytra canadensis*, Don). SQUIRREL-CORN, from the scattered little tubers resembling grains of maize. Fig. 1258. Stemless, fragile: lvs. finely cut, glaucous, the segms. linear and abruptly pointed: raceme simple, few-fl.; fls. white, tipped with rose; corolla merely heart-shaped, the spurs being short and rounded; crest of the inner petals conspicuous, projecting. Nova Scotia to Mich., to N. C. and Mo. and Neb., but chiefly northward in the vegetable mold of rich woods. B.M. 3031.

**Cucullaria**, Bernh. (*Dielytra Cucullaria*, Don). DUTCHMAN'S-BREECHES. Fig. 1259. Easily told from *D. canadensis* by its loose, granular cluster of tubers, forming a bulb-like body: lvs. finely cut, little or not at all glaucous: racemes simple, few-fl.; fls. white, tipped creamy yellow; corolla not heart-shaped, the spurs longer and divergent; crest of the inner petals minute. Nova Scotia to Ga. and Mo., and also along the Columbia River (the western form differing in having shorter and rounded spurs). I.H. 6:215. Mn. 6:41. A.G. 13:516. B.M. 1127 (as *Fumaria Cucullaria*).

AAA. *Fls. yellow.*

**chrysantha**, Walp. GOLDEN EARDROPS. Pale and glaucous, with leafy sts. 2-3 ft. high: lvs. bipinnate, 1 ft. or more long, segms. narrow: infl. thyrsoid paniculate; fls. numerous, as many as 50 in a thyse, erect, golden yellow; corolla linear-oblong; outer petals hardly larger than the inner, the tips soon recurving to below the middle, all distinct. Dry hills of the inner Coast range. Calif. B.M. 7954. F.S. 8:820 (as *Capnorchis chrysantha*).—Rare in cult.

*D. torulosa*, Hook. f. & Thoms., of the Himalayan region, has been intro. abroad. It is an annual climber, 10-16 ft.: lvs. attractively cut: fls. 6-8 together, yellow: fr. red.

L. H. B.†

**DICHORISANDRA** (compounded of Greek words referring to the division of the stamens into two series). *Commelinaceae*. Tropical perennial herbs, with handsome foliage, often beautifully variegated, and rich blue flowers borne in thyse-like panicles.

Stems simple or branched, erect or partially scandent, the lvs. sheathing at the nodes: lvs. entire, sessile or petiolate, mostly long: sepals 3, distinct, ovate or oblong, green or colored, not equal; petals 3, distinct, wider than the sepals; stamens 6 or 5; ovary sessile, 3-celled: fr. an ovate-3-angled 3-valved caps., few-seeded.—About 30 species in the American tropics.

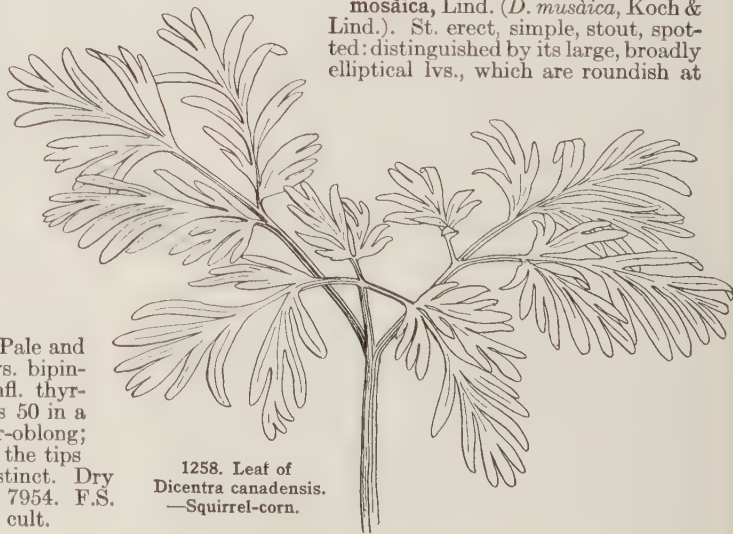
The dichorisandras are usually handled as warmhouse subjects, although some of them may be plunged in the open ground south of Philadelphia. *D. thyrsiflora* is a satisfactory plant of unusual and interesting appearance, which requires little attention when once well established, and may be relied upon to flower regularly year after year. It needs careful repotting every year at first until a good-sized pot (say 8-inch) is well filled with roots. It then throws up a strong shoot each year about 5 or 6 feet high, unbranched, and with perhaps 8 or 9 leaves near the top. The handsome thyse of blue flowers gives a color that is rare in the greenhouse. This plant may be the only representative of its interesting order in a private collection. It is willing to be crowded into the background, where its bare stem is hidden, and where the light may be poorest. The stem dies down in the winter time, when water should be gradually withdrawn. Water should be given liberally during the growing season. Of the foliage plants of this genus, *D. mosaica* is commonest. It is dwarfer, and does not flower so regularly. (Robert Shore.)

A. *Foliage not variegated.*

**thyrsiflora**, Mikan. Simple or nearly so, stout, 3-6 ft.: distinguished by its large lvs., which are lanceolate, narrowed into a distinct petiole, glabrous, 6-10 in. long, 2 in. wide, green on both sides: st. about 3 ft. high, scarcely branched, robust, glabrous: racemes subpanicked, pubescent; petals dark or light blue; sepals glabrous, blue or somewhat herbaceous. Brazil. B.R. 682. L.B.C. 12:1196. P.M. 3:127. G. 27:569. J.H. III. 43:262.

AA. *Foliage variegated.*

**mosaica**, Lind. (*D. musaica*, Koch & Lind.). St. erect, simple, stout, spotted: distinguished by its large, broadly elliptical lvs., which are roundish at



1258. Leaf of  
*Dicentra canadensis*.  
—Squirrel-corn.



the base, sessile, glabrous, about 6 in. long, 3-4 in. wide, with a short, sharp, rather abrupt point: st. unbranched, robust, spotted; raceme short, densely thyrsoid; sepals white or greenish. *Gt.* 1868:593. *F.S.* 16:1711.—Its chief beauty is the mosaic appearance of the foliage, due to numberless short transverse whitish lines, which do not pass by the longitudinal veins of the lf. The under side of the lvs. is a rich purplish color. *Var. gigantæa*, Hort., a large form, has been offered.

*Var. undata*, Miller (*D. undata*, C. Koch & Lind.). Foliage without any mosaic appearance, the variegation being entirely longitudinal. Each parallel vein



1259. *Dicentra Cucullaria*.—Dutchman's Breeches.

lies in the middle of a long, whitish band extending the full length of the lf. *F.S.* 17:1763. *G.W.* 3, p. 159.

*D. acutis*, Cogn. Stemless: lvs. in a rosette, almost sessile, narrowly oblong, wavy, acutish, short-cuneate at the base, sparsely pilose on both sides; panicles terminal, sessile, much shorter than the lvs. Brazil. *I.H.* 41:19. Handsomely variegated with countless short longitudinal lines.—*D. albo-marginata*, Lind. St. 3-4 ft.: lvs. lanceolate, acuminate, attenuate to base, glabrous: raceme peduncled, 2 in. long, dense; petals dark blue, white at base; sepals white. Brazil. *G.W.* 4, p. 307.—*D. angustifolia*, Lind. & Rod. St. purple, spotted green: lvs. oblong-lanceolate, sessile, glabrous, roundish at the base, acute, about 6 in. long, 2 in. wide at the middle, purple below, marked above with short transverse white lines. Ecuador. *I.H.* 39:158.—*D. leucophthalmos*, Hook., differs in having radical inf., its fls. lying flat on the ground. Lvs. elliptic, acuminate, green on both sides: fls. blue, with a white eye; stamens 6. Brazil. *B.M.* 4733. *J.F.* 4:428.—*D. ovalifolia*, Presl. Lvs. oval, sessile, acuminate, glabrous, the upper ones oblong-lanceolate; panicle wide-branched. Nicaragua to Colombia.—*D. oxyptala*, Hook., is instantly recognized by its acute petals, which are purple. Lvs. green on both sides. Brazil. *B.M.* 2721.—*D. picta*, Lodd., has narrower petals than usual, with a white spot at the base, but is told from all others here described by the irregular blotches of purple on the upper side of the lvs. The purple is the same color as that on the under surface. Brazil (?). *B.M.* 4760. *L.B.C.* 17:1667.—*D. Regina*, Hort. = *Tradescantia Regina*, Lind. & Rod., intro. about 20 years ago by a firm of Continental Eu.—*D. Saundersii*, Hook., differs from all others here described in the extreme density of its head-like inf. Lvs. green on both sides, lanceolate; sepals white, tinged blue. Brazil. *B.M.* 6165.—*D. Sibbertii*, Hort. A little-known plant with white midrib and margins; probably a form of *D. ovalifolia*.—*D. thysiana* = *Palisota*.

WILHELM MILLER.

L. H. B.†

**DÍCHROA** (Greek, *dis*, two, and *chros*, color). Syn. *Adámia*. *Saxifragaceæ*. Rare greenhouse shrub in habit resembling a *Hydrangea*, with violet-blue fls. in a pyramidal panicle a foot across, and handsome blue berries. Lvs. persistent, opposite, stalked, narrow, tapering both ways, serrate; panicles terminal, many-fl.; fls. blue, lilac, or violet; petals 5 or 6, valvate; styles 3-5, club-shaped; seeds numerous, small. The

genus has only 1 species, in the Himalayas, Malaya, and China. It is sometimes considered to be bitypic, but the other species, *D. pubescens*, Miq., is considered by Koorders (*Exkursionoflora von Java*) to be probably a true *Hydrangea*.

*febrífuga*, Lour. (*Adámia versicolor*, Fortune. *Cyanitis sylvatica*, Reinw.). Later writers also include *Adámia cyanea*, Wall., which Lindley distinguished by its smaller lvs. and fls., 5 petals, and 10 stamens, while *A. versicolor* had 7, or sometimes 6 petals, and 20 stamens. Plants may still be cult. under the name of *A. cyanea*, but it cannot be stated here how distinct they are for horticultural purposes. A somewhat virgate shrub 5-9 ft. tall, with lanceolate or obovate-lanceolate lvs. to 8 in. long, glabrous except on the nerves; petals less than  $\frac{1}{4}$  in. long. Clarke states that the Chinese varieties have larger fls. than the Indian forms. Occurs in the temperate Himalayas from 5,000-8,000 ft. *B.M.* 3046. *P.M.* 16:322.

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L. H. B.†

**DICHROPHYLLUM**: *Euphorbia*.

**DICHRÓSTACHYS** (two-colored spikes). *Leguminosæ*. Stiff shrubs, with bipinnate lvs. and small leathery lfts. and very small polygamous fls. in spikes, sometimes mentioned as useful for cult. in warmhouses. The species are few, in Trop. Asia, Afr., and Austral. Fls. in the upper part of the spike perfect, those of the lower part bearing 10 long filiform staminodia; corolla not papilionaceous, comprising 5 strap-shaped petals that are more or less united at base; stamens 10 in the perfect fls., free, slightly exerted; pod narrow, compressed, mostly or nearly indehiscent. *D. platycarpa*, Welw., is or has been in cult.: a slender spiny tree, 10-15 ft. high; pinnæ 10-18 pairs, the lfts. 1-2 lines long and very narrow; spikes usually shorter than the lvs.: pod twisted, 2-4 in. long, about 1 in. broad. Guinea. *D. nitans*, Benth. (*Cailliea Dichrostachys*, Guill. & Perr.), has been intro. in S. Calif.: spiny, much contorted shrub or small tree: lvs. glabrous or pubescent, acacia-like; pinnæ 5-10 pairs; lfts. 10-20 or more pairs, sessile, linear or linear-oblong, rarely as long as  $\frac{1}{2}$  in.: fls. in dense axillary twin or solitary spikes, the upper ones sulfur-yellow and the lower ones rosy lilac: pod twisted,  $\frac{1}{2}$  in. or less broad. Cent. Afr.

L. H. B.

**DICKSONIA** (named for James Dickson, an English botanist, 1738-1822). *Cyatheaceæ*. Tree ferns of greenhouses.

Plants with a distinctly 2-valved inferior indusium, the outer valve formed by the apex of the lf-segm.—A small genus, mostly of the southern hemisphere. For *D. pilosiuscula*, *D. punctilobula* and *D. Smithii*, see *Dennstaedtia*. For *D. Schiedeii* and *D. regalis*, see *Cibotium*. These are only two of several confusions of species which have been called Dicksonia, but really belong in other genera. Modern fern students are now reaching the conclusion that Dicksonia is not only very distinct from the genus *Cyathea* and its relatives, but belongs in a distinct family.

Dicksonias are amongst the most important tree ferns, both for their beauty and because of their relative hardiness. In their native countries some of them are occasionally weighted with snow, and *D. antarctica* has to endure frosts. They can be grown in coolhouses, and should be tried southward outdoors in sheltered places. Their trunks are more fibrous than those of most tree ferns, and hence more retentive of moisture, so that they need less care. A good trunk produces thirty to forty fronds a year, and retains them until the next set is matured, unless the trees suffer for moisture in winter. Although they rest in winter, the fronds soon shrivel up if the trunks are allowed to get too dry. Dicksonias should have their trunks thoroughly watered twice a day during the growing season. These waterings

should be gradually decreased until winter, when the trunks should be kept merely moist all the time. Only in the hottest summer days is slight shade needed. It is a pity to grow tree ferns in pots, but if this must be done several principles should be observed. The lapse of a single day's watering will often cause serious damage. As a rule, the pots should be of the smallest size consistent with the size of the trunk. Three or 4 inches of soil all around the trunks are enough. The above points are taken from Schneider's "Book of Choice Ferns;" see also the discussion of tree ferns under *Ferns*, Vol. III.

**antártica**, Labill. Lf.-stalks short, the scales dense, dark purplish brown; lvs. 5-6 ft. long, the middle pinnæ 12-18 in. long; segms. oblong, the sterile incised. Austral. and Tasmania. G.C. III. 9:81.—Trunk sometimes 30-35 ft. high. A very useful decorative plant.

**squarrosa**, Swartz. Lf.-stalks short, the scales hair-like, light colored; lvs. 3-4 ft. long, the pinnæ 9-15 in. long; segms. lanceolate, the sterile toothed, the ribs scabrous. New Zeal. and Chatham Isl.

L. M. UNDERWOOD and WILHELM MILLER.

**DICLIPTERA** (named in allusion to the 2-celled winged caps.). *Acanthaceæ*. Pubescent or hirsute annual or perennial herbs or sub-shrubs, with red, violet or blue bracted flowers in terminal or axillary clusters, in the tropical parts of the world, 1 or 2 of which may sometimes occur in the trade. Lvs. opposite, entire, the plant usually evergreen; corolla-tube, slender, often somewhat expanded above; limb 2-lipped, the lips narrow; stamens 2, on the throat. **D. Niederleiniana**, Lind., has been recently intro. abroad from Argentina: sub-shrub: lvs. oval, to 3 in. long, petioled, rounded at apex, densely pubescent: fls. about 1¼ in. long, several crowded in a terminal paniculate cyme. **D. Tweediana**, Nees, of Uruguay, is a showy perennial with orange-red fls. and oblong-obtuse lvs. There are probably 75 species of *Dicliptera*. Very likely the horticultural names are confused as between this genus and others.

L. H. B.

**DICLÝTRA**: An ancient typographical error for *Dielytra*. See *Dicentra*.

**DICTÁMNUS** (old Greek name, supposed to indicate foliage like the ash: hence *Fraxinella*, diminutive of the Latin *Fraxinus*, an ash). *Rutaceæ*. GAS-PLANT. BURNING-BUSH. *FRAXINELLA*. DITTANY. A hardy perennial herb.

Stout plants woody at the base: lvs. alternate, odd-pinnate, the lfts. ovate, serrulate and pellucid-punctate: fls. showy, white or rose, on bracted pedicels; petals 5, the lower one declined; disk thickish, annular; stamens 10, declined; ovary deeply 5-lobed, 5-celled, hispid, becoming a hard 5-divided caps., each division or separate part being 2-3-seeded.—One variable species, native from S. Eu. to N. China.

This genus includes an old garden favorite which has a strong smell of lemon, and which will give a flash of light on sultry still summer evenings when a lighted match is held under the flower-cluster and near the main stem. It is one of the most permanent and beautiful features of the hardy herbaceous border. Instances are known in which it has outlived father, son and grandson in the same spot. It thrives in the sun.

The gas plant makes a sturdy, bold, upright growth, and a clump 3 feet high and as much in thickness makes a brave sight when in flower. A strong, rather heavy soil, moderately rich, is best for these plants. They are not fastidious as to situation, succeeding as well in partial shade as when fully exposed to the sun, and drought will not affect them when once fairly established. Old strong clumps are good subjects as isolated specimens on a lawn, and a large patch, planted in the border, is not only effective while in full flower, but the dark,

persistent foliage is ornamental throughout the season. It is not advisable to disturb the plants very often, as they improve with age, producing taller flower-stems and more of them as they grow older. They are excellent for cutting, especially the white variety. Propagation is accomplished with difficulty by division, but easily by seeds, which are sown in the open ground in fall as soon as ripe, and covered an inch or so. They will germinate the next spring, and, when two years old, the seedlings may be removed to their permanent positions, where they will flower the following year. (J. B. Keller)

**álbus**, Linn. (*D. Fraxinella*, Pers. *Fraxinella álba*, Gaertn. *F. Dictamnus*, Moench). A vigorous, symmetrical, hardy herb, with glossy leathery foliage surmounted by long showy terminal racemes of good-sized fragrant fls.: lvs. alternate, odd-pinnate; lfts. ovate, serrulate, dotted with oil-glands: fls. white. G.C. III. 34:409. Gn. 35:458; 68, p. 73; 75, p. 381. G. 13:25. A.F. 5:328. Gng. 5:321. Var. **purpureus**, Hort., has large dark-colored fls. Var. **rúbra**, Hort., has rosy purple fls., the veins deeper colored. Var. **gigantæus**, Hort. (*D. gigantæus*, Hort.). Plant large. Var. **caucásicus** (*D. caucásicus*, Hort.), is a giant form with racemes twice the length of those of the common kind and standing well above the foliage. R.B. 32, p. 253. Perhaps the same as var. *gigantæus*.

WILHELM MILLER.

L. H. B.†

**DICTYOGRÁMMA**: *Coniogramme*.

**DICTYOSPERMA** (Greek, *netted seed*). *Palmaceæ*. *Areca*-like palms, comprising several species of desirable pinnate house and table palms that are becoming deservedly well known.

Slender spineless palms, with a ringed trunk: lvs. equally pinnatisect; segms. linear-lanceolate, acuminate or bifid, the apical ones confluent; margins thickened, recurved at the base; midrib and nerves prominent, sparsely clothed with persistent scales beneath, or naked; rachis and petiole slender, scaly, 3-sided, furrowed, sheath elongated, entire: spadix on a short glabrous or tomentose peduncle, the branches erect or spreading and flexuose, the lower ones with membranaceous bracts at the base; spathes 2, complete, dorsally compressed, papery, the lower one 2-crested; fl.-bearing areas much depressed; bracts and bractlets scaly; pistillate fls. rather large, white or yellowish: fr. scaly, small, olive-shaped or subglobose.—There are 6 or 8 species all from Trop. Asia but only the following seem to be known in the trade. For cult., see *Areca* from which *Dictyosperma* differs only in having a 1-celled and 1-seeded fr.

**álba**, Wendl. & Drude (*Arèca álba*, Bory. *Ptychosperma álba*, Scheff.). Distinguished by the whitish petioles and the whitish green veins of the lvs.: caudex about 30 ft. high, 8-9 in. diam., dilated at the base; lvs. 8-12 ft. long; petiole 6-18 in. long, grooved down the face; segms. 2½-3 ft. long, 2-3 in. wide, 7-nerved; veins and margins green or reddish: branches of the spadix 6-18 in. long, erect or slightly reflexed, zigzag when young.—By far the best of the genus and rather widely sold as *Areca* as is also *D. rubra*.

**aúrea**, Wendl. & Drude (*Arèca aúrea*, Hort.) Distinguished by the yellow or orange petioles and veins of young plants: caudex about 30 ft. high, smaller and more slender than the preceding: lvs. 4-8 ft. long; petiole 8 in. long; segms. 1½-2 ft. long, 1 in. wide; secondary veins scarcely visible: branches of the spadix rigidly erect, 9-11 in. long.

**furfurácea**, Wendl. & Drude (*Arèca furfurácea*, Hort.). Like *D. rubra*, but the petiole and lf.-sheath of the young plant tomentose.

**rúbra**, Wendl. & Drude (*Arèca rúbra*, Hort.). Resembling *D. álba*, but the lvs. of the young plants



darker green, the primary veins and margins dark red, the redness disappearing very much in adult plants: branches of the spadix longer and more reflexed. —Young plants of this may be used for table decorations as the plant grows quickly and is attractive in juvenile condition.

JARED G. SMITH.

N. TAYLOR.†

**DICÝRTA** (*twice curved*, referring to structure of fls.). *Gesneriaceæ*. Very closely related to *Achimenes* with which some authors unite it, differing in the smaller fls., and diverging anther-cells. Low-growing slender villous herbs with creeping roots: lvs. opposite, membranaceous: fls. axillary, small, white or pale lilac, sometimes spotted; corolla-tube declinate, the limb oblique with 5 nearly equal spreading lobes; stamens affixed in the base of the corolla-tube, included, the anther-cells distinct. Two species occur in Guatemala. **D. cándida**, Hanst. & Klotzsch (*Achimenes cándida*, Lindl. *Diastema gráclle*, Regel). To 1½ ft.: lvs. ovate to ovate-lanceolate, acuminate, serrate, short-petioled: fl. on a bracted pedicel that much exceeds the petiole, white, tubular-campanulate, the lowest lobe projecting. Summer. The other species is *D. Warscewicziana*, Regel (*A. misera*, Lindl.), apparently not in cult.: fls. smaller.

L. H. B.

**DIDÍSCUS**: *Trachymene*.

**DIDYMOCÁRPUS** (*twin fruit*). *Gesneriaceæ*. Attractive warmhouse herbs, with few showy flowers.

A polymorphous genus, distributed in E. India, Malaya, China, and Trop. Afr., differently named and defined by different authors. Roettlera is an older name, and has been used recently, but it is discarded by the "nomina conservanda" list of the Vienna code. The genus includes *Chirita* and *Trachystigma* according to Fritsch, and it then numbers more than 100 species. Bentham & Hooker omit *Chirita*, which differs in its 2-parted stigma, always 2 stamens, and other characters; in this work it is kept distinct. *Didymocarpus* comprises plants that are caulescent or nearly acaulescent, sometimes woody, of various habit: lvs. radical and cauline, those on the st. opposite or alternate, crenate, more or less wrinkled and hairy: fls. violet, blue, white or even yellow, on few-fl. scapes or axillary peduncles; corolla with an elongated tube which is widened at the throat or ventricose, the limb spreading and somewhat 2-lobed; stamens 2 or rarely 4, the anthers connivent or coherent and cells divergent; style long or short, the stigma little dilated and entire or nearly so.—The species require the treatment given the warmhouse gesneriaceous plants; usually difficult to grow, or are soon lost because seeds may not be produced. Several species are mentioned in horticultural literature; but the following are more recently intro. and are likely to be cult. or perhaps in the trade. They are low herbs with few lvs., resembling *Streptocarpus*. Many new species have recently been added to this interesting genus, and a number of them may be expected to appear in cult.

**cyaneus**, Ridley. Stemless: lvs. in a rosette, ovate, elliptic or obovate, ascending, somewhat obtuse, to 6 in. long, crenate-serrate, soft pubescent, petioled: fls. deep blue, trumpet-shaped, about 1½ in. long, with rounded spreading lobes, 4 or 5 on a scape. Malaya. B.M. 8204.—Blooms in autumn; should have warm treatment, such as is given *Streptocarpus*.

**Veitchiana**, W. W. Smith. Eight in. or less: lvs. 2-4 pairs, ovate, somewhat cordate at base, serrate, 4 in. or less long, stalked: fls. lilac with longitudinal lines, tubular, nearly 1¼ in. long, in few-fl. axillary cymes. China.

L. H. B.

**DIDYMOCHLÆNA** (Greek, *twin cloak*; alluding to the indusium). *Polypodiaceæ*. Greenhouse ferns of rather coarse foliage.

Indusium elliptical, emarginate at the base, attached along a central vein, free all around the margin.—One or 2 species. Large coarse ferns somewhat resembling the shield ferns, *Dryopteris*, in habit and gross appearance.

*D. lunulata* is a very distinct fern. It looks like a tree maidenhair, but the stems are thick and fleshy and the leaves are fleshier than any *Adiantum*. In cultivation the trunk is only a few inches high, but the fronds are 4 to 6 feet long and densely covered with long, brown, chafy scales and has a metallic luster. This is a warmhouse fern, and may be used for subtropical bedding. It has a bad trick of dropping its pinnules if allowed to get too dry at the root, but soon rallies under liberal treatment.

**lunulata**, Desv. (*D. trunculata*, Hort.). Fig. 1260. Lvs. clustered from an erect rigid st., bipinnate, 3-6 ft. long; pinnules almost quadrangular, ¾-1 in. broad, entire or slightly sinuate, each bearing 2-6 sori. Cuba to Brazil; the same or an allied species in Madagascar and Malaya. —*D. lunulata* is a very attractive fern while in a small state, but its deciduous articulated pinnules are a drawback as a commercial species, rendering it of little value for house decoration.

L. M. UNDERWOOD and  
W. H. TAPLIN.

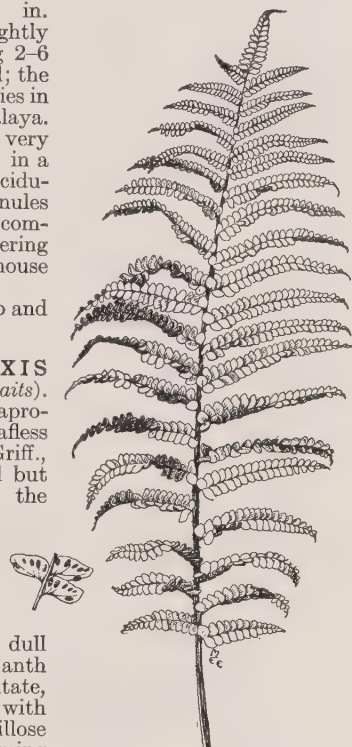
#### DIDYMOPLÉXIS

(*double or twin plaits*).

*Orchidaceæ*. One saprophytic orchid with leafless sts. *D. pallens*, Griff., has been cult. abroad but is probably not in the trade: root branching and tuberous, bearing a st. 4-6 in. high with loose sheaths: racemes terminal, with 4-8 small brownish or dull yellow-white fls.; perianth ½ in. diam.; lip stipitate, transversely oblong, with 3 nerves and a papillose disk; pedicels becoming greatly elongated after fertilization. E. India.—The genus *Didymoplexis* comprises 2 or 3 species (*Leucorchis* is a more recent name), in India, Malaya and the Pacific Isls., characterized by simple flexuous scapes, dorsal sepals and petals connate into a 3-parted upper lip, the lateral connate into an entire or 2-parted lower lip, the regular lip inserted on the foot of the column, very short and broad, entire; caps. becoming very long-pedicelled. Apparently of little horticultural interest.

**DIDYMOSPÉRMA** (Greek, *double-seeded*). *Palmaçæ*, tribe *Arècæ*. Low or almost stemless pinnate oriental palms.

Leaves terminal, unequally pinnatisect, silvery-scaly below; segms. opposite, alternate, solitary, or the lower ones in groups, cuneate at the base, obovate-oblong or oblanceolate, sinuate-lobed and erose, the terminal one cuneate; margins recurved at the base; midnerve distinct, nerves flabellate; sheath short, fibrous: spadices with a short, thick peduncle and thick branches; spathes numerous, sheathing the spadix; fls. rather large; calyx 3-ld., corolla with 3 stiff petals;



1260. *Didymochlæna lunulata*.  
(×¼)

ovary 2-3-celled: fr. ovoid or oblong, 2-3-, rarely 1-, seeded.

*Didymosperma* is a genus of East Indian palms of moderate growth, containing possibly eight species, most of which are stemless or else forming but a short trunk, the pinnate leaves rising from a mass of coarse brownish fibers that surround the base of the plant. The leaflets are of irregular shape, bearing some resemblance to those of *Caryota*, and the plants frequently throw up suckers from the base. The members of this genus are not very common in cultivation. The species that is most frequently seen is the plant known to the trade as *D. caryotoides*, an attractive warmhouse palm that has also appeared under the synonym *Harina caryotoides*, and has lately been referred to *Wallichia*, which see. While young, at least, the *didymospermas* enjoy a warm house and moist atmosphere with shading from full sunshine, though one species, *D. oblongifolia* (or *Wallichia*), is frequently found in Sikkim at an elevation of 3,000 feet above the sea. Propagated usually by seeds; occasionally by suckers, which are kept rather close for a time after their removal from the parent plant. See G.C. II. 24:362 for description of garden forms.

**porphyrocárpón**, Wendl. & Drude (*Wallichia porphyrocárpa*, Mart.). Sts. reedy, 3-6 ft.: lvs. 5-8 ft. long; lflets. 9-15, about 6 in. long, distant, narrowly oblong, long-cuneate, blunt, or sinuately 2-3-lobed, truncate, denticulate, glaucous beneath. Java.

**nànum**, Hook. A dwarf robust palm, 2-3 ft., covered with rusty pubescence: lvs. 1-2 ft. long, glabrous above, glaucous beneath; lflets. 1-3 pairs with an odd terminal one, 7-10 in. long, 3-5 in. broad, wedge-shaped, sharply toothed. Assam. B.M. 6836.—One of the smallest of all palms.

*D. Hookeriàna*, Becc. Resembles a *Caryota*, about 3 ft. high. Malay Penins. Plant scarcely known in cult. in Amer. but perhaps cult. in Eu.

JARED G. SMITH.

N. TAYLOR.†

**DIEFFENBÁCHIA** (J. F. Dieffenbach, a German botanist, 1794-1847) *Araceæ*. Popular hothouse plants, grown for their handsome and striking foliage.

Low, shrubby perennials: sts. rather thick, inclined or creeping at the base, then erect, with a leafy top:



1261. *Dieffenbachia picta* var. *Bausei*.

petioles half-cylindrical, sheathed to above the middle, long, cylindrical at the apex; blade oblong, with a thick midrib at the base; veins very numerous, the first and second parallel, ascending, curving upward at their ends; peduncle shorter than the lvs. Differs from *Aglaonema* in floral characters. Cent. and S. Amer.—

Perhaps a dozen species. Engler (in Engler & Prantl, 1889) recognizes many species, with many varieties.

For *dieffenbachias*, similar rooting material to that mentioned for *anthuriums*, combined with a high and moist atmosphere, will produce a very healthy and luxuriant growth of foliage, especially after the plants have made their first few leaves in ordinary light potting soil. Unless it be the very large-leaved kinds, like *D. triumphans*, *D. nobilis* and *D. Baummannii*, three or four plants may be placed together in large pots, keeping the balls near the surface in potting. *D. Jenmanii*, *D. Shuttleworthiana*, *D. Leopoldii* and *D. eburnea* are all well suited for massing together in large pots. When above a certain height, varying in different species, the plants come to have fewer leaves, and those that remain are small; they should then be topped, retaining a considerable piece of the stem, and placed in the sand-bed, where they will throw out thick roots in a week or two. The remaining part of the stems should then be cut up into pieces 2 or 3 inches long, dried for a day or so, and then put into boxes of sand, when, if kept warm and only slightly moist, every piece will send out a shoot, and from the base of this shoot roots will be produced. These can be potted up as soon as roots have formed. (G. W. Oliver.)

**picta**, Schott (*D. brasiliensis*, Veitch. *D. Shuttleworthiana*, Regel). Blade oblong, or oblong-elliptical, or oblong-lanceolate,  $2\frac{1}{2}$ -4 times longer than wide, rounded or acute at the base, gradually narrowing to the long acuminate-cuspidate apex, green, with numerous irregular oblong or linear spots between the veins; veins 15-20 on each side, ascending. L.B.C. 7:608 (as, *Caladium maculatum*). J.H. III. 46:165

Var. **Bausei**, Engler (*D. Bausei*, Regel). Fig. 1261. Blade nearly or completely yellowish green, with obscurely green-spotted margins and scattered white spots. I.H. 26:338.

Var. **Shuttleworthiana**, Engler (*D. Shuttleworthiana*, Bull.). Blade pale green along the midrib.

**Seguine**, Schott. Lvs. green, with white, more or less confluent stripes and spots, oblong or ovate-oblong, rounded or slightly cordate or subacute at the base, narrowed toward the apex, short cuspidate; primary veins 9-15, the lower spreading, the upper remote and ascending. Lowe 14 (as var. *maculata*). W. Indies.—Called "dumb plant" because those who chew it sometimes lose the power of speech for several days.

Var. **Baraquiniana**, Engler (*D. Baraquiniana*, Versch. & Lem. *D. gigantea*, Versch. *D. Verschaffeltii*, Hort. Petioles and also midribs almost entirely white; blade with scattered white spots. I.H. 11:387; 13:470, 471. G. 2:238.

Var. **nobilis**, Engler (*D. nobile*, Hort.). Fig. 1262. Blade elliptical, acute, dull green with dirty green spots. Brazil.

Var. **liturata**, Engler (*D. liturata*, Schott. *D. variegata*, Hort. *D. Leopoldii*, Bull. *D. Wallisii*, Lind.). Blade dark green, with a rather broad, yellowish green, ragged-margined stripe along the midrib: spathe glaucous-green. Province Para, Brazil. I.H. 17:11. S.H. 1, p. 455. G.Z. 25, p. 250.

Var. **irrorata**, Engler (*D. irrorata*, Schott. *D. Baumannii*, Hort.). Lvs. large and bright green, blotched and sprinkled with white. Brazil.

The above are the recognized two type species. The following are or have been in the American trade. Probably some or all of them belong to the foregoing species:

**Chélsonii**, Bull. Lvs. deep, satiny green, the middle gray-feathered, and the blade also blotched yellow-green. Colombia.

**eburnea**, Hort. Compact: lvs. light green, freely spotted with white, the sts. reddish and white-ribbed. Brazil.



**Fournièri**, Hort. Vigorous: lvs. large, leathery, with spots and blotches of white on a blackish green background. Colombia.

**illústris**, Hort. See *D. latimaculata*.

**imperator**, Hort. Lvs. 16-18 in. long, 5-6 in. wide, olive-green, fantastically blotched, marbled and spotted with pale yellow and white. Colombia.



1262. *Dieffenbachia Seguine* var. *nobilis*.

**insignis**, Hort. Lvs. dark green, with irregular, angular blotches of pale yellowish green, 6 or more in. wide, ovate and short-acuminate in form and with pale green petiole. Colombia.

**latimaculata**, Lind. & André (*D. illústris*, Hort.). Lvs. glaucous-green, profusely white-barred and white-spotted and blotched with yellow-green, the petioles also glaucous. Brazil. I.H. 23:234.

**Jénmanii**, Veitch. Lvs. rich, bright, glossy green, relieved by a milk-white band at every lateral nerve, and by a few white spots interspersed between the bands. Guiana. G.Z. 28, p. 218.

**magnifica**, Lind. & Rod. Lvs. ovate-acuminate, large, dark green, attractively blotched and spotted with white along the veins; sts. and petioles also variegated. Venezuela. I.H. 30:482. S.H. 2, p. 383. G. 13:643.

**marmorea**, Hort. See *D. Parlatoresi*.

**meleagrís**, L. Lind. & Rod. Lvs. with the long petioles green, marked with ivory-white, the blades dark green above, paler beneath, marked on both sides with a few white spots. Ecuador. I.H. 39:559.

**memòria-Còrsii**. A hybrid raised in the garden of the late Marquis Corsi.

**Parlatòrei**, Lind. & André, var. **marmorea**, André (*D. memòria*, *D. mormòra* and *D. Còrsii*, Hort.). Lvs. long-oblong, acuminate, the midrib white and the blades blotched white, the green deep and lustrous. Colombia. I.H. 24:291.—Engler refers this plant to the genus *Philodendron*.

**Regina**, Bull. Lvs. oblong-elliptical, rounded at base, short-acuminate at apex, greenish white, profusely mottled and blotched with alternate light and green tints. S. Amer. G.Z. 28, p. 26.—The vari-colored and margined lvs. are very attractive.

**Réx**, Hort. Compact: lvs. oblong-lanceolate, the two sides not equal, deep green, but the white angular blotches and midrib occupying more space than the green. S. Amer. G.Z. 28, p. 97.

**Sándæra**, Hort. Lvs. very broad-oval, green, mottled with cream-color.

**spléndens**, Bull. St. faintly mottled with dark and light green: lvs. have a thick, ivory-white midrib, and the ground-color is of a deep, rich, velvety bottle-green, with a resplendent, lustrous surface, freely marked with whitish striate blotches. Colombia. G.Z. 25, p. 193.

**tríumphans**, Bull. Lvs. dark green, ovate-lanceolate and acuminate, 1 ft. long, irregularly marked with angular yellowish blotches. Colombia. JARED G. SMITH

GEORGE V. NASH. †

**DIELÝTRA**: *Dicentra*.

**DIERÀMA** (a *funnel*, alluding to shape of fls.). *Iridacæ*. S. African cormous plants, related to *Sparaxis* and *Ixia*. Fls. large, white to purple and red, in panicle spikes: lvs. long, linear, rigid: perianth short-tubed, expanded at throat, with oblong nearly equal segms.; stamens 3, inserted on the perianth throat; ovary 3-celled, oblong, with many ovules, the style exerted: fr. a 3-valved caps. There are 2 or 3 species, of which *D. pulcherrima*, Baker, was intro. into S. Calif. many years ago: scape 2-6 ft., with remote branches: lvs. narrow-sword-shaped and with a very slender point: fls. 1½ in. long, pendulous, blood-red-purple, bell-shaped. B.M. 5555 (as *Sparaxis pulcherrima*). Requires the treatment given *Ixia*.

**DIERVILLA** (after Diereville, a French surgeon, who took *D. Lonicera* to Europe early in the eighteenth century). *Caprifoliacæ*. WEIGELA. Ornamental deciduous shrubs, grown for their showy flowers appearing profusely in spring and early summer.

Leaves opposite, petioled or nearly sessile, serrate: fls. in 1- to several-flid. axillary cymes, often panicle at the end of the branches, yellowish white, pink or crimson, epigynous; calyx 5-toothed or 5-parted; corolla tubular or campanulate, 5-lobed, sometimes slightly 2-lipped; stamens 5; style slender with large capitate stigma; ovary inferior, elongated, 2-celled: fr. a slender, 2-valved caps. with numerous minute seeds.—About 10 species in E. Asia and N. Amer.

*Diervillas* are shrubs of spreading habit, with more or less arching branches, rather large leaves, and, especially the Asiatic species, with very showy flowers from pure white to dark crimson, appearing in spring. A very large number of hybrids between the different Asiatic species have been raised and have become great favorites in gardens on account of their profusely produced and delicately tinted flowers. The earliest to bloom are *D. præcox* and its hybrids and also *D. florida* var. *venusta*, which begin to flower in Massachusetts about the middle of May; the latest is *D. rivularis*. The American species are hardy North and prefer moist and partly shaded positions. Of the Asiatic species *D. Middendorffiana* is the hardiest, but rarely does well: it seems to grow best in humid sandy or peaty soil and in positions sheltered from strong winds; it dislikes hot and dry air; *D. florida* also is rather hardy and one of the handsomest species of the genus. The other Asiatic species require protection during the winter or sheltered positions. They thrive well in any humid garden soil. Propagation is readily effected by greenwood cuttings or hardwood cuttings; the American species usually by suckers and by seeds sown in spring.

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a. Fls. yellow, slightly 2-lipped, small, about  $\frac{1}{2}$  in. long. (*Diervilla proper*).

b. Lvs. glabrous or nearly so.

1. *Lonicera*, Mill. (*D. trifida*, Moench. *D. canadensis*, Willd.). Shrub, to 3 ft.: branchlets nearly terete, glabrous: lvs. distinctly petioled, ovate-oblong, acuminate, serrate, nearly glabrous, finely ciliate,  $1\frac{1}{2}$ –4 in. long: cymes usually 3-fld.; limb nearly equal to the tube: caps. about  $\frac{1}{3}$  in. long. June, July. Newfoundland to Sask., south to Ky. and N. C. B.M. 1796.

2. *sessilifolia*, Buckl. Shrub, to 5 ft.: branchlets quadrangular: lvs. nearly sessile, ovate-lanceolate, serrate, nearly glabrous, of firmer texture, 2–6 in. long: cymes 3–7-fld., often crowded into dense, terminal panicles; limb shorter than the tube: caps. about  $\frac{1}{2}$  in.



1263. *Diervilla japonica*. ( $\times \frac{1}{3}$ )

long. June, July. N. C. and Tenn. to Ga. and Ala. G.C. III. 22:14; 42:427.—Hardy in Canada.

BB. Lvs., branchlets and infl. pubescent.

3. *rivularis*, Gatinger. Shrub, to 6 ft.: lvs. short-petioled, ovate to oblong-lanceolate, acuminate, truncate or cordate at the base, doubly serrate, pubescent on both sides,  $1\frac{1}{2}$ – $3\frac{1}{2}$  in. long: cymes few- to many-fld., crowded into terminal panicles; limb of corolla about as long as tube: caps.  $\frac{1}{4}$  in. long. July, Aug. N.C. to Tenn., Ga. and Ala. G.C. III. 38:339.

AA. Fls. showy, white, pink, or crimson, rarely yellowish.

b. Anthers not connected with each other. (*Weigela*.)

c. Calyx-lobes lanceolate, connate to or nearly to the middle; stigma 2-lobed: seeds almost wingless.

4. *florida*, Sieb. & Zucc. (*Weigela rosea*, Lindl. *W. amabilis*, Hort. *D. pauciflora*, Carr.). Shrub, to 6 ft.: branchlets with 2 hairy stripes: lvs. short-petioled or nearly sessile, elliptic or ovate-oblong to obovate, serrate, glabrous above except at the midrib, more or less pubescent or tomentose on the veins beneath, 2–4 in. long: calyx nearly glabrous, with lanceolate teeth; ovary slightly hairy; fls. 1–3, pale or deep rose,  $1\frac{1}{4}$  in. long; corolla broadly funnel-shaped, abruptly narrowed below the middle. May, June. N. China. B.M. 4396. F.S. 3:211. B.H. 1:577. Gt. 54, p. 86. R.H. 1849:381. H.F. 1854:21. V. 18:37.—This is one of the most cult. species, very free-flowering and rather hardy. Var. *alba*, Moore. Fls. white, changing to light pink. R.H. 1861:331. Var. *venusta*, Rehd.

Lvs. smaller, usually obovate,  $1\frac{1}{2}$ – $2\frac{1}{2}$  in. long, usually nearly glabrous: fls. in dense clusters with small lvs. at the base; corolla slender, about  $1\frac{1}{2}$  in. long, rather gradually narrowed toward the base, lobes oval to oval-oblong, rosy pink. Korea, N. China.—Recently intro.; very floriferous, early and hardy.

5. *præcox*, Lemoine. Shrub, to 6 ft.: branchlets glabrous: lvs. short-petioled, elliptic or elliptic-ovate, acuminate, serrate, hairy above, soft-pubescent below, 2– $3\frac{1}{2}$  in. long: fls. clustered, 3–5, nodding; calyx with subulate lobes; ovary hairy; corolla abruptly narrowed below the middle, purplish pink or rose-carmine. Japan. May. Gt. 46:1441; 53, p. 522. R.H. 1905:314.—The earliest of all species to bloom; has given rise to a race of early-flowering hybrids as *Avalanche*, *Gracieux*, *Vestale*, *Conquerant*, *Esperance*, *Seduction*, which see under *D. hybrida*.

cc. Calyx-lobes linear, divided to the base: seeds winged: stigma capitate.

d. Plant nearly glabrous.

6. *coræensis*, DC. (*D. grandiflora*, Sieb. & Zucc. *D. amabilis*, Carr.). Shrub, 5–10 ft.: lvs. rather large, obovate or elliptic, abruptly acuminate, crenately serrate, sparingly hairy on the veins beneath and on the petioles: fls. in 1–3-fld., peduncled cymes; corolla broadly funnelform, abruptly narrowed below the middle, changing from whitish or pale pink to carmine. May, June. Japan. S.Z. 31. F.S. 8:855. H.U. 1:19.—Vigorously growing shrub, with large lvs. and fls., but less free-flowering, and the type not common in cult. Var. *arborea*, Rehd. (*W. arborea grandiflora*, Hort.). Fls. yellowish white, changing to pale rose; of vigorous growth.

DD. Plant more or less pubescent: corolla finely pubescent outside.

7. *japonica*, DC. Fig. 1263. Shrub, to 6 ft.: lvs. oblong-obovate or elliptic, acuminate-serrate, sparingly pubescent above, tomentose beneath: fls. usually in 3-fld., short-peduncled cymes, often crowded at the end of short branchlets; corolla broadly funnelform, narrowed below the middle, whitish at first, changing to carmine, slightly pubescent or nearly glabrous outside; style somewhat exserted. May, June. Japan, China. G.F. 9:405 (adapted in Fig. 1263). Gn. 21, p. 184. Var. *hortensis*, Rehd. (*D. hortensis*, Sieb. & Zucc.). Lvs. nearly glabrous above, densely grayish tomentose beneath: cymes usually rather long-peduncled; fls. usually carmine. S.Z. 29, 30. More tender and slower-growing than the type. Var. *sinica*, Rehd. Lvs. slender-petioled, soft-pubescent beneath: fls. campanulate, abruptly contracted below the middle into a narrow tube, pale pink. Cent. China. Var. *alba*, Makino (*D. hortensis* var. *alba*, Sieb. & Zucc. *D. japonica* var. *nivea*, Rehd.). Like var. *hortensis* but fls. white. G.C. II. 10:80. Gn. 22, p. 185; 34, p. 352. G. 28:392.

8. *floribunda*, Sieb. & Zucc. (*D. multiflora*, Lem.). Shrub, to 8 ft.: lvs. oblong-ovate or elliptic, acuminate, serrate, sparingly pubescent above, more densely beneath: fls. 1–3, usually sessile, mostly crowded at the end of short branchlets; corolla rather gradually narrowed toward the base, pubescent outside, brownish crimson in the bud, changing to dark or bright crimson; lobes about 5 times shorter than the tube; style exserted. May, June. Japan. S.Z. 32. I.H. 10:383.—Vigorously growing shrub, with rather small but abundant fls. Var. *grandiflora*, Rehd. (*W. arborescens*, Hort.). Fls. rather large, brownish crimson. Var. *versicolor*, Rehd. (*D. versicolor*, Sieb. & Zucc.) Fls. greenish white at first, changing to crimson. S.Z. 33.

9. *hybrida*, Hort. (Fig. 1264), may be used as a collective name for the different hybrids between *D. florida*, *D. præcox*, *D. floribunda*, *D. japonica* and *D. coræensis*, which are now more commonly cult. than the







XXXVI. A border of dianthus and digitalis.



typical species. Some of the best and most distinct are the following, arranged according to the color of the fls. The numbers in parenthesis after the name refer to the number of the species and indicate the origin or probable origin of these hybrids:



1264. *Diervilla hybrida*. ( $\times \frac{1}{2}$ )

Fls. white or nearly white: *Avalanche*, Lemoine (5 $\times$ ?). Fls. pure white; early, *Dame Blanche* (6 $\times$ 7). Fls. large, white, slightly pinkish outside, yellowish white and bluish in bud. *Gracieux*, Lemoine (5 $\times$ ?). Fls. white, yellow in throat, buds light salmon-pink; early, *Isoline*, Van Houtte (4 $\times$ ?). Fls. white or slightly pink outside, yellow in throat. *Madame Couturier*, Billiard (4 $\times$ 6). Fls. yellowish white changing to pink. *Madame Lemoine*, Billiard (4 $\times$ 6). Fls. white with delicate bluish, changing to pink. *Madame Tellier*, Billiard (4 $\times$ 6). Fls. large, white, with delicate bluish. *Vestale*, Lemoine (5 $\times$ ?). Fls. pure creamy white. *Mont-blanc*, Lemoine (4 $\times$ 7). Fls. pure white, greenish white in bud, fading to pinkish. *Pavillon Blanc*, Lemoine. (4 $\times$ 7). Similar to the preceding. *Candida* (4 $\times$ 6). Fls. pure white. R.H. 1879:130.

Fls. pink or carmine: *Abel Carrière* (4 $\times$ 7). Fls. rose-carmine, purple-carmine in bud, with yellow spot in throat. *André Thouin* (4 $\times$ 6). Fls. pink, carmine in bud. *Conquérant*, Lemoine (5 $\times$ ?). Fls. very large, rose-colored, carmine outside and in throat; early. *Conquête* (4 $\times$ 7). Fls. very large, deep pink. *Dr. Buillard* (4 $\times$ 7). Fls. carmine. *Esperance*, Lemoine (5 $\times$ ?). Fls. very large, pinkish white tinged with salmon-red, buds pale salmon; early. *Gratissima* (4 $\times$ 7). Fls. light pink. *Gravevegenii* (4 $\times$ ?). Fls. red outside, whitish within, slightly striped with yellowish red. *Gustave Mallet*, Billiard (4 $\times$ 6). Fls. light pink, bordered white. *Hendersonii* (4 $\times$ 8). Fls. light crimson. *Intermedia* (4 $\times$ 7). Fls. carmine, buds darker. *Othello* (4 $\times$ 8). Fls. carmine, darker outside. *Seduction*, Lemoine (5 $\times$ ?). Fls. vinous carmine-red, early, very floriferous. *Steltzeri*, Van Houtte (4 $\times$ 7). Fls. dark red, abundant. *Styriaca*, Klenert (4 $\times$ 8). Fls. pink, changing to pinkish carmine, very floriferous. M.D. 1912:1. *Van Houttei* (4 $\times$ 7). Fls. carmine. F.S. 14:1447. *Venosa* (4 $\times$ 6). Fls. carmine-pink, carmine in bud, orange to crimson in throat. *Verschaffeltii* (4 $\times$ 6). Fls. carmine-pink, limb bordered whitish.

Fls. crimson or dark crimson: *Congo* (6 $\times$ 8). Fls. large, purplish crimson, abundant. *Desboisii* (8 $\times$ 7). Fls. small, dark crimson. *E. André* (8 $\times$ 6). Fls. very dark, brownish purple. *Eva Rathke* (8 $\times$ 6). Fls. deep carmine-red, erect; very free-flowering. R.B. 19:126. G. 14:1350. *Hendersonii* (4 $\times$ 8). Fls. light crimson, crimson in bud. *Incrinata* (6 $\times$ 8). Fls. deep red. *Lavallei* (6 $\times$ 8). Fls. bright crimson. H.F. 1870:5. G.W. 1, p. 60 (habit). *Loweii* (8 $\times$ 4). Fls. dark purplish crimson. H.F. 1870:8. *P. Duchartre* (4 $\times$ 8). Fls. deep amaranth, very dark; free-flowering.

Lvs. variously colored: *Kosteriana variegata*. Lvs. bordered yellow; fls. pink, paler in bud, dwarf. *Looymansii aurea*. Lvs. yellow; of slow growth. R.B. 2:173. *Luteo-marginata* (Weigela anabilisfol. var. Van Houtte). Lvs. bordered yellow. F.S. 12:1189. *Nana variegata* (Weigela rosea nana fol. var. Van Houtte). Lvs. variegated with white; fls. nearly white; dwarf. *Sieboldii argenteo-marginata* (4 $\times$ 7). Lvs. bordered white; fls. rose.

BB. Anthers connected with each other. (Calyptr stigma.)

10. *Middendorffiana*, Carr. Shrub, to 3 ft.: lvs. short-petioled, ovate-oblong or oblong-lanceolate, ser-

rate, glabrous at length; fls. in 2-3-fld. axillary and terminal clusters; corolla campanulate-funnelform, yellowish white, spotted orange or purplish inside  $1\frac{1}{2}$  in. long; calyx-teeth partially connate. May, June. E. Siberia, N. China, Japan. Gt. 6:183. R.H. 1854:261. F.S. 11:1137. I.H. 4:115. G.C. III. 7:581.—Hardy, but rarely does well; it demands a cool and moist climate and a position sheltered from strong winds.

*D. splendens*, Carr. (*D. Lonicera*  $\times$  *D. sessilifolia*). Intermediate between the parents; more similar to *L. sessilifolia*, but lvs. short-petioled. Garden origin.—*D. suavis*, Komarov. Allied to *D. japonica*. Lvs. ovate-lanceolate, ciliate, otherwise glabrous, sparingly serrate, 1-2 in. long; corolla white, pink outside; style not exerted. Manchuria. Recently intro.; presumably quite hardy.—*D. Wagneri*, Kusnezov (*D. japonica*  $\times$  *D. Middendorffiana*). Lvs. ovate-oblong, glabrous except on the veins below; fls. axillary on short branchlets; sepals lanceolate, distinct or partly connate, pink, tinged yellowish. Garden origin. Gt. 48:1461.—Doubtful whether still in cult.

ALFRED REHDER.

DIÈTES: *Moræa*.

**DIGITALIS** (Latin, *digitalis*, finger of a glove, referring to the shape of the flowers). *Scrophulariaceæ*, FOX-GLOVE. A fine genus, numbering several species, and some hybrids, of hardy or half-hardy herbaceous plants, well known for their long racemes of inflated flowers, which suggest spires or towers of bells. Plate XXXVI.

Upright herbs, sometimes woody at the base, glabrous or tomentose or woolly, mostly simple: lvs. alternate or scattered or crowded, entire or dentate: fls. showy, in a long terminal raceme or spike which is usually 1-sided, purple, ochroleucous or white; corolla declined, more or less campanulate, often constricted above the ovary, the limb erect-spreading and somewhat 2-lipped, spotted and bearded at the throat; stamens 4, didynamous, usually included; style slender, 2-lobed: fr. an ovate dehiscent caps.—About 25 species, Eu. and W. and Cent. Asia.

The foxgloves are old-fashioned and dignified, clean of growth and wholesome company in the choicest garden. The strong vertical lines of their flower-stalks, rising from rich and luxuriant masses of cauline leaves, give always an appearance of strength to the rambling outlines of the usual herbaceous border. For a week or two the foxgloves usually dominate the whole border. The usual species in cultivation is *D. purpurea*, which is one of the commonest English wild flowers. The name "foxglove" is so inappropriate that much ingenious speculation has been aroused, but its origin is lost in antiquity. The word "fox" is often said to be a corruption of "folk," meaning the "little folk" or fairies. Unfortunately, etymologists discredit this pretty suggestion. In the drugstores, several preparations of *D. purpurea* are sold. They are diuretic, sedative, narcotic. For medicinal purposes, the leaves of the second year's



1265. The juvenile or foliage stage of *Digitalis purpurea*, used as an edging. Year preceding the bloom.

growth are used.—Foxgloves are of the easiest culture. The common species and hybrids can be grown as biennials from seed. The perennial species are propagated by seeds or by division. The common *D. purpurea* is best treated as a biennial, although it may sometimes persist longer. Seeds sown one spring (or fall) will give good blooming plants the following season. The large root-leaves before the flower-stems appear are decorative (Fig. 1265).

*A. Middle lobe of the lower lip longer than the others.*

*ferruginea*, Linn. (*D. aurea*, Lindl.). Biennial or perennial, 4–6 ft. high: sts. densely leafy: lvs. glabrous or ciliate: racemes long, dense; fls. rusty red, reticulate-marked, downy outside; lower lip of corolla ovate, entire, bearded, July. S. Eu. B.M. 1828.

*lanata*, Ehrh. Perennial, or biennial, 2–3 ft. lvs. oblong or lanceolate, ciliate: fls. rather small, 1–1½ in. long, grayish or creamy yellow, sometimes whitish or purplish, downy, in a dense, many-fl. raceme, with bracts shorter than the fls. July, Aug. Danube River and Greece. B.M. 1159 (poor fig.).—A fine species.

*sibirica*, Lindl. Has the habit of *D. ambigua*, with fls. like those of *D. lanata*: lvs. downy, ovate-lanceolate, serrate or the upper entire: fls. ventricose, villose, yellowish; calyx-segms. linear, villose. Siberia. —This is a rare trade name, and it is doubtful whether this little known plant is really in cult.

*Thápsii*, Linn. Plant much like *D. purpurea*: perennial, 2–4 ft. high: lvs. ovate-lanceolate or oblong, rugose, decurrent: fls. purple, throat paler, marked with red dots in a lax raceme; calyx-segms. ovate or oblong. June–Sept. Spain. B.M. 2194 (as *D. tomentosa*).

*AA. Middle lobe of the lower lip shorter or hardly longer than the others.*

*ambigua*, Murr. (*D. grandiflora*, Lam. *D. ochroleuca*, Jacq.). Perennial or biennial, 2–3 ft. high: lvs.

ovate-lanceolate, toothed, sessile or clasping, downy below: fls. large, 2 in. long, yellowish, marked with brown; lower bracts about as long as the fls. Eu., W. Asia. B.R. 64.

*purpurea*, Linn. (*D. tomentosa*, Link & Hoffm.). COMMON FOXGLOVE. Fig. 1266. The species most commonly cult.: mostly biennial, but sometimes perennial: height 2–4 ft.: lvs. rugose, somewhat downy, the radical ones long-stalked and ovate to ovate-lanceolate, the st.-lvs. short-stalked and becoming small toward the top of the st.: fls. large, 2 in. long,

ranging from purple and more or less spotted, rather obscurely lobed. On dry hills and roadsides, Great Britain, W. and Cent. Eu., to Scandinavia, running into white and modified forms in cult.; sometimes escaped in this country. Gn. 34:488. Var. *gloxiniæflora*, Hort. (*D. gloxinoides*, Carr. *D. gloxinæflora*, Hort.). Of more robust habit, longer racemes, larger fls., which open wider, nearly always strongly spotted. Var. *alba*, Hort. Fls. white. Var. *monströsa*, Hort., is a double peloric form. P.G. 4:151. *D. maculata superba* is a trade name for highly improved spotted forms. Var. *campanulata*, Hort., is a monstrous form with the upper fls. united into a bell-shaped large bloom.

*D. Buxbaumii* is offered as a yellow-fl. species.—*D. dubia*, Rodr. Perennial, woolly: fls. slender, hanging, purplish, spotted inside. Balearic Isls. G. 30:309.—*D. laciniosa*, Lindl. Perennial, woody, 2 ft. high: lvs. lanceolate, jagged: fls. yellow, downy, with ovate, bearded segms.; bracts much shorter than the pedicels. Spain. B.R. 1201.—*D. levigata*, Walst. & Kit. Perennial, 2–3 ft. high: lvs. linear-lanceolate, radical ones obovate-lanceolate: fls. scattered, glabrous, yellow. Danube and Greece.—*D. lutea*, Linn. Perennial, glabrous: lvs. oblong or lanceolate, denticulate: raceme many-fl., secund; corolla yellow to white, glabrous; calyx-segms. lanceolate, acute. Eu. B.R. 251.—*D. maritima*, Boiss. Lvs. radical, very downy, ovate-oblong: fls. rose; corolla bearded. Spain.—*D. purpurascens*, Roth. Biennial: fls. yellow or sometimes purplish, pale inside, spotted at the mouth; lower lobe of corolla short. Eu.—*D. purpureo-ambigua* is a hybrid of *D. purpurea* var. *gloxiniæflora* and *D. ambigua*.

F. A. WAUGH.  
L. H. B.†

*DILIVARIA: Acanthus.*

*DILL* (*Anethum graveolens*, Linn.), an annual or biennial plant of the *Umbelliferae*, the seeds of which are used as a seasoning, as are seeds of caraway and coriander. It is of the easiest cult. from seeds. It should have a warm position. The plant grows 2–3 ft. high: the lvs. are cut into thread-like divisions: the st. is very smooth: the fls. are small and yellowish, the little petals falling early. It is a hardy plant. The foliage is sometimes used in flavoring, and medicinal preparations are made from the plant. The seeds are very flat and bitter-flavored. Native of S. E. Eu.

*DILLËNIA* (named by Linnæus for J. J. Dillenius, 1684–1747, botanist and professor at Oxford, author of important botanical works). *Dilleniaceæ*. Tall tropical trees from Asia, Indian Archipelago, Philippines, and Australia.

Leaves large, with pronounced pinnate parallel venation: fls. showy, white or yellow, lateral, solitary or clustered; sepals and petals 5, spreading; stamens many, free or somewhat united at base, the anthers linear, opening by 2 slits, the interior ones erect and introrse and the exterior ones recurved and extrorse: carpels 5–20, many-ovuled, in fr. becoming a fleshy body inclosed in the enlarging calyx.—Probably 40 species; allied to the *Magnolia* family. *D. indica* is said to be the showiest of the whole family, being attractive in foliage, fl. and fr. Dillénias may be grown in light sandy loam. Prop. readily by seeds, but with difficulty from cuttings.

*indica*, Linn. (*D. speciosa*, Thunb.). Trunk stout, not high: branches numerous, spreading, then ascending: lvs. confined to the ends of branches, on short, broad, channelled sheathing petioles, the blade 6–12 in. long, oblong, or oblong-lanceolate, acuminate, narrowed at the base, strongly serrate: sepals 5, thick, fleshy, enlarging and inclosing the fr.; petals obovate, white, large, making a fl. fully 9 in. across; stamens very numerous, forming a large yellow globe crowned by the white, slender, spreading rays of the stigma: fr. edible, acid, the size of an apple, many-celled and many-ovuled. Trop. Asia. Intro. in Fla. and S. Calif. B.M. 5016 (B.M. 449=*Hibbertia volubilis*). H.F. 1867 p. 119.

WILHELM MILLER.

*DIMORPHANTHUS: Aralia.*



1266. *Digitalis purpurea*.  
(× ½)



**DIMORPHOTHECA** (Greek, *two-formed achenes*). *Compositæ*. CAPE MARIGOLD. Annual and perennial herbs or sub-shrubs, some of which are excellent flower-garden plants.

Leaves alternate or radical, entire, toothed, or incised, often narrow: heads solitary, long-peduncled; disk-fls. yellow or brown or purple, the rays yellow, purple, or white with purple beneath. 'The genus is closely allied to *Calendula* but has straight instead of incurved frs. The fls. usually close up, like those of *Gazania*, unless they have sunlight; their backs have as great a variety of coloring as their faces.—About 20 species in S. Afr.

The flowers are often 3 inches across, and their long, slender rays (20 or more) give a distinct and charming effect. A dozen kinds are grown abroad, representing a wide range of colors and foliage. They are wintered in coolhouses and flowered in spring or else transplanted to the open, where they flower freely during summer. The shrubby kind, *D. Ecklonis*, has been grown as a summer bedding plant, flowering from July to frost, and as a coolhouse plant, making a much-branched subject 3 feet high, and flowering freely all spring.

*annua*, Less. (*Caléndula pluviâlis*, Linn.). Erect or diffuse, simple or branched annual, rough with jointed and gland-tipped hairs (seen with a small lens): lvs. narrowly oblong or obovate-oblong, tapering to the base, with a few distant teeth, pilose, the uppermost smaller and narrower: peduncles terminal, nodding in fr.; fls. white above, purple or discolored beneath. J.H. III. 57:501. Var. *ligulôsa*, Voss (*Caléndula Pöngel*, Hort.), is a double form (the heads full of rays) with heads white on upper side and yellow or violet beneath.

*sinuata*, DC. Annual, branched from the base, nearly glabrous: lvs. oblong, obtuse, sinuate, narrowed at base: involucre-scales lanceolate-acuminate, quite glabrous, longer than disk: achenes of ray trigonous, everywhere tubercled; of disk flat with thickened rim; rays orange.—Grows 12–15 in. high. Fls. shading to blue in center.

*aurantiaca*, DC. Perennial, the st. natively more or less shrubby, erect, glabrous, with rod-like branches: lvs. linear-oblong or spatulate, thickish, obtuse, entire: fl.-heads large, rays orange-yellow; involucre-scales linear-acuminate, exceeding the disk, with a central line of hairs and paler margins. This brief botanical description does not in all ways fit the plant now in common cult. as *D. aurantiaca*, which is treated as a half-hardy annual, and which is apparently more or less modified by cult.; it is a very showy plant (Fig. 1267), 12–16 in. high, from a short-decumbent base, with notched acute lvs., and terminal heads 2–2½ in. across, and with curving rays of a rich glossy apricot-orange and a disk of brown-black; it is one of the best flower-garden subjects of recent years, the fls. opening in the sun and making a brilliant display in summer and till frost; of simple culture from seeds. Although long described in horticultural literature, it appears not to have come really into cult. until within the past few years, having been offered in Eu. in the fall of 1908. Recent forms under the name of *D. aurantiaca hybrida* (hybrids with *D. annua*), intro. in 1912, range in color from white and bluish-white to red, yellow, orange and salmon. B.M. 408 (as *Caléndula Tragus*). G.C. III. 38:127. G. 31:205. J.H. III. 57:37. F.E. 31:308. Winter-flowering in S. Calif.

*Ecklonis*, DC. Shrubby at base, robust and erect, branching at top, 2 ft. or more: lvs. crowded, linear-lanceolate or lanceolate, entire or somewhat denticulate, acute: fl.-heads terminal, the rays 1½ in. long, white above and purplish beneath; involucre-scales long-acuminate. B.M. 7535. Gn. 75, p. 444. G. 24: 424; 25:565.—Not hardy north of Washington. It is grown as a summer bedding plant in England.

*D. Bárberia*, Haw. Perennial: fls. purple above, paler beneath; disk all purple, with corollas of 2 forms. B.M. 5337. H.F. II. 5:78. Var. *rosea*, Hort., has rose-colored fls.—*D. chrysanthemifolia*, DC. Lvs. cut like a chrysanthemum: fls. yellow, reverse reddish. B.M. 2218.—*D. cuneata*, DC. Lvs. strongly cut: fls. scarlet-orange. B.M. 1343.—*D. nudicaulis* var. *grammifolia*, Harv. & Sond. Fls. white, with a purple ring at the base, and orange-brown on the back, the disk purple. B.M. 5252.—*D. Tragus*, DC. Perennial: lvs. narrower than in *D. Ecklonis*, linear: fls. white, veined purple, the rays narrower at the base, reverse orange purplish, the disk purplish. B.M. 1981 (as *Calendula*). L. H. B. †

**DIOCLÆA** (after Diocles of Carystos, said to be second only to Hippocrates among the ancients for his knowledge of plants). *Leguminosæ*. Tender shrubby twiners, with delicate trifoliate leaves and blue, violet, scarlet or white flowers, sometimes nearly an inch long, and borne in clusters which have been roughly compared to *Wistaria*.

Flowers papilionaceous; calyx bell-shaped, 4-cut, 2 lobes shorter and narrower; standard orbicular or ovate, reflexed, auricled or appendaged at base; wings obovate or oblong, free; keel incurved, beaked or obtuse; ovary nearly sessile: pod wide, the upper suture thickened or 2-winged.—Perhaps 20 species in tropical regions, chiefly in the western hemisphere. What is said to be the following species is cult. in S. Calif., where it has a moderate growth, shining foliage, and clusters of 10 or more large fls. of a splendid scarlet (to be considered with reference to *Camptosema*).

*glycinoides*, Hort. Fls. 1 in. long, bright scarlet, in racemes, somewhat like *Wistaria*: will stand some cold. Prop. by seeds, cuttings, or suckers, freely produced on grown-up plants. Rio de la Plata.—Imperfectly understood botanically; said to be the same as *Camptosema rubicundum*, Hook. & Arn.

L. H. B. †

DION: *Dioon*.

**DIONÆA** (Greek name for Venus). *Droseracæ*. VENUS FLY-TRAP. A remarkable monotypic genus of insectivorous plants, often grown for



1267. *Dimorphotheca aurantiaca*, one of the best of recent flower-garden acquisitions. (×½)

curiosity and in botanical collections.

Leaves 1–5 in. long, 4–8 in number, are arranged in a spreading rosette over the soil, each consisting of a flat expanded petiole, and terminal bilobed blade; midrib of the blade contractile, the margins prolonged into bristles that interlock when the halves close, while each half bears 3 jointed and highly irritable hairs arranged in triangular manner over its upper surface; abundant sessile glands, usually of a crimson color, cover this surface and render it attractive to insects; but when grown in shade the glands and therefore the lvs. are quite green: a single neat touch of a hair fails to cause closure, but when one of the hairs is touched twice, or when two adjacent hairs are touched once within a short interval apart, the halves close. Owing

to continued and repeated stimuli caused by a caught insect, or to chemical stimuli caused by its tissues, the glands exude an acid and peptonizing digestive fluid after a few hours; this starts digestive disintegration of the insect's tissues, and the dissolved products are then absorbed by the lf.-halves: the fl.-stalk lengthens in May to 8-10 in. and bears 4-10 white fls. which expand in June, and which must be cross-pollinated for seed-production. By the end of June the caps. burst, and

expose small black shining seeds. These germinate in abundance under a bell-jar on moist sandy soil that is mixed with finely chopped sphagnum moss. Each seedling, after forming 2 lanceolate cotyledons, produces thereafter tiny fly-trapping lvs. that behave like the adult ones. Plants thrive well when grown in 3-5-in. pots amid a mixture of fine silver-sand and black silt. The pots should be kept immersed for about an inch in water, should have a slight top-covering of sphagnum, and must be kept near the glass in a green-

house with southeastern exposure. Inhabits the edges of moist sandy savannah "bottom" lands, is found wild over a narrow strip of territory about 10 miles in width and 40 miles north, also to an equal distance south of Wilmington, N. C., and grows well only

when the tips of its roots reach a moist substratum, and when active transpiration proceeds. The perennial underground part is a bulbous swelling that can readily be dug and distributed from Nov. to March.

It is seldom that this wonderful little plant is seen in a good state of cultivation any length of time after removal from its native haunts. Its cultivation in a greenhouse is usually attended with more or less difficulty, owing to unsuitable conditions, such as too much dry air, shade or unfriendly soil. It delights in full sunshine, with a very humid atmosphere. When the plants can be secured and transplanted with considerable of the soil in which they grow attached to the bulb-like rootstalks, they are quite easily dealt with, and may be kept in a healthy growing state for years. I find a round hanging earthenware receptacle most useful to grow them in; the bottom is carefully drained, first with large pieces of broken pots, then smaller pieces, and the upper layer is quite fine. Some chopped fibrous peat is placed above this, when the plants are built in with live sphagnum moss used to fill the spaces between the clumps. Arranged in this way, it is hardly possible to give them too much water, and they revel in abundant supplies. If kept in the sun the leaves take on a reddish tinge, but when grown in the shade they are always green. Flowers will develop about the middle of June, but they should be nipped off as they make their appearance, for they are apt to weaken the plant.—The *dionæa* has been grown successfully in a dwelling-house by a very different method. The plants were in a wide, shallow dish, without any drainage, and simply placed, not too firmly, in loose live sphagnum moss, with a glass covering. Water was given every other day by filling the space above the plants until the dish was filled, and then it was poured off. In this way the potting material never became sour. From the luxuriant condition in which these plants remained for years, I am inclined to think this was a close imitation of the conditions

under which they thrive in a wild state. Some years ago, owing to Asa Gray's endeavor to have the Government purchase a strip of land on which this plant grows, there existed a widespread idea that it was gradually becoming extinct. There seems to be little likelihood of this calamity, however, as *Dionæa* is found abundantly in some places. (G. W. Oliver, in *Garden and Forest*, 10:237 [1897]).

*muscipula*, Ellis. Fig. 1268. St. short, subterranean, coated by the swollen bases of lvs.: lvs. 1-5 in. long in radial rosette, divided into winged petiole and bilobed lamina; infl. umbellate; fls.  $\frac{3}{4}$ -1 in.; petals white; stamens usually 15; pistil of 5 united carpels, stigmas 5 penicillate; fr. a caps. B.M. 785. F.S. 3:280. Mn. 1, p. 69.

J. M. MACFARLANE.

**DIÖON** (Greek, *two* and *egg*; each scale covers two ovules and the seeds are in pairs). *Cycadaceæ*. Handsome foliage plants suitable for warm or temperate palm houses and for planting in the open far South.

This genus is said to be the closest to the fossil forms of any living representative of the family. It has the cones and twin seeds of *Zamia* and *Encephalartos*, with the flat woolly scales of *Cycas*, but without the marginal seeds and loose infl. of the latter.—*D. edule* has a flat rigid frond which is more easily kept free from scale insects than *Cycas revoluta*, the commonest species of the family in cult. A specimen at Kew had a trunk 3-4 ft. high and 8-10 in. thick, the crown spreading 8-10 ft. and containing 50 fronds, each 4-5 ft. long and 6-9 in. wide. Specimens of *D. spinulosum* are reported with trunk 24 ft. high. Both sexes make cones frequently, the male cone being 9-12 in. long and the female 7-12 in. The seeds, which are about the size of Spanish chestnuts are eaten by the Mexicans. There are a few species in Mex. Prop. by seeds. Cult. same as *Cycas*.

*edule*, Lindl. Lvs. pilose when young, finally glabrous, 3-5 ft. long, pinnatifid, rigid, narrowly lanceolate segms., about 100 on each side, linear-lanceolate, sharp-pointed, widest at the base, rachis flat above, convex beneath: male cones cylindrical, female cones ovoid. Mex. B.M. 6184. G.C. III. 40:289. Gn. 55, p. 365. Gt. 48, p. 157. Var. *lanuginosum*, Hort., is a very woolly kind. Gt. 48, pp. 154, 155. Variable.

*spinulosum*, Dyer. Plants 6-50 ft. high, crowned by a noble rosette of spreading lvs.: lvs. 4-3 ft. long, often with 100 lfts. on each side, these bearing 5-8 spines on each margin. This is one of the tallest of all the cycads, and is excelled only by the Australian *Cycas media*. It is very unlike *D. edule*, which has a stocky trunk and straight rigid lvs. Mex. G.W. 4, p. 326; 5, p. 331. A.F. 7:461.

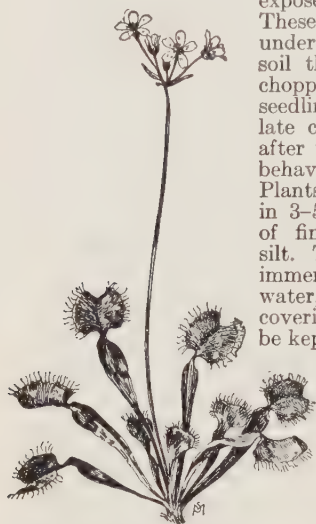
*D. Doheni*, Hort. Discovered in mts. of Guatemala and named for Edward L. Doheney of Los Angeles. Pacific Garden, Nov. 1912: 13.—*D. pectinatum*, Hort. Like *C. spinulosum*: foliage described as "very handsome, owing to the very numerous pinnae and their close and regular arrangement. The texture is also firm and leathery, with a sharp spiny point to each pinna." Gn. W. 24:5.—*D. Phippsii*, Rose. Trunk short, crowned with numerous stiff and ascending lvs. 3 ft. or more long; pinnae 2-4 in. long, sharp-pointed, entire on the lower margin but usually with 1, 2, or 3 spine-like teeth on the upper margin: male cones 6-8 in. long, the bracts with recurved ovate tips; female cones ovate, about 18 in. long, the bracts very woolly. S. Mex.

WILHELM MILLER.

L. H. B.†

**DIOSCOREA** (Dioscorides, Greek naturalist of the first or second century of the Christian era). *Dioscoreaceæ*. Twining herbs from tuberous or thickened rootstocks, grown as arbor vines or under glass for the foliage, and also for the edible rhizomes and aerial tubers.

Type genus of a small family (of about 9 genera) allied to Liliaceæ. It contains more than 200 widely dispersed and confused species, most of them native to tropical regions. Sts. herbaceous and twining or long-procumbent, usually from a large tuberous root,



1268. The Venus' Fly-trap—*Dionæa muscipula*.



and sometimes bearing tubers in the axils: lvs. broad, ribbed and netted-veined, petiolate, alternate or opposite, sometimes compound: fls. dioecious, small; calyx 6-parted; anthers 6; styles 3; ovary 3-loculed and calyx adherent to it: fr. a 3-winged caps.; seeds winged.—The great subterranean tubers of some species are eaten in the manner of potatoes. Some of the kinds have handsome colored foliage and are good glasshouse subjects. Numbers of species are more or less cult. in different warm countries (see, for example, Paillieux & Bois, "Le Potager d'un Curieux," and for Japanese species Georgeson, A.G. 13:80); but it is not known that many of them have appeared in the U. S. The tuber-bearing species need to be worked over thoroughly from living plants. For an inquiry into the prehistoric cult. of dioscoreas in Amer., see Gray & Trumbull, Amer. Journ. Sci. 25:250.

All the species are of very easy cultivation from seeds or tubers or cuttings. The tubers keep a long time, like potatoes.

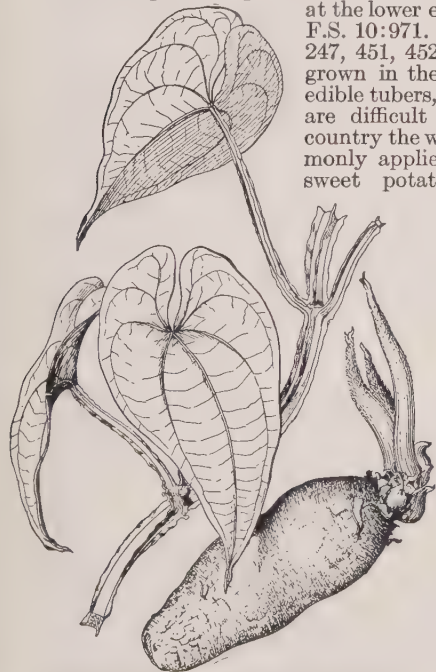
*A. Sts. strongly winged.*

**alata**, Linn. Fig. 1269. St. 4-winged or angular: lvs. opposite, cordate-oblong, or cordate-ovate, with a deep, basal sinus, glabrous, devoid of pellucid dots, 7-nerved (sometimes 9-nerved), with the outer pair united: staminate spikes compound, special ones whorled, short, flexuose; pistillate spikes simple; fls. distant, anthers subglobose, about as long as the filament: caps. leathery, elliptical. India and the South Sea Isls.—Widely cult. in the tropics under many vernacular names. Tubers reach a length of 6–8 ft., and sometimes weigh 100 lbs.; edible. The roots continue to grow for years. Variable.

*AA. Sts. terete (cylindrical).*

*B. Lvs. plain green.*

**Batatas**, Decne. (*D. divaricata*, Auth., not Blanco). **YAM. CHINESE YAM. CHINESE POTATO. CINNAMON-VINE.** Tall climbing (10–30 ft.), the lvs. 7–9-ribbed, cordate-ovate and shining, short-petioled, bearing small clusters of cinnamon-scented white fls. in the axils: root-tubers deep in the ground, 2–3 ft. long, usually larger at the lower end. Philippines. F.S. 10:971. R.H. 1854, pp. 247, 451, 452.—This is often grown in the tropics for its edible tubers, which, however, are difficult to dig. In this country the word yam is commonly applied to a tribe of sweet potatoes (see *Sweet Potato*). The yam is hardy. The root will remain in the ground over winter in New York, and send up handsome tall twining shoots in the spring. The plant bears little tubers in the lf.-axils, and these are usually planted to produce the cinnamon vine; but it is not until the second year that plants grown from these tubercles pro-



1269. *Dioscorea alata*, showing foliage ( $\times \frac{1}{3}$ ) and a small tuber.

duce the large or full-grown yams. A form with short and potato-like tubers is *D. Decaisneana*, Carr. (R.H. 1865:110).—A vine widely cult. since 1910 under the name "air potato" or "giant yam vine" has large potato-shaped bitter tubers. Its identity is in doubt. It is not *D. divaricata*, under which name it was intro. from Hawaii, nor *D. bulbifera*, which has angular and edible aerial tubers. In order to distin-



1270. Air potato.—Aerial tuber of *Dioscorea bulbifera*. ( $\times \frac{1}{4}$ )

guish it from the latter, it has recently been called the "Hawaiian bitter yam." The yampi is apparently a form of *D. alata*. This and other forms of this species are grown in Fla. and La., for the excellent edible tubers, which compare favorably with the potato.

**bulbifera**, Linn. **AIR POTATO.** Fig. 1270. Tall-climbing: lvs. alternate, cordate-ovate and cuspidate, 7–9-nerved, the stalks longer than the blade: fls. in long, lax, drooping, axillary racemes. Trop. Asia. G.C. III. 52:313.—Somewhat cult. S. as an oddity and for the very large angular axillary tubers (which vary greatly in size and shape). These tubers sometimes weigh several pounds. They are palatable and potato-like in flavor. The root-tubers are usually small or even none.

*BB. Lvs. variously marked and colored, at least beneath (greenhouse "foliage plants").*

**discolor**, Hort. Lvs. large, cordate-ovate, cuspidate, with several shades of green, white-banded along the midrib and purplish beneath: fls. greenish and inconspicuous: root tuberous. S. Amer. Lowe 54. F.W. 1877:353.—Useful for the conservatory. Suggestive of *Cissus discolor*.

**multicolor**, Lind. & André. Probably only a form of the last: lvs. variously marked and blotched and veined with silvery white, red, green and salmon. S. Amer. I.H. 18:53.—Very decorative glasshouse plant of several well-marked forms (some of them under Latin names).

*D. villosa*, Linn., a native dioscorea, is offered. Bartlett has recently worked over the species native to the U. S. (Bull. 189, Bur. Pl. Ind., U. S. Dept. of Agric., 1910) and has recognized 5 species in the material formerly passing as *D. villosa*; and the name villosa itself he finds to be untenable because of the confusion attending it (a similar case lies with *D. sativa*, Linn., a name applied to oriental species). The 5 species are as follows: *D. quaternata*, Gmel. Rhizomes stout,  $\frac{1}{2}$  in. diam., straight or forked, with few or no lateral branches: sts. 3–8 ft. long, rigid and erect at base but requiring support above: lvs. mostly 5 and 6 at a node, alternate above, cordate, repand, green on both sides, glabrous: staminate fls. panicle, the clusters solitary in the axils; pistillate fls. few in the cluster: fr. variable,  $\frac{1}{2}$ –1  $\frac{1}{2}$  in. long. Woods and banks, N. C. to Fla., La., Mo. and Ark.—*D. glauca*, Muhl. Rhizomes  $\frac{1}{2}$  in. or more diam., often forked and with many short lateral branches (the source of the drug "dioscorea"): st. 3–10 ft. long, rigid and erect at base but requiring support above: lvs. in whorls of 5–7, the upper ones alternate, larger than in *D. quaternata* and less or not at all repand glabrous or hirtellous, glaucous at maturity: staminate infl. solitary in all axils, paniculate; pistillate infl. few-fld.: fr. to 1  $\frac{1}{4}$  in. long. Pa. southward along the mts. to S. C. and west to E. Mo.—*D. paniculata*, Michx. Rhizomes long and slender, simple or rarely forked, less than  $\frac{1}{2}$  in. diam., with a few short thinner laterals: st. 3–14 ft., flexuose, glabrous: lvs. all alternate or nearly so, pubescent beneath: staminate infl. solitary in the upper axils; pistillate infl. densely many-fruited: fr. less than 1 in. Var. *glabrifolia*, Bartlett, has glabrous lvs. Mass. to Minn., south to Texas in the middle region.—*D. hirticaulis*, Bartlett. Rhizome less than  $\frac{1}{2}$  in. diam., simple or rarely forked, nearly

straight, with short thin laterals: st. 3-10 ft., weak and flexuose, pubescent: lvs. all alternate (except perhaps at lowest node), grayish pubescent: staminate infl. solitary in upper axils, the upper ones paniculate; pistillate infl. with 1-4 frs., which are nearly 1 in. long. Carolinas and Ga.—*D. floridana*, Bartlett. Rhizomes undescribed: st. flexuose and twining; lvs. alternate, wholly glabrous, green above and paler beneath: staminate infl. paniculate, in the upper axils and also terminal; pistillate infl. solitary, 5-7-fld.; fr. similar to those of *D. paniculata*, nearly 1 in. long, S. C. to Fla.

Of the many names appearing in horticultural literature, the following are recent: *D. argyrea*, Hort. Lvs. with silver-gray angular patches along the main nerves. Colombia. Probably one of the *D. discolor*-multicolor group.—*D. bicolor*, Hort. Greenhouse climber, with ovate and cordate lvs., variegated above and deep purple beneath. G.W. 13, p. 254. Perhaps a garden form of some species, although there is a *D. bicolor*, Prain & Burkill described in a Bengal Journal.—*D. Fargesii*, Franch. Twining, with spherical aerial tubers: lvs. of 3-5 parts or lfts., ternate or digitate, the parts oval or oval-lanceolate, more or less acuminate; female fls. in a very long cluster, sessile, subtended by lanceolate bracts; female fl. oblong, with 6 short segms.: subterranean tuber globular, said to be edible; plant produces aerial tubers. W. China. R.H. 1900, p. 685.—*D. globosa*, Roxbg. Cult. by Hindoos: tubers large, round and white; sts. 6-winged, prickly toward the root; lvs. sagittate-cordate, ensiform, 5-7-nerved, the long petiole 5-winged; staminate infl. long-pendulous and compound, and verticillate; pistillate infl. simple and erect in the axils, few-fld. India. This name is listed in Eu.—*D. illustrata*, Hort., appears in European lists: lvs. satiny green with a central band of gray, transverse lines of white, and gray patches, under surface purple. Brazil. Probably one of the *D. discolor* group.—*D. japonica*, Thunb. St. slender, climbing 10-12 ft.: lvs. ovate with tapering apex and deeply cordate base, with some of the axils bearing small oblong tubers or bulbels: pistillate fls. small, white, racemose near the top of the plant; fr. triangular, winged; root 3-4 ft. long, 1-2 in. diam., often branched. Japan. Cult. forms have thicker and more condensed roots, and are eaten after the manner of potatoes. Offered abroad.—*D. macrocarpa*, Harms. Lvs. simple, alternate, glabrous, stalked, cordate-ovate, 1 ft. each way, undulate, with an apical cusp  $1\frac{1}{2}$ -2 in. long; male fls. in a large panicle, the racemes reaching 2 ft., the fertile stamens 6 and very short. Upper Guinea (Trop. Afr.).—*D. retusa*, Mast. Sts. slender, much twining, finely pubescent; lvs. alternate, compound; lfts. 5, flat, few, in short-peduncled racemes; perianth-segms. oblong and connivent; fertile stamens 3 and staminodea 3. S. Afr. G.C. 1870: 1149. G.Z. 22, p. 242.

L. H. B.

**DIÓDMA** (Greek, *divine odor*). *Rutaceæ*. Small tender heath-like shrubs from southwestern Africa.

Leaves alternate or opposite, linear-acute, channeled, serrulate or sometimes ciliate, glandular

dotted: fls. white or reddish, terminal, subsolitary or corymbose, pedicellate; calyx 5-parted; hypogynous disk 5-sinuate, 5-plaited; petals 5; style short; stigma capitate: carpels 5.—Of the more than 200 species described, barely a dozen now remain in this genus, the others

being mostly referred to allied genera, especially *Adenandra*, *Agathosma* and *Barosma*.

The plant known to gardeners (and described by Linnæus) as *D. capitata* is now referred to *Audouinia capitata*, Brongn., which belongs in a different order (*Burseraceæ*) and even in a different subclass of the Dicotyledons (genus named for J. V. Audouin, born 1797, famous entomologist). It is a heath-like shrub 2-3 ft. high, with erect branches, and somewhat whorled, mostly clustered branchlets: lvs. spirally arranged, stalkless, overlapping, linear, 3-

angled, roughish, with 2 grooves beneath: fls. crimson (according to *Flora Capensis*), crowded into oblong spike-like, terminal heads. Generic characters are: calyx adhering to the ovary, 5-cleft, segms. large, overlapping; petals with a long, 2-keeled claw, and a spreading, roundish limb; stamens included; ovary half inferior, 3-celled, cells 2-ovuled; style 3-angled, with 3 small, papilla-like stigmas.—One species.

In America, *D. ericoides* is more or less well known, and is put to various uses in floral decorations, in sprays, or branchlets cut to the required length, and stuck in formal designs as a setting for other flowers in the same manner and for the same purpose as *Stevia* is used, to give that necessary grace and artistic effect to the whole. This species, like most of the genus, has an agreeable aromatic fragrance in the foliage. It is a strong grower, loose and heath-like in habit and foliage, as the specific name indicates; flowers white and small, one or more on the points of tiny branchlets. While diosmas undoubtedly do best in soil suitable for heaths, that is, soil composed largely of fibrous peat, they are not nearly so exacting in their requirements in this respect, and can be grown in good fibrous loam and leaf-mold in equal parts, with considerable clean sharp sand added thereto. The plants should be cut back rather severely after flowering to keep them low and bushy; this refers more particularly to the above species, other members of the genus being of more compact growth and needing very little corrective cutting to keep them in shape. *D. capitata* (properly *Audouinia capitata*) is a fine example of the latter class, and is much better than *D. ericoides* for exhibition and show purposes; flowers pinkish lilac, in corymbs. The propagation of diosmas by cuttings is similar to that of heaths, but much easier. The best material for cuttings is young wood. (Kenneth Finlayson.)

*ericoides*, Linn. Much-branched, 1-2 ft., leafy: branches and twigs quite glabrous: lvs. alternate, crowded, recurved-spreading, oblong, obtuse, keeled, pointless, glabrous: fls. terminal, 2-3 together, with very short pedicels; calyx-lobes ovate, obtuse; petals reddish, elliptic-oblong or obovate, obtuse, narrowed to a short claw, twice as long as the calyx; disk free and 5-lobed. B.M. 2332 under this name is in reality *D. vulgaris* var. *longifolia*. G. 33:501.

The plant cult. in Calif. as *Diosma purpurea* belongs to *Agathosma* (Greek, *good odor*), differing from *Diosma* chiefly in the presence of 5 stamens and in the 3 or 4 carpels; it is *A. villosa* Willd., a shrub about 1 ft. high with upright branches, spirally arranged upright and imbricate lvs. oblong-lanceolate, ciliate, pubescent beneath,  $\frac{1}{16}$ - $\frac{1}{8}$  in. long; fls. light purple, in dense terminal heads; pedicels unequal, at least the outer ones not exceeding the lvs. S. Afr. R.B. 5:369 (as *Diosma hirta*), H.I. 1:4. Another species sometimes cult. as *D. purpurea* is *Agathosma Ventenatiana*, Bartl. & Wendl. differing from the preceding species chiefly in the spreading lvs. and in nearly equal pedicels exceeding the lvs. L.B.C. 12:1122 (as *Diosma hirta*).

*D. fragrans*, Sims=*Adenandra fragrans*.—*D. vulgaris*, Schlecht., has narrower lvs. than *D. ericoides*, and they are acute: branchlets minutely pubescent: lvs. scattered, rarely opposite, linear, convex-carinate, subulate-acuminate: fls. corymbose, the petals white, or red on the outside: plant 1-2 or more ft. There are well-marked botanical varieties.

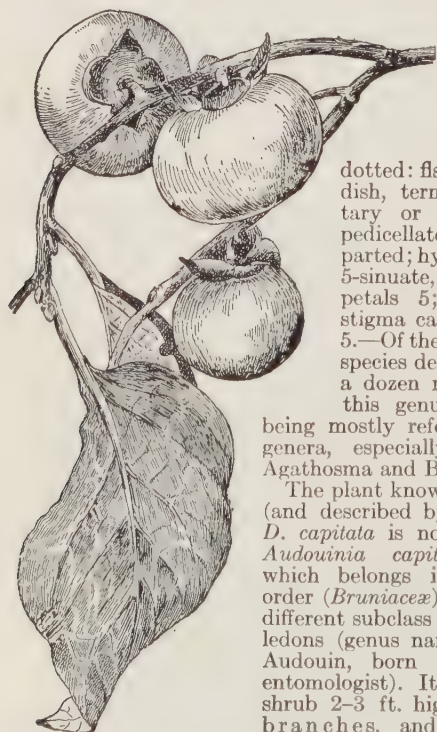
WILHELM MILLER.

L. H. B.†

**DIOSPÏROS** (*Dios*, Jove's, *pyros*, grain; alluding to its edible fruit). *Ebenaceæ*. **PERSIMMON**. **EBONY**. Woody plants grown partly for the handsome foliage and partly for their edible fruits; some species are valuable timber trees.

Deciduous or evergreen trees or shrubs, with alternate, rarely opposite, entire lvs., without stipules: fls. dioecious or polygamous in few- or many-fld., axillary cymes, the pistillate often solitary, yellowish or whitish; calyx and corolla 3-7-, usually 4-lobed; stamens usually 8-16, included; styles 2-6; ovary 4-12-celled: fr. a large, juicy berry, 1-10-seeded, bearing usually the enlarged calyx at the base; seed flat, rather large.—About 190 species in the tropics, few in colder climates.

The few cultivated species are ornamental trees,



1271. Native persimmon, *Diospyros virginiana*. ( $\times \frac{1}{4}$ )



with handsome lustrous foliage, rarely attacked by insects and with decorative and edible fruit. The only species which is tolerably hardy North is *D. virginiana*, while *D. Kaki*, much cultivated in Japan for its large edible fruits, is hardy only in the southern states. Most species have valuable hard and close-grained wood,



1272. *Diospyros Lotus*. ( $\times \frac{3}{8}$ )

and that of some tropical species is known as ebony. They thrive in almost any soil, but require, in cooler climates, sheltered and sunny positions. Propagated by seeds to be sown after maturity or stratified and sown in spring, and by cuttings of half-ripened wood or by layers; the tropical species by cuttings of mature wood in spring, with bottom heat; the fruit-bearing varieties are usually grafted or budded on seedling stock of *D. virginiana*. See *Persimmon*.

A. *Lvs. acuminate*.

B. *Fr.*  $\frac{1}{2}$ – $1\frac{1}{2}$  in. across, not ribbed: branches usually glabrous.

**virginiana**, Linn. COMMON PERSIMMON. Fig. 1271. Tree, to 50 ft., rarely to 100 ft., with round-topped head and spreading, often pendulous branches: lvs. ovate or elliptic, acuminate, shining above, glabrous at length or pubescent beneath, 3–6 in. long: fls. short-stalked, greenish yellow, staminate in 3's,  $\frac{1}{2}$  in. long, with 16 stamens; pistillate solitary, larger, with 4 2-lobed styles, connate at the base: fr. globose or obovate, plum-like, with the enlarged calyx at the base, 1– $1\frac{1}{2}$  in. diam., pale orange, often with red cheek, edible, varying in size, color and flavor. June. Conn. to Fla., west to Kans. and Texas. S.S. 6:252, 253. G.F. 8:265. Mn. 4:21. Gn. 57, p. 146. A.G. 11:651. V. 4:20. G.W. 16:230.

**Lôtus**, Linn. Fig. 1272. Round-headed tree, to 40 ft.: lvs. elliptic or oblong, acuminate, pubescent, often glabrous above at length, 3–5 in. long: fls. reddish white, staminate in 3's, with 16 stamens, pistillate solitary: fr. yellow at first, black when fully ripe, globular,  $\frac{1}{2}$ – $\frac{3}{4}$  in. diam., edible. June. W. Asia to China. A.G. 12:460. Gn. 32, p. 68. S.I.F. 1:79.

BB. *Fr.*  $1\frac{1}{2}$ –3 in. across, usually ribbed: branches with appressed brownish pubescence.

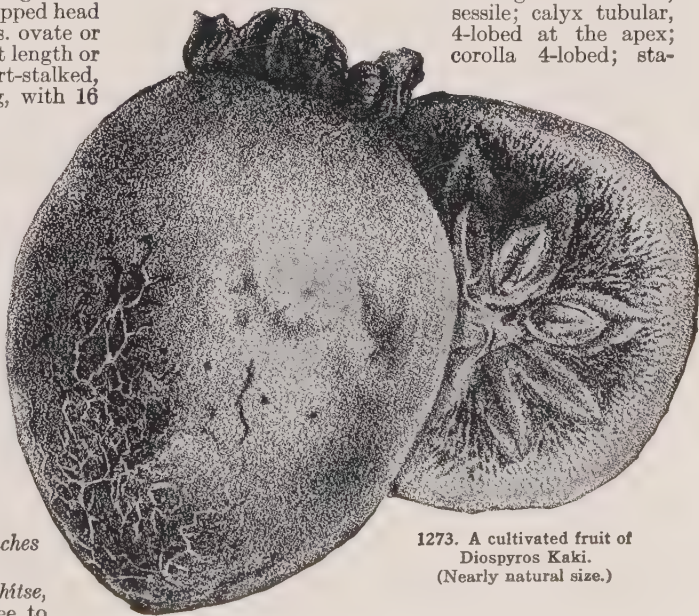
**Kâki**, Linn. f. (*D. chinensis*, Blume. *D. Schitse*, Bunge. *D. Roxburghii*, Carr.). Fig. 1273. Tree to

40 ft., with round head: lvs. ovate-elliptic, oblong-ovate or obovate, acuminate, subcoriaceous, glabrous and shining above, more or less pubescent beneath, 3–7 in. long: fls. yellowish white, staminate with 16–24 stamens, pistillate to  $\frac{3}{4}$  in. long; styles divided to the base, pubescent: fr. large,  $1\frac{1}{2}$ –3 in. across, very variable in shape and size, mostly resembling a tomato, orange or reddish. June. Japan, China. R.H. 1870, pp. 412, 413; 1872, pp. 254, 255. B.M. 8127. G.C. III. 41:22. Gn. 27, pp. 168, 169; 49, p. 171. M.D.G. 1909: 409. Var. **costata**, André. Fr. large, depressed, globular, orange-red, with 4 furrows. R.H. 1870:410, and p. 133. I.H. 18:78. G.C. II. 4:777; III. 9:171; 13:51. Gn. 49, p. 171. Var. **Mazélii**, Mouillef. Fr. orange-yellow, with 8 furrows. R.H. 1874:70. Other varieties are figured in R.H. 1872, p. 254; 1878:470; 1887:348; 1888:60. A.G. 12:331–8, 459–462.—A very desirable and beautiful fruit-bearing tree for the southern states, where a number of different varieties intro. from Japan are cult., but the hardier varieties from the north of Japan and China, which are likely to be hardy north to New England, seem hitherto not to have been intro. Fig. 1273 is from Georgeson's articles in A. G. 1891.—The plant cult. in Eu. as *D. chinensis*, which is apparently the same as *D. Roxburghii*, differs from the Japanese forms of Kaki, which usually have elliptic and glabrescent lvs., in the narrower usually oblong lvs. densely pubescent beneath, less so above, and in the greenish yellow subglobose fr.; it is tenderer than the common Kaki. It must not be confused with *D. sinensis*, Hemsl., an entirely different species from Cent. China, not in cult.

AA. *Lvs. obtuse or emarginate*.

**texana**, Scheele (*D. mexicana*, Scheele. *Brayodendron texanum*, Small). Small tree, intricately branched, rarely to 40 ft.: lvs. cuneate, oblong or obovate, pubescent below, 1–2 in. long: fls. with the lvs., pubescent, on branches of the previous year; calyx and corolla 5-lobed; staminate fls. with 16 stamens, pistillate with 4 pubescent styles connate at the base: fr. black,  $\frac{3}{4}$ –1 in. diam. Spring. Texas, New Mex. S.S. 6:254.

**tessellaria**, Poir. (*D. reticulata*, Willd.). Tree or shrub: lvs. coriaceous, oval or oblong, rounded at both ends, lustrous above, glabrous and reticulate below, 3–6 in. long: fls. clustered, sessile; calyx tubular, 4-lobed at the apex; corolla 4-lobed; sta-



1273. A cultivated fruit of *Diospyros Kaki*. (Nearly natural size.)

mens 12-13, glabrous; fr. ovoid, sericeous or glabrate.  $1\frac{1}{4}$ - $1\frac{1}{2}$  in. long, edible. Mauritius.—Yields the ebony of Mauritius. Cult. in S. Calif.

*D. armata*, Hemsl. Spiny tree, to 20 ft.: lvs. persistent, oval-oblong, obtuse, 1-2 in. long; staminate fls. in short panicles, creamy white, fragrant; fr. usually solitary,  $\frac{3}{4}$  in. across, Cent. China. Tender.—*D. Ebenaster*, Retz. The "guayabota" and "zapote negro," from Mex. and W. Indies, has been catalogued in S. Calif. It is a tall tree, with very sweet frs. the size of an orange, green outside and almost black inside; lvs. elliptic or oblong, usually obtuse, 3-12 in. long; fls. white, fragrant.—*D. Ebenum*, Koenig. Tree, to 50 ft.: lvs. elliptic-oblong, bluntly acuminate, glabrous; fls. white, staminate, in short racemes. E. Indies, Ceylon. For cult. in hothouses or tropical climates. This species is said to yield the best ebony.—*D. Morrisiana*, Hance. Evergreen shrub or small tree, glabrous; lvs. oval, obtusely acuminate, 2-3½ in. long; fls. whitish, drooping, on hairy stalks; fr. yellow, subglobose,  $\frac{1}{2}$ -¾ in. across. Hongkong, Formosa. The edible fr. ripens in Dec.—*D. utilis*, Hemsl. Evergreen large tree; branchlets silky-pubescent; lvs. oblong, short-petioled, glabrous above, whitish and silky-pubescent beneath, 5-8 in. long; fr. depressed-globose, pubescent, nearly 2 in. across. Formosa. The edible fr. is called Mao-shih.

ALFRED REHDER.

**DIOSTEA** (probably *two stones* or *seeds*). *Verbenaceae*. Once referred to *Baillonia*, but now kept distinct; closely allied to *Lippia*, but differing widely in habit, in the slender green branches, in the branchlets having very long internodes and being cylindric and hollow. *D. juncea*, Miers, of the Andes of Chile and Argentina, is a bush or small tree, with the long branches constricted when dry; lvs. opposite, 1 in. or less long, sessile, oblong or ovate-oblong, obtuse, crenate, rather fleshy; fls. small, pale lilac, in peduncled axillary or terminal spikes; corolla tubular, inflated above the middle, hairy inside, with 5 very short rounded spreading lobes; stamens 4, didynamous. B.M. 7695.

**DIOTIS** (*two-eared*, denoting the structure). *Compositae*. One cottony perennial on sea sands of Eu., sometimes planted in rock-gardens and for edgings. *D. candidissima*, Desf. (*D. maritima*, Smith). *COTTON-WEED*. Usually less than 1 ft. high, has hard sts. almost woody at base, arising from a creeping rootstock; lvs. alternate, oblong, entire or slightly toothed, about ½ in. long; fl.-heads nearly globular, ½ in. across, in dense terminal clusters, in Aug. and Sept. It is readily prop. by seeds or cuttings. *Diotis* is closely allied to *Achillea*, being distinguished by the florets being all tubular and having 2 ears at the base of the corolla which persist and inclose the achene.

**DIPCADI** (meaning uncertain). Including *Tricharis* and *Uropetalum*. *Liliaceae*. Tender bulbous scapose plants of minor importance, allied to *Galtonia*.

Leaves radical, thickish, narrowly linear: scape simple and leafless, bearing loose racemes of odd-colored fls.; perianth with a cylindrical tube, the lobes mostly equaling or exceeding the tube, the 3 exterior ones spreading or flaring and the 3 interior usually shorter and erect; stamens 6, on the throat of the perianth, the anthers linear and attached by the back; ovary sessile, ovoid or oblong, becoming a 3-sided dehiscent caps.: bulb tunicated.—About 50 species in S. Eu., Trop. and S. Afr. and India. During the winter, their resting time, the bulbs should be kept dry. A compost of light, sandy loam and leaf-mold has been recommended. Many species have been described in recent years from Trop. and S. Afr., and some of them may be expected to appear in the trade, and in lists of novelties.

A. *All perianth-segms. equally long.* (*Tricharis*.)

**serotinum**, Medikus. Lvs. 5-6, fleshy-herbaceous, glabrous, narrowly linear, 6-12 in. long, 2-3 lines wide near the base, channeled on the face; scape 4-12 in. long; raceme loose, 4-12-flid.; bracts lanceolate, 4-6 lines long, longer than the pedicels; perianth greenish brown, 5-6 lines long; ovary sessile or subsessile. S. Eu., N. Afr. B.M. 859 (as *Scilla serotina*).

AA. *Outer perianth-segms. longer than the inner and tailed.* (*Uropetalum*.)

**filamentosum**, Medikus (*D. viride*, Moench). Lvs. 5-6, fleshy-herbaceous, narrowly linear, glabrous, 1 ft. long,  $1\frac{1}{2}$ -3 lines wide near the base; scape 1-2 ft. high; raceme loose, 6-15-flid.; bracts linear-acuminate, 4-6 lines long; perianth green, 12-15 lines long, outer segms. 4-6 lines longer than the inner: caps. sessile or nearly so. S. Afr.

WILHELM MILLER.  
L. H. B.†

**DIPÉLTA** (Greek *dis*, twice, and *pelte*, shield; two of the floral bracts are shield-like). *Caprifoliaceae*. Ornamental deciduous shrubs, grown for their handsome pinkish or purple flowers.

Leaves opposite, short-petioled, entire or denticulate, without stipules; fls. solitary or in leafy few-flid. racemes, with 4 unequal conspicuous bracts at the base; calyx-lobes linear or lanceolate, 5; corolla tubular-campanulate, 2-lipped; stamens 4, inclosed; style slender, shorter than corolla; ovary inferior, elongated, 4-celled, 2 of the cells with 1 fertile ovule each and 2 cells with several sterile ovules; fr. a caps. inclosed by the enlarged, usually shield-like, bracts.—Four species in Cent. and W. Asia.

Dipeltas resemble diervillas in habit, with handsome pinkish or purple flowers in clusters along last year's branches; the flowers in shape are like those of a large-flowered abelia. *D. floribunda* has proved hardy at the Arnold Arboretum, while *D. ventricosa* seems to be somewhat tenderer. They are apparently not particular as to the soil. Propagation is by seeds sown in spring and probably, like *Abelia* and *Diervilla*, by greenwood and hardwood cuttings.

**floribunda**, Maxim. Shrub, to 15 ft.: lvs. ovate to lanceolate, acute or acuminate, rounded or narrowed at the base, entire, puberulous at first, soon glabrous, 2-4 in. long; fls. 1-6, on slender nodding pedicels, tubular-campanulate, pale rose, lower lip with orange marks,  $1\frac{1}{4}$  in. long; ovary inclosed by the 2 upper large shield-like bracts persisting on the fr. and  $\frac{3}{4}$ -1 in. across. May. Cent. China. B.M. 8310. G.C. III. 42:3. M.D.G. 1912:27.

**ventricosa**, Hemsl. Shrub, to 18 ft.: lvs. ovate-lanceolate to lanceolate, long-acuminate, usually rounded at the base, remotely glandular-denticulate, sparingly hairy above and villous along the veins beneath, 2-6 in. long; fls. 1-4 on drooping slender pedicels, campanulate, ventricose and scarcely tubular at the base, outside purple, whitish inside and marked with orange,  $1\frac{1}{4}$  in. long; ovary hidden by 2 large unequal auriculate bracts on the fr. about  $\frac{3}{4}$  in. across. May, June. W. China. B.M. 8294. G.C. III. 44:101.

*D. yunnanensis*, Franch. Allied to *D. ventricosa*. Lvs. entire; corolla distinctly tubular at the base. W. China. R.H. 1891, p. 246. Not yet intro.—*D. elegans*, Batal, is another handsome species not yet in cult.

ALFRED REHDER.

**DIPHYLLEIA** (Greek, *double leaf*). *Berberidaceae*. **UMBRELLA-LEAF**. An interesting hardy perennial herb, sometimes transferred to the wild-garden.

Plant with thick creeping jointed knotty rootstocks, sending up a huge peltate cut-lobed umbrella-like radical lf. on a stout stalk, and a flowering st. bearing 2 similar (but smaller and more 2-cleft) alternate lvs., which are peltate near one margin, and a terminal cyme of white fls.: sepals 6, fugacious; petals and stamens 6; ovules 5 or 6; berries globose, few-seeded. This is one of the genera having only 2 species, one of which is found in N. E. N. Amer., the other in E Asia or Japan, of which there are two others in this family.

**cymosa**, Michx. Root-lvs. 1-2 ft. across, 2-cleft, each division 5-7-lobed; lobes toothed: st. 1-4 ft. tall; berries blue. May. Wet or springy places in mountains from Va. to Ga. B.M. 1666.—Grows readily in dry soil under cult. but is dwarf.



**DIPHYSA** (*two bladders*, because of the structure of the pod). *Leguminosæ*. Shrubs or trees, usually glandular, with odd-pinnate lvs. and papilionaceous fls., of about 10 or 12 species in Mex., Cent. Amer., to Venezuela, rarely seen in cult. abroad in warmhouses: calyx with 5 unlike teeth, the 2 upper short; standard of the corolla orbicular, clawed, with 2 callosities inside; wings obovate or oblong or nearly lanceolate; keel as long as the wings or somewhat longer: fr. a stipitate more or less inflated pod: fls. yellow, in short racemes or fascicles. *D. carthagenensis*, Jacq., is a shrub or small unarmed tree, with 2-3-fld. axillary peduncles, and about 5 pairs of lfts. *D. floribunda*, Peyr., has been offered in S. Calif.: much-branching shrub: lvs. alternate; lfts. 7-13, elliptic or broad-oblong, the mid-nerve ending in a mucro: fls. yellow, in short secund racemes; standard strongly reflexed,  $\frac{1}{2}$  in. broad. S. Mex.

L. H. B.

**DÍPIDAX** (*double fountain*, from the pair of nectaries at the base of the perianth-segms.). *Liliacæ*. Two species in S. Afr., with tunicated corms, simple sts. and small whitish more or less tinted fls. in spikes, of little horticultural importance: perianth deciduous, polyphyllous; stamens 6, included; ovary sessile, 3-celled and 3-lobed, many-ovuled; styles 3, awl-shaped: fr. a turbinate 3-valved caps. *D. ciliata*, Baker. St. 6-12 in.: lvs. usually 3, ciliate, the lower 4-6 in. long and lanceolate-acuminate and the upper much shorter and amplexicaul: spike 2-6 in. long, densely many-fld.; fls. whitish more or less tinged red: there are several botanical vars., differing in lvs., number and color of fls. *D. triquetra*, Baker. St. 12-18 in.: lvs. 3 not ciliate, the lowest at base of st. and the upper near the spike (which is 1-6 in. long): fls. with numerous brown veins and 2 purple nectar-spots. B.M. 558 (as *Melanthium triquetrum*). The species are treated as greenhouse perennials.

**DÍPLACUS:** *Mimulus*.

**DIPLADÈNIA** (Greek, *double gland*, referring to the two glands at base of ovary, which distinguish this genus from *Echites*). *Apocynacæ*. A charming genus of greenhouse twiners (sometimes erect), mostly from Brazil.

Flowers large, showy, more or less funnel-shaped, having a remarkable range of color, rarely white or dark red, but especially rich in rosy shades and with throats often brilliantly colored with yellow; the buds, also, are charming; calyx 5-parted, the lobes lanceolate, with glands or scales in the inside; corolla without scales at the throat, the 5 lobes spreading, twisted in the bud; stamens 5, affixed in the top of the tube, included, the acuminate anthers connivent around the 5-lobed stigma; disk of 2 fleshy scales, alternating with the 2 distinct ovaries: fr. of 2 terete more or less spreading follicles.

Species 30-40, in Trop. S. Amer., woody (rarely herbaceous) and mostly at first erect but becoming scandent, the lvs. mostly opposite and entire and usually with bristles or glands at base; fls. usually in terminal or axillary racemes. The genus is fully as interesting as *Allamanda*, which belongs to

another tribe of the same family. Other allied genera of garden interest are *Echites*, *Odontadenia*, *Mandevilla* and *Urechites*. Some species are naturally erect bushes, at least when young, and many can be trained to the bush form. The group is a most tempting one to the hybridizer. Many names appear in European catalogues, but they are confused. Very many pictures are found in the European horticultural periodicals.

Of the twining glasshouse flowering subjects, dipladenias are amongst the best and ought to be in all collections of greenhouse plants. An erroneous idea is held by many that it is necessary to have a very high temperature to grow these plants successfully. This, however, is not the case. Except when started into active growth in the early spring, they do better in an intermediate temperature. Dipladenias have been known to live, and thrive well, after having been subjected to 7° of frost. A good time of the year to secure cuttings of dipladenias is about February 1. At that time they show signs of starting into growth and the weak wood should all be pruned back to the normal thickness of the stem. The thickest part of these prunings make good cuttings. Take a piece with two leaves attached, with about an inch of the stem under the leaves. Pot them singly in small pots, half filled with equal parts osmundine, broken up rather fine, sand, and charcoal. Fill the upper part of the pot with sand. Place the pots in a tight propagating bed, in a night-temperature of 70°. Allow the temperature to run up to 80° or more by day, but be sure and admit air several times during the day by opening up the case the plants are in for a few minutes. The cuttings will have the small pots filled with roots in about a month, when they may be shifted into larger pots. From now on, use for potting equal parts of osmundine, the fiber of loam out of which all the fine part has been shaken, sphagnum moss, sand and charcoal. When the plants reach a 6-inch pot, a sixth part of sheep-manure may be added and a sprinkling of chicken-bone. It is a good plan, provided one has a good sheltered border with a southern aspect, to plant small plants of dipladenia outdoors from June until the middle of September. It is astonishing how vigorously they start into growth and flower when potted after this treatment. Fifty-five degrees is a good night temperature to grow dipladenias in when possible. During the summer, if grown indoors, admit all the air that can be admitted day and night. They will stand the full sun under glass, but they do slightly better under a very light shade during the hotter part of the day, when the sun is shining. When the pots are filled with roots, and it is desired that they should remain in that pot for the rest of the season, feed with manure-water, a handful of cow-manure to a two-and-a-half-gallon watering-pot. The same amount to an equal quantity of water if a fertilizer such as "Clays" is used, is sufficient. Horse urine may also be used for a change, a 3-inch potful to two and one-half gallons of water. Be sure to water three times in between with clean water. Dipladenias show signs of completing their growth toward the end of November, at which time water should be gradually withheld, but never so as to allow the wood to shrivel. They may be treated in this manner until the end of January, when, as stated above, they will show signs of starting the season's growth. At this season they should have a general overhauling. Large plants should be turned out of their pots, and the loose dirt all washed out of them with a hose with a gentle pressure on it; and if possible repot in the same size of pot. After disturbing the roots in this manner, they are better to be placed for a few weeks in a temperature of not less than 65°. When they have gripped the new soil, they do better in 55° night temperature. Give each break a piece of thread attached from the plant to the roof to climb on until they set flower. A few breaks, near the highest part of the plant, will



1274. *Dipladenia atropurpurea*. (×  $\frac{1}{2}$ )

start climbing ahead of the others, and after they show a flower-stem pinch the shoot immediately ahead of the flower. This will encourage the belated breaks to start and catch up to these leaders. When they have all set flower, they may be trained evenly over a globe trellis if they are desired for a specimen plant. By the above treatment ninety-five open flowers, all at one time, have been secured on a plant in a 12-inch pot. Dipladenias are subject to mealy-bug, scale, thrips, and red-spider. Fumigate with hydrocyanic gas during the cold months, and syringe regularly and thoroughly during the summer, and these pests will give no trouble. (George F. Stewart.)

A. Fls. white; throat yellow inside.

**boliviensis**, Hook. Plant everywhere glabrous: st. slender: lvs. petioled, 2-3½ in. long, acuminate, acute at base,



1275. *Dipladenia splendens*. (×¼)

bright green and glossy above, pale beneath; stipules none: racemes axillary, 3-4-fld.; peduncles much shorter than the lvs., about as long as petioles and pedicels; bracts minute at the base of the twisted pedicels; calyx-lobes ovate, acuminate, 3 lines long; corolla almost salver-shaped, tube and throat slender and cylindrical, the former ½ in. long, the latter twice as long and half as broad again; limb 1½ in. across; lobes broadly ovate, more acuminate than in *D. atropurpurea*. Bolivia. B. M. 5783. Gn. 44: 140. Gng. 7:342.

AA. Fls. dark purple.

**atropurpurea**, DC. (*D. Marie Henriette*, Hort.). Fig. 1274. Glabrous: lvs. ovate-

acute, about 2 in. long, acute at the very base: racemes axillary, 2-fld.; peduncles a little longer than the lvs.; pedicels twisted, bracted; calyx-lobes lanceolate-acuminate, a little shorter than the pedicel, and a third as long as the cylindrical part of the corolla (of which the tube is about 2 in. long); corolla dark purple inside and out, tube funnel-shaped above the middle; lobes triangular, wavy, spreading, shorter than the dilated part of the tube. Brazil. B.R. 29:27 (as *Echites*). Gn. 44:488. I.H. 42:33. Gt. 43, p. 548. Var. *Clárkei*, Hort. Lvs. rather small: fl. deep crimson shaded velvet-black, about 2½ in. across, the tube paler. Gn. W. 8:661.—*D. atropurpurea* is a handsome species, but considered to be a shy bloomer.

AAA. Fls. rose; throat deep rose or purple within, whitish outside.

**spléndens**, DC. (*Echites splendens*, Hook.). Fig. 1275. St. glabrous, the branches terete: lvs. subsessile, 4-8 in. long, elliptic-acuminate, cordate at the base, wavy, pubescent, especially beneath, veins elevated, numerous: racemes axillary, longer than the lvs., 4-6-fld.; calyx-lobes red-tipped, awl-shaped, as long as the cylindrical part of the corolla-tube, which is half the length of the funnel-shaped portion; limb flat, 4 in. across, the lobes rotund, subacute, almost as long

as the tube; corolla-tube 1½ in. long, white outside, lobes rosy, throat deeper, almost purple. Brazil. B.M. 3976. F.S. 1:34 shows a yellow-throated form. Var. **profusa**, Rod. (*D. profusa*, Hort.), has larger and brighter rosy fls., lined with yellow inside, the outside of the tube rosy except at the base, which is yellow. J.H. III. 57:277. I.H. 30:491.—Intro. by B. S. Williams. *D. amabilis*, Hort., is said to be a hybrid of *D. crassinoda* and *D. splendens*. Lvs. short-stalked, oblong, acute: fls. rosy crimson, 4-5 in. across; corolla-lobes very round and stiff. Gn. 51, p. 227. G. 12:89; 14:461. I.H. 27:396, shows a 12-fld. raceme with exceptionally bright red fls.

AAAA. Fls. salmon-colored; throat yellow inside and out.

**urophýlla**, Hook. Glabrous erect bush, not a vine: branches numerous, swollen at the joints: lvs. ovate-oblong, obtuse at the base, suddenly narrowed at the apex into a narrow point ¾ in. long; peduncles long, drooping, flexuose; racemes axillary, 4-6-fld.; calyx-segms. awl-shaped; corolla dull yellow outside, deeper and brighter yellow within; tube cylindrical in lower third, then swelling into an almost bell-shaped throat; lobes of the limb salmon inclined to purple, acute. Brazil. B.M. 4414. P.M. 16:66. F.S. 5:425.

*D. amena*, Moore. Free-flowering, with good foliage: lvs. oblong-acuminate: fls. pink tinted with rose; corolla-lobes rounded and not reflexed. Of garden origin (*D. splendens* × *D. amabilis*); offered abroad. F. 1868:73. G. 6:391; 11:43.—*D. Brearleyana*, Hort. Lvs. oblong, acute, dark green: fls. pink at first, changing to rich crimson, very large. Gn. 51, p. 226. F.W. 1875:161. G. 8:92; 12:703. Probably a form of *Odontadenia speciosa*.—*D. carissima*, Hort. Fls. very large (about 5 in. diam.), delicate pink lined with bright rose. Garder origin. G.Z. 27, p. 49.—*D. crassinoda*, DC. Glabrous: st. much knotted, with many nodes: lvs. lanceolate, acute or almost acuminate, acute at the base, shining and leathery on both sides: racemes axillary, about 6-fld.; calyx-lobes lanceolate, acuminate, a little shorter than the cylindrical part of the corolla-tube, 2 or 3 times shorter than the pedicel; corolla-tube bell-shaped above the middle; lobes obovate-orbicular. Brazil. The above is the original description by De Candolle, who adds that the lvs. are 3-3½ in. long, ¾-1 in. wide; petiole 2-3 lines long; stipules interpetiolar, with 4 short cuspidate teeth. The plant pictured in B.R. 30:64 was renamed *D. Lindleyi* by Lemaire chiefly for its pilose st. and stellate-lobed stipules. Later authorities refer B.R. 30:64 to *D. Martiana*. F.S. 22:2310 may be the same plant as B.R. 30:64, but with variable lvs. and stipules. The plant was prized for its delicate colors, being white at first, then shot with soft rose like a flame tulip, and finally a deep rose. Only 1 fl. in a raceme was open at a time, and each lasted 8 or 9 days; throat orange inside.—*D. extima*, Hemsl. Very slender, twining, nearly glabrous, the st. rose-red: lvs. opposite, very short-stalked, 1-1½ in. long, orbicular-ovate to elliptic: fls. 6-8 in a cyme, 2½-3 in. across, rose-colored, the tube nearly 2 in. long, corolla-lobes orbicular and obtusely cuspidate. Probably Brazil. B.M. 7720.—*D. Java*, Hook. Fls. size and color of common yellow allamanda; climbing: lvs. opposite, short-stalked, ovate to elliptic: fls. 4-6 in a lax cyme, yellow, the tube very hairy on the outside and suddenly enlarged above. Colombia. B.M. 4702. J.F. 4:373. See *Urechites*, to which this is properly referred.—*D. Harrisii*, Hook. = *Odontadenia speciosa*.—*D. hybrida*. Lvs. large, stout, bright green: fls. flaming crimson-red. Garden form. G. 32:647.—*D. illustris*, DC. Glabrous or pubescent: lvs. oblong or rotund, obtuse or nearly acute, rounded or subcordate at the base, many-nerved; stipules none; petiole short: racemes terminal, 4-8-fld.; fls. rosy, throat yellow inside, purple at the mouth; corolla-tube cylindrical to the middle, then funnel-shaped; limb 3-3½ in. across, lobes rosy, orbicular-ovate, obtuse. Brazil. F.S. 3:256. Var. *glabra*, Muell. Arg. B.M. 7156.—*D. insignis*, Hort. Stout-growing: foliage strong: fls. rosy purple. Of garden origin. R.H. 1904, p. 419. G.Z. 16:145.—*D. pastorum*, Mart., var. *tenuifolia*, Hook. f. A very slender tuberous-rooted glabrous twining herb with very narrow (½ in. or less broad) lvs. 2-3 in. long, and rose-colored fls. 1½ in. across and bearing a golden 5-cleft ring at the throat. Brazil. B.M. 7725.—*D. Sánderti*, Hemsl., has flesh-colored, fls. with throat yellow inside, and outside at the base, has smaller lvs. than *D. illustris*, and no circle of purple at the mouth of the fl. Gn. 51:226.

WILHELM MILLER.

L. H. B.†

**DIPLARRHENA** (Greek, *two anthers*; the third being imperfect). *Iridaceæ*. Tender rhizomatous plants from Australia and Tasmania, with white and variegated flowers. Herbs: rhizome short: sts. erect, simple or somewhat branched: lvs. mostly radical, narrow, rigid, acuminate, equitant: spathe terminal, rigid, acuminate; perianth without any tube above the ovary; segms. unequal, inner ones shorter, connivent; upper stamen imperfect; fls. usually more than 1 to a spathe, not lasting.



**Moræa**, Labill. Sts.  $1\frac{1}{2}$ –2 ft. long, with a single terminal cluster, and several sheathing bracts: lvs. 6–8 in a tuft,  $1\frac{1}{2}$  ft. long,  $\frac{1}{4}$ – $\frac{1}{2}$  in. wide: spathes cylindrical, 2–3-fld., 2 in. long; fls. whitish: caps. 1 in. long. New S. Wales, Victoria, and Tasmania. This species has been offered. The only other species is *D. latifolia*, Benth. (*D. Moræa* var. *latifolia*, Baker), from Tasmania, with longer and broader lvs. (nearly 1 in. wide), longer spathes which are 5–6-fld., and fls. variegated with lilac and yellow.

L. H. B.

**DIPLAZIUM** (Greek, doubled). *Polypodiaceæ*. Rather large, coarse ferns, of greenhouse culture.

Allied to *Asplenium*, but with the indusia often double, extending along both sides of some of the free veins. The dividing line between *Diplazium* and *Asplenium* is technical. In general appearance and in cultural requirements, the two genera are practically identical.—Eighty or more species are found, mostly in the warmer portions of the world.

A. Lvs. simple.

**lanceum**, Presl. Lvs. 6–9 in. long,  $\frac{3}{4}$ –1 in. wide, narrowed upward and downward, the margin mostly entire; sori reaching nearer to the edge than the midrib. India, China, Japan.

AA. Lvs. pinnate, with the pinnae deeply lobed: rootstock not rising to form a trunk.

**arboreum**, Presl (*Asplenium arboreum*, Linn.). Lvs. 12–18 in. long, 6–8 in. wide, with a distinct auricle or lobe at the base. The habit is not arboreous, as originally supposed, and as the name would indicate; quite near the next, but less deeply cut. W. Indies and Venezuela.

**Shépherdii**, Link (*Asplenium Shépherdii*, Spreng.). Lvs. 12–18 in. long, 6–9 in. broad, deeply lobed, the lobes at the base sometimes reaching down to the rachis, somewhat toothed and often  $\frac{1}{4}$  in. broad; sori long-linear. Cuba and Mex. to Brazil.

AAA. Lvs. bipinnate: trunk somewhat arborescent.

**maximum**, C. Chr. (*D. latifolium*, Moore. *Asplenium latifolium*, Don). St. erect, somewhat arborescent: lvs. 3–4 ft. long, 12–18 in. wide, with about 12 pinnae on either side. India, China and the Philippines.

L. M. UNDERWOOD.

**DIPLOGLÓTTIS** (double-tongued, referring to the divided scale inside the petals). *Sapindaceæ*. Australian tree; one species: *D. australis*, Radlk. (*D. Cunninghamii*, Hook. f.), mentioned in recent horticultural literature. Lvs. large (1–2 ft. or more), pinnate, more or less villous; lfts. 8–12, oblong-elliptic to ovate-lanceolate, sometimes more than 1 ft. long; fls. greenish, many, in a large panicle; calyx deeply 5-lobed, small; petals about twice as long as calyx ( $\frac{1}{4}$  in.), 4, thin, orbicular, ciliate, about equaled by the 2 inner scales; stamens 8, exserted or included; ovary 3-celled, the style short and incurved, stigma entire or somewhat 3-lobed: fr. a nearly globular 3-valved caps., tomentose, about  $\frac{1}{2}$  in. diam. B.M. 4470 (as *Cupania Cunninghamii*).

**DIPLOLÈNA** (double cloak, in allusion to the double involucre). *Rutaceæ*. W. Australian tomentose shrubs, sometimes cult., but apparently not in American trade. Lvs. simple and entire, stalked, alternate: fls. red from the appearance of the many stamens in the terminal heads which are flower-like and short-peduncled or sessile and surrounded by an involucre of broad bracts in 3 or 4 series of which the inner ones are large and petal-like; calyx wanting; petals 5, small and narrow; disk small; stamens 10, much exserted, the filaments bearded; ovary 5-lobed, the styles united into 1: fr. 2-valved cocci, resulting from the division of the ovary.—About 4 species. *D. grandiflora*, Desf., 5–6 ft., with rigid spreading branches, the ovate or broad-oblong

very obtuse lvs. tomentose or hoary on both sides. *D. Dampieri*, Desf., distinguished chiefly by the lvs being green and smooth on the upper surface. B.M. 4059. B.R. 27:64. H.U. 5:42. L. H. B.

**DIPLOPAPPUS**: *Aster*.

**DIPLOSTÈPHIUM** (double crown or pappus). *Compósitæ*. This genus as now defined comprises upward of a dozen species in Venezuela, Colombia and to Peru, probably not in cult.; the *D. amygdalinum*, Cass., of gardens is *Aster umbellatus*, Mill., under Gray's treatment, and *Dœllingeria umbellata*, Nees, of some other authors. *Dœllingeria* differs from *Aster* proper in its double pappus, the inner bristles long and capillary and the outer short and rigid; involucre-bracts short and lacking herbaceous tips; heads corymbose or solitary; rays rather few, white or rose-tinged: lvs. veiny, not stiff. (Named for Th. Dœllinger, botanical explorer.)

*Aster umbellatus* is a stout plant (2–7 ft.) of low grounds from Newfoundland to Ga. and Ark., variable, and lower forms occurring: very leafy, with numerous crowded heads: lvs. lanceolate to oblong-lanceolate (to 6 in. long), tapering to both ends: involucre short; rays white. A good plant for the wild garden.

L. H. B.

**DIPLOTHÈMIUM** (Greek, double sheathed). *Palmaeæ*, tribe *Coccothææ*. Spineless pinnate palms, low or stemless, or often with ringed, stout, solitary or fascicled trunks.

Leaves terminal, pinnatisect; segms. crowded, lanceolate or ensiform, acuminate, glaucous or silvery beneath, margins recurved at the base, midnerve prominent; rachis 2-faced, strongly laterally compressed; petiole concave above; sheath fibrous, open: spadices erect, long or short-peduncled, strict, thickish; spathes 2, the lower coriaceous, the upper cymbiform, beaked, ventrally dehiscent; bracts short, coriaceous; fls. rather large, cream-colored or yellow, more showy than almost any other palm: fr. ovoid or obovoid, small.—Species 5. Brazil.

*Diplothemium* is a group of very handsome palms. In size the members of this genus seem to vary as much as those included in the *Cocos* group. *D. maritimum*, which is found along the coast of Brazil, is but 10 feet in height when fully developed. This genus is without spines, the leaves being pinnate, very dark green on the upper side and usually covered with white tomentum on the under side, the pinnae being clustered along the midrib in most instances. In a very young plant of this genus the ultimate character is not at all apparent from the fact that the seedling plants have undivided or simple leaves, this characteristic frequently obtaining in the case of *D. caudescens* until the plant is strong enough to produce leaves 4 or 5 feet long or about one and one-half years from germination. Frequently the plant bears both sorts of leaves while young. A warm greenhouse, rich soil and a plentiful supply of water are among the chief requisites for the successful culture of *diplothemiums*. *D. caudescens* is the best known of the genus, and when space may be had for its free development it is one of the handsomest palms in cultivation. See G.C. II. 24:394 for horticultural account of the group.

**caudescens**, Mart. (*Cerôxylon niveum*, Hort.). WAX-PALM. St. 12–20 ft. high, 10–12 in. thick, remotely ringed, often swollen at the middle: lvs. 9–12 ft., short-petioled; segms. 70–90 on each side, ensiform, densely waxy white below, the middle ones 24–28 in. long,  $1\frac{1}{4}$  in. wide, the upper and lower ones shorter and narrower, all obtuse at the apex. Brazil. R.H. 1876, p. 235.

*D. littorale*, Mart. A small graceful palm with finely dissected lvs. and very bright yellow fl.-clusters making it attractive during the spring months. B.M. 4861.—Hardly in cult. in Amer.

JARED G. SMITH.  
N. TAYLOR.†

**DÍPSACUS** (*to thirst*, from the Greek, because the bases of the connate lvs. in some species hold water). *Dipsacaceæ*. TEASEL. Stout tall biennial or perennial herbs of the Old World, two or three of which are weeds; and one of them is cultivated for fuller's teasels.

The plants are prickly or rough-hairy: lvs. opposite, entire, toothed or pinnatifid: fls. small and in dense heads, like those of compositous plants, but the anthers are not united (or syngenesious) as they are in the Compositæ; blue or lilac; involucre-bracts and scales of receptacle sharp or spine-pointed. There are a dozen or more species in Eu., N. Afr. to Abyssinia, and Asia. *D. sylvestris*, Huds., is an intro. weed along roadsides in the northeastern states and Ohio Valley. It is biennial, the st. arising the second year and reaching a height of 5 or 6 ft. It is said to be a good bee plant. Lvs. lance-oblong, toothed and more or less prickly on the margin. The dead stiff stalks of this teasel are conspicuous winter objects in the E. U. S., where it has run wild extensively. *D. laciniatus*, Linn., has been found wild in the U. S.: lvs. pinnatifid or bipinnatifid, ciliate. The fuller's teasel, *D. fullonum*, Linn. (Fig. 1276), is probably derived from the first, and differs from it chiefly in the very strong and hooked floral scales. These scales give the head its value for the teasing or raising the nap on woollen cloth, for which no machinery is so efficient. This plant is grown commercially in a limited area in Cent. N. Y.; see Cyclo. Amer. Agric., Vol. II, p. 636.

L. H. B.

**DIPTERÒNIA** (Greek *dis*, twice and *pteron* wing: the fruit consists of two winged carpels). *Aceraceæ*. Ornamental deciduous tree with handsome large pinnate foliage.

Leaves opposite, petioled, odd-pinnate, with 9-15 serrate lfts.: fls. polygamous, small, in large terminal panicles; sepals 5, longer than the short and broad petals; staminate fls. with usually 8 stamens and a rudimentary ovary in the center; pistillate fls. with a 2-celled compressed ovary; style cylindric with 2 slender recurved stigmas: fr. consisting of 2 1-seeded compressed nutlets connate only at the base and with the wing extending all around.—Two species in Cent. and S. W. China.

The species in cultivation is a small tree with handsome foliage, insignificant flowers, but conspicuous winged fruits in large panicles. It is apparently not hardy North. It grows well in any good soil. Propagation is by seeds.

**sinénsis**, Oliver. Tree, to 30 ft.: lvs.  $\frac{3}{4}$ -1½ ft. long; lfts. 9-15, short-petioled, the upper nearly sessile, the lowest pair sometimes 3-parted, ovate-lanceolate to lanceolate, long-acuminate, coarsely serrate, glabrous or sparingly hairy, 2-4 in. long; panicles loose, 6-12 in. long; fls. whitish, minute, slender-pedicelled: each carpel (samara) of the fr. broadly obovate or nearly orbicular, light brown, about 1 in. long, with the seed near the middle. June; fr. in Sept. Cent. China. J.H. S. 28:60. H.L. 19:1898.

ALFRED REHDER.

**DÍRCA** (*Dirke*, mythological name; also a spring near Thebes). *Thymelæaceæ*. LEATHERWOOD. Two North American small early-blooming shrubs, sometimes planted.

Bushes with tough fibrous bark, alternate, thin short entire petiolate deciduous lvs., apetalous perfect fls. in peduncled fascicles of the previous season's growth, the branches developing subsequently from the same nodes: calyx corolla-like, yellowish, campanulate, undulately obscurely 4-toothed, bearing twice as many exerted stamens as its lobes (usually 8); ovary nearly sessile, free, 1-loculed, with a single hanging ovule; style exerted, filiform: fr. berry-like, oval-oblong. The dircas often have the habit of miniature trees. The bark is of interlaced strong fibers, and branches are so tough and flexible that they may be bent into hoops and thongs without breaking, and were so used by the Indians and early settlers. The leatherwood is not one of the showiest of hardy shrubs, but its small yellowish fls. are abundant enough to make it attractive, and it deserves cult. especially for the earliness of its bloom in spring. It is of slow growth, and when planted singly makes a very shapely specimen; planted in masses or under shade it assumes a straggling habit. It thrives in any moist loam. Prop. by seeds, which are abundant and germinate readily; also by layers.

**palústris**, Linn. LEATHERWOOD. MOOSEWOOD. WICOPY. Fig. 1277. Two to 6 ft. high, with numerous branches having scars which make them appear as if jointed, at the beginning of each annual growth, and with yellow-brown glabrous twigs: lvs. oval or obovate, with obtuse apex, 2-3 in. long, green and smooth above, whitish and downy below, becoming smooth, the base of the petiole covering buds of the next season: fls. yellowish, abundant enough to be attractive, nearly sessile,  $\frac{1}{4}$  in. long, falling as the lvs. expand: fr. hidden by the abundant foliage, egg- or top-shaped,  $\frac{1}{2}$  in. long, reddish, or pale green. Woods and thickets, mostly in wet soil Canada to Fla. and Mo. B.R. 292.—Common.

*D. occidentális*, Gray. A similar species found on northerly slopes of cañons in Calif., differs mainly in the deeper calyx-lobes, lower insertion of the stamens, sessile fls., and white involucre; blooms Nov.-Feb. Not in the trade, but worthy of cult.

A. PHELPS WYMAN.

**DÍSA** (origin of name unknown). *Orchidaceæ*. Terrestrial orchids, mostly South African, of which several are known to fanciers, but only one of which is in the American trade.

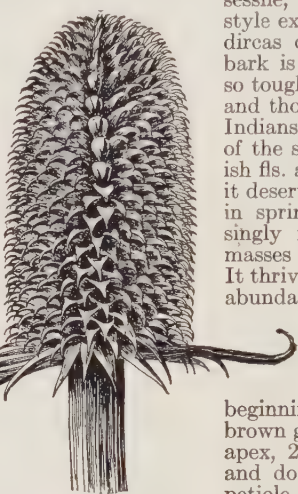
Sepals free, spreading, upper one galeate, produced in a horn or spur at the base; petals inconspicuous, small, adnate to the base of the column.—Sixty or more species. *D. grandiflora* is undoubtedly one of the most beautiful of known orchids, but as yet difficult to manage under artificial conditions.

**grandiflora**, Linn. FLOWER OF THE GODS. Root-stock tuberous: sts. 1 ft. or more high, unbranched: lvs. dark green: fls. several; upper sepal hood-like or galeate, 3 in. long, rose-color, with branching crimson veins; lateral sepals slightly shorter, brilliant carmine-red; petals and labellum orange, inconspicuous. S. Afr. B.M. 4073. G.C. II. 18:521; III. 9:365; 33:37. G.M. 54:608. Gt. 59, p. 374. J.H. III. 52:339. O.R. 6:241; 9:273; 20:336.

*D. crassicornis*, Lindl. Spike few-fl'd; lateral sepals oblong, the dorsal smaller; reflexed petals, and lip lan-



1277. Leatherwood—*Dirca palustris*. ( $\times \frac{1}{2}$ )



1276. Fuller's teasel—*Dipsacus fullonum*. ( $\times \frac{1}{2}$ )



ceolate. S. Afr. Gn. 73, p. 187.—*D. Elwesii*, Hort. A garden hybrid, probably between *D. kewensis* and *D. Veitchii*.—*D. equetris*, Reichb. f. Dorsal sepal funnel-shaped, pale blue; petals white. Rhodesia.—*D. erubescens*, Rendle. Fls. large and handsome, somewhat resembling *D. grandiflora* in color. Trop. Afr.—*D. kewensis*, Hort. Hybrid between *D. grandiflora* and *D. tripetaloides*. Spike few-fl.; fls.  $1\frac{1}{2}$  in. across; lateral sepals rosy pink, the dorsal paler, red-spotted; lip yellowish, crimson-spotted. Gt. 52:1510. O.R. 6:24; 9:273; 20:336.—*D. longicorym*, Linn. f. Plant  $\frac{1}{2}$  ft. high, producing a single fl. about  $\frac{1}{2}$  in. long resembling a light blue delphinium. S. Afr.—*D. lugens*, Bolus. Spike 10–15-fl.; fls. dull purple, the lip green, lacerated. S. Afr. B.M. 8415.—*D. Luna*, Hort. A garden hybrid between *D. racemosa* and *D. Veitchii*.—*D. pulchra*, Sond. Spike 6–12 in. long; fls. rose. S. Afr. G. 28; 201.—*D. racemosa*, Linn. f. Racemes 4–9-fl.; fls. deep rose-red, about  $1\frac{1}{2}$  in. across. S. Afr. B.M. 7021. J.H. III. 47:213.—*D. sagittalis*, Swartz. Fls. in a short raceme, about  $\frac{2}{3}$  in. long, pale lilac, the petals and lip red-streaked. S. Afr. B.M. 7403. G.C. III. 51:312.—*D. Veitchii*, Hort. Hybrid between *D. racemosa* and *D. grandiflora*. Fls. about  $2\frac{1}{2}$  in. across, rose-lilac. J.H. III. 43:145. C.O. 1. O.R. 6:241; 9:273; 20:336.—*D. venusta*, Bolus. A slender species with grass-like lvs. S. Afr.

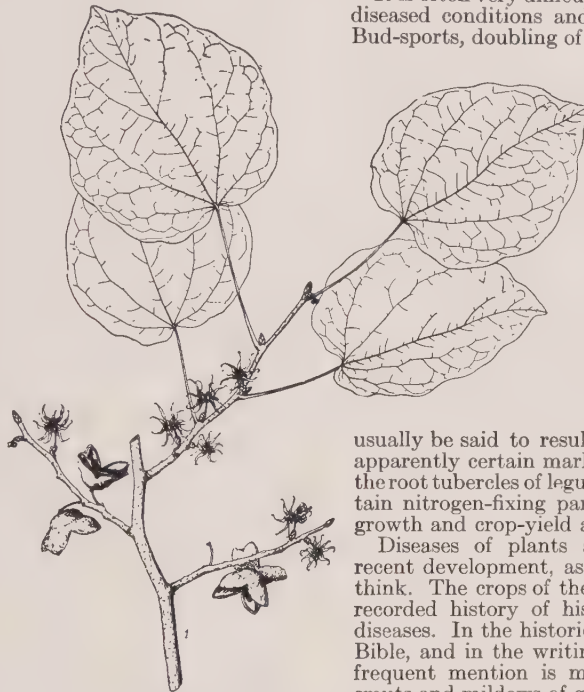
GEORGE V. NASH.†

**DISANTHUS** (Greek, *dis*, twice, and *anthos*, flower; the fls. being in 2-fl. heads). *Hamamelidaceæ*. Ornamental shrub, grown for its handsome foliage, assuming beautiful autumnal tints.

Deciduous, glabrous: lvs. alternate, long-petioled, entire, palmately veined: fls. perfect, axillary, in pairs on erect peduncles and connate back to back; calyx 5-parted; petals 5, spreading; stamens 5, shorter than sepals; ovary superior, with 2 short styles: fr. a dehiscent caps. with several black glossy seeds in each cell.—One species in Japan. Hardy ornamental shrub of elegant habit, with distinct, handsome foliage, turning to a beautiful claret-red or red and orange in fall. Prop. by seeds, germinating the second or third year, and by layers; possibly also by grafting on *Hamamelis*.

*cercidifolius*, Maxim. Fig. 1278. Shrub, to 10 ft., with slender branches: lvs. roundish-ovate, obtuse or acutish, truncate or cordate at the base, leathery at maturity, dark bluish green above, paler below, 2–4 in. long: fls. dark purple, about  $\frac{3}{4}$  in. across, with linear-lanceolate petals. Oct.: fr. ripens the following Oct. High Mountains of Cent. Japan. G.F. 6:215 (adapted in Fig. 1278). R.H. 1910:363. Demands a light peaty soil.

ALFRED REHDER.



1278. *Disanthus cercidifolius*. ( $\times \frac{1}{2}$ )

The reader now has before him a comprehensive survey of the subject. It is impossible, of course, to list all the plant diseases and all the insect pests in a compilation of this kind; but it is desired that the catalogues shall comprise the most important depredators of the leading horticultural plants. The reader should keep himself informed of the new knowledge and new practice by consulting current publications of the government and the experiment stations.

### Diseases of plants.

Disease in plants may be defined as any derangement or disorganization of the normal structure or physiological functions of the plant, as for example the formation of galls, cankers or distortions, rotting of plant parts, or disturbances in the sap system resulting in wilting, or in the nutritive processes resulting in such symptoms as dwarfing, chlorosis, and the like. Forms of plant diseases are shown in Figs. 1279–1292.

It is often very difficult to distinguish clearly between diseased conditions and abnormalities of other types. Bud-sports, doubling of blossoms, fasciations and many

other similar abnormalities, while often the result of reaction to some pathogen, are not apparently always so and they are often spoken of as teratological phenomena. While the reaction of plants to insect attacks in the formation of galls, cankers, and so on, is to be regarded as symptom of disease, the injuries produced by the mere eating away of parts of leaf, stem or fruit are not usually so to be regarded. Even here, however, it is often difficult to draw a sharp line of demarcation. While disease may

usually be said to result in ultimate injury, there are apparently certain marked exceptions, as in the case of the root tubercles of legumes caused by the attacks of certain nitrogen-fixing parasitic bacteria. Here increased growth and crop-yield are generally held to result.

Diseases of plants are not something new or of recent development, as the grower is often inclined to think. The crops of the husbandman, from the earliest recorded history of his art, have been afflicted with diseases. In the historical writings of the Hebrews, the Bible, and in the writings of the Greeks and Romans, frequent mention is made of such diseases as rusts, smuts and mildews of grain and canker of trees. To be sure, the extensive and intensive crop-cultivation of modern times, together with the extraordinary worldwide transportation and exchange of crop-products, have greatly favored the distribution of plant pathogens (insects, fungi and bacteria), and afford them exceptional opportunities for destructive development. Nor are cultivated plants alone subject to disease. Disease epidemics among weeds and the wild flowers of the woods may be observed any season in localities in which weather conditions especially favor the causal organisms.

The study of the nature and control of plant diseases, however, is of recent development. The first man really to study plant diseases from the true modern economic point of view, that is, with the object of helping the grower to understand and combat or control diseases in his crops, was Julius Kühn. This German, the son of a German land-owner and for many years himself the manager of a large agricultural estate, was the founder of an early German agricultural college. He interested himself, among other phases of agriculture, in plant diseases and their control and his

**DISEASES AND INSECTS.** Under one head it is thought best to bring together the discussions of the so-called enemies of plants,—the parasitic fungi and the depredating insects, together with the means of control. This composite article therefore comprises:

	Page
Diseases due to parasitic fungi.....	1021
Fungicides, or remedies for these diseases.....	1027
Catalogue of diseases, with advice.....	1029
Insects and their depredations on plants.....	1034
Insecticides and fumigation.....	1042
Catalogue of insect depredators, with advice.....	1047
Spraying.....	1057

book, "Die Krankheit der Kulturgewächse," published in 1858, is to be regarded as the first book of real economic importance on the subject of diseases in plants. In this remarkable volume is given a concise statement of the thoroughly digested and personally tested knowledge of his time, on the nature and control of plant diseases. He also describes a number of new methods, especially for seed treatment of cereals against smuts, which have become the foundation for many of our present-day practices.

Since Kühn's day there have been remarkable developments in the control of plant diseases. The discovery of bordeaux mixture by the Frenchman Millardet in 1882; the discovery of the formaldehyde treatment of seed for smut by the American plant pathologist, Arthur, in 1896; and the recent development of the use of lime-sulfur solutions and mixtures as a substitute for bordeaux in the spraying of apples and peaches, are but the most noteworthy of the many discoveries and developments in the remarkable growth of this economic science within the last half century.

The economic importance of plant diseases can scarcely be overestimated, as they constitute one of the chief losses in our agricultural resources. The loss from 5 to 25 per cent of many crops from diseases alone each year is so common as to be the general rule. The loss from potato diseases each season in the United States has been carefully estimated at not less than \$36,000,000. Yet, it has been conclusively demonstrated by extensive experiments among potato-growers during a continuous period of ten years, that an annual average increase of over forty bushels per acre may be expected from spraying the crop with bordeaux mixture, from three to five times in the season at a total average cost of about \$5 per acre. The loss from oat-smut commonly averages from 5 to 25 per cent of the crop, yet it may be absolutely prevented by seed treatment at almost insignificant cost. The loss from scab in the apple crop of New York State often totals not less than \$3,000,000 and for the United States a corresponding loss of over \$40,000,000. In 1900, the peach-growers of Georgia lost \$5,000,000 by brown rot, while the average annual loss from the same disease in the entire United States is never less. Yet in each case here mentioned, as well as in most of the other of our common and destructive diseases, cheap and effective means of control are within the reach of every grower.

The value and efficiency of these means have been established beyond doubt. Their profitable application requires only intelligence and practice on the part of the grower.

Symptoms of disease in plants are so varied in character as to make an attempt at wholly satisfactory grouping for practical purposes of doubtful value. Mention of some of the more common types, however, may be useful. The grower must learn by study and experience the more striking symptoms characteristic of those diseases peculiar to the crops that he grows.

Disease may be exhibited in malformations of the leaf, stem, root or fruit, as for example, knots, galls, tubercles, curling,

wrinkling or other distortions. There are such symptoms in crown-gall of trees, black-knot of plums and cherries and leaf-curl of the peach (Fig. 1279). Another type are cankers, dead sunken or roughened areas in the bark of trees or the outer rind of herbaceous



1280. Early blight of potato.

The leaf- or fruit-spot type is also very common. Brown or black spots appear in foliage or fruit. They may be brown dead or rotted areas, or spots due to the growth of the parasite on or under the surface. Bordeaux-injury spots on apple foliage, shot-hole leaf injury of stone fruits, leaf-spot of the currant (Fig. 1281), celery or alfalfa, the tar-spot of the maple, the black-spot of the rose and the apple-scab are of this type. Another not uncommon type is that exhibited in certain bacterial and fungous diseases, where the pathogen infects the sap-true regions of the stems or petioles, resulting in a sudden wilting of leaves and shoots. The wilt diseases of cotton, cucumber, ginseng, watermelon and cowpeas are characterized by this symptom. The yellowing of the foliage, either suffused or localized as spots, rings, and blotches and often accompanied by dwarfing and wrinkling of the affected organs is a common symptom of certain so-called physiological diseases like the peach yellows (Figs. 1282, 1283), little-peach, mosaic disease of tobacco, infectious chlorosis and nitrogen-poisoning of greenhouse cucumbers (Fig. 1284) and other plants.

#### *The causes of disease in plants.*

Etiology, or the cause of disease, has been more generally and carefully investigated than any other phase of the subject, so that we now know much regarding the agents primarily responsible for most plant diseases. These agents may be grouped as follows:

Slime molds, lowly organisms having characters of both plants and animals (see article *Fungi*). The club-root of cabbage, cauliflower and other crucifers, is the best known slime-mold disease.

Bacteria, microscopic unicellular plants which multiply very rapidly by simple fusion (see article *Fungi*). While most species are harmless scavengers of dead organic matter, and a few are known to cause diseases of men and animals, not less than 150 different diseases of plants are now known to be due to the attacks of parasitic bacteria. Some of the commonest bacterial diseases of plants are, fire-blight, crown-gall, olive-knot, soft-rot of vegetables, potato-scab, cucumber-wilt and black-leg of potatoes.

Fungi (see Vol. III) are perhaps responsible for far the greater number of the diseases of plants. They are the causal agents in such well-known diseases as apple-scab, brown-rot of plums and peaches (Fig. 1285), black-rot of grapes, (Fig. 1286) bitter-rot of apples, brown-rot of lemons, late blight of potatoes, peach-



1279. Effects of the leaf-curl fungus on peach foliage. ( $\times \frac{1}{2}$ )



leaf-curl, heart-rot and canker of trees, mildew of many plants, rusts and smuts of cereals (Figs. 1287, 1288, Kansas Experiment Station); in fact the mere enumeration of the more common fungous diseases of plants would fill many columns in this volume.

Algæ, low forms of green plants, most of them living in water or very damp places. Few are known to pro-



1281. Currant foliage attacked by the leaf-spot fungus. ( $\times \frac{1}{2}$ )

duce disease in plants. The red rust of tea is one of the best known algal diseases.

Parasitic angiosperms,—flowering plants, of which there is no inconsiderable number, causing more or less injury to the plants upon which they live. These parasites are usually markedly degenerate in one or more respects, as a result of their parasitism, being often without true roots, or without leaves and frequently without chlorophyll green. As examples we may mention the mistletoes, dodders and broom rapes.

Insects (see page 1034) cause such diseases as galls and similar malformations.

Nematode worms,—minute all but microscopic in size and multiplying rapidly, they constitute one of the greatest crop pests, especially in warm or tropical countries. They usually infest the roots, causing galls or swellings. Some species injure the plants by destroying the fine feeding roots as in the case of the nematode parasites of oats so destructive in certain countries of northern Europe. Over 400 different plants are known to be subject to the nematode root-gall disease. (See pp. 1041-2.)

Physiological disease is a term under which is included all those diseases the cause of which cannot be attributed to some parasitic organism. Their origin is variously attributed to abnormal enzymic activity, disturbed nutrition, and the like. The best-known of these are peach-yellows, chlorosis of the vine, tip-burn (Fig. 1291) mosaic disease of tobacco and leaf-roll disease of potatoes.

The various parasitic organisms cause disease in one of two ways, either by the secretion of toxins and enzymes which at once kill the plant tissues and change them into forms readily available as food for the invader; or the toxins and enzymes secreted merely stimulate or irritate the plant tissues in such a way as to result in abnormal tissue growth or diversion of the food substances of the host to the advantage of the parasite making its home between or in the cells of the host. Both types of disease-production have the same ultimate result, the serious injury or destruction of the infested plant, although the former is usually the more rapid and destructive. Of the first type, rots, blights and leaf-spots are the best examples, and are

characterized by the rapid death and destruction of the affected tissues; of the second type, galls, leaf-curls, rusts and smuts are good examples and are characterized by a rather long period of association of the parasite with the living tissues of its host before marked injury or death of the plant results.

The causal agent is usually associated with the tissues of the host, either the dead or living, during its entire cycle of development. The apple-scab pathogen, *Venturia inæqualis*, will serve admirably to illustrate. It passes the summer on the surface of leaf and fruit. In the autumn when the infested leaves fall to the ground, the fungus, which as a parasite has invaded only the cuticle of the leaf or fruit, now penetrates the dead tissues and develops there during the autumn the winter form of fruit bodies, the minute globose black perithecia, in which during the warm days of early spring the ascospores are rapidly developed. These ascospores (Fig. 1292), eight in a sac, ripen and are discharged by the spring rains that come during the blossoming period. The old leaves on the ground are filled with millions of these minute perithecia with many sacs of ascospores in each perithecium. The spores are shot into the air during the rain and being exceedingly light are carried to the opening leaves and forming fruits, where they germinate, sending out mycelial threads into the cuticle of leaf or fruit forming the characteristic dense dark green or black mats or crusts, the scab-spots. The leaves become crumpled and injured, the young fruits grow one-sided, or if the stem be attacked, soon drop from the tree, thus giving no set of fruit. On the scab-spots the conidia or summer spores cut off from the tips of upright branches in great numbers, are carried by the wind to other leaves and fruits where, with the next rain, they germinate and give rise to new scab-spots and more conidia.

The life-cycle as given for the apple-scab fungus is typical of many of the fungous pathogens of our crops. It must be remembered, however, that each pathogen has habits peculiar to itself; hence the necessity for the most careful study of each that we may know its habits and peculiarities and thus be able successfully to



1282. "Tip growth" of yellows.

Left-hand specimen shows two small-leaved tips appearing in October, two or three of the normal leaves still remaining near the top. The middle specimen shows numerous tips appearing in August. Right-hand specimen is a healthy twig, for comparison.



combat it. The following illustrations will serve to explain and impress this point.

*Plowrightia morbosa*, the fungus causing black-knot of plums and cherries, requires two seasons to complete its life-cycle. The first season there appears on the knots only conidia, followed the second season by a crop of ascospores, produced in perithecia, which form a black crust on the surface where the conidia were earlier produced. Other pathogens like *Exoascus cerasi*, the "witches broom" pathogen of the cherry, lives from year to year as mycelium in the branch and twigs of the broom-like growths it excites, producing each season a crop of spores on the under sides of the leaves. The blister-rust fungus of the white pine, *Cronartium ribicola*, also lives from season to season



1283. The tufted shoots of peach yellows.

in the tissues of the pine, producing each spring a new crop of spores. This pathogen exhibits another habit peculiar chiefly to certain of the rust fungi, namely that it has another stage or spore form on an entirely different host plant, in this case, the currant, especially the European black currant. The apple-rust pathogen, *Gymnosporangium macropus*, exhibits the same habit, passing the winter in galls formed on the twigs of the red cedar. In the spring spores appear on these galls, which germinating in situ give rise to other minute spore bodies, the sporidia. These sporidia are carried by the wind to the young apple leaves and fruit, giving rise there to the rust disease so destructive to certain varieties like the McIntosh and York Imperial. The spores formed on the rusted leaves and fruit of the apple are carried to the cedar, originating a new crop of galls and thus completing the life-cycle.

While some pathogens may develop in both living and dead tissues of their host, as we have seen in the

case of the apple-scab fungus, other pathogens like the rust organism just described or the potato-blight pathogen, *Phytophthora infestans*, require to be constantly associated with the living tissues of their host. The last-mentioned fungus passes the winter as mycelium in the tissues of diseased tubers, grows from thence up through the new shoots, slowly killing them and forming thereon the first crop of conidia, which, carried by the wind to nearby healthy plants, produce the primary infections of the season. The successive crops of conidia produced during the season on the blighted tops are washed into the soil by the rains, and their way to the newly formed tubers, and, infecting them, complete the seasonal cycle of the parasite.

Many fungous pathogens are now known to pass from one generation of the host plant to the next through the seed. The smut parasites of cereals afford remarkable examples of this habit. In the case of the oat-smut fungus, *Ustilago avenae*, the spores ripen as dusty black masses in the panicles of affected plants just as the healthy plants are in blossom. At this time the two hulls inclosing the grain are open. The wind-scattered spores lodge in the open flowers against the young kernel where they are soon safely housed by the closing hulls. They lie dormant along with the ripened seeds until they are planted. Then as the oat kernels germinate, the smut spores do likewise, sending forth their germ tubes which penetrate the young oat sprouts before they emerge from the hull. The mycelium grows along up through the growing oat straw, finally giving rise to the black spore masses in the unfolding panicle. In the case of stinking smut of wheat the seasonal life-cycle of the pathogen, *Tilletia tritici*, is much the same, except that the spores are disseminated at threshing time. Some very important differences in the habits of the loose smut pathogens of wheat, *Ustilago tritici* and of barley, *Ustilago nuda*, have recently been discovered (1902). The spores of these pathogens are also ripened and disseminated at blossoming time, but on falling within the open blossom they germinate at once, sending their germ-tubes into the tender young kernels. The affected kernels are apparently not injured but continue to develop and ripen. The mycelium of the pathogen within remains dormant until the seeds are planted and begin to grow, at which time the mycelium also becomes active. It grows out into the young shoots and up through the lengthening culms eventually to give rise to the black spore masses of the smutted heads. The bean anthracnose fungus, *Colletotrichum lindemuthianum*, is also carried over in the seed. Here the fungus in the black spots or cankers on the pods penetrates into the tender cotyledons of the seed within, goes into a dormant condition as the seed ripens, to become active again when the germinating seed lifts these cotyledons from the soil. A new crop of spores is produced, which, if the season be rainy, are splattered on to the stems and leaves of nearby healthy plants and the pathogen becomes established for another season.

While the wind is the most common disseminating agent of fungus spores, often carrying them for great distances, such agents as rain, flowing water, insects and even man himself, are frequently responsible. It is in the dissemination of bacterial pathogens, however, that insects most generally function. The dreaded fire-blight bacteria are disseminated only by insects or man. They pass the winter in a semi-active state in the half-living tissues along the margins of cankers on limbs or twigs, multiply rapidly with the rise of sap and the heat of spring. They ooze from the affected bark in sticky, milky drops. This ooze is visited by bees and flies, which with besmeared legs and mouthparts fly away to visit the opening apple or pear blossoms. Here they leave some of the bacteria in the nectar where they rapidly multiply, to be more widely distributed by each succeeding visitor. They soon pene-



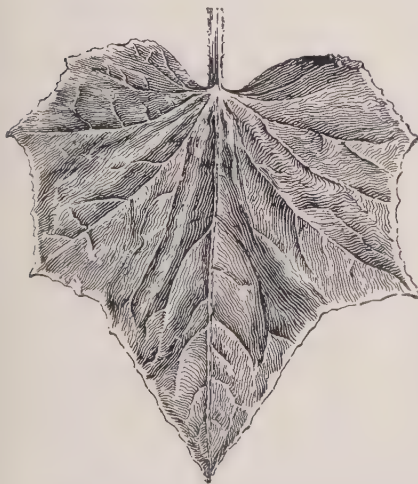
trate into the tender tissues of the blossom, causing the blossom blight. From these blighted blossoms, sucking insects like the aphids carry the bacteria to the tips of the rapidly growing shoots when in sucking sap they introduce the organisms and twig blight follows. The striped cucumber beetle is probably the chief disseminator of *Bacillus tracheiphilus*, which causes the cucumber-wilt.

#### *Ecological conditions as affecting disease.*

By ecology is meant the influence of such environmental factors as climate, weather, soil and fertilizers, on the disease, its severity, epidemic occurrence, and the like. These factors may influence the severity of the disease by their effect on either the pathogen or the host, or both. For example, most fungous parasites require the presence of water on the host plant in which their spores may germinate, hence severe epidemics of such diseases as potato-blight, apple-scab, brown-rot of stone fruits and black-rot of grapes usually appear in wet seasons. Moreover, the attacking pathogen is especially favored by wet weather at certain seasons or periods in its development, especially the infection period. Continued spring rains about blossoming time favor apple-scab and peach leaf-curl. Late summer rains bring with them epidemics of late blight of potatoes, brown-rot of peaches or late infections of apple-scab. Frequent or continuous rains during June and July in grape regions are usually accompanied by severe attacks of the black-rot pathogen. The relation of rainfall to the pathogen explains why, when there has been a severe epidemic the previous season, the crop may escape if the following season be dry. There is ever a critical period in the development of the pathogen, usually when it is passing from its resting or winter stage to the active vegetative period of the growing season. Moisture and temperature conditions at such periods largely determine whether the disease will be epidemic or not. Of course the necessary abundance of spores to be disseminated is an evident necessity. Favorable weather alone cannot bring on disease as the grower too often believes.

The absence of rains at certain stages in their development is for other pathogens equally essential. The loose smuts of cereals afford good examples. Their spores are powdery and wind-borne and if rains fall when they

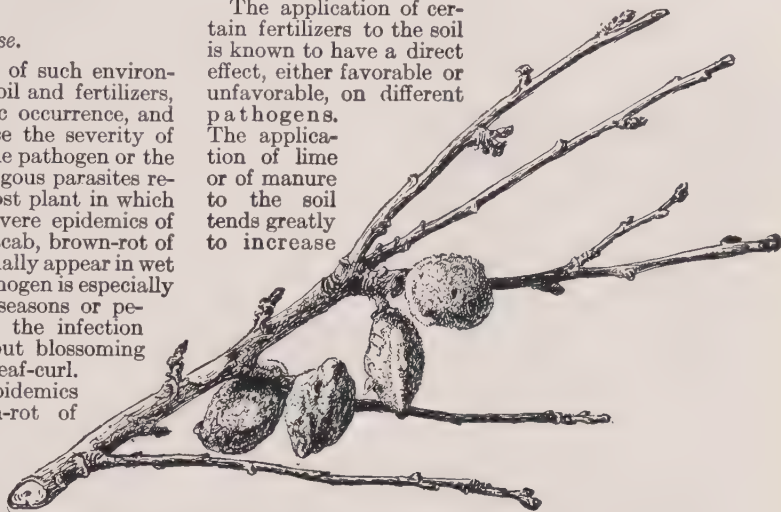
are being disseminated, they are washed to the ground and perish instead of finding their way into the open blossoms of their host. Thus, clear sunny weather during the blossoming period of wheat and oats one season usually means a more or less severe epidemic of smuts the next, while rains at this time, even though there be an abundance of the disease, may mean a clean crop the following year.



1284. Disease of cucumber leaf. The dying margin indicates that the trouble is due to some interference with the food supply. ( $\times \frac{1}{2}$ )

On the other hand, weather conditions may determine the severity or absence of certain diseases by its effect on the host. Long-continued cold rainy weather in the spring, especially following a warm spell, results in a slow succulent growth of the developing peach leaves, rendering them especially susceptible to the attacks of the leaf-curl pathogen.

The application of certain fertilizers to the soil is known to have a direct effect, either favorable or unfavorable, on different pathogens. The application of lime or of manure to the soil tends greatly to increase



1285. Peaches of last year's crop still hanging on the tree, attacked by monilia. The branch is dead from the effects of the fungus. ( $\times \frac{1}{2}$ )

the scab of potatoes planted thereon; while, on the other hand, liming the soil prevents infection of cabbage and cauliflower by the club-root pathogen. Lime likewise favors the development of the root-rot of tobacco and ginseng caused by *Thielavia basicola*, while applications of acid phosphate tend to prevent infection by this pathogen. The effect of fertilizers on the susceptibility of the host has also been shown to be marked in certain cases. Barley, when fertilized with nitrogenous manures, becomes very susceptible to attacks of the mildew *Erysiphe graminis*. Certain varieties of wheat have been observed in Denmark to suffer severely from attacks of the rust *Puccinia glumarum* only when nitrogenous manures are applied. Excessive applications of barnyard manure to greenhouse cucumbers often cause a physiological disease, the symptoms of which are a curling, and dying of the margins of the leaves, accompanied by marked chlorosis or yellowing. Fertilizers or late continued cultivation of pear trees, by lengthening the period of active twig-growth, favor fire-blight, the bacteria of which infect only tender actively growing tissues.

#### *Control of diseases.*

By the term control is meant the profitable reduction of the losses ordinarily sustained from a given disease. The absolute prevention of many plant diseases is either impossible or unprofitable.

There are four fundamental principles upon which all methods of plant-disease control are based, viz.: (1) *exclusion*, (2) *eradication*, (3) *protection* and (4) *immunization*. Upon the first two are based those measures which are directed primarily against the pathogen, upon the last two those which are directed merely toward the protection of the host from pathogens commonly present in the environment. The order in which these principles are here presented represent the logical, though unfortunately not the historical or usual order of their development and application. We will consider briefly under each some of the more important methods now employed for the control of plant diseases.

1. *Exclusion* measures are directed toward keeping disease organisms, usually insects, fungi and bacteria, out of areas, regions or countries in which they do not occur. This is commonly attempted by the passing of laws forbidding the importation of plants affected with

such parasites. As means of enforcing such regulations, some sort of inspection, either at port of entry or at point of destination, is provided. Inspection in the country from which they are exported is also often required. Absolute quarantine against all importation of certain plants from those countries in which dangerous diseases are known to occur is also being practised in some countries, as, for example, prohibit-

ing the importation of potatoes into the United States from those countries in which the black-scab is now known to occur. Exclusion measures, often undertaken when it is too late, are at best under present conditions of doubtful efficiency. Those interested in these methods of control should consult the various pest and disease acts of the different countries of the world. See *Inspection*, in Vol. III.

2. *Eradication*.—On the principle of eradication are based those measures which are directed to the elimination of pathogens already established. While absolute eradication is seldom to be effected, the pathogen may often be eliminated to such an extent as to reduce losses therefrom to a profitable minimum. In Denmark, the destruction of all barberry bushes, the alternate host of the grain-rust fungus, *Puccinia graminis*, has decidedly reduced the severity of this disease in recent years. The careful eradication of all diseased plants is often quite effective even in a small area, like a raspberry or blackberry plantation suffering from the red rust. Here the mycelium of the pathogen lives from year to year in the roots of diseased plants, which each spring send up diseased shoots. On the under side of the leaves of these shoots, the orange-red spores are produced in great abundance, and serve to spread the pathogen to healthy plants. As diseased plants are readily detected in early spring by the pale clustered shoots, they may be removed before spores appear and the pathogen thus eradicated. The black-knot of plums and cherries is most readily and profitably controlled in a similar manner, the knot-affected limbs and twigs being cut out and burned early in the spring before spores appear. The

fire-blight of pears is to be controlled only by systematic eradication, first of all cankers in autumn or early spring, then of all blossom blight as fast as it appears and later of the affected twigs when twig-blight comes on. To be effective, the trees must be inspected two or three times each week throughout the growing season and all diseased parts removed *at once* as soon as discovered.

Another method of eradication especially applicable to seeds, tubers or bulbs, on which spores of the pathogen pass the dormant period, is disinfection. This is accomplished by the application of chemical poisons, either in solution, as powder or as gas, at a strength and for a period of time sufficient to destroy the pathogen without injury to the host. When the pathogen lives over as mycelium in the seed or tuber, the application of heat is sometimes effective. Formaldehyde, as a gas or in solution in water, is now generally employed for the eradication of the smut of oats, the stinking smut of wheat and the potato-scab. (For details of method, see *Formaldehyde*, p. 1028). The spraying of peach trees with copper-sulfate solution, lime-sulfur solution or bordeaux, just before the buds start in the spring, disinfects the trees by destroying the spores of the leaf-curl fungus which pass the winter on the buds.

Pathogens which attack the underground parts of plants may sometimes be eradicated by disinfection of the soil before planting. Drenching the soil with a formaldehyde solution of a strength sufficient to distribute one gallon of the strong 40 per cent solution to each 100 square feet of surface, wetting the soil to a depth of 6 to 8 inches, has been found to be very effective against damping-off, root-rot and similar diseases in forest tree seed-beds, ginseng seed-beds and in the benches in greenhouses. It is also often effective in the eradication of nematodes in greenhouses. Steaming of the soil is also very effective, destroying insects and weed seeds as well as pathogenic fungi. It is not always conveniently applied.

3. *Protection* measures are to be employed in those regions in which the pathogen is very generally and very thoroughly established, or in which for one reason or another eradication is impossible or unprofitable. They aim to protect the crop against attacks of the parasite by means of some external barrier. Spraying is the most commonly employed protective measure. In spraying, the susceptible surfaces of the plant are coated with some slowly soluble poison, known as a fungicide. Fungicides are of various types. They are applied in suspension in water, in solution or dry, *i.e.*, in the form of a fine impalpable powder. The fungicide most generally applied in liquid spraying is bordeaux, a colloidal compound formed by the union of lime-milk and copper-sulfate solution. Minute blue gelatinous



1286. Grapes ruined by black-rot.



1287. Smut of oats.



1288. Loose smut of barley.



membranes are formed which remain for a time suspended in the liquid. When sprayed upon the plants the water soon evaporates, leaving a coating of these dried membranes. The active fungicidal principal in these bordeaux membranes is the copper. When leaves or fruit are rewetted by rains enough of the copper in these membranes comes into solution to prevent the germination of the spores of the parasite that may have been deposited thereon. (See under *Bordeaux*, p. 1028.)

Bordeaux, however, is sometimes injurious to such plants as peaches, plums and apples, and has, within the last few years, been largely replaced as a summer spray, especially for apples. Lime-sulfur, unlike bordeaux, is a solution. It is made by boiling together in water, lime and sulfur. A concentrated solution of certain poly-sulfides of calcium, chiefly penta- and tetrasulfide, is thus obtained which, when properly diluted is applied in the same way as the bordeaux. (For method of preparation, see *Lime-sulfur*, p. 1028). When this solution dries on the leaves and fruit, it is rapidly converted by the action of the atmosphere into other calcium compounds and free sulfur. The sulfur is in a very finely divided state and is the active principal of lime-sulfur. It becomes oxidized in the presence of moisture probably as sulfuric or sulfurous acid, which prevents the germination of the spores of the pathogen. Flowers of sulfur and sulfur-flour, when very finely ground and applied dry by dusting or sprayed on in suspension in water, alone or with lime-milk (the so-called self-boiled lime-sulfur) are also quite effective against certain diseases. Dusting with sulfur is employed in combating powdery mildews of grapes, hops, roses and the rust of asparagus.

Lime-sulfur may not be used on potatoes and grapes, as it dwarfs the plants and reduces the yield, while bordeaux has just the opposite effect on these crops. Bordeaux, as already pointed out, is, however, injurious to leaves and fruit of the apple and to the foliage of peaches and certain varieties of plums. It will thus be seen that there is no universal fungicide and also that both the effect on the host and on the parasite must be considered. It is now known for example that while lime-sulfur is very effective against the apple-scab fungus, it has little fungicidal effect on the spores of the bitter-rot pathogen.

To be effective, fungicides must be applied before the disease appears. As the spores of most parasitic fungi germinate during the period of rainy cloudy weather, the fungicide, to be effective, must be applied *before* and not after such periods. They must not only be thoroughly applied to the susceptible parts but also at the proper stage of growth or development of the plant. To illustrate: the only effective periods for spraying apple trees for scab are: just before the blossoms open (not dormant); just after the petals fall; ten days or two weeks later; and again in late summer just before the late summer rains, to protect the rapidly developing fruit from late infection.

4. *Immunization* consists in establishing within the plant itself some condition which renders it immune or resistant to the attacks of the pathogens. Immune crops may be developed

by selection and propagation of individuals naturally immune, whose immunity has been evidenced by their coming through an epidemic unscathed. Immune varieties may be crossed with susceptible ones having other especially desirable qualities and then by segregation and propagation strains of the crop may be developed combining the resistance or immunity of the one parent with the desirable qualities of the other. Some striking results have been obtained in this line of disease control as witness the wilt-resistant cotton, cowpeas and watermelon, the nematode-free Iron cowpea, rust-resistant wheat, barley, and asparagus, and the anthracnose-resistant clover. Nevertheless, this method of control, while the most ideal, is beset with many difficulties and uncertainties. That pathogens, as well as crops, vary, giving strains capable of attacking host plants immune to other strains of the same pathogen, has generally been overlooked by breeders, and doubtless accounts for the frequent failure of supposedly resistant varieties when transferred to new localities. The production of artificial immunity by the injection of some substance into the plant or by the application of certain substances (fertilizers, etc.) to the soil is at most only in the preliminary stages of experimentation and as yet offers but little of practical value to the grower.

H. H. WHETZEL.

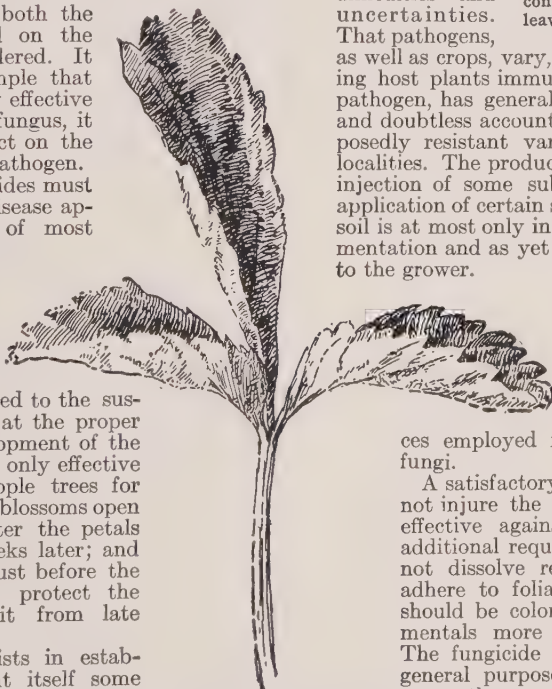
### Fungicides.

A fungicide is any material or substance that kills fungi or their spores. The word is used particularly for those substances employed in the warfare against parasitic fungi.

A satisfactory fungicide must be one that does not injure the plants and at the same time is effective against the parasite. For spraying, additional requirements are imposed: it should not dissolve readily in rain-water; it should adhere to foliage and fruit; in some cases it should be colorless in order not to make ornamentals more unsightly than when diseased. The fungicide which has been used most for general purposes is bordeaux mixture. Lately some other preparations, particularly lime-sulfur combinations, have come into use, and in many cases are supplanting bordeaux. There are in



1290. A blight of grapes due to some constitutional disorder. Notice that the leaves die first at the edges. ( $\times \frac{1}{2}$ )



1289. Strawberry leaf rolled up from the attack of the mildew.



addition a large number of other substances which have fungicidal value and are in more limited use for specific cases. The following directions are taken, with modifications, from the author's part in Bailey's "Farm and Garden Rule-Book."



1291. Tip-burn of potato leaf.—A physiological difficulty or disease, due to some so-called "constitutional" disorder or obstruction (Vermont Experiment Station).

house, where it may be applied (a) through sub-irrigation tile or through specially laid perforated steam pipes in the bottom of the bed. Cover the beds with blankets, introduce steam under pressure of forty to eighty pounds for two hours. Insert thermometers at various places to see that the soil is being uniformly heated. (b) A large galvanized iron tight box may be constructed with finely perforated trays 4 to 6 inches in depth. Soil placed in these trays and steamed for two hours as above will be freed from parasitic organisms. In this case the frames should be sprayed with a solution of formaldehyde, one pint in twelve gallons of water. Steam sterilization of soil may be used on intensively cultivated areas or extensive seed-beds. A portable boiler is necessary. The beds are sterilized after they have been prepared for seed, and just before the seed is sown. A galvanized pan of convenient dimensions and 6 to 8 inches deep is inverted, and the edges are pushed down into the soil 1 or 2 inches. The pan is connected with the steam boiler by means of a steam hose and live steam is run into the pan from twenty to forty minutes under a pressure of eighty pounds and up. The higher the pressure the deeper the soil will be sterilized. The pan must be weighted. Paths should be disinfected by spraying with copper sulfate one pound to fifty gallons of water or with formaldehyde solution one pint to twelve gallons of water. The cost of sterilizing is approximately three-fourths of a cent the square foot. It should be noted that soil-sterilization has an invigorating effect on many plants, and it will be necessary to run green-houses at a lower temperature (5° to 10°) both night and day. Field-sterilization also kills weed seeds, and with the reduction of the cost of weeding makes the process practicable.

#### Substances.

**Bordeaux mixture.**—A bluish green copper compound that settles out when freshly slaked lime and a solution of copper sulfate (blue-stone) are mixed. Many formulas have been recommended and used. The 5-5-50 formula may be regarded as standard. In such a formula the first figure refers to the number of pounds of copper sulfate, the second to the stone or hydrated lime, and the third to the number of gallons of water. Bordeaux must often be used as weak as 2-2-50, on account of injury to some plants.

To make fifty gallons of bordeaux mixture, proceed as follows:

(1) Pulverize five pounds of copper sulfate (blue vitriol), place in a glass, wooden, or brass vessel, and add two or three gallons of hot water. In another vessel slake five pounds of quicklime in a small amount of water. When the copper sulfate is all dissolved, pour into a barrel and add water to make forty or forty-five gallons. Now strain the lime into this, using a sieve fifty meshes to the inch or a piece of cheese-cloth supported by ordinary screening. Stir thoroughly, and add water to the fifty-gallon mark. The flocculent substance which settles is the effective fungicide. Always stir vigorously before filling the sprayer. Never add the strong lime to strong vitriol. Always add a large amount of water to one or the other first. Blue vitriol used alone would not only wash off quickly in a rain, but cause a severe burning of fruit and foliage. Lime is added to neutralize this burning effect of the copper. If the lime were absolutely pure, only slightly more than one pound would be required to neutralize this burning effect. For many purposes an excess of lime is not objectionable and may be desirable.

#### Practices.

**Destroying affected parts.**—It is important that all affected parts should be removed and burned, if possible. In the fall all leaves and fruit that have been attacked by fungi should be raked up and burned. Diseased branches should be severed at some distance below the lowest visible point of attack. Fungous diseases often spread rapidly, and prompt action is usually necessary. Practice clean and tidy culture.

**Rotation of crops.**—This is one of the most effective and practical means of heading off fungous diseases. It is especially applicable to diseases of roots or root-crops, but also to many other diseases of annual plants.

**Sterilizing by steam.**—This is an effective fungicidal practice for several soil-inhabiting organisms which attack roots and stems. This includes nematode worms. It is especially applicable in the green-

For nearly ripe fruit and ornamentals an excess of lime augments spotting. In such cases the least amount of lime possible should be used. Determine this by applying the cyanide test (2).

(2) Secure from the druggist 10 cents' worth of potassium ferrocyanide (yellow prussiate of potash) and dissolve it in water in an eight-ounce bottle. Cut a V-shaped slit in one side of the cork, so that a few drops of the liquid can be obtained. Now proceed as before. Add lime with constant stirring until a drop of the ferrocyanide ceases to give a reddish-brown color.

(3) When bordeaux mixture is desired in large quantities, stock solutions should be made. Place one hundred pounds of copper sulfate in a bag of coffee-sacking, and suspend in the top of a fifty-gallon barrel, and add water to the fifty-gallon mark. In twelve to fifteen hours the vitriol will be dissolved and each gallon of solution will contain two pounds of copper sulfate. Slake a barrel of lime, and store in a tight barrel, keeping it covered with water. Lime so treated will keep all summer. It is really hydrated lime. This is often dried, pulverized, and offered on the market in paper bags of forty pounds each, under such names as ground lime, prepared lime, hydrated lime, and the like. If the paper is not broken, the lime does not air-slake for a long time. One and one-third pounds of hydrated lime equals in value one pound of quicklime. Air-slaked lime cannot be used in preparing bordeaux mixture.

Arsenical poisons can be combined with bordeaux mixture.

**Ammoniacal copper carbonate.**—For use on nearly mature fruit and on ornamentals. Does not discolor. Weigh out three ounces of copper carbonate, and make a thick paste with water in a wooden pail. Measure five pints of strong ammonia (26° Baumé) and dilute with three or four parts of water. Add ammonia to the paste, and stir. This makes a deep blue solution. Add water to make fifty gallons.

**Copper carbonate.**—For use in the above formula, it may be secured as a green powder, or may be prepared as follows: Dissolve twelve pounds of copper sulfate in twelve gallons of water in a barrel. Dissolve fifteen pounds of sal-soda in fifteen gallons of water (preferably hot). Allow the solution to cool; then add the sal-soda solution to the copper-sulfate solution, pouring slowly in order to prevent the mixture from working up and running over. A fine precipitate is formed which will settle to the bottom if allowed to stand over night. Siphon off the clear liquid. Wash the precipitate by adding clear water, stirring, and allowing to settle. Siphon off the clear water, strain the precipitate through muslin, and allow it to dry. This is copper carbonate. The above amounts will make about six pounds.

**Copper sulfate.**—See Sulfate of copper.

**Corrosive sublimate** (mercuric chloride).—Used for disinfecting pruned stubs and cleaned-out cankers, at the rate of one part in 1,000 parts of water. Can be secured from the druggist in tablet form in vials of twenty-five each, and costing 25 cents. One tablet makes a pint of solution. Make and store solution in glass and label "poison."

**Formaldehyde** (40 per cent solution of formaldehyde gas in water).—A pungent, clear liquid, very irritating to eyes and nose. Obtained at any drugstore at about 40 cents a pint. Used for potato-scab, oat smut, bunt in wheat, soil disinfection, and so on.

**Lime.**—Offered for sale in the following forms: (a) Ground rock or ground limestone; air-slaked lime is of the same composition, i.e. a carbonate of calcium. (b) Lump, barrel, stone, or quicklime; this is burned limestone, and should test at least 90 per cent oxide of calcium. (c) Prepared, ground, or hydrated lime; this is water- or steam-slaked quicklime, dried and pulverized. Used as an applicant to the soil to correct acidity, for club-root of cabbage, and for preparing spray mixtures.

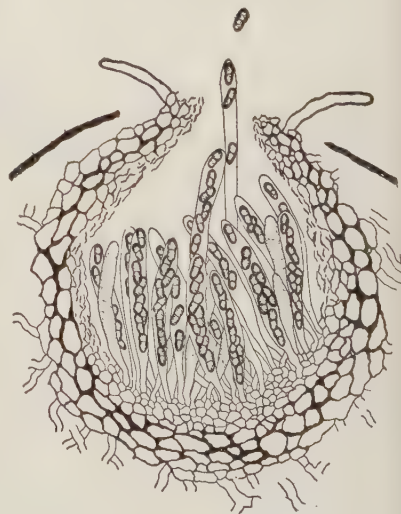
**Lime-sulfur.**—In the many possible combinations, lime-sulfur is coming to be equally as important as bordeaux mixture, in the control of many plant diseases.

(1) Flowers of sulfur or very finely powdered sulfur is often dusted on plants for surface mildews.

(2) A paste of equal parts of lime, sulfur, and water. This is painted on the heating-pipes in the greenhouse, and is valuable for keeping off surface mildews.

(3) Home-boiled dilute lime-sulfur. This solution has been widely used in the past as a dormant spray, particularly for San José scale and peach leaf-curl. It is likely to be supplanted by (4) or (5). For preparation see page 1043.

(4) Home-boiled concentrated lime-sulfur. When a great deal of spraying is to be done, a concentrated lime-sulfur



1292. Perithecial of apple scab, showing spores.



solution may be boiled at home and stored in barrels to be used as needed. For method of preparation see page 1043.

Test with a Baumé hydrometer, which has a scale reading from 25° to 35°. Dilutions are reckoned from a standard solution testing 32°. If the solution tests only 28°, it is not so strong as standard, and cannot be diluted so much as a solution testing 32°. The table shows the proper dilution for solutions testing 25° to 35° Baumé:

	1-10	1-15	1-20	1-25	1-30	1-40	1-50	1-60	1-75	1-100
25°	7.4	11	14.7	18.4	22.1	29.5	36.8	44.2	55	73
26°	7.7	11.6	15.4	19.3	23.2	30.9	38.6	46.3	58	77.2
27°	8.1	12.1	16.1	20.2	24.3	32.4	40.5	48.5	60.6	80.7
28°	8.4	12.7	16.9	21.1	25.4	33.8	42.3	50.7	63.5	84.5
29°	8.8	13.2	17.6	22.1	26.5	35.3	44.2	53	66.3	88.2
30°	9.2	13.9	18.4	23	27.6	36.9	46.1	55.3	69	92
31°	9.6	14.4	19.3	24	28.8	38.4	48	58	72	96
32°	10	15	20	25	30	40	50	60	75	100
33°	10.4	15.6	20.8	26	31.2	41.5	52	62.4	78	104
34°	10.8	16.2	21.6	26.8	32.4	43.2	54	64.7	80.8	108
35°	11.2	16.8	22.4	28	33.4	44.9	56	67.4	84.2	112

Decimals are given in all cases, but for practical purposes the nearest even gallon or half gallon can be used, unless appliances for more accurate measurement are at hand. It is understood in making all dilutions that water is added to one gallon of the concentrate to make the stated amount. Do not measure out the stated amount of water and add the concentrated solution to it.

(5) Commercial concentrated lime-sulfur.—As manufactured and placed on the market is a clear amber liquid, and should test 32° to 35° Baumé. It costs about 20 cents a gallon retail, and comes ready to pour into the spray tank. For apple and pear diseases. Arsenate of lead can be used with this solution, and increases its fungicidal value.

(6) Scott's self-boiled lime-sulfur.—This is a mechanical mixture of the two substances, and is really not boiled, the heat being supplied by the slaking lime. In a small barrel or keg place eight pounds of good quicklime. Add water from time to time in just sufficient amounts to prevent burning. As soon as the lime begins to slake well, add slowly (preferably through a sieve) eight pounds of sulfur flour. Stir constantly, and add water as needed. As soon as all bubbling has ceased, check further action by adding a quantity of cold water, or pour into a barrel or tank and make up to fifty gallons. Keep well agitated. Very effective against peach scab and brown rot. Several other formulas have been used: 10-10-50 and 5-5-50. Arsenate of lead can be used with this mixture.

By using boiling water and allowing the hot mixture to stand for half an hour, a stronger spray mixture than the above can be secured. It cannot be used safely on peaches, but has been used successfully on grapes for surface mildew. The addition of sulfate of iron or sulfate of copper, one or two pounds to fifty gallons, has been used for apple rust.

Potassium sulfid (liver of sulfur).—Simple solution, three ounces in ten gallons of water. For mildew in greenhouses, on rose bushes and other ornamentals.

Resin-sal-soda sticker.—Resin, two pounds; sal-soda (crystals), one pound; water, one gallon. Boil until of a clear brown color, i.e. from one to one and a half hours. Cook in an iron kettle in the open. Add this amount to fifty gallons of bordeaux. Useful for onions, cabbage, and other plants to which spray does not adhere well.

Sulfate of copper (blue vitriol).—Dissolve one pound of pure sulfate of copper in twenty-five gallons of water. A specific for peach leaf-curl. Apply once before buds swell in the spring. Cover every bud. For use in preparing bordeaux mixture. Costs from 5 to 7 cents a pound, in quantity.

Sulfate of iron (copperas).—A greenish granular crystalline substance. Dissolve one hundred pounds in fifty gallons of water. For mustard in oats, wheat and the like, apply at the rate of fifty gallons an acre. Also for anthracnose of grapes as a dormant spray.

Sulfur (ground brimstone, sulfur flour, flowers of sulfur).—Should be 99 per cent pure. Valuable for surface mildews. Dust on dry or in the greenhouse used in fumes. Evaporate it over a steady heat, as an oil-stove, until the house is filled with vapor. Do not heat to the burning point, as burning sulfur destroys most plants. To prevent burning, place the sulfur and pan in a larger pan of sand and set the whole upon the oil-stove.

DONALD REDDICK.

### Catalogue of diseases.

**Abies.** WITCHES' BROOM (*Æcidium elatinum*, *Melampsorella elatina*).—On fir causing swellings, cankers, and witches' brooms. Control.—Prune off all affected parts.

**Abutilon.** RUST.—See under *Hollyhock*.

CONTAGIOUS CHLOROSIS.—Variegated leaves.

Control.—Remove variegated leaves and their shoots, keep in dark and remove any further variegated leaves; then the plant should remain green.

**Acacia.** RUSTS (*Æcidium* sp.).—Distorts branches and twigs.

Control.—Prune off diseased parts.

### CATALOGUE OF DISEASES, continued.

**Acer.** TAR-SPOT (*Rhytisma acerinum*).—Black tar-like spots on upper side of the leaves.

Control.—Burn all old leaves in fall or winter.

**SUN SCALD or SCORCH.**—Maples suffer commonly from a drying up of the foliage, due to over-transpiration of water at times when hot winds occur.

**Actinidia.** MILDEW (*Uncinula necator*).—See under *Ampelopsis*.

**Æsculus.** LEAF-SPOT (*Phyllosticta paviae*).—Irregular spots develop rapidly, the larger part of the leaf being involved. Leaves fall prematurely.

Control.—Spray with bordeaux mixture, beginning when the leaves are about half-grown and repeating the process every three weeks.

**Agave.** LEAF-BLOTCH (*Coniothyrium concentricum*).—Grayish, more or less circular dead patches, ranging from ½ to 1 inch in diameter.

Control.—Remove and burn diseased leaves.

**Allium.**—See under *Onion*.

**Almond.** BLIGHT (*Corynyne beyernkii*).—See *Peach Blight*.

YELLOW.—See under *Peach*.

**Alnus.** ROOT-TUBERCLES.—Clumps of small tubercles on the roots. Not important.

WITCHES' BROOMS and BLADDERY DEFORMATIONS OF FLOWERS (*Ezoascus* sp.).—Broom-like tufts of branches and irregular deforming and contortion of fruits.

Control.—See under *Peach Leaf-Curl*.

**Alyssum.** MILDEW (*Erysiphe polygoni*).—See under *Verbena*. Disease very similar.

**Amarantus.** WHITE "RUST" or MILDEW (*Albugo bliti*).—See similar disease under *Radish*.

**Amelanchier.** RUST (*Gymnosporangium* sp.).—Orange rust spots on leaves.

Control.—Keep junipers at a considerable distance.

WITCHES' BROOM (*Dimerosporium collinsii*).—Thick twisted broom-like growth of branches.

Control.—Cut out the brooms.

**Ampelopsis.** BLACK-ROT.—See under *Grape*.

MILDEW (*Uncinula necator*).—Powdery mildew growths on upper side of leaf.

Control.—Dust with sulfur.

**Anemone.** ROOT-DECAY (*Sclerotinia tuberosa*).—Rhizomes decayed and large lumps form on the outside.

Control.—Eradicate affected rhizomes and the cup-like fungous bodies near such plants.

RUST.—Several rusts attack species of *Anemone*.

**Anthurium.** BLIGHT (*Glomerella cincta*).—See under *Orchids*.

**Apple.** BLIGHT.—The same disease as *Pear Blight*, which see.

CANKER.—Smooth cankers in bark of trunk or limbs usually indicate blight (*Bacillus amylovorus*); rough ones, New York apple-tree canker (*Sphaeropsis malorum*), or the nail-head canker (*Numularia discreta*).

Control.—As soon as noticed, cut away dead bark and wood to the living tissue and paint over with lead paint or coal-tar. SCAB (*Venturia inaequalis*).—Olive-green, brownish or blackish scab-like spots on leaves and fruit.

Control.—Rake and burn or plow under old leaves very early in spring. Spray with lime-sulfur 32° Baumé, 1-40, or bordeaux, 3-3-50: (1) when blossom buds show pink; (2) when majority of petals have fallen; (3) three weeks after 2, depending upon the weather; (4) if a late attack is feared, spray before fall rains begin.

**Apricot.** YELLOW.—See under *Peach*.

BLACK-SPOT or SCAB.—See under *Peach*.

**Aquilegia.** MILDEW (*Erysiphe polygoni*).—See under *Verbena*. Disease very similar.

BLACK-SPOT (*Bacillus delphini*).—Sunken black spots on leaves and stems.

Control.—Remove and burn diseased parts.

**Artemisia.** RUST (*Puccinia asteris*).—Same rust as on *Asters*, which see.

**Artichoke.** SOFT-ROT.—See under *Carrot*.

**Arum.** LEAF-SPOT (*Protomyces ari*).—Irregular bleached patches on leaves and leaf-stalks of *A. maculatum*.

Control.—Burn diseased plants.

**Asparagus.** RUST (*Puccinia asparagi*).—A rust of the tops which is often so severe as to kill them, thus interfering with root-development.

Control.—Dust with flowers of sulfur about every three weeks while dew is still on in the morning. Use dusting machines.

**Aspidistra.** LEAF-BLOTCH (*Ascochyta aspidistræ*).—Large, irregular, bleached spots with black streaks running across.

Control.—Remove diseased leaves.

**Aster.** RUST (*Puccinia asteris*).—Brown rust of leaves.

Control.—Eradicate the affected leaves.

**Aucuba.** FREEZING.—Young leaves suffer from spring frosts.

**Auricula.** LEAF-BLOTCH (*Heterosporium auriculi*).—Three or four olive-green spots on each leaf. Spots become brown and fall out.

Control.—Do not have excessive moisture. Spray with potassium sulfid and ventilate well.

**Avocado, or Persea.** ANTHRACNOSE (*Colletotrichum gloeosporioides*).—See under *Pomelo*.

## CATALOGUE OF DISEASES, continued.

- Bamboo.** SMUT (*Ustilago shiriana*).—Internodes and tips of young shoots attacked. Wild and cultivated bamboo attacked in Japan.  
*Control.*—Bordeaux mixture and sprinkling soil with lime before the shoots appear.
- Banana.** ROT (*Bacillus musæ*).—Leaf-blades droop, turn yellow; petioles decay, letting leaves drop, and finally whole plant rots to the ground.  
*Control.*—Practise sanitation.
- Bean.** ANTHRACNOSE, or POD-SPOT (*Colletotrichum lindemuthianum*).—Reddish brown, scab-like spots on stems, pods, and veins of leaves, particularly on yellow-podded snap beans. Fungus enters the beans.  
*Control.*—Use seed only from pods without spots. Spray plants, from beneath and above, every ten days.  
 BLIGHT (*Bacterium phaseoli*).—Large papery spots on leaves and watery spots on pods.  
*Control.*—As for Anthracnose.
- Beet.** HEART-ROT (*Phoma betæ*).—Leaves appear spotted late in July, then wilt, and finally a dry heart-rot appears.  
*Control.*—Destroy affected plants. Practise long rotations. Treat seed with formalin, one pint in thirty gallons of water.  
 SCAB.—The same disease as *Potato Scab*, which see.
- Begonia.** ROOT-ROT (*Thielavia basicola*).—See under *Nicotiana*.
- Berberis.** RUST (*Puccinia graminis*).—Orange-colored rust spots on under side of leaf.
- Betula.** LEAF-SPOT (*Glaeosporium betularum*).—Round spots with blackish margin.  
 HEART-ROT (*Fomes ignarius*).—See under *Fagus*.
- Blackberry.** CROWN-GALL, or ROOT-GALL (*Bacterium tumefaciens*).—Swellings, hard or soft, on roots and stem below ground.  
*Treatment.*—Plow up and burn all bushes in a diseased patch. Plant clean roots in a new place.  
 ANTHRACNOSE.—See under *Raspberry*.  
 RED or ORANGE RUST.—See under *Raspberry*.  
 LEAF-SPOT.—See under *Deuberry*. Same disease.
- Blueberry.** RUST (*Calyptospora goeppertiana*).—Stem attacked, swollen, spongy, at first pink, changing to brown and blackish. Plants taller than healthy and leaves dwarfed.  
*Control.*—Segregate from species of fir and spruce.
- Brassica.** See under *Cabbage*.
- Brussels Sprouts.** CLUB-ROOT.—See under *Cabbage*.
- Buxus.** STEM-BLIGHT (*Nectria rousseliana*).—Twigs killed, reddish pustules appearing on stems and leaves.  
*Control.*—Remove all diseased parts and burn.
- Cabbage.** CLUB-ROOT, or CLUB-FOOT (*Plasmodiophora brassicæ*).—A contorted swelling of roots and sickly wilted tops.  
*Control.*—Destroy affected seedlings. Lime the soil at least eighteen months before planting cabbage, using at the rate of two tons of quicklime to the acre.  
 BLACK-ROT (*Bacillus campestris*).—Sap-tubes in leaves and stem turn black and the leaves drop, thus preventing heading.  
*Control.*—Practise crop-rotation. Soak the seed for fifteen minutes in a solution of mercuric chloride, one tablet in a pint of water.
- Cactus.** SPOT (*Diplodia opuntiae*).—Sometimes a serious disease.
- Calathea.** LEAF-BLIGHT (*Cephaleurus parasiticus*).—The epidermal cells contain the alga, which spreads over the leaf, blackening and killing it.  
*Control.*—Remove diseased leaves.
- Calceolaria.** LEAF-BLIGHT (Ascribed to a *Micrococcus*).—Brownish patches on lower leaves, many times bordered by the small veins of the leaf.  
*Control.*—Burn affected plants.
- Campanula.** RUST (*Coleosporium campanulæ*).—Red and brown rust spots on leaves.  
*Control.*—Segregate from *Pinus rigida*.
- Capsicum.** ANTHRACNOSE.—Same as on *Piper*, which see.
- Carnation.** RUST (*Uromyces caryophyllinus*).—Brown, powdery pustules on stems and leaves.  
*Control.*—Spray once in two weeks with a solution of copper sulfate, one pound to twenty gallons of water. Pick off diseased leaves. Keep temperature low.
- Carpinus.** BLACK-MOLD (*Dimerosporium pulchrum*).—On leaves.  
*Control.*—Spray with any good fungicide.  
 HEART-ROT (*Fomes fulvus*).—Red-brown decay; crumbles when crushed.  
*Control.*—Surgery methods.
- Carrot.** SOFT-ROT (*Bacillus carotovorus*).—A soft-rotting of the root identical with the soft rots of other root crops.  
*Control.*—Good drainage of soil. Steam sterilization of soil.  
 LEAF-SPOT or EARLY LEAF-BLIGHT (*Cercospora apii*).—See under *Celery*.
- Carya.**—See under *Hickory-Nut*.
- Castanea.**—See under *Chestnut*.
- Catalpa.** LEAF-BLIGHT.—Sudden blackening and dying of leaves in early summer.  
 HEART-ROT (*Polystictus versicolor*).—Heart-wood becomes straw-colored and finally soft.  
*Control.*—Surgery.  
 ROOT-ROT of seedlings (*Thielavia basicola*).—See under *Nicotiana*.
- Cauliflower.**—See under *Cabbage*.

## CATALOGUE OF DISEASES, continued.

- Celastrus.** MILDEW (*Phyllactinia coryleæ*).—Powdery mildew of leaves.  
*Control.*—Dust with sulfur.
- Celery.** EARLY LEAF-BLIGHT (*Cercospora apii*).—A spotting and eventual blighting of leaves.  
*Control.*—Spray with ammoniacal copper carbonate, 5-3-50, beginning in seed-bed and keeping new growth covered throughout the season.  
 LATE BLIGHT (*Septoria petroselinii* var. *apii*).—Blight of foliage appearing late in season and in storage.  
*Control.*—As above. Grow under half shade.
- Celtis.** MILDEW (*Peronosporium celidis*).—Definite spots on veins, water-soaked dark green becoming gray.  
*Control.*—Spray with bordeaux mixture.
- Cercis.** LEAF-SPOT (*Ascochyta pisi*).—Spots round, yellowish with brown margin on leaves and stem.  
*Control.*—Spray with dilute bordeaux mixture on first appearance.
- Chamaecyparis.** TWIG DISEASE (*Pestalotia funerea*).—Bark of young branches killed, needles die.  
*Control.*—Prune off affected parts and clean up litter and burn.
- Chard (Beta).** HEART-ROT (*Steccherinum ballonii*).—Kills tops of trees.  
 LEAF-SPOT (*Cercospora beticola*).—Brown, purplish bordered spots on leaves.  
*Control.*—Pick off and destroy diseased leaves.
- Cherry.** BROWN-ROT (*Sclerotinia fructigena*).—The flowers decay, the leaves become discolored with irregular brown spots, and the fruit rots on the tree.  
*Control.*—Spray with bordeaux mixture, 4-4-50, or lime-sulfur, 1-40 (1) just before the blossom buds open; (2) just after the blossoms fall; (3) one or two more applications at intervals of ten days.  
 POWDERY MILDEW (*Podospheera oxycanthæ*).—Leaves and twigs affected, often causing defoliation.  
*Control.*—Spray with lime-sulfur, 1-40, or dust heavily with powdered sulfur.
- Black-Knot.**—See under *Plum*. Same disease.
- Chestnut.** CANKER, or BARK DISEASE (*Endothia parasitica*).—Sunken or swollen cankers on limbs or trunk. Limbs die and leaves and buds cling in winter.  
*Control.*—Remove diseased parts and burn. Paint all wounds. Little chance of saving trees in infested locality.
- Chicory.** STEM-SPOT (*Pleospora albicans*).—Yellowish-gray spots on lower portion of the stem. Later on smaller branches and leaves. Plant destroyed.  
*Control.*—Eradicate diseased plants.
- Chrysanthemum.** LEAF-SPOT (*Septoria chrysanthemi*).—Small dark brown spots, which increase in size until leaf is killed.  
*Control.*—Pick and burn affected leaves. Spray with bordeaux mixture, 4-4-50.  
 RUST (*Puccinia chrysanthemi*).—Reddish brown rust pustules on leaves.  
*Control.*—As for *Leaf-Spot*.
- Cineraria.** MILDEW (*Bremia lactucae*).—Plants stunted and of a pale color, finally wilting. Same disease on lettuce.  
*Control.*—Remove diseased plants. Do not use same soil again.  
 RUST.—See under *Senecio*.
- Citrus.**—See under *Orange*, *Lemon*, *Grapefruit*, etc. The "wither tip" disease described under *Pomelo* is common to species of citrus.
- Clematis.** LEAF-SPOT (*Cylindrosporium clematidis* var. *jackmanii*).—Causing loss of lower leaves at times. Not serious.
- Cocoanut.** BUD-ROT (*Bacillus coli*).—Rot of soft tissues of cocoanut plant and is perhaps responsible for cocoanut bud-rot.  
*Control.*—Not given.
- Coffea.** LEAF-DISEASE (*Hemileia vastatrix* and *H. woodii*).—Circular discolored areas, turning pale yellow and becoming studded with orange-yellow spots.  
*Control.*—Burn all diseased leaves.
- Colchicum.** RUST (*Uromyces colchici*).—Black spots on leaves. Looks like a smut disease.  
*Control.*—Diseased leaves should be burned.
- Colocasia.** ROOT-ROT (*Peronospora trichomata*).—Sap-tubes turn yellow and finally entire tuber becomes black.  
*Control.*—Dry tubers thoroughly before storing. Do not plant in soil in which the disease has occurred.
- Convolvulus.** MILDEW (*Albugo ipomæe-panduræ*).—Distortions and white or yellow blisters.  
*Control.*—Remove diseased plants and spray with bordeaux mixture frequently.
- Cordyline.** BLIGHT.—See under *Orchids*.
- Coreopsis.** MILDEW (*Sphaerotheca humuli* var. *fuliginea*).—Powdery mildew of the leaves.  
*Control.*—Dust with sulfur.
- Corn.** SMUT (*Ustilago zeæ*).—Boils on stalks, ears or tassels, at first white, then black, and, when burst open, containing black powder, the spores.  
*Control.*—Cut out developing smut-boils and burn.  
 WILT (*Pseudomonas Stewartii*).—Sap-tubes turn yellow and plant wilts and dries up.  
*Control.*—Burn affected plants. Grow varieties not affected



## CATALOGUE OF DISEASES, continued.

- Cornus.** TWIG-BLIGHT (*Diaporthe albocanis*).—Twigs die, bark turns yellow and is covered with numerous small pimples.  
Control.—Prune off and destroy affected parts.
- Corylus.**—See under *Filbert*.
- Cosmos.** STEM-BLIGHT (*Phomopsis stewartii*).—Brown spots rapidly enlarging on stems of mature plants. Parts above wilt and die.  
Control.—Difficult and no certain methods known. Remove diseased stems and burn.
- Cotoneaster.** RUST (*Gymnosporangium clavariæforme*).—Orange rust pustules on leaves.  
Control.—Keep at a distance from junipers.
- Cranberry.** BLAST, or SCALD (*Guignardia vaccinii*).—Young flower and fruits blasted, older fruits appear scalded or watery.  
Control.—Spray five or six times with bordeaux mixture, 5-5-50, to which has been added four pounds of resin fish-oil soap. Begin just before the blossoms open.
- Cratægus.** RUST (*Gymnosporangium* sp.).—Orange rust pustules on leaves and petioles.  
Control.—Keep at a distance from junipers.
- Cress.** WHITE MOLD.—See under *Horse-Radish*.
- Crocus.** ROOT-ROT (*Rhizoctonia* sp.).—Important in France and likely occurring here.  
Control.—Sanitation, new soil frequently or soil sterilization.
- Cucumber.** BLIGHT, or MILDEW (*Pseudoperonospora cubensis*).—A blighting and premature yellowing of the leaves.  
Control.—Spray with bordeaux mixture, 5-5-50, every ten to fourteen days after plants begin to run.
- WILT.**—See under *Cucurbita*.
- Cucurbita.** WILT (*Bacillus tracheiphilus*).—Sap-tubes are clogged and destroyed, causing the plant to wilt.  
Control.—Eradicate the striped beetle. Gather and destroy all wilted leaves and plants.
- Cupressus.** ROOT-ROT.—See under *Pine*. Same disease.
- Twig Disease.**—See under *Chamæcyparis*.
- Witches' Broom** (*Gymnosporangium ellisii*).—Fasciation of branches.  
Control.—Prune off affected parts.
- Current.** WILT, or CANE-BLIGHT (*Botryosphæria ribis*).—Canes die suddenly, the leaves wilting.  
Control.—No satisfactory method known. Cut out and burn affected plants.
- Rust** (*Cronartium ribicola*).—Brown rust pustules and brown felt-like growth on under side of leaf. Black currants especially susceptible.  
Control.—Grow at least 500 feet from white pine trees.
- Cycas.** LEAF-SPOT (*Mycosphaerella tulasnei*=*Cladosporium herbarum*).—Gray spots and final death of leaves.  
Control.—Remove and burn affected parts.
- Cyclamen.** LEAF-SPOT (*Glomerella rufomaculans* var. *cyclaminis*).—Spots circular, slightly water-logged, with sharply defined outlines.  
Control.—Destroy affected leaves by burning.
- BLIGHT.**—Similar to *Lilium Leaf-Spot*, which see.
- Dahlia.** WILT (*Sclerotinia sclerotiorum*).—White mold on stem, later yellowing and wilting of plant, and finally stem collapses.  
Control.—Remove and burn affected plants. Green stable manure favors the disease.
- Daphne.** LEAF-SPOT (*Mycosphaerella laureola*).—Similar to *Strawberry Leaf-Spot*, which see.
- Date.** See under *Palms*.
- Delphinium.** BLACK-SPOT (*Bacillus delphini*).—Sunken black spots on stem and leaves.  
Control.—Remove and burn diseased parts.
- Dewberry.** LEAF-SPOT (*Septoria rubi*).—Small pale spots of dead leaf-tissue finally becoming dotted with black specks.  
Control.—No successful method of treatment is known.
- Dianthus.**—See under *Carnation*.
- Digitalis.** MILDEW (*Peronospora sordida*).—Broadly effused, dingy lilac patches of mildew on under surface of leaves.  
Control.—Spray with bordeaux mixture.
- Diospyros.** MILDEW (*Podosphaera ozyacanthæ*).—Powdery mildew of the leaves.  
Control.—Dust with sulfur.
- Dracæna.** BLIGHT.—See under *Orchids*.
- Eggplant.** ANTHRACNOSE (*Gloeosporium melongenæ*).—Spots on fruit. Same as on *Piper*, which see.
- STEM ROT** (*Nectria ipomææ*).—Spreading spots on the stem.  
Control.—Spray mixtures may be of avail.
- Elæagnus.** ROOT-TUBERCLES.—See under *Alnus*. Not destructive.
- Endive.** RUST (*Puccinia endiviæ*).—Rust spots on leaves.  
STEM-ROT.—See under *Chicory*.
- Eucalyptus.** TUMOR (*Ustilago vriesiana*).—Woody tumors at collar of tree. Production of black soot-like mass of spores between wood and bark.  
Control.—Surgery methods.
- Euphorbia.** BLIGHT (*Gloeosporium euphorbiæ*).—Causes death of floral portion just before flowering time and the parts below are soon blighted.  
Control.—Burn affected plants. Spray with bordeaux mixture.

## CATALOGUE OF DISEASES, continued.

- Fagus.** HEART-ROT (*Fomes ignarius*).—White, dry, and somewhat solid decay of heart-wood bordered by fine black lines.  
Control.—See under *Arboriculture, Diseases of Trees*.
- Ferns.** TIP BLIGHT (*Phyllosticta pteridis*).—Brown spots at or near tips of the fronds covered with minute black dots.  
Control.—Remove and burn the blighted leaves and then spray with bordeaux mixture.
- Ficus.** LEAF-SPOT (*Leptostromella elastica*).—Causes spots on leaves. See also under *Fig*.
- Fig.** LEAF-SPOT (*Cercospora bolleana*).—Brown spots on leaves. Leaves turn yellow and drop off.  
Control.—Spray with bordeaux mixture while leaves are young.
- Filbert.** BLACK-KNOT (*Cryptosporella anomala*).—Serious stem disease, canker girdles the stems and kills parts above.  
Control.—Prune off affected parts and burn.
- Forsythia.** LEAF-SPOT (*Alternaria forsythiæ*).—Forms sub-circular spots.  
Control.—Spray with bordeaux mixture.
- Fraxinus.** RUST (*Puccinia fraxinata*).—Swellings of midribs of leaves and petioles with orange rust spots on them.  
Control.—Keep the common grass *Spartina cynosuroides* away from the trees.
- Freesia.** LEAF-SPOT and WILT (*Heterosporium gracile*).—Large brown spots with darker margin, numerous; soon the leaves wilt and die.  
Control.—Spray with ammoniacal copper sulfate.
- Galanthus.** DECAY (*Sclerotinia galanthi*).—In place of the flower a shapeless mass is produced covered with brown mildew. Tubers decay also.  
Control.—Remove all affected parts and burn. Use new soil thereafter.
- Gardenia.** RUST.—See under *Coffea*. Same disease.
- Genista.** ROOT-TUBERCLES.—Beneficial.
- Gentiana.** RUST (*Puccinia gentianæ*).—Lower leaves first attacked, become yellow and die. Disease gradually works upward.  
Control.—Destroy affected plants.
- Geranium.** MILDEW (*Plasmopara geranii*).—Downy mildew of leaves.  
Control.—Spray with bordeaux mixture.
- Gladiolus.** SMUT (*Urocystis gladioli*).—Black smut pustules on corms.  
Control.—Destroy affected corms. Use new soil.
- Gleditsia.** LEAF-SPOT (*Leptostroma hypophylla*).—Leaflets become covered with small black specks, causing some of them to turn yellow and fall.
- Gooseberry.** MILDEW (*Sphaerotheca mors-uvæ*).—A powdery mildew of the fruit and young growth of English varieties.  
Control.—Spray with potassium sulfid, one ounce to two gallons of water, at intervals after leaves begin to unfold.
- Grape.** BLACK-ROT (*Guignardia bidwellii*).—Brown circular spots on leaves, black, elongated, sunken pits on petioles, canes, etc., and on the berry a brown rot with shriveling and wrinkling.  
Control.—Spray with bordeaux mixture, 4-4-50, before rains. Spray (1) when the third or fourth leaf unfolds; (2) as soon as the blossoms have fallen; (3) when berries are size of a pea; (4) about two weeks later. Two more applications if wet season.
- Downy Mildew, or Leaf-Blight** (*Plasmopara viticola*).—White frost-like patches on under side of the leaf.  
Control.—Same as *Black-Rot*.
- Grapefruit.** LEAF-SPOT (*Pestalotzia guépini*).—Large spots with dark margins. Leaves fall prematurely. On other species of *Citrus* also.  
Control.—Destroy affected leaves.
- Guava.** ANTHRACNOSE (*Glomerella psidii*).—Circular brown, decayed areas on fruit. Like apple bitter-rot.  
Control.—None given.
- Hedera.** LEAF-SPOT and LEAF BLIGHT (*Vermicularia trichella*).—Rapid blackening of the etiolated portion of the leaf.  
Control.—Remove and burn affected leaves and spray with bordeaux mixture.
- Helianthus.** RUST (*Puccinia helianthi*).—Red rust pustules on leaves of most species of *Helianthus*.  
Control.—No specific control measures worked out.
- Helleborus.** LEAF-BLOTCH (*Coniothyrium hellebori*).—Large circular brownish blotches of scorched appearance, covered with minute black dots.  
Control.—Cut off and burn affected leaves.
- Hemerocallis.** LEAF-SPOT.—See under *Freesia*.
- Hibiscus.** LEAF-SPOT (*Phyllosticta idæcola*).—Indistinct brown spots with whitish centers.  
Control.—Burn affected leaves.
- MILDEW** (*Microsphaera euphorbiæ*).—Powdery mildew of leaves.  
Control.—Dust with sulfur.
- Hickory-nut.** LEAF-SPOT (*Marsonia juglandis*).—Large leaf-spot, causing premature dying of leaves.  
Control.—Spraying with bordeaux mixture may be of value.

## CATALOGUE OF DISEASES, continued.

- Hollyhock.** RUST (*Puccinia malvacearum*).—All parts of plant show reddish brown pustules.  
Control.—Eradicate mallow. Pick off diseased leaves and burn. Spray every week with bordeaux mixture, 4-3-50.
- Horse-Radish.** WHITE MOLD (*Cystopus candidus*).—Deforming and swelling of leaves and stems, with white powdery surface growth.  
Control.—Hardly important enough on the radish to necessitate control.
- Hyacinthus.** BLIGHT (*Pseudomonas hyacinthi*).—Serious pest in the Netherlands. Sap-tubes filled with yellow slime.  
Control.—Destroy all affected plants.
- Hydrangea.** LEAF-BLIGHT (*Phyllosticta hydrangeæ*).—Leaf-spot disease which becomes serious at times.  
Control.—Destroy diseased leaves as soon as noticed.
- Iberis.** CLUB-ROOT.—See under *Cabbage*.
- Impatiens.** MILDEW (*Plasmopara obducens*).—Downy mildew of the leaves.  
Control.—Remove affected leaves and spray with bordeaux mixture.
- Ipomœa.** RUST (*Coleosporium ipomœæ*).—Common rust spotting of leaves.  
Control.—Destroy affected leaves.  
MILDEW.—See under *Convolvulus*.
- Iris.** LEAF-BLIGHT (*Botrytis galanthina*).—First the leaves and flowers are much distorted and covered with black mold growth; later the bulb may be destroyed.  
Control.—Eradicate diseased plants and grow in new soil.
- Juglans.** LEAF-SPOT (*Gnomonia leptostyla*).—Brown leaf-spot, causing defoliation.  
Control.—Collect and burn fallen leaves. Spray with bordeaux mixture while leaves are young.
- Juniperus.** CEDAR APPLES (*Gymnosporangium spp.*).—Large or small red and woody growth at tips of branches. Gelatinous in wet weather.  
Control.—Prune off affected parts. Keep apples, pears, and hawthorns at a distance.
- Kale.** BLACK-ROT.—See under *Cabbage*.
- Kohlrabi.** CLUB-ROOT.—See under *Cabbage*.
- Laburnum.** LEAF-SPOT (*Peronospora cystisi*).—Leaves become brown-spotted. Seedlings killed.  
Control.—Spray with bordeaux mixture.  
CONTAGIOUS CHLOROSIS.—See under *Abutilon*.
- Larix.** CANKER (*Dasyctypha willkomi*).—Canker of trunk and branches, usually around base of trunk.  
Control.—Eradicate diseased parts, using tree surgery methods.
- Laurus.** WITCHES' BROOM (*Exobasidium lauri*).—Branched out growths, antler-like, 2 or 3 feet in length, springing from the leaves.  
Control.—Prune off affected parts.
- Lemon.** BROWN-ROT (*Pythiacystis citrophthora*).—White mold on surface of fruit.  
Control.—Not destructive in orchard. Add copper sulfate to water when washing lemons to prevent infection of healthy ones.  
LEAF-DISEASES.—Not well understood. Probably controllable by spraying.
- Lespedeza.** MILDEW (*Microsphaera diffusa*).—Powdery mildew of leaves.  
Control.—Dust with sulfur.
- Lettuce.** DROP, or ROT (*Sclerotinia libertiana*).—Base of stems or leaves rots off, allowing leaves to drop.  
Control.—Sterilize soil with steam before planting.  
MILDEW.—See under *Cineraria*.
- Ligustrum.** ANTHRACNOSE (*Glaeosporium cingulatum*).—Affected areas light brown either oblong on one side of the stem or completely girdling it.  
Control.—Destroy by burning affected plants.
- Lilium.** LEAF-SPOT (*Botrytis sp.*).—Orange-brown or buff blotches on leaves, stem and flowers of *L. candidum*. May be same as *Tulipa* Mold, which see.  
Control.—Eradicate diseased plants.
- Lily-of-the-Valley.** STEM-ROT.—See under *Pæonia*.
- Liriodendron.** TWIG BLIGHT (*Myxosporium longisporium*).—Killing twigs.  
Control.—Prune off diseased twigs.
- Lobelia.** CANKER (*Phoma devastatrix*).—Portions of the stems covered with minute black dots.  
Control.—Remove diseased plants. They never bloom.
- Lonicera.** CANKER (*Nectria cinnabarina*).—Rough canker on limbs covered with flesh-colored or red bodies.  
Control.—Prune off or cut out all affected parts and cover wounds with tar.
- Lupinus.**—See under *Pea*.
- Lychnis.** SMUT (*Ustilago violacea*).—Pollen-sacs filled with black dust which escapes and discolors the flower.  
Control.—Destroy the affected plants and use new soil.
- Lycopersicum.**—See under *Tomato*.
- Magnolia.** LEAF-SPOT.—See under *Grapefruit*.
- Malva.** RUST.—See under *Hollyhock*. Same disease.

## CATALOGUE OF DISEASES, continued.

- Mangifera.** BLACK BLIGHT (*Dimerosporium mangiferum*).—Intense black velvety patches on both surfaces of the leaves.  
Control.—Spray with any good spray mixture.
- Matthiola.** CLUB-ROOT.—See under *Cabbage*.
- Mentha.** RUST (*Puccinia menthæ*).—A most destructive rust disease.  
Control.—None given.
- Mignonette.** LEAF-SPOT (*Cercospora resedæ*).—First reddish discoloration of leaves. Later small depressed spots with brownish or yellowish margin.  
Control.—Spraying with bordeaux mixture gives good results.
- Morus.** LEAF-SPOT (*Cercospora moricola*).—Not serious.  
LEAF-BLIGHT (*Pseudomonas mori*).—Wilt and death of leaves. Cankers girdle the twigs.  
Control.—Prune off diseased parts and burn.
- Muscari.** SMUT (*Urocystis colchici*).—Long black powdery streaks on leaves.  
Control.—Destroy affected plants by burning. Use new soil.
- Mushroom.** MOLD (*Mycogone perniciosa*).—Mushrooms develop abnormally as monstrous soft growths. These develop into a moldy mass and rot.  
Control.—Affected beds should be thoroughly cleaned and sprayed with copper sulfate, one pound to fifty gallons of water.
- Muskmelon.** DOWNY MILDEW.—See under *Cucumber*.  
WILT.—See under *Cucurbita*.
- Narcissus.** LEAF-SPOT (*Ramularia narcissi*).—Spots on leaves and stem.  
Control.—Burn diseased parts and spray with bordeaux mixture.
- Nasturtium.** WHITE "RUST." (*Cystopus candidus*).—See under *Horse-Radish*.
- Nectarine.** YELLOWS, etc.—See under *Peach*.
- Nerium.** BLACK MOLD (*Capnodium fædum*).—Black velvety-like growth on leaves.  
Control.—Spray with bordeaux mixture.
- Nicotiana.** ROOT-ROT (*Thielavia basicola*).—Blackening and rotting of the roots of seedling plants.  
Control.—Steam sterilization of seed-beds.
- MOsaic or CALICO DISEASE.**—Enzymic disease. Mottling of leaf. Spread by touch.
- Oak.** ANTHRACNOSE (*Gnomonia veneta*).—Brown spotting on under side of leaves, along veins. Brown pustules on spots. Death of leaves and twigs. See under *Arboriculture, Diseases of Trees*.  
Control.—Collect and burn all diseased twigs and leaves. Spray with bordeaux mixture frequently from time buds swell.
- Oenothera.** LEAF-GALLS (*Synchytrium fulgens*).—Yellow swellings on the leaves.  
Control.—Destroy affected leaves.
- Okra.**—See under *Hibiscus*.
- Olive.** LIMB-GALL, or KNOT (*Pseudomonas oleæ*).—Knots or galls on the twigs and limbs.  
Control.—Remove and burn affected limbs.
- Onion.** MILDEW (*Peronospora schleideniana*).—Causes a wilt or blight of the leaves.  
Control.—Spray with bordeaux mixture, 5-5-50, to which has been added one gallon of resin sal-soda sticker. First application when third leaf has developed, repeating every ten days until harvest time.  
SMUT (*Urocystis cepulæ*).—Black pustules on leaves and bulbs. Seedlings may be killed outright.  
Control.—Grow seed in new soil. Drill in with the seed one hundred pounds of sulfur and fifty pounds of air-slaked lime to the acre.
- Opuntia.** SPOT (*Diplodia opuntia*).—Sometimes a serious pest of cactus.
- Orach.** GALLS (*Urophylctis pulposa*).—Glassy swellings on leaves, stems and flowers of *Chenopodium* and *Atriplex*.  
Control.—Burn affected plants.
- Orange.** BLACK-MOLD (*Capnodium citri*).—Black mold-like growth on leaves and fruit.  
Control.—Spray with any good fungicide.
- Orchids.** LEAF-BLIGHT (*Glomerella cincta*).—Leaf dies back from the tip, turning brown.  
Control.—Burn affected leaves. Spray frequently then with bordeaux mixture.
- Ornithogalum.** WARTS (*Synchytrium niesii*).—Dirty white warts on leaves, bounded by a dark line.  
Control.—Burn diseased leaves.
- Pæonia.** STEM-ROT and WILT (*Sclerotinia pæonia*).—Gradual wilting and dying of leaves caused by decay of stem at or near surface of soil.  
Control.—Spray the stems frequently with a strong fungicide. Burn affected plants.
- Palms.** LEAF-SPOT (*Glaeosporium allescheri*).—May cause ultimate death of leaves.  
Control.—Frequent spraying with bordeaux mixture and eradication of diseased leaves may prove beneficial.



## CATALOGUE OF DISEASES, continued.

- Pandanus.** BLACK CANKER (*Nectria pandani*).—Kills branches and entire plants. Black pustules on bark oozing black tendrils.  
*Control.*—Cut out diseased portions as soon as noticed.
- Pansy.** LEAF-SPOT (*Peronospora viola*).—Discolored spots with pale violet growth on them.  
*Control.*—Spray with bordeaux mixture.
- Papaver.** MILDEW (*Peronospora arborescens*).—Downy mildew of wild and cultivated poppies. Especially injurious to seedlings of garden species.  
*Control.*—Spray with bordeaux mixture.
- Parsley.** LEAF-SCORCH (*Septoria petroselinii*).—Small scattered brown patches, which increase in size until whole leaf is covered.  
*Control.*—Spray early with dilute bordeaux. Pick off and burn affected leaves.
- Parsnip.** LEAF-BLIGHT.—See under *Celery*, *Early Leaf-Blight*.
- Pea.** MILDEW (*Erysiphe polygoni*).—A powdery mildew on pods and leaves.  
*Control.*—Dust sulfur over the plants.
- Peach.** BLIGHT (*Coryneum beyerinkii*).—A spotting, gumming and death of the buds and twigs, particularly in the lower parts of the tree. The fruit drops.  
*Control.*—For California conditions, two applications bordeaux mixture, 5-5-50, or lime-sulfur, 1-10, (1) in November or December, and (2) in February or March.
- LEAF-CURL** (*Eozosus deformans*).—Leaves curl and wrinkle.  
*Control.*—Spray with lime-sulfur, 1-11, before buds swell.
- BROWN-ROT** (*Sclerotinia fructigena*).—Rot on fruit and cankers on limbs.  
*Control.*—Spray with self-boiled lime-sulfur, 8-8-50, adding two pounds arsenate of lead. Spray (1) about time shucks are shedding from young fruit; (2) two or three weeks later; (3) one month before fruit ripens.
- SCAB, or BLACK-SPOT** (*Cladosporium carpophilum*).—Black scab-like spots on fruit.  
*Control.*—Self-boiled lime-sulfur applied as under *Brown-Rot*.
- YELLOW.**—A fatal disease. Red spots in fruit. Tuft-like growth of new shoots and finally yellow foliage.  
*Control.*—Burn affected trees.
- Pear.** BLIGHT (*Bacillus amylovorus*).—Flowers, young fruit, twigs, and leaves turn black and die. Limbs die back and sunken cankers form in bark.  
*Control.*—Eradicate all wild hawthorns, pears and apples. Inspect and remove all blighted parts of tree. Paint wounds with coal-tar.
- SCAB.**—Very similar disease to *Apple Scab*, which see.
- Pecan.** LEAF-BLOTCH (*Mycosphaerella convexula*).—Dark-colored blotches covered with minute black dots on leaves in mid-summer.  
*Control.*—None given.
- Pelargonium.** DROPSY.—Translucent spotting of leaf. Spots finally die.  
*Control.*—Withhold water until absolutely necessary.
- Persimmon.** ANTHRACNOSE (*Glomerella rufomaculans*).—Similar if not identical to *Piper Anthracnose*, which see.
- Petunia.** WILT.—See under *Dahlia*.
- Phlox.** STEM-CANKER (*Pyrenochaeta phloxidis*).—Canker just above the ground on the stem. Plant dies; first turning yellow and then falls over.  
*Control.*—Diseased stems should be removed and burned.
- Physalis.** WILT (*Bacillus solanacearum*).—Pith of stem turns brown, sap-tubes filled with viscid ooze.  
*Control.*—Get rid of insects such as potato beetle and burn all affected plants.
- Picea.** LEAF-SPOT and LEAF-CAST (*Phoma sp.*).—Causes discoloration and dropping of needles. Black dots on affected needles.  
*Control.*—Clean up all fallen needles and burn.
- DROUGHT INJURY.**—Drying up of needles. Water in dry weather.
- Pine.** ROOT-ROT (*Armillaria mellea*).—Tops turn yellow and die, swelling of trunk at surface of ground. Decay of roots with black threads abundantly present. Toadstools around base of tree.  
*Control.*—Dig up and burn and destroy all toadstools near the affected trees.
- Pineapple.** HEART-ROT.—Browning of the axis of the fruit, due to excessive moisture at time of ripening.  
*Control.*—Keep down humidity in greenhouses.
- Piper.** ANTHRACNOSE (*Glосporium piperatum*).—Spots on leaves of plants. Also apple bitter-rot fungus (*Glomerella rufomaculans*) causes similar spots on the fruits.  
*Control.*—Frequent spraying with bordeaux mixture.
- Platanus.** ANTHRACNOSE.—See under *Oak*. Same disease.
- Plum.** BLACK-KNOT (*Plowrightia morbosa*).—Black tumorous swellings from 1 to several inches in length, on limbs and twigs.  
*Control.*—Burn all affected parts in the fall. Burn whole tree if badly affected.
- BROWN-ROT.**—See under *Peach*.
- Polygonum.** TAR-SPOT (*Rhytisma bistortæ*).—Black tar-like spots on leaves.  
*Control.*—Burn affected leaves.
- Pomegranate.** INTERNAL ROT (*Sterigmatocystis castanea*).—Central cavity of fruit occupied by a black sporulating fungus.  
*Control.*—None known.

## CATALOGUE OF DISEASES, continued.

- Pomelo.** WITHER-TIP (*Colletotrichum gloeosporioides*).—Anthracnose cankers of stem, spots on leaves and flowers and general wilting of tips of branches.  
*Control.*—Prune off affected parts and spray with bordeaux mixture.
- Populus.** HEART-ROT (*Polyporus sulphureus*).—Red rot of the wood, which finally breaks up into cubes.  
*Control.*—Surgery methods.
- Potato.** EARLY BLIGHT (*Alternaria solani*).—Circular spots, usually in July and final blighting of whole leaf.  
*Control.*—Spray with bordeaux mixture, every ten days, beginning when plants are 6 to 8 inches high.
- LATE BLIGHT and POTATO-ROT** (*Phytophthora infestans*).—Quick-spreading watery appearing spots in leaves. Mildew on under side. Plants appear as scalded by hot water. Tubers rot in soil or soon after digging.  
*Control.*—Spray with bordeaux mixture, 5-5-50, at least three applications and in wet seasons, six or more may be necessary. Use from forty to one hundred gallons per acre.
- SCAB** (*Oöspora scabies*).—A scabby and pitted roughness of the tubers.  
*Control.*—Keep lime and ashes off the land. Soak uncut seed tubers in a solution of formalin, one pint to thirty gallons of water for two hours. Avoid land that has grown scabby potatoes.
- Potentilla.** LEAF-SPOT.—See under *Strawberry*.
- Primula.** ROT (*Botrytis sp.*).—Similar to rot of *Pæonia*, which see.
- Prune.**—See under *Plum*.
- Prunus.**—See under *Cherry*, *Plum* and *Peach*.
- Pseudotsuga.** BLIGHT (*Sclerotinia fockeliana*).—Gray mold of seedlings and younger shoots of older trees in moist situations.  
*Control.*—Spray with bordeaux mixture.
- Psidium.**—See under *Guava*.
- Pyrus.**—See under *Apple* and *Pear*.
- Quince.** BLIGHT.—See under *Pear*.
- RUST** (*Gymnosporangium globosum*).—Orange rust of fruit.  
*Control.*—Destroy red cedars in the neighborhood, also wild apples and hawthorns. Spray as for *Apple Scab*.
- Radish.** WHITE "RUST" or MILDEW (*Albugo candidus*).—A whitish powdery growth on the leaves and petioles, often causing distortion.  
*Control.*—Steam sterilize the soil before planting.
- CLUB-ROOT.**—See under *Cabbage*.
- BLACK-ROT.**—See under *Cabbage*.
- Ranunculus.** MILDEW (*Plasmopara pygmaea*).—Downy mildew of leaves.  
*Control.*—Spray with bordeaux mixture.
- Raspberry.** ANTHRACNOSE (*Glосporium venetum*).—Circular or elliptical, gray scab-like spots on the canes.  
*Control.*—Remove diseased canes as soon as fruit is picked. Avoid taking young plants from diseased plantings.
- CROWN-GALL.**—See under *Blackberry*.
- RED, or ORANGE RUST** (*Gymnosporangium interstitialis*).—Dense red powdery growth on under side of leaves of black varieties and blackberries.  
*Control.*—Dig up and destroy affected plants.
- LEAF-SPOT.**—See under *Dewberry*. Same disease.
- Retinospora.** GALL (*Gymnosporangium sp.*).—Swellings on limbs and twigs with red-brown pustules covering them.  
*Control.*—Prune off affected parts and keep at a distance from species of *Pomæ*.
- Rhamnus.** RUST (*Puccinia coronata*).—Irregular yellow blotches, with yellow pustules on under side of leaf. Also on fruit and flowers.  
*Control.*—Keep at a distance from "rusted" cereals and other grasses.
- Rheum.** SOFT-ROT.—See under *Carrot*.
- Rhododendron.** GALLS (*Exobasidium rhododendri*).—Galls of the size of a pea or larger, at first pale green, then red and brownish covered with white bloom.  
*Control.*—Leaves bearing galls should be removed and burned.
- Rhubarb.** SOFT-ROT.—See under *Carrot*.
- Rhus.** CANKER and TWIG BLIGHT (*Endothia parasitica*).—See under *Chestnut*. Causes death of twigs.
- Ribes.**—See under *Currant* and *Gooseberry*.
- Richardia.** SOFT-ROT (*Bacillus arbores*).—Soft rotting of corms (bulbs) and leaves.  
*Control.*—Change soil every three or four years. Reject corms which show the disease.
- Robinia.** HEART-ROT (*Trametes robinophila* and *Fomes rimosus*).—Heart-wood converted into punk. Shelf-like bodies grow from wounds.  
*Control.*—Surgery methods.
- Rose.** MILDEW (*Sphaerotheca vannosa*).—A white powdery mildew on new growth.  
*Control.*—In greenhouses, keep steam-pipes painted with a paste of equal parts lime and sulfur mixed in water. Out-of-doors roses should be dusted with sulfur flower or sprayed with potassium sulfid, one ounce to three gallons of water.
- STEM-BLIGHT.**—Similar to *Raspberry Anthracnose*, which see.

## CATALOGUE OF DISEASES, continued.

- Rubus.**—See under *Raspberry*.
- Salix.** RUST.—Numerous species of the rust fungi produce red rust spots on the leaves.  
Control.—Keep at a distance from species of conifers.
- HEART-ROT** (*Trametes suaveolens*).—Enters through wounds.  
Control.—Surgery methods.
- Salsify.** MILDEW (*Albugo tragopogonis*).—Distortion and white blisters on host.  
Control.—Eradicate affected plants and grow on new soil apart from wild and cultivated species of the Compositæ.
- Sambucus.** CANKERS.—See under *Lonicera*.
- Sarracenia.** BLIGHT.—See under *Orchids*.
- Saxifraga.** RUST (*Puccinia pascchkei* and *P. saxifrage*).—Dark brown concentric circles of rust pustules on upper surface of the leaves.  
Control.—Burn affected leaves.
- Scilla.** BULB-ROT (*Sclerotinia bulborum*).—Yellow stripes and blotches on leaves in early summer, with olive-brown mold on them. Rots the bulb later.  
Control.—Destroy affected plants. Spray with potassium sulfid. Use new soil thereafter.
- Sedum.** LEAF-SPOT (*Septoria sedi*).—Dark circular blotches appear on the leaves and defoliation occurs.  
Control.—Destroy affected parts by burning.
- Sempervivum.** RUST (*Endophyllum sempervivi*).—Brown rust pustules rupturing epidermis of leaf.  
Control.—Destroy affected plants as the fungus lives over from year to year in the same plant.
- Senecio.** RUST (*Coleosporium senecionis*).—Orange patches on under surface of leaf.  
Control.—Keep at a distance from species of *Pinus*. Burn affected plants to protect neighboring pines.
- Sequoia.** BLIGHT.—See under *Pseudotsuga*.
- Silene.** SMUT.—See under *Lychnis*.
- Solanum.**—See under *Potato*, *Eggplant*, etc.
- Sorbus.** BLIGHT.—See under *Pear*.
- Spinach.** ANTHRACNOSE (*Colletotrichum spinaceæ*).—Spots on leaves, at first minute and watery, gradually increasing in size and becoming gray and dry.  
Control.—Gather and destroy all diseased leaves.
- MILDEW (*Peronospora effusa*).—Gray, slightly violet, patches of a velvety texture on under side of leaves.  
Control.—As for Anthracnose, which see.
- Spiræa.** RUST (*Triphragmium ulmaricæ*).—Reddish yellow and dark brown rust pustules on leaves.  
Control.—Burn affected parts.
- Squash.** WILT.—See under *Cucurbita*.
- Strawberry.** LEAF-SPOT, or LEAF-BLIGHT (*Mycosphærella fragariæ*).—Small purple or red spots appearing on leaves. Leaf appears blotched.  
Control.—Spray with bordeaux mixture, 4-4-50, soon after growth begins and make three or four additional sprayings during season.
- Sweet Pea.** MILDEW.—See under *Pea*.
- Sweet Potato.** BLACK-ROT (*Ceratocystis fimbriata*).—Black shank and a black rot of tuber.  
Control.—Never use sprouts from affected potatoes. Steam sterilize hotbeds.
- ROTS.—The sweet potato is susceptible to a large number of rots, soft, dry, hard, white, etc.  
Control.—Use soil which has not grown diseased sweet potatoes heretofore.
- Syringa.** MILDEW (*Microsphaera alni*).—White powdery mildew on upper surface of leaves.  
Control.—Dust with sulfur.
- TWIG AND BUD DISEASE (*Phytophthora syringæ*).—Tips of twigs killed.  
Control.—Prune off twigs.
- Thalictrum.** RED-SPOT (*Synchytrium anemones*).—Red eruptions on stem, leaf and flower. Causing at times swelling and crumpling of the organ.  
Control.—Burn affected parts.
- Thuja.** ROOT-ROT (*Polyporus schweinitzii*).—Diseased wood yellowish, cheesy, brittle when dry.
- HEART-ROT (*Fomes carneus*).—Causes pockets in the affected wood.  
Control.—Remove all affected wood, using surgery methods.
- Tilia.** LEAF-SPOT (*Cercospora microsora*).—Causes spotting and defoliation.  
Control.—Two sprayings in Massachusetts resulted in longer retention of the leaves.
- Tomato.** LEAF-SPOT (*Septoria lycopersica*).—At first small spots appear, which spread until the whole leaf is consumed. Fruit may be attacked.  
Control.—Spray with bordeaux mixture, 4-4-50, making the first application two weeks after the plants are set out and repeating every two weeks throughout the season.
- DOWNY MILDEW.—See under *Potato*. Late Blight.
- END-ROT.—Due to lack of sufficient soil moisture.  
Control.—Water soil in dry periods.
- Toxylon** (*Maclura*). RUST (*Physopella ficæ*).—Pale cinnamon-brown rust pustules on under side of leaf.  
Control.—Destroy by burning the affected leaves.

## CATALOGUE OF DISEASES, continued.

- Tropæolum.**—See under *Horse-Radish*.
- Tsuga.** HEART-ROT (*Trametes pini*).—Light brown decay pitted with small oblong cavities, which are white-lined.
- SAP-ROT (*Fomes pinicola*).—Soft decay of sap-wood.  
Control.—Surgery methods.
- Tulipa.** MOLD (*Sclerotinia parasitica*).—Olive-brown, velvety patches formed on leaves, stem, and flowers; also, later, small black lumps at base of stems.  
Control.—Burn affected plants.
- Turnip.** CLUB-ROOT.—See under *Cabbage*. Same disease.
- SOFT-ROT.—See under *Carrot*. Same disease.
- Ulmus.** TAR-SPOT (*Gnomonia ulmea*).—Black spots on upper surface of leaves.  
Control.—Burn old leaves in fall or winter.
- HEART-ROT (*Pleurotus ulmaris*).—Soft rotting of wood.  
Control.—Surgery methods.
- Vaccinium.** LEAF-BLISTER (*Exobasidium vaccinii*).—Large blisters on leaves, petioles and stems, of a red or purple color. White bloom beneath.  
Control.—Remove and burn diseased parts.
- Verbena.** MILDEW (*Erysiphe cichoracearum* and others).—Powdery mildew growths on leaves.  
Control.—Spray with any good fungicide or dust with powdered sulfur.
- Veronica.** LEAF-SPOT (*Septoria veronicæ*).—Well-defined spots on leaves.  
Control.—Pick off and burn affected leaves.
- Vinca.** LEAF-SPOT (*Sphæropsis vincæ*).—Leaves disfigured by spots which occur on the stem at times as well.  
Control.—Destroy diseased parts of plants.
- Violet.** ROOT-ROT (*Thielavia basicola*).—Plants make poor growth; roots rotted off.  
Control.—Start in steam-sterilized soil, and transfer to sterilized beds.
- Vitis.**—See under *Grape*.
- Walnut.** BLIGHT (*Pseudomonas juglandis*).—Black spotting of fruit and black cankers on the stems. Twigs and fruit-spurs killed.  
Control.—None known except such as mentioned under *Pear Blight*. Grow immune varieties.
- ANTHRACNOSE, or LEAF-BLIGHT (*Marsonia juglandis*).—See under *Hickory-Nut*. Same disease.
- Watermelon.** MILDEW.—See under *Cucumber*.
- WILT (*Fusarium vasinfecta*).—Wilting of leaves and plant dries up.  
Control.—None recommended. Resistant varieties should be grown.
- Yucca.** LEAF-BLOTCH.—See under *Agave*.
- Zea.**—See under *Corn*.
- Zinnia.** WILT.—See under *Dahlia*.

DONALD REDDICK.

## Insect enemies of plants.

The animals which constitute the insect world play an important part in most horticultural operations. The busy bee is an indispensable aid in the production of many fruits, but the equally busy jaws of canker-worms or other insects oftentimes seriously interfere with man's plans for profitable crops. Horticulturists should become more intimately acquainted with their little friends and foes in the insect world. Not only from the economic standpoint is this knowledge necessary in the business of growing plants, but the striking peculiarities of form, coloring, structure, habits, and the wonderful transformations of insects afford one of the most interesting fields in nature. The life-stories of many insects, if told in detail, would rival in variety and interest many a famous fairy tale. The science that treats of insects, or entomology, has now reached the stage at which its devotees are no longer looked upon with ridicule in most communities. At the present time more than 350 trained men are officially employed in entomological work in the United States and Canada.

*What they are.*—An insect is an animal which, in the adult stage, has its body divided into three distinct regions: the head, the thorax and the abdomen (Fig. 1293). The head bears one pair of antennæ, and there are always three pairs of legs and usually either one or two pairs of wings attached to the thorax. By these characteristics one can usually readily distinguish an adult insect from any other animal. Among the near relatives of insects in the animal world are the cray-



fish, sow-bugs, and crabs, but these are mostly aquatic animals, breathing by true gills; they have two pairs of antennæ, and at least five pairs of legs. Centipedes, or "hundred-legged worms," and millipedes, or "thousand-legged worms," are also nearly related to insects, but they have the thorax and abdomen forming a continuous region, and with six to 200 segments, each bearing one or two pairs of legs; they have one pair of antennæ.

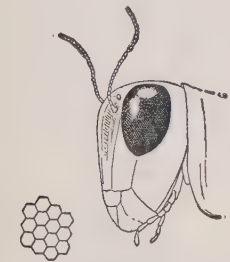


1293. A beetle, showing the different parts.

*How they are constructed.*—Insects are constructed on an entirely different plan from the higher animals. Their supporting skeleton is outside, it being simply the skin hardened more or less by a horny substance, known as chitin. This firm outer wall, or skeleton, supports and protects the muscles, blood-vessels, nerves, and other organs within. The mouth-parts, antennæ and eyes of an insect are attached to its head, and all are exceedingly useful organs, as will be shown later in discussing the feeling and the other sensations of an insect. An insect's wings and legs are always borne by the thorax. The wings are primarily organs of flight, but are used as musical organs by some of the grasshoppers and crickets. Female canker-worm moths, bed-bugs, and some other insects have practically no wings, and the house-flies, mosquitos, male bark lice, and similar insects have but one pair of wings. Insects use their legs primarily for locomotion; some have their front legs modified for catching other insects for food; others have hind legs fitted for jumping, while the honey-bee has little "pockets" on its hind legs for carrying pollen to feed its young.

The arrangement of the internal organs in insects is interesting and somewhat peculiar. The alimentary or food canal in larvæ is a nearly straight tube, occupying the central portion of the body; in adult insects it is usually much longer than the body and is more or less folded; from the mouth the food passes through a

pharynx, an esophagus, sometimes a crop and a gizzard, a stomach, and a small and large intestine. The nervous system of an insect is similar to that in the higher animals, but it extends along the venter instead of the back. There is a little brain in the upper part of the head, and two nerve cords extend from this around the food-canal to another ganglion or nerve center in the lower part of the head; two nerve cords then extend longitudinally along the venter and connect a series of nerve centers or ganglia, typically one for each segment of the body.



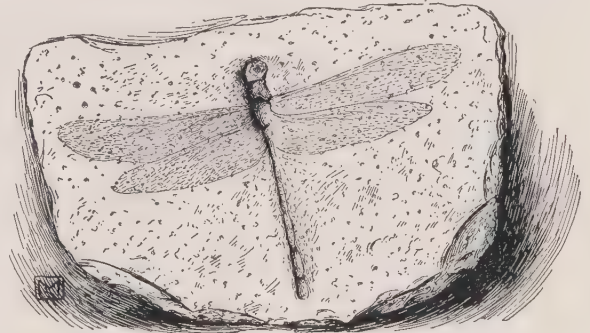
1294.

Head of grasshopper.

Showing the great eye. A detail of a part of the surface of the compound eye is also shown.

From each of these ganglia or little brains nerves arise, which supply the adjacent organs and ramify throughout the body. In insects, all parts of the body cavity that are not occupied by the internal organs are filled with a rich, colorless or slightly greenish blood. There is no system of tubes like our arteries and veins, in which the blood is con-

fined and through which it flows. There is a so-called "heart" above the food-canal, along the middle line of the back; it is a tube consisting of several chambers communicating with each other and with the body cavity by valvular openings. The blood is forced through this heart into the head, where it escapes into the body cavity. It then flows to all parts of the body, even out into the appendages, in regular streams which have definite directions, but which are not confined in tubes. They, like the ocean currents, are definite streams with liquid shores. Insects do not breathe through the mouth, as many suppose, but through a series of holes along the sides of the body. These openings, or spiracles, lead into a system of air-tubes, called tracheæ. These tracheæ branch and finally ramify all through the insect. Insects have no lungs, but the tracheæ sometimes connect with air-sacs or bladders in the body, which help to buoy up the insect when flying. Thus the relation between the circulation of the blood and respiration is not nearly so intimate in insects as in man. In insects the air is carried to all the tissues of the body in the tracheæ and the blood simply bathes these tissues. Just how the blood is purified and how the waste matter is disposed of in insects are not yet clearly understood. Aquatic insects breathe by either carrying down bubbles of air from the surface entangled under their wings, or they may be provided with organs known as tracheal gills; these



1295. Fossil dragon-fly, *Petalia longialata*. ( $\times \frac{1}{4}$ )

are usually plate-like expansions of the body that are abundantly supplied with tracheæ, in which the air is brought practically in contact with the air in water, and may thus be purified. More than 4,000 different muscles have been found in a single caterpillar. Notwithstanding their delicate appearance, these muscles are really very strong and their rapidity of action is wonderful; in certain gnats the muscles move or vibrate the wings 15,000 times a second.

*Their sensations.*—Insects can see, feel, hear, taste and smell, and they may also possess other senses, as a sense of direction. Many insects have two kinds of eyes. On each side of the head the large compound eye is easily recognized (Fig. 1294); each compound eye is composed of many small eyes, from fifty in some ants to many thousands in a butterfly or dragon-fly. Between these compound eyes, from one to four simple eyes are to be found in many adult insects. Caterpillars and other larvæ possess only simple eyes. It is thought that each facet of the compound eye sees a part of an object; thus the whole eye would form a mosaic picture on the insect's brain. The simple eyes doubtless see as our eyes do, and seem to be best adapted for use in dark places and for near vision. Insects do not see the form of objects distinctly, but their eyes are doubtless superior to ours in distinguishing the smallest movements of an object. It is now supposed that no insects can distinctly see objects at a greater distance than 6 feet. It must be a sixth

sense, a sense of direction, which enables the bee to find its way for a mile or more back to its home. Insects are doubtless able to distinguish the color of objects, and some insects seem to prefer certain colors. Blue is said to be the favorite color of the honey-bee, and violet that of ants; ants are also apparently sensitive to the ultra-violet rays of light, which man cannot perceive. It is generally supposed that the shape and high colors of flowers attract insects; but recent experiments seem to show that insects are guided to flowers by the sense of smell rather than by sight. The hard outer

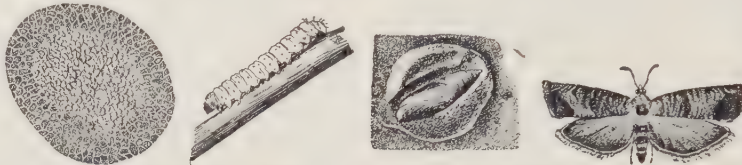
skin of an insect has no nerves distributed in it, hence it is not sensitive; but it is pierced with holes, in which grow hairs that are in connection with nerves at their base. It is by means of these sensory hairs that insects feel, and are sensitive to touch on most parts of the body. Doubtless insects are not deaf, for we know that many of them make sounds, and it must naturally follow that they have ears to hear, for there is every reason to suppose that they make these sounds as love-songs to attract the

of each front leg. Some think that mosquitos have the faculty of the perception of the direction of sound more highly developed than in any other class of animals. Insects undoubtedly possess the sense of taste. When morphine or strychnine was mixed with honey, ants perceived the fraud the moment they began to feed. The substitution of alum for sugar was soon detected by wasps. Bees and wasps seem to have a more delicate

gustatory sense than flies. Taste organs have been found in many insects, and are usually situated either in the mouth or on the organs immediately surrounding it.

Many experiments have shown that the antennæ are the principal organs of smell in insects. Blow-flies and cockroaches which have had their antennæ removed are not attracted by their favorite food, and male insects find their mates with difficulty when deprived of their antennæ. The familiar world which surrounds us may be a totally different place to insects. To them it may be full of music which we cannot hear, of color which we cannot see, of sensations which we cannot perceive. Do insects think or reason? Why not? Their actions are said to be the result of inherited habit or instinct. But some of them have been seen to do things which require the exercise of instinctive powers so acute and so closely akin to reason that one can hardly escape the conclusion that some insects are endowed with reasoning powers.

*Their number, size and age.*—Experts guess that there are from 2,000,000 to 10,000,000 different kinds of insects in the world. Only about 400,000 of these have yet been described and named by man. Between 30,000 and 40,000 are now known in North America. Four-fifths of all the kinds of animals are insects; some single families of insects are said to contain more species than one can see stars in a clear sky at night; and there are as many butterflies as birds in North America. The larger part of the land animals are insects, and it is asserted that the larger proportion of the animal matter existing on the lands of the globe is probably locked up in the forms of insects. Insects vary in size from little beetles, of which it would take 100, placed end to end, to measure an inch, up to tropical species 6 or 8 inches in length, or of equal bulk to a mouse. Insects have a very long, but, as yet, very imperfect pedigree extending through the geological ages to Silurian times. Fossil remains of many different kinds of insects have been found in the rocks (Fig. 1295); even such delicate insects as plant-lice left their impress on the rocks ages ago. In the carboniferous or coal age, the insect world was evidently quite different from that of today, for fossils of veritable insect mammoths have been found; dragon-flies with a wing-expanse of 2 to 3 feet then existed. Insect fossils found in the tertiary rocks



1296. The four stages in an insect's life—egg, larva, pupa, imago.—The codlin-moth. (Egg much enlarged; others  $\times 1\frac{1}{2}$ )

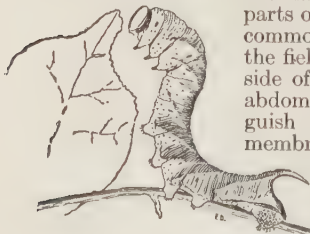


1297. Nymphs of the four-lined leaf-bug, and adult of the tarnished plant-bug.

The smaller one at the left is the nymph recently hatched. The next is the nymph after the first moult. The imago is shown at the right. Hair lines at the right of nymphs, and small figure near imago indicate the natural size.

sexes, as a means of communication, or possibly to express their emotions. Some think that bees and ants hear sounds too shrill for our ears. Insects have no true voice, but produce various noises mechanically, either by rapid movements of their wings, which causes the humming of bees and flies, or by friction between roughened surfaces on the body or its appendages, thus producing the rasping sounds or shrill cries of some crickets and grasshoppers. The house-fly hums on F, thus vibrating its wings 335 times in a second, while the wing tone of the honey-bee is A. Usually the males are the musicians of the insect world, but it is the female of the familiar mosquito which does the singing, and the "biting" also. The male mosquito doubtless hears the song of his mate by means of his antennæ, as the song causes the antennal hairs to vibrate rapidly. Organs which are structurally ear-

like have been found in various parts of the body of insects. The common brown grasshoppers of the fields have a large ear on each side of the first segment of the abdomen; one can easily distinguish with the naked eye the membrane or tympanum stretched over a cavity. Many of the long-horned green grasshoppers, katydids and crickets have two similar ears on the tibia



1298. Larva of a sphinx moth.



1299. Tent-caterpillar.

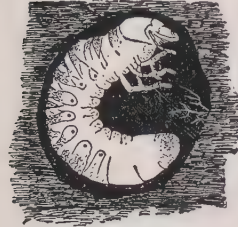


indicate that there were even more kinds of insects than now.

*Their growth and transformations.* Fig. 1296.—Insects begin life as an egg; in some cases the egg stage is passed within the body of the mother, which then gives birth to living young. The eggs of insects exhibit a wonderful variety of forms, sizes, colors and characteristic markings. A single scale insect may lay thousands of eggs, while some plant-lice produce only one. Remarkable instinct is often shown by the mother insect in placing her eggs where her young will find proper food. From their birth the young of some of the lowest or most generalized insects closely resemble their parents, and they undergo no striking change during their life; hence are said to have no metamorphosis. In the case of grasshoppers, stink-bugs, dragon-flies, and many



1300. A maggot. Larva of a dipterous insect.



1301. A grub. Larva of a beetle.

other insects, the young at birth resemble their parents, but have no wings. As they grow, wings gradually develop and often changes in markings occur, until the adult stage is reached. The growth, however, is gradual, and no striking or complete change occurs, and these insects are said to undergo an incomplete metamorphosis. The young insects in all stages are called *nymphs* (Fig. 1297); thus insects with an incomplete metamorphosis pass through three different forms during their life: an *egg*, the young or *nymph* stage, and the *adult*. From the eggs of butterflies, moths, flies, beetles, bees and some other insects, there hatches a worm-like creature, much unlike the parent insect. It is called a *larva* (Fig. 1298); the larvæ of butterflies and moths are often called *caterpillars* (Fig. 1299); *maggots* are the larvæ of flies (Fig. 1300); and the term *grub* is applied to the larvæ of beetles and bees (Fig. 1301).

When these larvæ get their full growth, some of them go into the ground where they form an earthen cell, while others proceed to spin around themselves a silken home or *cocoon* (Figs. 1302–1304). In these retreats the larvæ change to a quiescent or lifeless-appearing creature which has little resemblance to either the larva or the parent insect. It is called a *pupa* (Fig. 1305). The pupæ of butterflies are often called *chrysalids*. Flies change to pupæ in the hardened skin of the maggot. Some pupæ, like those of mosquitos, are very active. Wonderful changes take place within the skin of the pupa. Nearly all the larval tissues break down and the insect is practically made over, from a crawling larva to a beautiful, flying adult insect. When the adult is fully formed, it breaks its pupal shroud and emerges to spend a comparatively brief existence as a winged creature. Such insects are said to undergo a complete metamorphosis, and pass through four strikingly different



1303. Lengthwise section of the *Promethea* cocoon.

Showing at apex the valve-like opening through which the moth escaped.

*How they grow.*—Many persons think that the small house-flies grow to be the large ones. While most insects feed after they become adults, they get little or none of their growth during their adult life. Insects grow mostly while they are larvæ, or nymphs. The maggots from which the little house-flies develop doubtless do not have as luxuriant or favorable feeding-grounds as do those of the larger flies. In thirty days some leaf-feeding caterpillars will increase in size 10,000 times; and a certain flesh-feeding maggot will in twenty-four hours consume two hundred times its own weight, which would be paralleled in the human race if a one-day-old baby ate 1,500 pounds the first day of its existence! The skin of insects is so hard and inelastic that it cannot stretch to accommodate such rapid growth. But nature obviates this difficulty by teaching these creatures how to grow a new suit of clothes or a new skin underneath the old one, and then to shed or molt the latter. The old skin is shed in its entirety, even from all the appendages, and sometimes remains in such a natural position where the insect left it as to easily deceive one into thinking that he is looking at the insect rather than at its cast-off clothes. Some insects are so neat and economical that they devour their old suits or skins soon after molting them. Larvæ, or nymphs, may molt from two or three to ten or more times; the larvæ do not often change strikingly in appear-



1304. End of cocoon of *Cecropia* moth.

Inside view, showing where the moth gets out.



1302. Cocoon of *Promethea* moth.

Made in the roll of a leaf. The insect weaves a web about the leaf-stalk and ties it to the parent stem, so that the leaf cannot fall.



1305. Pupa of tomato worm.



1306. The cabbage butterfly.

ance, but the nymphs gradually acquire the characters and structures of the adult.

*How they eat.*—To the horticulturist, the mouth-parts of an insect are its most important organs or appendages. The mouth-parts are built on two very different plans.



1307. Imago of a tent-caterpillar.

Grasshoppers, beetles, caterpillars and grubs have two pairs of horny jaws, working from side to side, with which they bite or chew off pieces of their food, that then pass into the food-canal for digestion (Fig. 1312). The scale insects (Fig. 1313), plant-lice, true bugs (Fig. 1314), mosquitos and others have these jaws drawn out into thread-like organs, which are worked along a groove in a stiff beak or extended under-lip. Such insects can eat only liquid food, which they suck with their beak-like mouth-parts. The insect places its beak on the surface of the plant, forces the thread-like jaws into the tissues, and then begins a sucking operation, which draws the juices of the plant up along the jaws, and the groove in the beak into the food-canal of the insect. Thus a sucking insect could not partake of particles of poison sprayed on the surface of a plant. Its mouth-parts are not built for such feeding, and as it is impracticable to poison the juice of the plant, one is forced to fight such insects with a deadly gas, or each individual insect must be actually hit with some insecticide. A knowledge of these fundamental facts about the eating habits of insects would have saved much time and money that have been wasted in trying to check the ravages of sucking insects with paris green and similar poisons. Some insects, like the fruit flies, have mouth-parts fitted for lapping up liquids.



1308. A beetle. The adult of a borer larva.

#### Beneficial insects.

The horticulturist has many staunch and true friends among the insects. The honey-bee, the many wild bees, and other insects, as they visit the blossoms to get food for themselves, for their young, and honey for man, leave an insurance policy in the shape of tiny grains of pollen, which often insures a crop of fruit that otherwise might be extremely uncertain. The honey-bee is often accused of biting into ripe fruits, especially grapes. They have not yet been proved guilty, and careful, exhaustive experiments have shown that they will not do it under the most favorable circumstances. Wasps and other strong-jawed insects are responsible for most of this injury, the bees only sipping the juice from the wound. See *Bees*, Vol. I.



1309. One of the weevil beetles. With a long and strong proboscis.

Most of the pretty little beetles known to every child as "lady-bugs" eat nothing but injurious insects; many other beetles are also predaceous. Man is also often deeply indebted to many of the two-winged insects or true flies whose larvæ live as parasites inside the body of insect pests or feed upon them predaceously. Were it not for the ravenous larvæ of the "lady-bugs" and of the syrphus flies, plant-lice of all kinds would soon get beyond control. While man must recognize these little friends as valuable aids in his warfare against the hordes of insect pests, it will rarely be safe

to wait for the pests to be controlled by their enemies. Fig. 1315 shows a tomato worm bearing the cocoons of a parasite. Fig. 1310 shows one of the predaceous beetles destroying a cutworm.

#### Injurious insects.

There are now several thousand different kinds of insects that may be classed as injurious in the United States and Canada. Over 600 kinds were exhibited at the Columbian Exposition in 1893. All of these may not be injurious every year, as most insect pests have periods of subsidence, when certain factors, possibly their enemies or perhaps climate conditions, hold them in check. The outlook for American horticulturists, so far as injurious insects are concerned, is not encouraging. Nowhere else in the world are insects being fought as intelligently, successfully and scientifically as in America, yet we never have exterminated, and it is very doubtful if we ever will, a single insect pest. This means that American horticulturists will never have any fewer kinds of insects to fight. On the contrary, there are many more insect pests now than in our grandfather's early days, and new pests are appearing every year. This alarming state of affairs is largely due to two causes, for both of which man is responsible. Man is continually encroaching upon and thereby disturbing nature's primitive domain and the equilibrium which has there become established between animals and plants. In consequence, insects like the Colorado potato beetle, the apple-tree or the peach-tree borers have been attracted from their original wild food-plants to man's cultivated crops, which often offer practically unlimited feeding-grounds. Most of the new insect pests, however, are now coming to America from foreign shores. American horticulturists are continually importing plants from the ends of the earth, and oftentimes the plants are accompanied by one or more of their insect pests. Some comparatively recent introductions of this kind are the sinuate pear-borer, the pear midge, the gypsy moth, the brown-tail moth, the horn-fly and the elm leaf-beetle; such standard pests as the Hessian fly, the cabbage butterfly, the currant-worm, the codlin-moth (Fig. 1296) came in many years ago. Of the seventy-three insects which rank as first-class pests, each of them almost annually causing a loss of hundreds of thousands of dollars, over



1310. Ground beetle. One of the commonest predaceous insects.



1311. Moths of the peach-tree borer. The lowest one is male.



one-half have been introduced from foreign countries, mostly from Europe. It is a significant fact that usually these imported insects become much more serious pests here than in their native home; this is doubtless largely due to the absence of their native enemies, to more favorable climatic conditions here, and to a less intense system of agriculture in this country. Most of our worst insect pests of the fruits, of the garden crops, of the granary, of the household, of the greenhouse,



1312. Mouth-parts of a biting insect.

and practically all of our most dangerous scale insects, are of foreign origin. Man will continue to encroach on and disturb nature's primitive domain, and commercial operations will never cease, nor is there much hope of ever effectually quarantining our shores against these little foes; hence there seems to be no practicable way to stop this increase of the insect enemies of the horticulturist. The one who is the best fitted by nature, and who best fits himself with a knowledge of these pests and how to fight them, will usually be the one

to survive and reap the reward of profitable crops. No part of a plant, from its roots to the fruit it produces, escapes the tiny jaws or the sucking beaks of insects.

#### *Root-feeding insects.*

—Many of the small fruits and vegetables are often seriously injured by insects feeding on the roots. The grape-vine fidia (the grub of a small beetle) and the grape phylloxera plant-louse live on grape roots. Strawberries often succumb to the attacks of the grubs of several small beetles known as strawberry-root worms, and to the large white grubs of the May beetles. The roots of cabbages, radishes and



1313. San José Scale.

Showing the mature winter scale; also the insect itself, with its thread-like feeding organs.

other cruciferous plants are often devoured by hordes of hungry maggots. These underground root-feeding insects are difficult pests to control, like any other unseen foe. Sometimes they can be reached successfully by injecting a little carbon bisulfide into the soil around the base of the plant. The cabbage maggots can be prevented largely by the use of tarred paper pads placed around the plants, or by pouring a carbolic acid emulsion at the base of the infested plants. The strawberry root-feeders are best controlled by frequent cultivation and a short rotation of crops.

**Borers.**—These are the larvæ of several different kinds of insects, which burrow into and feed upon the inner bark, the solid wood, or the interior pith of the larger roots, trunks, branches, and stems or stalks of many horticultural plants. Nearly every kind of fruit trees is attacked by its special kind of borer, as are



1314. Hemipterous insect. Known to entomologists as a true bug.

also many of the smaller vine and bush-fruits and garden crops. Borers are often the most destructive of insect pests. The two apple-tree borers, the round-headed (Fig. 1316) and the flat-headed species, and the peach-tree borer (Fig. 1311) doubtless cause the death of as many apple and peach trees in America as all other enemies combined. The fruit-bark beetles, or "shot-hole" borers, usually attack only unthrifty or sickly fruit trees, and a tree once infested by them is usually doomed. Two borers, one the grub of a beetle



1315. Tomato worm attacked by parasitic insects.

and the other the caterpillar of a moth, sometimes tunnel down the stems of currants and gooseberries. Raspberries and blackberries (Fig. 1317) also suffer from two or three kinds of borers, one working in the root, one in the stem, and a maggot bores down and kills the new shoots. A caterpillar closely allied to the peach-tree borer lives in squash vines, often ruining the crop. The potato-stalk weevil sometimes does much damage in potato fields. Sometimes one can prevent borers from getting into a fruit tree with a paper bandage closely wrapped around the part liable to be attacked, or by the application of some "wash." Most of the washes recommended will prove ineffectual or dangerous to use. Gas-tar has given good results, but some report injury to peach trees from its use; hence one should first experiment with it on a few trees. No way has been found to keep borers out of the small fruits or garden crops; usually if infested canes, stems or plants are cut out and burned early in the fall or whenever noticed, most of the borers will be killed. When borers once get into fruit trees, the "digging-out" process is usually the only resort, although some report that they readily kill the depredator by simply injecting a little carbon bisulfide into the entrance of his burrow and quickly closing it with putty.

#### *Bud- and leaf-feeding insects.*

—The buds and leaves of horticultural crops often swarm with legions of biting and sucking insects. A mere enumeration of the different kinds of these pests would weary the reader. Some insects, like the rose chafer, work on several different kinds of plants, while many others attack only one or two kinds. In apple orchards, the opening buds are seized upon by the hungry bud-moth and case-bearing caterpillars, by



1316. Burrows of an apple-tree borer.

The holes at a show where the imago or beetle emerged.

the newly hatched canker-worms, and by tent-caterpillars, whose tents or "sign-boards" are familiar objects in many orchards. These pests continue their destructive work on the leaves. The pear slug often needs to be checked in its work of skeletonizing the leaves of

the pear and cherry. The pear psylla, one of the jumping plantlice, is a very serious menace to pear-growing in many localities; the fruit is either dwarfed or drops from badly infested trees, and sometimes so many little pumps sucking out its life finally cause the death of the tree. The little blue grapevine flea-beetle often literally nips the prospective crop of fruit in the bud, or the rose-chafer may swarm over the vines and eat the foliage or blossoms. Currant and gooseberry growers realize that eternal vigilance against the familiar green currant worms is the price of a crop of fruit. The asparagus beetles would soon appropriate every asparagus shoot that appears in many localities. It is a

continual struggle against insect pests to get a paying crop of almost any vegetable. The several kinds of cabbage caterpillars would soon riddle the leaves. The hungry striped cucumber beetles can hardly wait for the melon, squash, or cucumber vines to come up. Two sucking insects, the harlequin cabbage bug and the squash stink-bug, are equally as destructive as their biting relatives. The bud- and leaf-feeding insects are usually readily controlled by spraying some poison on their food, or by hitting them with some oil or soap spray. As the female moths of canker-worms are wingless, a wire trap or sticky bandage placed around the trunk of the tree in the late fall and early spring, to capture the moths as they crawl up the tree to lay their eggs, will greatly help to check these serious pests. The collection and burning of the conspicuous egg-rings of the

tent-caterpillars at any time between August and the following April will greatly reduce the vast numbers of shiftlessness in apple orchards. Hand-picking or collecting is the most successful method of controlling the rose-chafer, harlequin cabbage bug, and

*Fruit-eating insects.*—"Wormy" apples, pears, quinces, plums, peaches, cherries, apricots, grapes, currants and nuts are often the rule rather than the exception. The codlin-moth or apple-worm often ruins from one-third to one-half of the crop each year in many localities; it also infests pears seriously. The apple maggot tunnels its way through and through the flesh of a large percentage of the apples in the northern sections of the country. Most of the wormy plums, peaches, cherries and apricots are the work of the grub of that worst insect enemy of the stone fruits—the plum curculio; the plum gouger, a similar insect, whose grub works in the pit of plums, is equally destructive to this fruit in some states. "Knotty" quinces are largely the work of the adults of the quince curculio, while its grub often ruins the fruit with its disgusting worm-hole. There is also a grape curculio that, with the aid of the caterpillar of a little moth, works havoc in grapes. Currants and gooseberries are often wormy from the work of two or three different kinds of maggots and caterpillars. Two kinds of

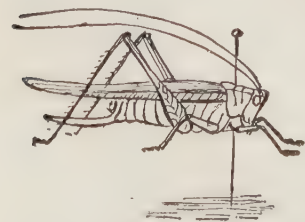
fruit flies attack the cherry; infested cherries may show no external signs of the presence of the maggot reveling in the juices within. Various small beetles known as weevils, are responsible for most wormy nuts. Most of the fruit-eating insects are out of the reach of the ordinary insecticides. The codlin-moth is a noted exception, however, for the peculiar habit that the little caterpillar has of usually entering the blossom end of the fruit and feeding therein for a few days, gives the man with a poison spray a very vulnerable point of attack. It is only necessary to spray a bit of poison into the open calyx cup within a few days after the petals fall, and let nature soon close the calices and keep the poison therein until the newly-hatched caterpillar includes it in its first menu. Often 95 per cent of the apples that would otherwise be ruined by the worms are saved by an application of paris green at this critical time.

*Plant-lice.*—Scarcely a plant escapes the little suction pump or beak of some kind of a plant-louse or aphid. More than 300 different kinds of plant-lice have been identified in the United States, and nearly every kind of fruit, flower, farm or garden crop has its special plant-louse enemy, which is often a serious factor in the production of a crop. These little creatures are so small, so variable, so hard to perceive, present so many different forms in the same species, and have such varied and interesting life-stories to tell, that what is known about them is but a mere beginning as compared to what is yet to be learned. It would take a large volume to include the interesting stories which might be told of the lives and of the relations with ants of some of the commonest of these plant-lice. No other group of insects presents so many curious, varied, interesting, and wonderful problems of life as do the aphids. In the aggregate, the damage done by plant-lice is very great.



1317. A beetle borer and its work.

The larva bores in the young wood of raspberry and blackberry canes, causing the swellings seen in the picture.



1318. Grasshopper. (Mounted)

the squash stink-bug in many cases. Prompt action, guided by a knowledge of the insect's habits and life-history, and any intelligent use of materials and apparatus, are essential in any successful effort to control these bud- and leaf-feeding pests of the horticulturist.



1319. A crane fly. (Mounted)



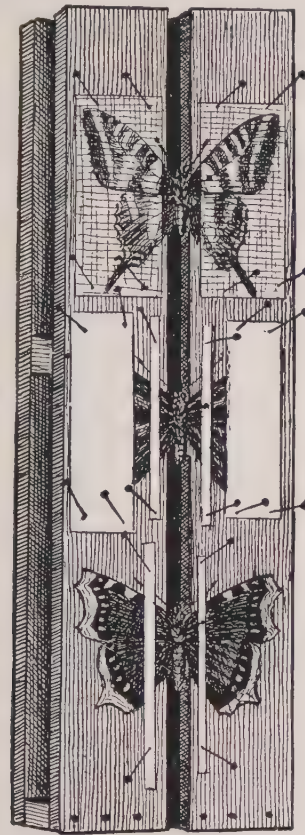
1320. A snapping beetle. (Mounted)



At times hundreds of acres of peas have been ruined by an aphid. Nursery stock often suffers severely and bearing fruit trees are often seriously injured by them. About forty different kinds of aphides live in greenhouses where a perpetual warfare has to be waged against them. In four

years nearly 100 generations of a common aphid have been reared in greenhouses, and there were no indications of any egg-stage or of male forms during this time, so that they may thus breed indefinitely in houses, their young being born alive and no males appearing. The standard remedies for plant-lice are whale-oil soap, kerosene emulsion, and tobacco in various ways (as a decoction, dry as a dust, or in the form of similar extracts), and these are successfully used to kill the aphides in all situations.

**Scale insects.**—Since the advent of San José scale into the eastern United States, scale insects of all kinds have attracted world-wide attention. They are all small insects, and derive their name from the fact that their tender bodies are protected by hard, scale-like coverings secreted by the insects. Thus protected, they are difficult insects to kill, and as they are easily transported on nursery stock, buds or cions, and also multiply rapidly,



1321. A spreading board for drying soft-winged insects.

the scale insects are justly to be considered as among the most dangerous and destructive of injurious insects. A single female San José scale may rear a brood of from 100 to 600 young, and there may be four or five generations a year; and more than 2,000 eggs have been laid by a single *Lecanium* scale. The scale insects, the dreaded San José species included, can be controlled successfully by judicious, intelligent and timely work with sprays of lime-sulfur, crude petroleum, or hydrocyanic acid gas, which should be used in the case of nursery stock. Since 1889 fumigation with hydrocyanic acid gas has been extensively practised in the citrus orchards of California, and now Florida and South African fruit-growers are also using it in their orchards. Large gas-tight tents or boxes are placed over the trees and the gas then generated within. Much nursery stock is now treated with the gas in tight boxes or houses; this is required by law in many states, and it should be practised in other regions. Recently greenhouses, railway coaches, rooms in private houses, and whole flouring mills have been effectively fumigated with this gas.

Insects are preserved in collections by securing them in tight cases by means of a pin inserted through the thorax, or through the right wing if the subject is a beetle. Moths and butterflies are pinned in position on a spreading-board until thoroughly dried. See Figs. 1318-1322. Every horticulturist should make a collection of injurious insects.

**Insect literature for horticulturists.**—Horticulturists should keep in close touch with the experiment stations and state entomologists of their own and of other states, and also with the Department of Agriculture at Washington; for it is from these sources that the best and latest advice regarding injurious insects is now being disseminated free, either by personal correspondence or by means of bulletins. Among the books, one or more of which may well find a place in a horticulturist's library are the following: Weed's "Insects and Insecticides," Lodeman's "The Spraying of Plants," Saunders' "Insects Injurious to Fruits," Sanderson's "Insect Pests of Orchard, Farm and Garden," and Slingerland and Crosby's "Fruit Insects."

M. V. SLINGERLAND.

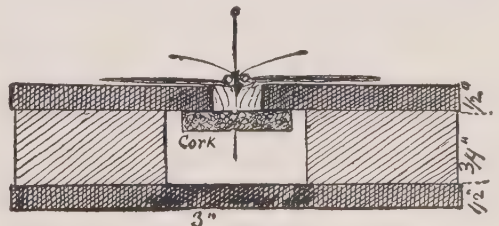
C. R. CROSBY†

#### Other invertebrate animals.

**Mites.**—Mites belong to the class of animals known as Arachnida, which are closely related to insects. Spiders and scorpions also belong in this group. Mites are small creatures, usually possessing four pairs of legs when mature, and the body is not divided into three divisions as in the case of insects. The greenhouse red-spider (*Tetranychus bimaculatus*) is one of the most common and injurious species. It occurs on a wide variety of plants grown under glass and also out-of-doors on the foliage of many wild and cultivated plants. It is about  $\frac{1}{16}$  in. long and varies in color from yellow through orange to brown and dark green, often with a darker spot on each side of the body. It spins a very delicate silken web-like nest over its breeding-ground. It can be killed on the foliage of plants grown in the open with soap solution, dusting with sulfur, and hydrated lime, or by using a flour-paste spray. In greenhouses, it is best controlled by repeated spraying with water, using much force and little water to avoid drenching the beds.

The clover mite (*Bryobia pratensis*) is a minute, spider-like, oval, reddish brown mite about  $\frac{1}{100}$  inch in length with long front legs. It attacks the foliage of many fruit and forest trees as well as clover and grasses. The tiny, round, reddish eggs often occur in great numbers on the bark of trees in winter giving the branches a reddish color. It may be controlled by the same treatment as for red-spider. In addition, the eggs may be killed with a lime-sulfur solution while the trees are dormant.

The pear-leaf blister-mite (*Eriophyes pyri*) differs from most other mites in having only two pairs of legs and in its elongate body. The mite is only  $\frac{1}{100}$  inch in length; it burrows in the tissue of the leaf, causing blister-like galls. The eggs are laid within the gall,



1322. A cross-section of spreading board in front of the cleat "d," in Fig. 1321.

and some of the mites when mature leave through a small opening and migrate to new leaves. The mature mites hibernate under the bud-scales. This pest is controlled by applications of lime-sulfur or miscible oils while the trees are dormant.

**Nematodes.**—A species of nematode worm (*Heterodera radiculicola*) lives parasitically in the roots of a wide variety of wild and cultivated plants producing enlarged knots or swellings. This disease is known as



root-knot and is more prevalent in light soils. It is especially troublesome in greenhouses. The adult female worm is flask-shaped, .5 to 1 mm. in length, pearly white in color, and is found within the knots on the roots. Each female lays several hundred eggs. The young worms may continue within the same root or migrate through the soil to others. Nematode root-galls have been found on nearly 500 different species of plants. It is especially destructive to okra, hollyhock, *Amarantus tricolor*, peach, snapdragon, celery, heart-leaved basil, wax gourd, beet, rape, red pepper, balloon vine, melon papaw, catalpa, endive, watermelon, coffee, muskmelon, cucumber, squash, pumpkin, carrot, deutzia, California poppy, fig, soybean, pecan, morning-glory, lettuce, gourd, sweet pea, flax, tomato, tobacco, peony, ginseng, passiflora, petunia, tuberose, cherry, pomegranate, eggplant, potato, salsify, clovers, violet, Old World grape. See page 1023.

This pest may be controlled in greenhouses by the use of live steam to sterilize the soil or by a weak solution of formaldehyde, one part, 36 to 40 per cent formaldehyde, to one hundred parts water, applied at the rate of one to one and one-half gallons to every square yard of soil surface of shallow beds. After the application, the soil should be thoroughly stirred and planting should not be done till at least ten days later. Under field conditions, the problem is more difficult. The most feasible method is a system of crop-rotation in which an immune crop is grown for at least two years between susceptible crops. One of the most resistant crops is the Iron variety of cowpea. Clean cultivation should be practised so as to destroy all susceptible plants.

### Insecticides.

Insecticides are substances used to kill insects, as poisons, washes and gases. Insects are subject to many natural checks, such as wind, rains, sudden changes of temperature, the attacks of parasites and predaceous enemies, and are often destroyed in great numbers by bacterial and fungous diseases. In spite of these natural checks it is, however, usually necessary to resort to a spray or some other artificial insecticide for the protection of our crops.

The essential requirements for a satisfactory insecticide are: efficient killing power, safety to the foliage, cheapness and ease of application. The choice of an insecticide for any particular case will depend upon a number of factors: upon the structure, habits, and life-history of the insect to be killed; and upon the susceptibility of the host plant to injury, its mode of growth and the conditions under which it is cultivated. Some insects, as the plant-lice, are soft-bodied and provided with a thin and delicate integument; others, like the beetles and wireworms, have hard, horny shells impervious to ordinary spray liquids; some insects bite off and swallow portions of the plant, while others merely suck out the sap by means of a slender tube; some are injurious in the larval stage, others as adults; some attack the roots, some the foliage and fruit, while others burrow in the trunk and branches. Plants vary greatly in their susceptibility to injury from the use of insecticides; the peach and Japan plum have especially tender foliage, while the apple is not so easily injured. All these points and many more must be considered in selecting an insecticide which will be adapted to the control of any injurious insect. Our methods of fighting insects are constantly changing as new facts are discovered, new methods devised and new insecticides invented. Our present methods are the results of a more or less unconscious coöperation extending over many years between the practical grower, the student of insect life and the progressive manufacturers of spraying materials and spray machinery.

Insecticides may be classed into those which are eaten with the food and kill by poisoning; those that

kill by contact with the insect's body; and fumes of gases used for fumigation. The poisons are effective against the biting or chewing and lapping (fruit flies) insects; the contact insecticides are used as a rule against sucking insects; and fumes and gases are employed principally in greenhouses and for the fumigation of nursery stock, stored seeds, and citrus trees.

### Poisoning insecticides.

The most widely used substance for the poisoning of insects is arsenic in its various compounds. For this purpose only compounds insoluble in water can be used, as soluble arsenic is very injurious to foliage.

*White arsenic.*—This is the cheapest form in which arsenic can be obtained. It is a white powder, soluble in water and very injurious to foliage. A cheap and efficient insecticide may be prepared from it as follows:

*For use with bordeaux mixture only.* Sal-soda, two pounds; water, one gallon; arsenic, one pound. Mix the white arsenic into a paste and then add the sal-soda and water, and boil until dissolved. Add water to replace any that has boiled away, so that one gallon of stock solution is the result. Use one quart of this stock solution to fifty gallons of bordeaux mixture for fruit trees. Make sure that there is enough lime in the mixture to prevent the caustic action of the arsenic.

*For use without bordeaux mixture.* Sal-soda, one pound; water, one gallon; white arsenic, one pound; quicklime, two pounds. Dissolve the white arsenic with the water and sal-soda as above, and use this solution while hot to slake the two pounds of lime. Add enough water to make two gallons. Use two quarts of this stock solution in fifty gallons of water.

As there is always some danger of foliage injury from the use of these home-made arsenic compounds, and as they cannot be safely combined with the dilute lime-sulfur when used as a summer spray, they are now rarely employed in commercial orchard spraying.

*Paris green.*—Paris green is composed of copper oxid, acetic acid and arsenious oxid chemically combined as copper-aceto-arsenite. By the National Insecticide Law of 1910, paris green must contain at least 50 per cent arsenious oxid and must not contain arsenic in water-soluble form equivalent to more than 3½ per cent arsenious oxid. For many years paris green has been the standard insecticide for orchard use, but is now largely replaced by the safer and more adhesive arsenate of lead. In spraying apples, paris green is used at the rate of one-half pound to one hundred gallons of water or bordeaux mixture. When used with water, lime twice the bulk of the paris green should be added to lessen the danger of foliage injury. Paris green cannot safely be used with either the dilute lime-sulfur as used for summer spraying or with the self-boiled lime-sulfur.

*London purple.*—London purple is an arsenite of lime and is a by-product in the manufacture of aniline dyes. Its composition is variable, the arsenic content varying from 30 to 50 per cent. Owing to the presence of much soluble arsenic it is likely to cause foliage injury, and it is now little used in commercial spraying.

*Arsenate of lead.*—Arsenate of lead was first used as an insecticide in 1893, in Massachusetts. It has now almost entirely replaced paris green for orchard work throughout the country. It adheres better to the leaves, may be used at considerably greater strength without injuring the foliage and may be combined with a dilute lime-sulfur solution or with the self-boiled lime-sulfur. Chemically, arsenate of lead may be either triplumbic arsenate or plumbic-hydrogen arsenate. The commercial product usually consists of a mixture of these two forms, the proportion depending on the method of manufacture employed. It is usually sold in the form of a thick paste, but for some purposes the powdered form is preferred. Under the National Insecticide Law of 1910, arsenate of lead paste must not contain more than 50 per cent water and must contain the arsenic equivalent of at least 12½ per cent arsenious oxid. The water-soluble arsenic must not exceed an equivalent of three-fourths of 1 per cent of arsenic oxid. In the best grades of arsenate of lead paste the chemical is in a finely divided condition, and thus when diluted for use remains in suspension for a considerable time. Arsenate of lead is used at various strengths, depending upon the insect to be killed and on the susceptibility of the foliage to injury. Four pounds in one hundred gallons can be used on the peach if combined with the self-boiled lime-sulfur; on apple, four or five pounds in one hundred gallons is usually sufficient; on grapes for killing the grape root-worm beetles and the rose-chaffer, eight to ten pounds in one hundred gallons have been found necessary. The poison is more readily eaten by these beetles if sweetened by two gallons of molasses in one hundred gallons, but, unfortunately, the addition of molasses greatly decreases the adhesiveness of the poison. Some species of fruit flies may be controlled by the use of sweetened arsenate of lead sprayed on the foliage of the plants at the first appearance of the flies. They lap up the poison with their fleshy tongue-like mouth-parts and succumb before ovipositing.

*Arsenite of zinc.*—Arsenite of zinc is a light fluffy powder and contains the equivalent of about 40 per cent arsenious oxid. It has been used extensively on the Pacific slope as a substitute for arsenate of lead. It kills somewhat more quickly and is fairly safe on apple foliage when used with bordeaux mixture or with lime. When sweetened with molasses, it is injurious to foliage. One pound of zinc arsenite is equivalent to about three pounds of arsenate of lead. In orchard experiments, as a rule, it has not shown that it is superior to the latter.



**Hellebore.**—Hellebore is a light brown powder made from the roots of the white hellebore plant (*Veratrum album*), one of the lily family. It is applied both dry and in water. In the dry state, it is usually applied without dilution, although the addition of a little flour will render it more adhesive. In water, four ounces of the poison is mixed with two or three gallons, and an ounce of glue, or thin flour paste, is sometimes added to make it adhere. A decoction is made by using boiling water in the same proportions. Hellebore soon loses its strength, and a fresh article should always be demanded. It is much less poisonous than the arsenicals, and should be used in place of them upon ripening fruit. It is used for various leaf-eating insects, particularly for the currant-worm and rose-slug.

### Contact insecticides.

The most important contact insecticides are soaps, sulfur, sulfur compound, and oily or resinous emulsions.

**Soaps.**—The most commonly used soap solution is that prepared from fish-oil soap. The commercial brands of this soap are usually by-products and contain many impurities; further, many of them contain an excess of free or uncombined alkali and are thus likely to injure young and tender foliage. A good fish-oil soap may be prepared by the following formula: Caustic soda, six pounds; water, one-half gallon; fish-oil, twenty-two pounds. Dissolve the caustic soda in the water and then add the fish-oil gradually under constant and vigorous stirring. The combination occurs readily at ordinary summer temperatures, and boiling is unnecessary. Stir briskly for about twenty minutes after the last of the oil has been added. There is now on the market a good brand of insecticide soap prepared from cotton-seed oil soap stock or from an impure grade known as pancoline.

**Sulfur.**—Sulfur may be obtained in two forms,—flowers of sulfur and flour of sulfur. In the form of a powder or dust, sulfur is especially valuable against red-spider. In California, flowers of sulfur mixed with equal parts of hydrated lime is blown on the trees for the control of red-spider and mite. It may also be used for the same purpose mixed with water at the rate of one pound in three gallons of water, to which has been added a little soap to keep the sulfur in suspension. The mixture should be agitated constantly during spraying. The sulfur remains longer in suspension if it is first made into a paste with water containing one-half of 1 per cent of glue. Page 1028.

**Lime-sulfur solution.**—A solution of lime-sulfur was first used as an insecticide in California in 1886. It is now the standard remedy for blister mite, San José scale and similar scales, as well as an efficient fungicide. The lime-sulfur solution may be purchased in the concentrated form or may be prepared as follows: Lump lime (95 per cent calcium oxide), thirty-eight pounds; lump lime (90 per cent calcium oxide), forty pounds; sulfur, eighty pounds; water, fifty gallons. Make a paste of the sulfur with about ten gallons of hot water. Add the lime. As the lime slakes, add hot water as necessary to prevent caking. When the lime has slaked, add hot water to make fifty gallons and boil one hour, stirring constantly. Water should be added from time to time to keep the liquid up to fifty gallons. Store in air-tight hardwood barrels. Test the strength of the solution with a Baumé hydrometer and dilute for use according to the following table (see also p. 1029):

DILUTIONS FOR DORMANT AND SUMMER SPRAYING WITH LIME-SULFUR MIXTURES

Reading on hydrometer	Amount of dilution. Number of gallons of water to one gallon of lime-sulfur solution.		
	For San José scale	For blister mite	For summer spraying of apples
Degrees Baumé			
35	9	12½	45
34	8¾	12	43¾
33	8½	11½	41½
32	8	11	40
31	7½	10½	37¾
30	7¼	10	36¾
29	6¾	9½	34¾
28	6½	9	32¾
27	6	8½	31
26	5¾	8	29½
25	5¼	7½	27¾
24	5	7	26
23	4½	6½	24¼
22	4¼	6	22¾
21	3¾	5½	21¼
20	3½	5	19¾
19	3¼	4¾	18¼
18	3	4¼	17
17	2¾	4	16
16	2½	3¾	15
15	2¼	3½	14
14	2	3	12¾

**Emulsions.**—Emulsions are oily or resinous sprays in which these substances are suspended in water in the form of minute globules, a condition brought about by the addition of soap. They form an important class of contact insecticides, useful particularly against scale insects and plant-lice.

**Kerosene emulsion.**—Kerosene emulsion is the oldest of our contact insecticides. It is especially valuable for use against plant-lice and other small, soft-bodied insects. It is prepared by the following formula: Soap, one-half pound; water, one gallon; kerosene, two gallons. Dissolve the soap in hot water; remove from the fire and, while still hot, add the kerosene. Pump the liquid back into itself for five or ten minutes or until it becomes a creamy mass. If properly made, the oil will not separate on cooling. For use on dormant trees, dilute with five to seven parts of water. For killing plant-lice on foliage, dilute with ten to fifteen parts of water.—Crude-oil emulsion is made in the same way by substituting crude oil in place of kerosene. The strength of oil emulsions is frequently indicated by the percentage of oil in the diluted liquid: for a 10 per cent emulsion, add seventeen gallons of water to three gallons of stock emulsion; for a 15 per cent emulsion, add ten and one-half gallons of water to three gallons of stock emulsion; for a 20 per cent emulsion, add seven gallons of water to three gallons of stock emulsion; for a 25 per cent emulsion, add five gallons of water to three gallons of stock emulsion.

**Distillate emulsion.**—Distillate emulsion is widely used in California. Distillate (28° Baumé), twenty gallons; whale-oil soap, thirty pounds; water, twelve gallons. Dissolve the whale-oil soap in the water which should be heated to the boiling point, add the distillate and agitate thoroughly while the solution is hot. For use, add twenty gallons of water to each gallon of the stock solution.

**Carbolic acid emulsion.**—This spray is used in California for mealy-bugs, plant-lice, and the soft brown scale: Whale-oil soap, forty pounds; crude carbolic acid, five gallons; water, forty gallons. Dissolve the soap completely in hot water, add the carbolic acid, and heat to the boiling point for twenty minutes. For use, add twenty gallons of water to each gallon of stock solution.

**Miscible oils.**—There are now on the market a number of concentrated oil emulsions, known as soluble or miscible oils, intended primarily for use against the San José scale. For this purpose they are fairly effective when diluted with not more than fifteen parts of water. To lessen danger of injury to the trees, applications should not be made when the temperature is below freezing, nor when the trees are wet with snow or rain. Methods have been devised for preparing these concentrated emulsions at home, but as there is considerable danger attending the process, it is better to buy them ready-made.

**Tobacco.**—Tobacco is one of our most useful insecticides. The poisonous principle in tobacco is an alkaloid nicotine, which in the pure state is a colorless fluid, slightly heavier than water, of little smell when cold and with an exceedingly acrid burning taste even when largely diluted. It is soluble in water and entirely volatile. It is one of the most virulent poisons known; a single drop is sufficient to kill a dog. Commercial tobacco preparations have been on the market for many years. The most important of these are black leaf, "black leaf 40," and nicofume.

**Black Leaf.**—Black leaf was formerly the most widely used tobacco extract. It contains only 2.7 per cent nicotine and has now been replaced by the more concentrated extracts. It is used for plant-lice at the rate of one gallon to sixty-five gallons of water.

**"Black leaf 40."**—"Black leaf 40" is a concentrated tobacco extract containing 40 per cent nicotine sulfate. Its specific gravity is about 1.25. In this preparation the nicotine is in a non-volatile form, it having been treated with sulfuric acid to form the sulfate. "Black leaf 40" is used at strengths varying from one part in 800 parts of water to one part in 1,600 parts. It can be satisfactorily combined with other sprays, as for example, lime-sulfur solution, arsenate of lead, and the various soap solutions. When used with water, about four pounds of soap should be added to make the mixture spread and stick better.

**Nicofume** is a tobacco extract containing 40 per cent of nicotine in the volatile form. It is intended primarily for use in greenhouses. Strips of paper soaked in this preparation are smudged in greenhouses to destroy aphids.

Tobacco is also used in the form of dust for the same purpose. It is especially valuable against roof-lice on asters and other plants. Tobacco extracts can be made at home by steeping tobacco stems in water, but as they vary greatly in nicotine content and are sometimes likely to injure tender foliage, it is better to buy the standardized extracts.

**Pyrethrum.**—A very fine, light brown powder, made from the flower-heads of species of pyrethrum. It is scarcely injurious to man. Three brands are on the market:

**Persian insect-powder,** made from the heads of *Pyrethrum roseum*, a species also cultivated as an ornamental plant. The plant is native to the Caucasus region.

**Dalmation insect-powder,** made from *Pyrethrum cinerariæ-folium*.

**Buhach,** made in California from cultivated plants of *Pyrethrum cinerariæ-folium*.

When fresh and pure, all these brands appear to be equally valuable, but the home-grown product is usually considered most reliable. Pyrethrum soon loses its value when exposed to the air. It is used in various ways:

(1) In solution in water, one ounce to three gallons. Should be mixed up twenty-four hours before using.

(2) Dry, without dilution. In this form it is excellent for thrips and lice on roses and other bushes. Apply when the bush is wet. Useful for aphids on house plants.

(3) Dry, diluted with flour or any light and fine powder. The poison may be used in the proportion of one part to from six to thirty of the diluent.

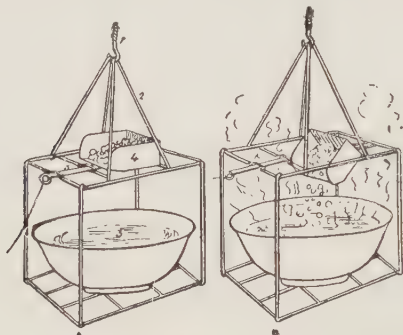
(4) In fumigation. It may be scattered directly upon coals, or made into small balls by wetting and molding with the hands and

then set upon coals. This is a desirable way of dealing with mosquitos and flies.

(5) In alcohol. (a) Put a part of pyrethrum (buhach) and four parts alcohol, by weight, in any tight vessel. Shake occasionally, and after eight days filter. Apply with an atomizer. Excellent for greenhouse pests. For some plants it needs to be diluted a little. (b) Dissolve about four ounces of powder in one gill of alcohol, and add twelve gallons of water.

(6) Decoction. Whole flower-heads are treated to boiling water, and the liquid is covered to prevent evaporation. Boiling the liquid destroys its value.

Good insect-powder can be made from *Pyrethrum roseum*, and probably also from *P. cinerariaefolium*, grown in the home garden.



1323. Device for discharging the cyanide into the acid.

**Bait, vegetable bait.**—Spray a patch of clover or some other plant that the insects will eat with paris green or some other arsenical; mow it close to the ground, and while fresh place it in small piles round the infested plants. To avoid wilting of the bait, cover the heaps with a shingle or piece of board.

**Bran-arsenic mash.**—White arsenic, one-half pound, or paris green, one pound; bran, fifty pounds. Mix thoroughly and then add enough water to make a wet mash. Sugar or molasses may be added, but is unnecessary. Poisoned baits are used against cutworms and grasshoppers.

**Kansas grasshopper bait.**—This bait is the most efficient means of controlling grasshoppers yet devised. It is prepared as follows: Bran, twenty pounds; paris green, one pound; syrup, two quarts; oranges or lemons, three fruits; water, three and one-half gallons. Mix the bran and paris green thoroughly in a wash-tub while dry. Squeeze the juice of the oranges or lemons into the water; chop the pulp and peel fine and add them also. Dissolve the syrup in the water and wet the bran and poison with the mixture, stirring at the same time so as to dampen the mash thoroughly. Sow the bait broadcast in the infested area early in the morning.

**Criddle mixture.**—Mix one pound of paris green with one-half barrel of horse droppings, and add one pound of salt if the material is not fresh. For use against grasshoppers.

**Gas tar** is used extensively for painting wounds to keep out the moisture and prevent the entrance of insects. It is also sometimes used on peach trees to keep out the borers. In this case it should be applied in the spring only, as there is danger of injuring the trees in the fall.

**Asphalt.**—Certain grades of asphalt have been used successfully on peach in California to keep out the Pacific peach tree-borer. Experiments in the eastern states indicate that it may be used to advantage against the common peach tree-borer.

**Hot-water.**—Submerge affected plants or branches in water at a temperature of about 125°. For aphids. It will also kill rose-bugs at a temperature of 125° to 135°.

**Gasolene torch.**—The gasolene torch has been successfully used for the control of scale insects on date palms in Arizona. The trees are first pruned closely, drenched with gasolene and fired. They are then scorched with a gasolene blast torch.

**Flour paste.**—Mix a cheap grade of wheat flour with cold water, making a thin batter, without lumps; or wash the flour through a wire screen with a stream of cold water. Dilute until there is one pound of flour in each gallon of mixture. Cook until a paste is formed, stirring constantly to prevent caking or burning. Add sufficient water to make up for evaporation. For use, add eight gallons of this stock solution to one hundred gallons of water. Used for red spider in California.

#### General practices.

**Cleanliness.**—Much can be done to check the ravages of insects by destroying their breeding-places and hiding-places. Weeds, rubbish, and refuse should be eliminated.

**Hand-picking** is often still the best means of destroying insects despite all the perfection of machinery and of materials. This is, particularly true about the home grounds and in the garden. The cultivator should not scorn this method.

**Promoting growth.**—Any course that tends to promote vigor will be helpful in enabling plants to withstand the attacks of plant-lice and other insects.

**Burning.**—Larvæ which live or feed in webs, like the tent-caterpillar and fall web-worm may be burned with a torch. The lamp or torch used in campaign parades finds its most efficient use here.

**Banding.**—To prevent the ascent of canker-worm moths and gypsy-moth caterpillars, various forms of sticky bands are in use. For this purpose there is no better substance than "tree tanglefoot." It may be applied directly to the tree-trunk, but when so used leaves an unsightly mark and requires more material than when the following method is used: First place a strip of cotton batting 3 inches wide around the trunk; cover this with a strip of tarred paper 5 inches wide; draw the paper tight and fasten at the lap only with three or four tacks. Spread the tanglefoot on the upper two-thirds of the paper, and comb it from time to time to keep the surface sticky. Burlap bands are made by tying or tacking a strip of burlap around the trunk and letting the edges hang down. The larvæ will hide under the loose edge, where they may be killed. Banding is now little used for codlin-moth, since spraying with poison has been found so much more effective.

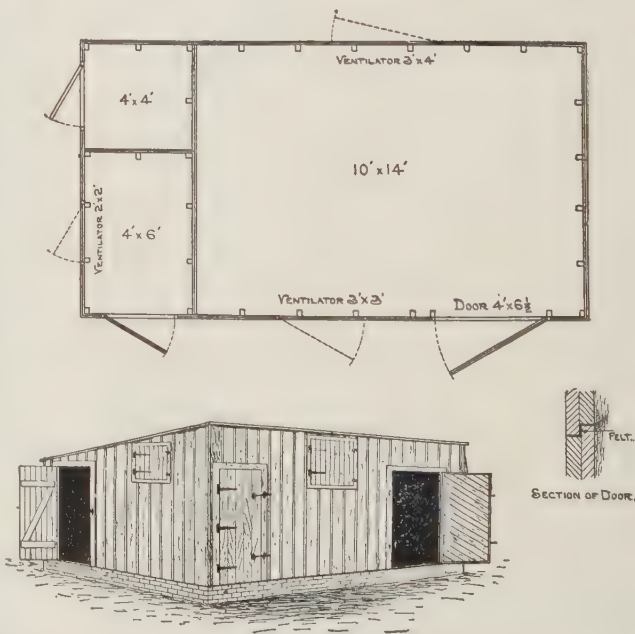
#### Fumigation.

Poisonous gases are widely used in killing insects under certain conditions. Hydrocyanic acid gas is employed in the fumigation of greenhouses and citrus trees. It is a most deadly and effective material. In Europe, fumigation with this gas is known as cyaniding and cyanization. Nicotine preparations are used extensively in greenhouse fumigation. Carbon bisulfid is employed almost exclusively for the treatment of stored grains and seeds.

**Hydrocyanic acid gas.**—This gas is generated by adding potassium or sodium cyanide to dilute sulfuric acid. The gas is a deadly poison, and great care should be taken not to inhale it. One breath is fatal!

Potassium cyanide is a white amorphous salt that readily absorbs moisture when exposed to the air. Pure potassium cyanide contains 40 per cent of cyanogen (CN) by weight. When potassium cyanide (KCN) is placed in dilute sulfuric acid the cyanogen (CN) unites with the hydrogen (H) of the acid ( $H_2SO_4$ ) to form hydrocyanic acid gas (HCN). In the preparation of this gas for fumigation purposes use a potassium cyanide which is at least 98 per cent pure. The chemicals should always be combined in the following proportions: Potassium cyanide, one ounce; sulfuric acid, one fluid ounce; water, three fluid ounces.

Always use an earthen dish, *pour in the water first*, and add the sulfuric acid. When all is ready, drop in the proper quantity of potassium cyanide and retire



1324. Shed for the fumigation of nursery stock.



immediately, before the gas arises. Fig. 1323 shows a device used abroad (from the "Gardening World") for dumping the cyanide (at 4) into the acid by means of a cord that extends outside the house.

*White-fly.*—The quantity of chemicals used for a given space will depend on the nature of the insects to be killed and the susceptibility of the plants to injury. This quantity is usually indicated by amount of potassium cyanide required for each 100 cubic feet of space. For treating white-fly on tomatoes in green-houses, use one ounce to 3,000 cubic feet, letting the fumigation continue all night. The same treatment applies for cucumber. Fumigate on dry, dark nights when there is no wind. The house should be as dry as practicable and the temperature not above 60° F.

**Greenhouses.**—No one formula can be given for fumigating with hydrocyanic acid gas the different kinds of plants grown in greenhouses, as the species and varieties differ greatly in their ability to withstand the effects of the gas. For the general run of greenhouse subjects, the practice is to use one ounce of potassium cyanide, one ounce of sulfuric acid, two ounces water, to each 2,000 cubic feet of space. The cyanide should be 98 per cent pure. Fumigate at night when there is no wind and when the plants are dry and the house cool; leave the house closed till morning, and open it up and let it air out before entering it. This applies to chrysanthemums, cinerarias, azaleas, bulbs, carnations and other common plants.

Ferns and roses are very susceptible to injury, and fumigation, if attempted at all, should be performed with great care. In cases of doubt, or when there is reason to suspect that the plants are particularly susceptible, and when one does not have definite instructions, it is well to fumigate with the weakest strength in use, and increase it in subsequent fumigations if the insects are not killed and if the plants are not injured.

Violets are very susceptible to injury from tobacco fumigation, and commercial growers therefore regularly use hydrocyanic acid gas for the control of "green-fly" and "black-fly," two species of plant-lice. The latter is much more difficult to kill. For over-night fumigation from one-fourth to one-half ounce potassium cyanide to each 1,000 cubic feet is generally used. Sometimes one ounce potassium cyanide to each 1,000 cubic feet is used, the fumigation continuing only from twenty-five to thirty-five minutes. This treatment is more likely to injure the plants. Violets may be injured severely by the gas without the leaves being burned. This injury consists in a weakening of the plants which defers blooming for several weeks.

*Dormant nursery stock* may be fumigated with hydrocyanic acid gas in a tight box or fumigating-house made especially for the purpose. Fumigating-houses are built

of two thicknesses of matched boards with building-paper between, and are provided with a tight-fitting floor and ventilators. The stock should be reasonably dry to avoid injury, and should be piled loosely in the house to permit a free circulation of the gas. Use one ounce of potassium cyanide for each 100 cubic feet of space, and let the fumigation continue forty minutes to one hour.

A fumigating-house is shown in Fig. 1324 (from a bulletin on "The San José Scale," by A. E. Stene, of the Rhode Island State Board of Agriculture and College of Agriculture). It is a house or box as nearly airtight as possible. The floor should have a movable slat grating on which the plants may be laid, some distance from the ground, to allow of circulation of the gas. The house shown in the cut is 8 feet high in front and 6 feet in rear, and the larger room contains 980 cubic feet, requiring approximately ten ounces of cyanide. The other rooms allow of smaller quantities to be fumigated. The doors opening from the outside provide quick discharge of the air when fumigation is completed.

*Fumigation of citrus trees.*—In this case, the tree to be fumigated with the hydrocyanic acid gas is covered with an octagonal sheet tent (Fig. 1325) made of six and one-half ounce special drill or eight-ounce special army duck, and the gas is generated in the ordinary way beneath it. The tent is so marked that when in position it is an easy matter to determine the distance over the tent and the circumference at the ground. When these figures are known, the proper dosage may be obtained from the following chart, which has been prepared for a strength of one ounce of cyanide for each 100 cubic feet of space:

	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68		
10	2	2	2	2	2																							10	
12	2	2	3	3	3	3																						12	
14	3	3	3	3	3	3	4	4	4	4	4	5																14	
16	3	3	3	3	4	4	4	4	4	5	5	5	5	5														16	
18	3	3	3	4	4	4	5	5	5	5	5	5	5	5	6													18	
20			20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	20	
22			3	4	4	5	5	5	5	5	5	6	6	6	7	7	8	8										22	
24					5	5	5	5	5	5	6	6	7	7	8	8	8											24	
26						5	5	5	5	6	6	6	7	8	8	8	8	9	9									26	
28							5	6	6	7	7	8	8	8	9	9	10	10	10	11	11	11						28	
30									30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	30
32									7	8	8	8	9	9	10	10	11	11	11	11	12	13	14	14	15	16	16	32	
34												9	10	10	11	11	12	12	13	13	14	14	15	16	17	17	34		
36													10	11	11	12	13	13	14	14	15	16	17	17	18	19	36		
38													11	11	12	13	13	14	15	15	16	17	17	18	19	20	38		
40														12	12	13	14	15	16	16	17	17	18	19	20	21	40		
41															14	15	15	16	17	17	18	18	19	20	20	21	41		
42																15	15	16	17	17	18	19	19	20	20	21	42		
43																	16	17	17	18	19	19	20	20	21	22	43		
44																		17	18	19	19	20	20	21	22	22	44		
45																			50	52	54	56	58	60	62	64	66	68	45
46																				17	18	19	20	20	21	22	23	23	46
47																				18	19	20	20	21	22	22	23	24	47
48																				19	20	20	21	22	22	23	24	24	48
49																				19	20	21	21	22	23	23	24	25	49

DISTANCE OVER, IN FEET.

Dosage chart for fumigating citrus trees with high-grade sodium cyanide (Bureau of Entomology, United States Department of Agriculture).

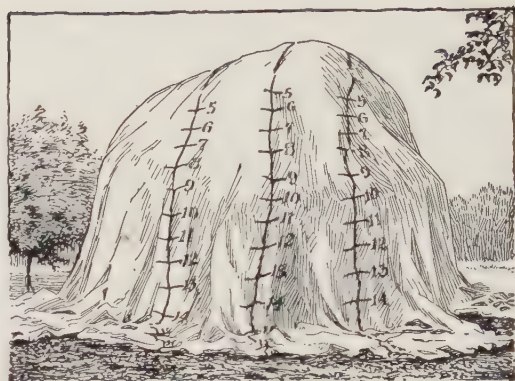
The top line of numbers, beginning at 16 and continuing to 68, represents the distance in feet around the bottom of the tent. The outer vertical columns of larger numbers running from 10 to 49 represent the distance in feet over the top of the tent. The number of ounces of cyanide to use for a tree of known dimensions is found in that square where the vertical column

headed by the distance around the tree intersects the horizontal line of figures corresponding to the distance over. For certain insects it is not advisable to use the full dosage schedule.

Sodium cyanide (NaCN) is coming into use as a substitute for potassium cyanide. When pure, this compound contains 53 per cent of cyanogen; that is, about 33 per cent more of cyanogen than is present in potassium cyanide. It is customary to indicate the strength of sodium cyanide in terms of potassium cyanide; that is, pure sodium cyanide is said to be 133 per cent pure. This means that 100 pounds of sodium cyanide will yield as much cyanogen as 133 pounds of potassium cyanide. For fumigation purposes, sodium cyanide should be at least 124 per cent pure and should not contain more than 1 per cent of common salt.

Because of the greater content of cyanogen of sodium cyanide, a smaller quantity is required. The chemicals should be combined in the following proportions: Sodium cyanide, one ounce; sulfuric acid, one and one-half fluid ounces; water, two ounces.

The following dosage schedule corresponds to the one given above for potassium cyanide:



1325. A fumigating tent (Morrill system).

often. It is always well to smoke through two consecutive days, for the insects which persist through the first treatment, being weak, will be killed by the second.

If the plants are wet, the smoke is more likely to scorch them. The smudge often injures flowers, as those of roses and chrysanthemums. In order to avoid this injury, the flowers should be covered with paper bags. Violet plants are very liable to injury.

Tobacco fumes can be more conveniently generated by burning strips of prepared nicotine paper, or by vaporizing a concentrated aqueous solution of nicotine over alcohol or special kerosene lamps.

Bisulfid of carbon is a thin liquid that volatilizes at a very low temperature, the vapor being very destructive to animal life. It is exceedingly inflammable, and should never be used near a lamp or fire. It is sometimes used for the control of certain root insects. It is poured into holes made around the infested plants, and these are then immediately

closed up causing the fumes to permeate the soil in all directions.

Against weevils infesting stored grain and seeds, carbon bisulfid is effective at the rate of five to eight pounds for each 1,000 cubic feet, provided the application is made while the temperature is not below 65° F. Make the bins as tight as possible. If bins are only single sheathed with common flooring use twenty to twenty-five pounds carbon bisulfid. Let the fumigation continue for at least twenty-four hours. Care should be taken not to apply carbon bisulfid when there is indication of heating in the grain.

C. R. CROSBY.  
ROBERT MATHESON.

	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	76	78		
10	1	1	1	1 1/2	1 1/2																												10	
12	1 1/2	1 1/2	1 1/2	2	2	2 1/2																												12
14	1 1/2	2	2	2 1/2	2 1/2	2 1/2	3																											14
16	2	2 1/2	2 1/2	3	3	3	3 1/2	3 1/2	4	4 1/2	5	5 1/2																						16
18				3	3	3 1/2	3 1/2	4	4 1/2	4 1/2	5 1/2	5 1/2	6	7	7 1/2	8																		18
				20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	76	78	
20				3	4	4 1/2	5	5 1/2	5 1/2	6	6 1/2	7	7	8	8 1/2	9	9 1/2																	20
22					4 1/2	5	5 1/2	6	6 1/2	7	7 1/2	7 1/2	8	8 1/2	8 1/2	9 1/2	10	10 1/2																22
24						5 1/2	6 1/2	7	7 1/2	8	8 1/2	9 1/2	9 1/2	9 1/2	10	10 1/2	11	11 1/2	12															24
26							7	8	8 1/2	9	9 1/2	10	10 1/2	10 1/2	11	11	11 1/2	12	13	14	14 1/2	15												26
28								8 1/2	9 1/2	10	10 1/2	11	11 1/2	11 1/2	12 1/2	12 1/2	13	13 1/2	14	14 1/2	15	16												28
								30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	76	78		
30								10	11	11 1/2	12	12 1/2	13	13 1/2	14	14 1/2	14 1/2	15	15 1/2	16 1/2	17 1/2	18	19	20	20 1/2	21 1/2								30
32									12	12 1/2	13	13 1/2	14	14 1/2	15	15 1/2	16	16 1/2	17	17 1/2	18	18 1/2	19	19 1/2	20 1/2	21 1/2	22 1/2							32
34										13	14	15	16	17	17 1/2	18	18 1/2	19	19 1/2	20	20 1/2	21	21 1/2	22 1/2	23	23 1/2	25							34
36											14	15	16	17	17 1/2	18	19	20	20 1/2	21 1/2	22	22 1/2	23	23 1/2	25								36	
38												16	16 1/2	17 1/2	18 1/2	19	20	21	21 1/2	22	22 1/2	23 1/2	24	24 1/2	25	25 1/2							38	
												40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	76	78			
40													17	18	19	20	21	22	22 1/2	23	24	24 1/2	25	25 1/2	26	26 1/2	27	27 1/2	28				40	
41													18	19	20	21	22	22 1/2	23	24	24 1/2	25	25 1/2	26	26 1/2	27	27 1/2	28	28 1/2	29			41	
42														20	20 1/2	22	22 1/2	23	24	24 1/2	25	25 1/2	26	26 1/2	27	27 1/2	28	28 1/2	29	29 1/2	30	30 1/2	42	
43															21 1/2	22 1/2	23	23 1/2	25	25 1/2	26	26 1/2	27	27 1/2	28	28 1/2	29	29 1/2	30	30 1/2			43	
44																23	23 1/2	24	25	26	26 1/2	27	27 1/2	28	28 1/2	29	29 1/2	30	31	31 1/2	32		44	
																		50	52	54	56	58	60	62	64	66	68	70	72	74	76	78		
45																		24	25	26	26 1/2	27	27 1/2	28	29	29 1/2	30	30 1/2	31	31 1/2	32	33		45
46																			24 1/2	25 1/2	26 1/2	27 1/2	28	28 1/2	29 1/2	30	30 1/2	31	31 1/2	32 1/2	33	34		46
47																			25	26	27	27 1/2	28	28 1/2	29	30	30 1/2	31 1/2	32	32 1/2	33	34	35	47
48																				25 1/2	26 1/2	27 1/2	28	28 1/2	29	29 1/2	30	31	32	32 1/2	33	34	35	36
49																				26 1/2	27	28	28 1/2	29	29 1/2	30	31	31 1/2	32 1/2	33	34	35	36	49
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Dosage chart for fumigating citrus trees with potassium cyanide (Bureau of Entomology, United States Department of Agriculture).

*Nicotine preparations.*—Tobacco is used in various ways in fumigating greenhouses. For smoking or smudging greenhouses, tobacco-stems are burned slowly. Best results are secured when a sheet-iron vessel made for the purpose is used, having holes in the bottom to supply draft. A quart of live coals is placed in the bottom of the vessel, and about a painful of tobacco-stems is laid on them. The stems should not blaze, but burn with a slow smudge. If they are slightly damp, better results are obtained. Some plants are injured by a very heavy smoke, and in order to avoid this injury, and also more effectually to destroy the insects, it is better to smoke rather lightly and



## Catalogue of insects.

**Abutilon.** **ABUTILON MOTH** (*Cosmophila erosa*).—A pale pea-green caterpillar striped with lemon-yellow often defoliates the plants in the southern states.

*Treatment.*—The young caterpillar may be killed by spraying with "Black Leaf 40" tobacco extract, one part in 650 parts water, adding soap to make the liquid spread and stick better.

**Acacia.** **COTTONY CUSHION SCALE.**—See *Citrus*.

**OLEANDER SCALE.**—See *Hedera*.

**RED SCALE.**—See *Citrus*.

**Acer.** **BOX-ELDER BUG** (*Leptocoris trivittatus*) is about  $\frac{1}{2}$  inch in length, dark gray in color marked with red. They congregate about box elder in great numbers, on the sap of which they feed. The young nymphs may be killed by spraying with ordinary contact insecticides.

**COTTONY MAPLE SCALE** (*Pulvinaria vitis*) is a brown, soft-bodied, scale insect,  $\frac{1}{2}$  inch in length. The eggs are laid beneath a conspicuous cottony mass which protrudes from under the scale. The eggs hatch during June and July, and the fertilized females hibernate on the smaller branches. There is one generation annually.

*Treatment.*—A stiff stream of water will dislodge many of the mature scales in June or July. The young scales may be killed with tobacco extract. The most effective treatment on maples is 15 per cent kerosene emulsion applied during the dormant season to kill the hibernating females.

**GREEN-STRIPED MAPLE WORM** (*Anisota rubicunda*) is a large, pale yellowish green caterpillar, striped with dark green, that occasionally defoliates the maple.

*Treatment.*—The young caterpillars may be controlled by spraying with arsenate of lead, four to eight pounds to one hundred gallons of water.

**PIGEON TREMEX** (*Tremex columba*) is a large four-winged fly having a wing expanse of  $2\frac{1}{2}$  inches. The abdomen ends in a prominent ovipositor. The larva, over 2 inches long when full-grown, burrows in the wood, seriously injuring the tree when abundant. Vigorous trees usually overcome the attack.

**PLANT-LICE.**—Several species are occasionally injurious.

*Treatment.*—"Black Leaf 40" tobacco extract, three-fourths of a pint to one hundred gallons of water, adding four pounds of soap, is an efficient remedy.

**SUGAR-MAPLE BORER** (*Plagionotus speciosus*) is very destructive to hard maples. The parent beetle is about an inch long, black, brilliantly marked and banded with yellow. The larva is a large borer about 2 inches in length when mature. They burrow mostly in the sapwood, several often girdling and killing a tree. It is a difficult matter to prevent this injury.

*Treatment.*—Digging out the borers is the only remedy known.

**WOOLLY MAPLE-LEAF SCALE** (*Phenacoccus acericola*) is a soft-bodied woolly-covered insect about  $\frac{1}{4}$  inch long, found on the under side of the leaves. There are two or three generations a year. They hibernate as young on the bark of the trunk and branches.

*Treatment.*—Winter applications of whale-oil soap, one pound in one gallon of water, have given the best results.

**Æsculus.** **TUSsock-MOTH.**—See *Apple*.

**Agave.** **OLEANDER SCALE.**—See *Hedera*.

**RED SCALE.**—See *Citrus*.

**Alder.** **ALDER BLIGHT APHIS** (*Pemphigus tessellata*) occurs in colonies on the branches and appears as conspicuous white, woolly masses.

*Treatment.*—They may be dislodged by a stiff stream of water or may be killed by spraying with kerosene emulsion.

**SAW-FLY LEAF-MINER** (*Kaliopsisphinga dohrnii*) feeds between the upper and lower layers of the leaves, causing large blotch mines.

No remedy known.

**Allamanda.** **CITRUS WHITE FLY.**—See *Citrus*.

**Almond.** **BLACK SCALE.**—See *Citrus*.

**CLOVER MITE.**—See *Peach*.

**COTTONY CUSHION SCALE.**—See *Citrus*.

**PEAR THRIPS.**—See *Pear*.

**SAN JOSÉ SCALE.**—See *Apple*.

**Aloe.** **OLEANDER SCALE.**—See *Hedera*.

**Amaryllis.** **NARCISSE BULB-FLY.**—See *Narcissus*.

**Ampelopsis.** **MYRON SPHINX** (*Ampelophaga myron*).—Large, green or brown, smooth caterpillars occasionally defoliate the vines.

*Treatment.*—Hand-picking.

**Annona.** **FLORIDA WAX SCALE.**—See *Citrus*.

**Anthurium.** **FLORIDA WAX SCALE.**—See *Citrus*.

**Apple.** **APHIDS OR PLANT-LICE.**—There are three species which commonly attack the opening buds and leaves of apple,—the leaf aphid (*Aphis pomi*), rosy aphid (*Aphis sorbi*) and bud aphid (*Siphocoryne avenae*).

*Treatment.*—These small, soft-bodied insects may be controlled by thorough spraying with "Black Leaf 40" tobacco extract, three-fourths of a pint, in one-hundred gallons of water, adding four pounds of soap. Make the application before the leaves curl.

**APPLE-CURCULIO** (*Anthonomus quadrigibbus*).—A soft, white grub, about  $\frac{1}{2}$  inch long, living in the fruit.

*Treatment.*—Clean cultivation. Rake the small apples that drop early out into the sun where they will dry up.

## CATALOGUE OF INSECTS, continued.

**APPLE FLEA-BEETLE** (*Graptodera foliacea*).—Brassy, green beetle,  $\frac{1}{2}$  inch or less long, feeding upon leaves.

*Treatment.*—Arsenicals. Lime-sulfur or bordeaux mixture as a repellent.

**APPLE LEAF-HOPPER** (*Empoasca mali*).—A slender pale yellowish green bug; the nymphs are pale greenish and usually found on the under side of the leaves. The winter eggs are laid in blisters under the bark of the smaller branches; summer eggs, in the leaf veins and petioles. Four generations annually. The insect feeds by extracting the juices from the leaves, causing them to turn pale and curl. It is most injurious to nursery stock.

*Treatment.*—The young nymphs may be killed by spraying with "Black Leaf 40" tobacco extract, three-fourths of a pint in one hundred gallons of water, adding three to four pounds of soap. Nurserymen often catch the adults by the use of sticky shields.

**APPLE LEAF-ROLLER** (*Archips argyrospila*).—A green caterpillar with a black head, 1 inch or less in length when mature, attacks the opening buds rolling and webbing together the leaves, flowers and young fruit into a nest. Holes are eaten in the young apples, deforming them. Eggs are laid in June in small, flat masses on the bark and are covered with a smooth varnish-like coating. They do not hatch till the following spring.

*Treatment.*—To kill eggs spray with miscible oil, one gallon in fifteen gallons of water, making the application as late as possible before the buds open. If the eggs have been neglected, recourse must be had to arsenate of lead, six pounds in one hundred gallons of water. Apply before the blossoms open.

**APPLE MAGGOT** (*Rhagoletis pomonella*).—A white maggot that tunnels apples through and through, causing decay and falling of the fruit. The parent flies appear the latter part of June and early July and insert the eggs under the skin of the fruit. Hibernation takes place in small puparia just below the surface of the soil. Sweet and subacid varieties are most susceptible, but others are sometimes attacked.

*Treatment.*—Clean cultivation. Spray when flies appear with arsenate of lead, four pounds in one hundred gallons of water. The addition of two or three gallons of molasses is supposed to render the poison more attractive to the flies.

**BROWN-TAIL MOTH** (*Euproctis chrysorrhæa*).—This highly destructive European insect was introduced near Boston a number of years ago, and is now rapidly spreading over New England. The snow-white moths, with a large tuft of brown hairs at the tip of the abdomen, appear in July and deposit eggs on the leaves in elongate masses covered with brown hairs from the body of the female. The caterpillars become only partly grown the first season, and hibernate in conspicuous nests, 3 or 4 inches long, at the tips of the branches. The black-bodied caterpillars, clothed with rather long, brownish, stinging hairs, complete their growth the next spring, feeding ravenously on the tender foliage and causing great damage in orchards, parks, and forests.

*Treatment.*—Cut out and burn all winter nests before the buds start. In the spring, spray with arsenate of lead, as recommended for the gipsy-moth. Prevent the ascent of caterpillars from other trees by banding the trunks with tanglefoot. Keep the bands fresh by combing the surface every few days.

**BUD-MOTH** (*Tmetocera ocellana*).—The small brown caterpillars with black heads burrow into the buds, feeding on the opening leaves and flowers and web them together.

*Treatment.*—Spray with arsenate of lead, four pounds in one hundred gallons of water, just as the blossoms show pink, and again as the last of the petals are falling.

**CANKER-WORM, FALL** (*Alsophila pometaria*).—Wingless female moths usually emerge from the ground in late autumn, crawl up the trees and deposit their eggs on the smaller branches. The eggs hatch in April or May and the blackish yellow-striped, looping caterpillars defoliate the trees.

*Treatment.*—Band tree trunks in the fall with tanglefoot or cotton batting to prevent ascent of moths. The young canker-worms may be killed by spraying with arsenate of lead, six pounds to one hundred gallons of water.

**CANKER-WORM, SPRING** (*Paleacrita vernata*).—Habits similar to the fall canker-worm, but the moths emerge in March and April. Caterpillars are distinguished by having only two pairs of prolegs.

*Treatment.*—Same as for fall canker-worm except the bands should be applied in early spring.

**CASE-BEARERS.**—The pistol-case-bearer (*Coleophora malivorella*) and the cigar-case-bearer (*C. fletcherella*).—The small caterpillars live in pistol or cigar-shaped cases, about  $\frac{1}{4}$  inch long, that they carry around with them. They appear in spring on the opening buds at the same time as the bud-moth, and may be controlled by the same means.

**CODLIN-MOTH** (*Carpocapsa pomonella*).—This is the pinkish caterpillar which causes a large proportion of wormy apples. The eggs are laid by a small moth on the leaves and the skin of the fruit. Most of the caterpillars enter the apple at the blossom end. When the petals fall, the calyx is open, and this is the time to spray. The calyx soon closes, and keeps the poison inside ready for the young caterpillars' first meal. After the calyx has closed, it is too late to spray effectively. The caterpillars become full-grown in July and August, leave the fruit, crawl down on the trunk, and there most of them spin cocoons under the loose bark. In most parts of the country there are two broods annually.

## CATALOGUE OF INSECTS, continued.

**Treatment.**—As the last of the petals are falling, spray with four pounds arsenate of lead in one hundred gallons of water, using a stiff spray to force it into the blossom end of the apple. Repeat the application three weeks later.

**FALL WEB-WORM** (*Hyphantria cunea*).—Hairy larva, about an inch long, varying from gray to pale yellow or bluish black, feeding upon the leaves of many trees, in tents or webs.

**Treatment.**—Destroy by burning the webs, or removing them and crushing the larvæ. Spray with arsenicals.

**FLAT-HEADED BORER** (*Chrysobothris femorata*).—Larva about an inch long, flesh-colored, the second segment ("head") greatly enlarged; boring under the bark and sometimes into the wood. They are readily located in late summer or fall by the dead and sunken patches of bark.

**Preventive.**—Soap and carbolic acid washes applied from May to July. Keep trees vigorous.

**GREEN FRUIT-WORMS** (*Xylina* sp.).—Yellowish or apple-green caterpillars, striped with cream-color, 1 to 1½ inches in length when mature, attack the opening leaves and blossoms and eat holes in the developing fruit. The parent moths emerge from hibernation in early spring and lay their eggs on the smaller branches. One brood annually.

**Treatment.**—Thorough and repeated spraying with arsenate of lead, six pounds in one hundred gallons of water, will kill many of the young caterpillars. Make the application when blossom clusters appear.

**GYPSEY MOTH** (*Porthetria dispar*).—The full-grown caterpillar is about 2 inches long, dark gray in ground-color with eleven pairs of prominent tubercles on the back, the first five pairs blue, the last six dark red. They become full-grown about the first of July. They pupate in slight cocoons. The moths emerge in seven to seventeen days. The male has a light brown body, wings yellowish brown, and each front wing is crossed by four wavy dark brown lines. In the female the body is light buff and the wings grayish white. The dark markings on the front wings are similar to those of the male. The females do not fly, but each lays its eggs in a mass about an inch in length covered with hairs from its body. Hibernation takes place in the egg stage. The eggs hatch just as the buds are bursting.

**Treatment.**—Kill the eggs by saturating the masses with crude coal-tar creosote, to which a little lamp-black has been added as a marker. When the young caterpillars hatch, spray the trees with arsenate of lead, ten pounds in one hundred gallons of water. When the caterpillars are half-grown, use thirteen to fifteen pounds of lead arsenate. Full-grown caterpillars are very resistant to poisons. Band the tree trunks with tanglefoot to prevent the ascent of wandering caterpillars.

**LEAF-BLISTER MITE.**—See *Pear*.

**LEAF-CRUMPLER** (*Mineola indigenella*).—Reddish brown caterpillars that live in slender, horn-shaped cases and feed on the tender leaves. They hibernate as partly grown larvæ and attack the opening buds the following spring. They usually live in a nest of several leaves fastened together with silk.

**Treatment.**—Gather the nests and burn them. Arsenicals when the buds open.

**LESSER APPLE-WORM** (*Ecnarmonia prunivora*).—Similar to the codlin-moth, but larvæ often feed just under the skin of the fruit, causing blotched areas.

**Treatment.**—As for codlin-moth.

**OYSTER-SHELL SCALE** (*Lepidosaphes ulmi*).—This is an elongate scale (sometimes called bark-louse), ½ inch in length, resembling an oyster-shell in shape and often incrusting the bark. It hibernates as minute white eggs under the old scales. The eggs hatch during the latter part of May or in June, the date depending on the season. After they hatch, the young may be seen as tiny whitish lice crawling about on the bark. When these young appear, spray with kerosene emulsion, diluted with six parts of water, or whale-oil, or any good soap, one pound in four or five gallons of water. Where trees are regularly sprayed with lime-sulfur, as for the San José scale or blister mite, the oyster-shell scale is usually controlled.

**PALMER WORM** (*Ypsolophus pometellus*).—The brownish green, white-striped caterpillars, ½ inch in length when mature, skeletonize the tender foliage in June and eat holes in the young apples. There is only one brood a year.

**Treatment.**—Spray with arsenate of lead, four pounds in one hundred gallons of water when the caterpillars first appear.

**PLUM-CURCULIO** (*Conotrachelus nenuphar*).—A snout-beetle that deforms the fruit by its characteristic feeding and egg-laying punctures. The grubs develop in the fruit and cause it to fall.

**Treatment.**—Spraying with arsenate of lead, as for codlin-moth, whenever it can be applied with a fungicide so as not to increase expense, will help to control the trouble. Thorough superficial tillage of the surface of soil during July and August will kill many of the pupæ, and is recommended. For treatment on plum, see under *Plum*.

**RED BUGS** (*Heloroodylus malinus* and *Lygidea mendax*).—The winter is passed as eggs inserted in the smaller branches. The brilliant red nymphs appear as the buds open and feed on the foliage for a time. Then they puncture the newly set apples causing one of three things: some drop, some dry up and remain on trees till next spring, and others mature as knotty, misshapen, worthless fruit. One generation a year.

**Treatment.**—The young nymphs may be killed by thorough spraying with "Black Leaf 40" tobacco extract, one pint in one hundred gallons water, adding four pounds of soap, (1) when blossoms show pink, (2) when the last of the petals are falling.

## CATALOGUE OF INSECTS, continued.

**RED-HUMPED APPLE CATERPILLAR** (*Schizeura concinna*).—These red-headed, black-and-yellow-striped caterpillars with a red hump on the fourth segment often attract attention in August and September by feeding in colonies on the ends of the branches.

**Treatment.**—Spray for the young caterpillars with arsenate of lead, four pounds in one hundred gallons of water. As they are most troublesome on newly planted trees the older caterpillars may be shaken to the ground and crushed under foot.

**RIBBED COCOON-MAKER** (*Bucculatrix pomifoliella*).—A minute yellow or green larva feeding upon the upper surface of the leaves, causing the lower surface to turn brown. The cocoons are white and slender, and are laid side by side upon the under side of twigs, where they are conspicuous in winter.

**Treatment.**—Lime-sulfur while tree is dormant. Arsenicals for the larvæ in summer.

**ROSE-CHAFER.**—See *Grape*.

**ROUND-HEADED BORER** (*Saperda candida*).—A yellowish white grub with dark brown head, about 1 inch long when mature. It is said to remain in the larval state three years. The parent beetle is silvery white on the head and beneath; the thorax and wing-covers are light brown; two silvery white stripes extend from the head to the tip of the wing-covers. The eggs are laid in slits in the bark, mostly in June.

**Preventive.**—Keep the beetles from laying eggs by spraying the trunks several times during the spring and summer with kerosene emulsion or by coating them with an alkaline wash made from soap, caustic potash, and carbolic acid. Tared paper tree-protectors well tied at the top, or wire mosquito-netting protectors closed at the top and encircling the trunk so loosely that the beetles cannot reach the bark, are effective in preventing egg-laying. Practise clean cultivation, and do not let water sprouts or other rank vegetation encircle the base of the tree.

**Remedial.**—Dig out the borers whenever they can be located by discolored bark or by the sawdust thrown out of the burrow.

**SAN JOSÉ SCALE** (*Aspidiotus perniciosus*).—This scale is nearly circular in outline and about the size of a pinhead. When abundant it forms a crust on the branches, and causes small red spots on the fruit. It multiplies with marvelous rapidity, there being three or four broods annually, and each mother scale may give birth to several hundred young. The young are born alive, and breeding continues until late autumn, when all stages are killed by the cold weather, except the tiny, half-grown, black scales, many of which hibernate safely.

**Treatment.**—Spray thoroughly in the fall after the leaves drop, or early in the spring before growth begins, with lime-sulfur wash, one gallon in eight gallons of water, or miscible oil, one gallon in fifteen gallons of water. When badly infested, make two applications, one in the fall and another in the spring. In case of large, old trees, 25 per cent crude-oil emulsion should be applied just as the buds are swelling.

**SCURFY SCALE** (*Chionaspis furfurus*).—This whitish, pear-shaped scale, about ½ inch in length, often incrusts the bark, giving it a scurfy appearance. It hibernates as purplish eggs under the old scales.

**Treatment.**—Spray as recommended for oyster-shell scale.

**TENT-CATERPILLARS** (*Malacosoma americana* and *M. dissimilis*).—Larvæ nearly 2 inches long, spotted and striped with yellow, white, and black; feeding upon the leaves. They congregate in tents or in clusters on the bark at night and in cool weather, and forage out upon the branches during the day.

**Treatment.**—Arsenicals, as for codlin-moth. Burn out nests with torch, or cut them out and crush the larvæ. Pick off egg masses from twigs during winter and spring.

**TUSsock-MOTH** (*Hemerocampa leucostigma*).—A handsome, red-headed, yellow and black tufted caterpillar, about an inch long, which devours the leaves and sometimes eats into the fruit.

**Remedial.**—Collect the frothy egg-masses in fall and winter and band the trees to prevent a reinfestation by migrating caterpillars. Spray with arsenicals as for codlin-moth, taking care to cover the under side of the leaves.

**TWIG-BORER** (*Schistoceros hamatus*).—Beetle, ¾ inch long, cylindrical and dark brown, boring into twigs of apple, pear, and other trees. The beetle enters just above a bud.

**Treatment.**—Burn the twigs. The early stages are passed in dying wood, such as prunings, diseased canes, and in upturned roots. Burn such rubbish, and thus destroy their breeding-places. This is also a grape pest.

**TWIG-GIRDLER** (*Oncideres cingulatus*).—Small branches are often girdled by a handsome ash-sprinkled reddish brown beetle, about ½ inch in length. The girdled twigs soon fall and the grubs develop in the fallen branches.

**Treatment.**—Collect and burn all fallen branches.

**WOOLLY APHIS** (*Schizoneura lanigera*).—Small reddish brown plant-lice covered with a conspicuous mass of white, waxy fibers, found on the branches, sprouts, trunks and roots.

**Treatment.**—For the form above ground drench the infested parts with 15 per cent kerosene emulsion; for the underground form remove the earth beneath the tree to a depth of 3 inches, and apply 10 per cent kerosene emulsion liberally, and replace the earth. In the case of nursery stock the emulsion may be applied in a shallow furrow close to the row. Do not set infested trees.

**YELLOW-NECKED APPLE CATERPILLARS** (*Datana ministra*).—Apple branches are often defoliated in late summer by colonies of black- and yellow-striped caterpillars about 2 inches in length when mature.

**Treatment.**—Same as for Red-humped Caterpillar, which see.



## CATALOGUE OF INSECTS, continued.

**Apricot.** BARK BEETLE.—See *Peach*.

BLACK SCALE.—See *Citrus*.

CANKER-WORMS.—See *Apple*.

CLOVER MITE.—See *Peach*.

COTTONY CUSHION SCALE.—See *Citrus*.

EUROPEAN FRUIT LECANIUM.—See *Plum*.

FROSTED SCALE (*Eulecanium prunosum*).—A large soft-bodied scale,  $\frac{1}{2}$  inch in length, hemispherical in shape with a frost-like covering of wax.

*Treatment*.—Kerosene or distillate emulsion while the trees are dormant.

PEACH TREE-BORERS.—See *Peach*.

PEAR THRIPS.—See *Pear*.

PLUM-CURCULIO.—See *Plum*.

**Aquilegia.** COLUMBINE BORER (*Papaipema purpurifascia*).—The full-grown caterpillar measures  $1\frac{1}{4}$  inches in length, salmon-pink in color with three narrow stripes visible from above, the two lateral ones broadly interrupted in the middle. It bores in the stems near the base.

*Treatment*.—Dig out and destroy caterpillars.

**Artichoke.** STEM MAGGOT (*Straussia longipennis*).—A small yellowish maggot boring in the pith of the stems. The adult are two-winged yellowish flies with banded wings.

*Treatment*.—Encourage growth; vigorous plants outlive injury.

**Asparagus.** COMMON ASPARAGUS-BEETLE (*Crioceris asparagi*).—Beetle, less than  $\frac{1}{4}$  inch in length, yellow, red, and shining black, with conspicuous ornamentation, feeding upon the tender shoots. Larva feeds upon the leaves and tender bark.

*Treatment*.—Freshly slaked lime dusted on before the dew has disappeared in the morning. Poultry. Cut down all plants in early spring to force the beetles to deposit their eggs upon the new shoots, which are then cut every few days before the eggs hatch; or leave a row or so around the field as a lure for the beetles where they may be killed with arsenicals.

TWELVE-SPOTTED ASPARAGUS-BEETLE (*Crioceris 12-punctata*).—Similar to the last, but with twelve spots on the wing-covers.

*Treatment*.—Similar to that used above, except that the grubs cannot be destroyed by lime, since they live within the berry.

ASPARGUS MINER (*Agromyza simplex*).—A maggot mining under the skin near the base of the plant.

*Treatment*.—Leave a few volunteer plants as a trap in which the fly will deposit her eggs. Pull and burn these plants in late June and early July. The flies may be killed before ovipositing with sweetened arsenate of lead.

**Aspidistra.** FLORIDA RED SCALE.—See *Citrus*.

**Aster.** BLISTER BEETLES.—Large, black, grayish or striped beetles that feed on the flowers. The larvæ in general feed on grass-hopper eggs.

*Treatment*.—Hand-picking.

TARNISHED PLANT-BUG (*Lygus pratensis*).—An active bronzy brown sucking bug  $\frac{1}{2}$  inch long, mottled with various shades of yellowish, that stunts the terminal buds by its feeding punctures and also injures the flower-buds so that they either do not open or produce imperfect flowers. Injured plants are dwarfed and stunted.

*Treatment*.—No satisfactory control measures are known. Plants grown in shade are less liable to injury.

ROOT-LOUSE (*Aphis maidiradicis*).—Small bluish green plant-lice infesting the roots, causing the plants to turn yellow and sickly.

*Treatment*.—Mix tobacco dust into the soil around the plants when transplanting.

WHITE GRUBS.—See *Corn*.

**Aucuba.** THE YELLOW SCALE.—See *Citrus*.

**Avocado.** LEAF-ROLLER (*Amorbia emigratella*).—A yellowish green caterpillar striped with pinkish brown, about 1 inch long when mature, rolls the leaves and eats small holes in the fruit, rendering it unfit for sale.

*Treatment*.—Arsenate of lead when the caterpillars appear.

MEALY-BUG (*Dactylopius nipæ*).—A small unarmored scale with white mealy covering.

*Treatment*.—Kerosene emulsion, one part to ten parts water.

**Bamboo.** COTTONY BAMBOO SCALE (*Antonina crawi*).—Small purplish red scales  $\frac{1}{2}$  to  $\frac{1}{4}$  inch in length, covered with a dense cottony coating; often  $\frac{1}{2}$  inch in diameter. They collect in large numbers in the crotches and leaf-axils.

*Treatment*.—Repeated applications of kerosene emulsion.

PLANT LOUSE (*Myzocallis arundincolens*).—Small yellowish lice which collect in large numbers on the under surface of the leaves.

*Treatment*.—Contact sprays.

**Banana.** BANANA WEEVIL (*Sphenophorus sordidus*).—A small grub boring in the stems.

FLORIDA RED SCALE.—See *Citrus*.

MEALY-BUG (*Ceropota yuccæ*).—Soft scales closely resembling the common mealy-bug (*Pseudococcus*).

*Treatment*.—Kerosene emulsion.

**Bean.** BEAN LADY-BIRD (*Epilachna corrupta*).—A light yellowish brown lady-bird beetle, with four black spots on each wing-cover, attacks and devours all parts of the bean plant. The larva, which is yellow and covered with stout branched spines, also feeds on the bean.

*Treatment*.—Arsenate of lead or kerosene emulsion.

## CATALOGUE OF INSECTS, continued.

**BEAN LEAF-BEETLE** (*Cerotoma trifurcata*).—A pale yellow beetle  $\frac{1}{2}$  inch in length, with black markings on the wing-covers, often eats round holes in the leaves. The larvæ feed on the roots and main stems of the plants.

*Treatment*.—Arsenate of lead as soon as the beetles appear.

**BEAN-WEEVIL** (*Bruchus obtectus*).—Closely resembles the pea-weevil, which see for description and remedies. Holding over the seed will be of no value with this insect.

**CORN-EAR WORM**.—See *Corn*.

**CUTWORM**.—See *Corn*.

**PEA APHIS**.—See *Pea*.

**SEED-CORN MAGGOT** (*Pegomya fusciceps*).—A maggot attacking germinating seeds and roots of young plants.

*Treatment*.—Avoid stable manure; practise crop-rotation. In the garden, use sand moistened with kerosene around the plants to keep the flies from laying the eggs.

**Beet.** BEET APHIS (*Pemphigus betæ*).—A root-infesting plant-louse locally abundant in certain western states.

*Treatment*.—Rotation of crops.

**BEET LEAF-HOPPER** (*Eutettix tenella*).—A small, pale yellowish green leaf-hopper punctures the leaves, causing the disease, curly top. Present in the western states.

*Treatment*.—No satisfactory treatment known.

**BLISTER BEETLES**.—See *Aster*.

**CUTWORMS**.—See *Corn*.

**FALSE CHINCH BUG** (*Nysius angustatus* var. *minutus*).—Small grayish brown bugs,  $\frac{1}{8}$  inch in length. Destructive to sugar beets grown for seed.

*Control*.—Contact insecticides; clean cultivation.

**GRASSHOPPERS**.—See *Corn*.

**LEAF-MINER**.—See *Spinach*.

**LARGER BEET LEAF-BEETLE** (*Monoxia puncticollis*).—A dull brown beetle with striped wing-covers. Both larvæ and adults feed on the sugar beet, often in immense numbers.

*Treatment*.—Same as for *Flea-Beetles*. See *Potato*.

**FLEA-BEETLE**.—See *Potato*.

**WESTERN BEET BEETLE** (*Monoxia consputa*).—A beetle closely allied to the larger beet leaf-beetle, feeding on the leaves, leaving only the veins.

*Treatment*.—Same as for *Flea-Beetles*. See *Potato*.

**BEET ARMY WORM** (*Laphygma exiqua*).—A large caterpillar about  $1\frac{1}{4}$  inches long when mature, olivaceous to greenish in color, broadly striped with lighter green; defoliates the plants.

*Treatment*.—See *Army Worm, Corn*.

**BEET WEB-WORM** (*Loxostege sticticalis*).—Pale yellowish green caterpillars striped with lighter green, about  $\frac{1}{4}$  inch long, frequently defoliate the plants in certain regions.

*Treatment*.—Destroy all weeds. Spray with arsenate of lead.

**Begonia.** GREENHOUSE THRIPS.—See *Citrus*.

GREENHOUSE WHITE-FLY.—See *Tomato*.

MEALY-BUGS.—See *Citrus*.

WHITE-FLY.—See *Citrus*.

**Berberis.** BARBERRY PLANT-LOUSE (*Rhopalosiphium berberidis*).—Small, greenish yellow lice attacking the leaves and young growth.

*Treatment*.—Tobacco extract or kerosene emulsion.

**Betula.** BIRCH APHIS (*Callipterus betulecoleus*).—A small, yellowish plant-louse occasionally abundant on the under side of birch foliage (cut-leaf varieties).

*Treatment*.—'Black Leaf 40' tobacco extract three-fourths of a pint to one hundred gallons of water.

**BIRCH LEAF BUCCULATRIX** (*Bucculatrix canadensisella*).—Small, whitish larvæ skeletonizing the leaves.

*Treatment*.—Arsenate of lead, six pounds in one hundred gallons water.

**BRONZE BIRCH BORER** (*Agrilus anxius*).—Slender, flattened yellowish white grubs,  $\frac{3}{4}$  inch long when full-grown, burrow under the bark on all parts of the tree. The top branch usually dies first and is the first indication that the tree is infested.

*Treatment*.—Cut down and burn all infested trees immediately to prevent spread to other trees.

**FROSTED SCALE**.—See *Apricot*. Occurs in California on birch.

**OYSTER-SHELL SCALE**.—See *Apple*.

**Bignonia.** HEMISPHERICAL SCALE.—See *Citrus*.

MEALY-BUGS.—See *Citrus*.

**Billbergia.** PINEAPPLE SCALE.—See *Pineapple*.

**Blackberry.**—See *Bramble Fruits*.

**Bramble Fruits.** BLACKBERRY LEAF-MINER (*Metellus rubi*).—A greenish white larva with brown markings,  $\frac{1}{2}$  inch in length when full-grown, causing blotch mines in the leaves.

*Treatment*.—No satisfactory treatment known.

**CANE-BORER** (*Obera bimaculata*).—Beetle, black, small, and slim; making two girdles about an inch apart near the tip of the cane, in June, and laying an egg just above the lower girdle; the larva, attaining the length of nearly an inch, bores down the cane. Also in blackberry.

*Remedy*.—As soon as the tip of the cane wilts, cut it off below the lower girdle and burn it.

**RASPBERRY BEETLE** (*Bythorus unicolor*).—A light brown beetle one-seventh inch long feeds on the opening leaves and blossoms. The small white grub feeds between the berry and receptacle of red raspberries.

**RASPBERRY CANE MAGGOT** (*Phorbia rubivora*).—Small, white maggot which burrows in the new canes and girdles the shoot. The eggs are laid by a fly in April or May.

## CATALOGUE OF INSECTS, continued.

*Treatment*.—Pull up or cut off canes several inches below the girdle and burn them.

**RASPBERRY HORNTAIL** (*Hartigia abdominalis*).—A whitish larva, about 1 inch in length when mature; when young it burrows under the bark, girdling the tip. It then tunnels out the pith.

*Treatment*.—Cut off infested canes when wilting is observed.

**RASPBERRY ROOT-BORER** (*Bembecia marginata*).—Larva about 1 inch long, boring in the roots and the lower parts of the cane, remaining in the root over winter.

*Remedy*.—Dig out the borers. Destroy wild berry bushes.

**RASPBERRY SAW-FLY** (*Monophadnus rubi*).—Larva about  $\frac{3}{4}$  inch long, green, feeding upon the leaves.

*Remedies*.—Hellebore; arsenicals, after fruiting.

**RED-NECKED CANE-BORER** (*Agrilus ruficollis*).—A yellowish white flattened grub,  $\frac{3}{4}$  inch in length when mature, burrows in the canes causing swellings or galls characterized by the splitting of the bark. The parent beetle is  $\frac{1}{2}$  inch in length, black, with thorax or "neck" reddish.

*Treatment*.—Cut out and burn all infested canes.

**RED-SPIDER**.—See *Peach*. Do not use lime-sulfur on raspberry foliage.

**TREE-CHICKET** (*Ecanthus nigricornis*).—Small and whitish cricket-like insect, puncturing canes for 2 or 3 inches, and depositing eggs in the punctures.

*Remedy*.—Burn all infested canes in winter or very early spring.

**Brassica**.—See *Cabbage*.

**Brussels Sprouts**.—See *Cabbage*.

**Buxus**. **OLEANDER SCALE**.—See *Hedera*.

**Cabbage**. **CABBAGE APHIS** (*Aphis brassicæ*).—These small, mealy plant-lice are especially troublesome during cool, dry seasons, when their natural enemies are less active.

*Treatment*.—Thorough spraying with "Black Leaf 40" tobacco extract, three-fourths of a pint in one hundred gallons water, adding four or five pounds of soap.

**CABBAGE-LOOPER** (*Antographa brassicæ*).—A pale green looping caterpillar, striped with lighter lines, over 1 inch in length when mature. Especially destructive to late cauliflower.

*Treatment*.—Very difficult to poison. Some growers dust the plants with pure paris green, using a blower.

**CABBAGE MAGGOT** (*Pegomya brassicæ*).—A small white maggot, the larva of a small fly, eating into the crown and roots of young cabbage, cauliflower, radish, and turnip plants.

*Treatment*.—Carbolic acid emulsion diluted with thirty parts of water, applied the day following the transplanting of the cabbage plants, and repeated once a week for several applications. Remove a little earth from about the plants, and spray on the emulsion forcibly. Better results may be secured by using tightly fitting cards cut from tarred paper. In seed-beds, protect the plants by surrounding the bed with boards 1 foot wide placed on edge, across which a tight cover of cheese cloth is stretched.

**CABBAGE-WORM** or **CABBAGE-BUTTERFLY** (*Pontia rapæ*).—The green caterpillars hatch from eggs laid by the common white butterfly. There are several broods every season.

*Treatment*.—If plants are not heading, spray with kerosene emulsion or with paris green to which the sticker has been added. If heading, apply hellebore.

**CUTWORMS**.—See *Corn*.

**DIAMOND-BACK MOTH** (*Plutella maculipennis*).—A pale green, active caterpillar, about  $\frac{1}{2}$  inch in length when mature, feeds on the under sides of the leaves. Pupates in an open-work silken cocoon on the leaves. Destructive to late cauliflower.

*Treatment*.—Same as for cabbage looper.

**FLEA-BEETLES**.—See *Potato*.

**HARLEQUIN CABBAGE-BUG** (*Murgantia histrionica*).—Bug about  $\frac{1}{2}$  inch long, gaudily colored with orange dots and stripes over a blue-black ground, feeding upon cabbage; two to six broods.

*Treatment*.—Hand-picking. Place blocks about the patch, and the bugs will collect under them. In the fall make small piles of the rubbish in the patch, and burn them at the approach of winter. Practice clean culture. Destroy all cabbage stalks and other cruciferous plants in fall. Early in the spring, plant a trap crop of mustard, radish, rape, or kale. When the overwintering bugs congregate on these plants, destroy them with pure kerosene or by hand.

**Cactus**. **MEALY-BUGS**.—See *Citrus*.

**Cactus**. *Chelinidea vittiger*.—A yellowish bug resembling the common squash stink bug (*Anasa tristis*), feeding on the joints of opuntia, causing small circular discolored areas and destruction of the plants.

*Treatment*.—Destroy young with gasoline torch. In winter, burn trash in which adults are hibernating.

**COTTONY COCHINEAL INSECT** (*Dactylopius confusus*).—A scale insect covered with large flocculent masses of pure white wax.

*Control*.—Usually kept in check by its predaceous enemies. *Melittara juncotinella*.—Large indigo-blue (young), or conspicuously banded (last stage) larvae living within the joints of opuntia, causing tumor-like swellings.

*Control*.—Burn injured joints with gasoline torch.

*Mimorista flavidissimilis*.—Yellowish caterpillars burrowing in the young joints, thus destroying new growth. Their presence is indicated by exuding sap.

*Treatment*.—Powdered arsenate of lead dusted on the young growth early in the season.

*Narnia pallidicornis*.—Brownish yellow bugs about  $\frac{3}{4}$  inch in length injuring the fruit.

## CATALOGUE OF INSECTS, continued.

*Control*.—Destroy the gregarious bugs with the gasoline torch.

*Opuntia longicornis* (*Moneilema* sp.).—Shining, black, wingless beetles  $\frac{3}{4}$  to 1 inch in length. The larvae burrow in the main stems and older joints of the prickly pear.

*Control*.—Hand-picking the beetles; burning infested stems; spraying with arsenate of lead.

**Carnation**. **CARNATION MITE** (*Pediculopsis graminum*).—A minute mite found in the buds and instrumental in transmitting the bud-rot disease.

*Treatment*.—Gather and burn all infested buds.

**GREEN PLANT-LOUSE** (*Myzus persicæ*).—Small greenish plant-lice infesting the terminal branches.

*Treatment*.—Fumigation with hydrocyanic acid gas or tobacco.

**Carrot**. **CARROT BEETLE** (*Ligyrus gibbosus*).—A reddish brown beetle  $\frac{1}{2}$  inch or more long, which attacks the young plants. The larva lives in the ground, where it feeds on humus.

*Preventive*.—Crop-rotation and other remedies for white grub. See under *Corn*.

**CARROT RUST FLY**.—See *Celery*.

**PARSNIP LEAF-MINER**.—See *Parsnip*.

**PARSNIP PLANT-LOUSE**.—See *Parsnip*.

**PARSNIP WEB-WORM**.—See *Parsnip*.

**Carya**.—See *Hickory*.

**Castanea**.—See *Chestnut*.

**Catalpa**. **CATALPA-MIDGE** (*Cecidomyia catalpæ*).—Small yellowish-maggots, scarcely  $\frac{1}{2}$  inch in length when mature, attacking the seeds, terminal buds, ends of branches and leaves, deforming them.

*Treatment*.—Plow in early fall or late spring to destroy pupæ in nurseries.

**CATALPA SPHINX** (*Sphinx catalpæ*).—A sulfur-yellow caterpillar with black head and a broad black stripe down the back, about 2  $\frac{1}{2}$  inches in length when mature, defoliates the trees. Several broods a season.

*Treatment*.—Arsenate of lead when the caterpillars are small. Hand-picking later.

**Cauliflower**.—See *Cabbage*.

**Ceanothus**. **CITRUS MEALY-BUG**.—See *Citrus*.

**MEALY-BUG**.—See *Banana*.

**OYSTER-SHELL SCALE**.—See *Apple*.

**Celery**. **CARROT RUST-FLY** (*Psila rosæ*).—Minute whitish yellow maggots infesting the roots and stunting the plants.

*Preventive*.—Late sowing and rotation of crops. Celery or carrots should not follow each other.

**CELERY CATERPILLAR** (*Papilio polyxenes*).—A large green caterpillar, ringed with black and spotted with yellow, which feeds on the leaves.

*Treatment*.—Hand-picking as soon as observed.

**CELERY LEAF-TYER** (*Phlyctantia ferrugalis*).—A greenish caterpillar, feeding on the under side of the leaves.

*Treatment*.—Spray with arsenicals while the larvae are still young.

**CELERY LOOPER** (*Antographa falcigera*).—A greenish looping caterpillar with white stripes, about 1  $\frac{1}{2}$  inches long when mature; feeds on the tender leaves.

*Treatment*.—No satisfactory treatment known.

**LITTLE NEGRO BUG** (*Corimelana pulcra*).—Glossy black bugs,  $\frac{1}{2}$  inch in length, that collect in clusters in the axils of the leaflets and cause the plants to wilt.

*Treatment*.—Kerosene emulsion or tobacco extract.

**PARSNIP PLANT-LOUSE**.—See *Parsnip*.

**Chard**.—See *Beet*.

**Cherry**. **APHIS** (*Myzus cerasi*).—Blackish plant-lice infesting the leaves and tips of new growth.

*Treatment*.—Spray as soon as the first lice appear with whale-oil soap or tobacco extract.

**CANKER WORM**.—See *Apple*.

**CHERRY FRUIT FLIES** (*Rhagoletis cingulata* and *R. fausta*).—Small maggots infesting ripening fruit. Adults are flies with banded wings and insert their eggs under the skin of the fruit.

*Treatment*.—Spray with arsenate of lead, five pounds in one hundred gallons sweetened with three gallons molasses to kill flies before egg-laying. Should be done when flies first appear,—last of June in New York.

**CHERRY SCALE** (*Aspidiotus forbesi*).—Resembles the San José scale.

*Treatment*.—Same as for *San José Scale*. See *Apple*.

**PLUM-CURCULIO**.—See *Plum*.

**ROSE-CHAFER**.—See *Grape*.

**SLUG** (*Eriocampoides limacina*).—Larva,  $\frac{1}{2}$  inch long, blackish and slimy, feeding upon the leaves; two broods.

*Treatment*.—Arsenicals, hellebore, tobacco extract.

**CHERRY TREE TORTRIX** (*Archips cerasivorana*).—Tips of branches are frequently webbed into nests by colonies of lemon-yellow caterpillars.

*Treatment*.—Wipe out nests and destroy the caterpillars.

**PEACH TREE BORER**.—See *Peach*.

**FRUIT TREE BARK BEETLE**.—See *Peach*.

**Chestnut**. **CHESTNUT WEEVILS** (*Balaninus proboscideus* and *B. rectus*).—Brownish beetles with extremely long, slender snouts with which they bore holes into the nuts for deposition of eggs. The grubs feed on the kernel, producing wormy nuts.

*Treatment*.—No satisfactory control measures known.



## CATALOGUE OF INSECTS, continued.

- TWO-LINED CHESTNUT BORER** (*Agilus bilineatus*).—Slender, flattened grubs,  $\frac{3}{4}$  inch long when mature, burrowing under the bark and girdling the trees.  
*Treatment*.—Cut and burn infested trees to prevent spread.
- EUROPEAN FRUIT LECANIUM**.—See *Plum*.
- CHRYSANTHEMUM GREEN APHIS** (*Aphis rufomaculata*).—Small, green lice attacking the terminal shoots.  
*Treatment*.—Fumigation.
- BLACK APHIS** (*Macrosiphum sanborni*).—Small, black lice attacking the terminal shoots.  
*Treatment*.—Fumigation.
- TARNISHED PLANT-BUG**.—See *Aster*.
- CHRYSANTHEMUM LEAF-MINER** (*Oscinis* sp.).—Works in the leaves.  
*Treatment*.—Hand-picking.
- CINERARIA LEAF-TYER**.—See *Celery*.
- CITRUS BARNACLE SCALE** (*Ceroplastes cirripediformis*).—A large, dark brown scale covered with a waxy secretion  $\frac{1}{2}$  inch in length. Surface of scale sculptured like a miniature barnacle.  
*Control*.—Resin wash or kerosene emulsion before the waxy covering is secreted.
- BLACK CITRUS LOUSE** (*Toxoptera aurantiae*).—Small, dull black lice, curling the leaves and killing the new growth.  
*Control*.—Contact sprays before the leaves curl.
- BLACK SCALE** (*Saissetia oleae*).—A black, oval scale  $\frac{1}{4}$  inch in diameter with an "H"-shaped mark on the back of the female. The young are light yellow to brown, unmarked. The scales secrete honey dew in which a fungus grows smutting the fruit.  
*Treatment*.—Fumigation. On citrus, use a half to three-fourths of regular dosage between September and January. On deciduous fruits and olive, water distillate, caustic soda mechanical mixtures or distillate emulsion may be used to kill scales less than one-half grown.
- CITRUS RED-SPIDER** (*Tetranychus mytilaspidis*).—Bright red, minute mite, frequently abundant on fruit and foliage.  
*Treatment*.—Dusting with sulphur or commercial lime-sulphur solution diluted 1-35 or 50 of water.
- CITRUS THRIPS** (*Euthrips citri*).—Slender, minute, orange-yellow insects, less than one-thirtieth inch in length, scarring the fruit and injuring the foliage.  
*Treatment*.—Lime-sulphur solution one part in eighty parts water (likely to cause slight injury to foliage) or "Black Leaf 40" tobacco extract, one part in 1,300 parts water. Make four applications: (1) As the last of petals are falling; (2) ten to fifteen days later; (3) three to four weeks after the second; (4) during the months of August or September (for California). In greenhouses, fumigate with hydrocyanic acid gas.
- COTTONY CUSHION SCALE** (*Icerya purchasi*).—Red or yellowish scale insects with large, white, fluted, cottony masses which cover the eggs from  $\frac{1}{4}$  to  $\frac{1}{2}$  inch in length.  
*Control*.—Natural enemies, principally by the common Vedalia.
- FLORIDA RED SCALE** (*Chrysomphalus anidum*).—Circular flat, brown scales,  $\frac{1}{8}$  to  $\frac{1}{4}$  inch in diameter.  
*Treatment*.—Fumigation with full dosage schedule.
- FLORIDA WAX SCALE** (*Ceroplastes floridensis*).—Oval convex, white or pinkish, waxy scales with the upper surface evenly lobed, 1-12 to  $\frac{1}{2}$  inch in diameter.  
*Control*.—Resin wash or kerosene emulsion applied to the young scales before the waxy covering is formed.
- FULLER'S ROSE BEETLE**.—See *Strawberry*.
- GLOVER'S SCALE** (*Lepidosaphes gloveri*).—Closely resembles the purple scale, but is longer and narrower.  
*Control*.—Same as for Purple Scale, which see.
- GREENHOUSE THRIPS** (*Heliothrips hamorrhoidalis*).—A slender, minute, yellowish brown insect destroying the blossoms and russeting the fruit.  
*Treatment*.—Same as for Citrus Thrips, which see.
- HEMISPHERICAL SCALE** (*Saissetia hemispherica*).—A smooth, oval, convex soft scale without markings. Common in greenhouses.  
*Treatment*.—Same as for Black Scale, which see.
- MEALY-BUG** (*Pseudococcus citri*).—Small, soft-bodied scale insects,  $\frac{1}{4}$  to  $\frac{3}{8}$  inch long, covered with a white waxy secretion.  
*Control*.—A thorough application of carbolic acid emulsion; spray under heavy pressure.
- MELON APHIS**.—See *Muskmelon*.
- MEDITERRANEAN FRUIT FLY** (*Ceratitis capitata*).—Small white maggots burrowing in a great variety of soft, juicy fruits. The parent fly is about the size of the house fly, yellowish marked with black, and with faintly banded wings. Widely distributed in the tropical and subtropical regions of the world and a most serious horticultural pest wherever it occurs. Rigid quarantine regulations have prevented its introduction into the United States.  
*Treatment*.—Sweetened arsenate of lead to kill the flies before oviposition.
- ORANGE CHIONASPIS** (*Chionaspis citri*).—Elongate, blackish brown scale with a gray margin and dark yellow exuvia.  
*Treatment*.—Fumigation; kerosene emulsion, one part in five parts of water; three applications at three-week intervals.
- ORANGE MAGGOT** (*Trypeta ludens*).—Dirty white maggots, about  $\frac{1}{2}$  inch in length when mature, burrowing in the pulp. From four to twenty maggots may occur in a single orange. The adult two-winged fly is straw-yellow in color with brownish markings and bands on the wings. A serious pest to oranges in Mexico.  
*Control*.—Pick up and destroy all infested fruit.

## CATALOGUE OF INSECTS, continued.

- ORANGE TORTRIX** (*Tortrix citrana*).—Greenish white to dark, irregularly striped caterpillars,  $\frac{1}{2}$  inch long when mature, that burrow into the rind and induce decay.  
*Control*.—Destroy all infested fruit.
- PURPLE SCALE** (*Lepidosaphes beckii*).—Reddish brown to rich purple oyster-shell-shaped scales  $\frac{1}{8}$  to  $\frac{1}{4}$  inch in length.  
*Control*.—Fumigate with full dosage schedule.
- RED SCALE** (*Chrysomphalus aurantii*).—Circular, flat, reddish scales,  $\frac{1}{8}$  to  $\frac{1}{4}$  inch in diameter.  
*Control*.—Fumigation with full dosage schedule. On deciduous trees lime-sulphur solution, one part in nine parts of water; or distillate emulsion.
- SILVER MITE** (*Eriophyes oleivorus*).—A minute, elongate four-legged yellow mite causing russeting of the orange and silvering of the lemon.  
*Control*.—Same as for Citrus Red Spider, which see.
- SOFT BROWN SCALE** (*Coccus hesperidum*).—Oval, yellowish brown, flat, soft scale, sometimes with darker markings,  $\frac{1}{4}$  inch in length.  
*Control*.—Same as for Black Scale, which see.
- WHITE-FLY** (*Aleyrodes citri* and *A. nubilifera*).—The immature stages are found on the under side of the leaves and are scale-like in form. The adults are minute white-winged flies.  
*Treatment*.—Fumigation. Fungous parasites.
- YELLOW SCALE** (*Chrysomphalus citrinus*).—Similar to the red scale but yellowish in color.  
*Control*.—Same as for Red Scale, which see.
- CLEMATIS RED SPIDER**.—See *Peach*.
- SOFT BROWN SCALE**.—See *Citrus*.
- COCONUT COCONUT SCALE** (*Aspidiotus destructor*).—Whitish to creamy transparent scales often abundant on under side of leaves and fruit.  
*Treatment*.—When occurring on young trees spray with whale-oil soap; on older trees it is advisable to remove and burn badly infested leaves.
- COCONUT BEETLE** (*Strategus anachoreta*).—Large black beetles attacking young trees near the "collar." One beetle will destroy a tree if not removed in time.  
*Treatment*.—Dig out and destroy.
- COCONUT WHITE-FLY** (*Aleyrodes cocois*).—Similar to the citrus white fly.  
*Control*.—Contact insecticides. Destroy wild food plants.
- FLORIDA RED SCALE**.—See *Citrus*.
- PALM WEEVIL** (*Rhynchophorus palmarum*).—Shining black snout beetles, the larvae of which live in young palm trees reducing the interior tissues to a mass of pulp.  
*Treatment*.—Dress all wounds with tar or similar preparations. Avoid all unnecessary pruning. Destroy all felled trees and stumps not used as traps. The beetles may be attracted by the use of injured palm cabbages and trapped under rubbish.
- RHINOCEROS BEETLE** (*Oryctes rhinoceros*).—A large beetle about 1  $\frac{1}{2}$  inches long, attacking and burrowing through the crown and stem.  
*Treatment*.—Destroy all breeding-places, such as old coconut trees, stump, and cocoa pods.
- COCOS**.—See *Coconut*.
- CODIÆUM GREENHOUSE THRIPS**.—See *Citrus*.
- MEALY-BUGS**.—See *Citrus*.
- PURPLE SCALE**.—See *Citrus*.
- COFFEE BLACK CITRUS LOUSE**.—See *Citrus*.
- COFFEE LEAF-MINER** (*Cemistoma coffeella*).—A small caterpillar about  $\frac{1}{2}$  inch long, mines in the leaves producing small brownish areas. Badly infested leaves drop.  
*Treatment*.—No satisfactory treatment known.
- HEMISPHERICAL SCALE**.—See *Citrus*.
- MEALY-BUG**.—See *Citrus*.
- COLEUS MEALY-BUG**.—See *Citrus*.
- Orthesia insignis**.—Ocherous to dark green scale insect covered with a white waxy secretion extending posteriorly into a broad plate.  
*Treatment*.—Contact insecticides.
- WHITE-FLY**.—See *Tomato*.
- CORN ARMY-WORM** (*Leucania unipuncta*).—A cut-worm-like caterpillar, which normally feeds on grass. When this food-supply is exhausted, they migrate in numbers to other fields and attack corn, wheat, and similar crops.  
*Preventive*.—To stop the advance of the "army," plow deep furrows so the dirt is thrown toward the colony; in the bottom of the furrows dig post-holes into which the caterpillars will fall and where they may be killed with kerosene.
- CHINCH-BUG** (*Blissus leucopterus*).—A red or white and black sucking bug, three-twentieths of an inch long. Attacks wheat and corn in great numbers.  
*Preventives*.—Clean farming to destroy suitable hibernating shelter. Stop the migration of the bugs from the wheat-fields into corn by maintaining along the field a dust strip 10 feet wide in which a furrow and post-hole barrier has been constructed. This may be supplemented by a coal-tar barrier.
- ANGOUMOIS GRAIN MOTH** (*Sitotroga cerealella*).—A small caterpillar living in the grains. The adult is a small grayish brown moth. Most destructive in storage.  
*Treatment*.—Fumigate with carbon bisulphid, five pounds to 1,000 cubic feet. Make bins perfectly tight and sprinkle over grain, covering with gas-proof tarpaulin. Fumigate at least twenty-four hours. This should be done when the temperature is not below 65° F. In steam-heated mills, the most practicable method of destroying grain-infesting insects is by holding temperature from 118° to 122° for several hours.

## CATALOGUE OF INSECTS, continued.

**CORN EAR-WORM** (*Heliothis armiger*).—A green or brownish striped caterpillar feeding on the corn beneath the husk. Three to six generations yearly.

*Preventives*.—Plant as early as possible, and still avoid a "set-back" to the crop.

**CORN-ROOT APHIS** (*Aphis maidiradicis*).—A bluish green aphid infesting the roots.

*Preventives*.—A short rotation period in corn, especially in dry years. Deep and thorough and repeated stirring of old corn ground in fall and spring as a preparation for corn-planting. Maintenance and increase of the fertility of the soil.

**CUTWORMS** (*Agrotis*, *Hadena*, etc.).—Soft-bodied caterpillars eating and cutting off the young plants.

*Preventives*.—Early fall plowing of grass lands intended for corn; pasturing by pigs of grass or clover land intended for corn; distributing a line of poisoned bran by means of a seed-drill. To prevent the caterpillars entering from a neighboring grass field, destroy them with a line of poisoned vegetable bait.

**GRASSHOPPERS** (*Acrididae*).—Poison them with the following mixture: Bran, twenty pounds; paris green, one pound; syrup, two quarts; oranges or lemons, three fruits; water, three and one-half gallons. Mix the bran and paris green thoroughly in a wash-tub while dry. Squeeze the juice of oranges or lemons into the water and add pulp and peel cut into small pieces. Dissolve the syrup in the water and moisten the bran mixture with it, mixing thoroughly. Sow broadcast in infested areas early in the morning.

**NORTHERN CORN ROOT-WORM** (*Diabrotica longicornis*).—A whitish grub  $\frac{1}{2}$  inch long, which burrows in the roots.

*Preventive*.—Crop-rotation; corn should not follow corn.

**SOD WEB-WORMS** (*Crambus* sp.).—Gray or brownish caterpillars about  $\frac{1}{2}$  inch long, living in silk-lined burrows in the soil at base of plant. They thrive in grass land.

*Preventive*.—Early fall plowing of grass land intended for corn, or else plow as late as possible the next spring.

**WHITE GRUBS** (*Lechnosterna* sp.).—The large white curved larvæ of the common June beetle.

*Preventives*.—Rotation of crops; do not let corn follow sod, but let a crop of clover or clover and oats intervene. To help clear sod land of grubs, pasture to hogs any time between April and October. To prevent laying of eggs in corn-field, keep the ground free from weeds during May and June. Thorough cultivation and heavy fertilization.

**WIRE-WORMS** (*Elatride*).—Hard, yellowish, or reddish, cylindrical larvæ feeding on the roots.

*Preventives*.—Crop-rotation; let clover intervene between sod and corn, planting the corn late the second or third year. Early fall plowing.

**Cornus**. **OYSTER-SHELL SCALE**.—See *Apple*.

**SAN JOSE SCALE**.—See *Apple*.

**Corylus**. **HAZELNUT WEEVIL** (*Balaninus obtusus*).—Small whitish grubs living in the kernels. The adult is a yellowish brown beetle with a long, slender snout.

*Control*.—No efficient treatment known.

**Cosmos**. **ROOT APHIS** (*Aphis middletont*).—Small bluish lice on the roots.

*Treatment*.—Tobacco dust mixed in the soil.

**Cotoneaster**. **PEAR LEAF-BLISTER MITE**.—See *Pear*.

**Cranberry**. **CRANBERRY FULGORID** (*Phylloscelis atra*).—Small, broad-bodied, black jumping insect punctures the vines, causing the leaves to turn brown and the fruit to shrivel.

*Treatment*.—"Black Leaf 40" tobacco extract, one pint to one hundred gallons of water, adding four to five pounds soap to kill young nymphs.

**CRANBERRY-GIRDLER** (*Crambus hortuellus*).—Small caterpillars, feeding on the stems just beneath the surface of the sand.

*Preventive*.—Reflow just after picking, for a week or ten days, or reflow for a day or two about June 10.

**FALSE ARMY-WORM** (*Calocampa nupera*).—Green to blackish caterpillars devouring the leaves and buds.

*Treatment*.—Reflow for from twenty-four to thirty-six hours soon after the middle of May. It may be necessary to reflow a second time. Destroy all caterpillars washed ashore while the water is on. In dry bogs, spray early in May with arsenate of lead.

**FIRE-WORM**, **CRANBERRY WORM**, or **BLACK-HEADED CRANBERRY WORM** (*Eudemis vacciniana*).—Small larva, green, black-headed, feeding upon the shoots and young leaves, drawing them together by silken threads; two broods.

*Treatment*.—Flooding for two or three days when the worms come down to pupate. Arsenicals.

**FRUIT-WORM** (*Mineola vaccinii*).—Small caterpillar working in the fruits, eating out the insides.

*Preventives*.—For bogs with abundant water, reflow for ten days immediately after picking. Let the foliage ripen, and then turn on water for winter. Draw off water early in April, and every third or fourth year hold it on until the middle of May. For dry bogs spray three times with arsenate of lead during July. Bury all screenings.

**YELLOW-HEADED CRANBERRY-WORM** (*Acleris minuta*).—Stout, yellowish green, small caterpillar, with a yellow head, webbing up the leaves as it works.

*Treatment*.—Hold the water late on the bog in spring to prevent egg-laying. Arsenicals from the middle of May till July 1.

## CATALOGUE OF INSECTS, continued.

**Cratægus**. **PLANT-LICE**.—See *Apple*.

**OYSTER-SHELL SCALE**.—See *Apple*.

**RED-HUMPED CATERPILLAR**.—See *Apple*.

**SAN JOSE SCALE**.—See *Apple*.

**SCURFY SCALE**.—See *Apple*.

**WOOLLY APHIS**.—See *Apple*.

**Cucumber**. **FLEA-BEETLES**.—See *Potato*.

**MELON-WORM**.—See *Muskmelon*.

**PICKLE-WORM** (*Diaphania nitidalis*).—Larva, about an inch long, yellowish white, tinged with green, boring into cucumbers; two broods.

*Preventives*.—Clean farming, fall plowing, and rotation of crops.

*Remedies*.—Kill the caterpillars before they enter the fruit by spraying with arsenate of lead about the time the buds begin to form, and repeat in two weeks.

**RED-SPIDER**.—See *Peach*.

**SPOTTED CUCUMBER BEETLE** (*Diabrotica 12-punctata*).—Beetle, yellowish and black spotted, about  $\frac{1}{4}$  inch long, feeding upon the leaves and fruit. Sometimes attacks fruit trees, and the larva may injure roots of corn.

*Treatment*.—Same as for *Striped Cucumber Beetle*, which see.

**STEM-BORER**.—See *Squash*.

**STRIPED CUCUMBER BEETLE** (*Diabrotica vittata*).—Beetle,  $\frac{1}{4}$  inch long, yellow with black stripes, feeding on leaves. Larva  $\frac{1}{2}$  inch long and size of a pin, feeding on roots; two broods.

*Preventive*.—Cheap boxes covered with thin muslin or screens of mosquito netting, placed over young plants.

*Remedies*.—Arsenicals in flour; arsenate of lead; ashes, lime, plaster, or fine road dust sprinkled on the plants every two or three days when they are wet; air-slaked lime; plaster and kerosene; tobacco powder, applied liberally. Apply remedies when dew is on, and see that it strikes the under side of the leaves.

**WHITE-FLY**.—See *Tomato*.

**Cucurbita**.—See *Squash*.

**Currant**. **BORER** (*Sesia tipuliformis*).—A whitish larva, boring in the canes of currants, and sometimes of gooseberries. The larva remains in the cane over winter.

*Treatment*.—In fall and early spring cut and burn all affected canes. These canes may be distinguished by a lack of vigor and by limberness.

**CURRANT APHIS** (*Myzus ribis*).—Small yellowish green lice attacking the under side of the leaves, distorting the leaves and causing them to turn red.

*Treatment*.—Contact insecticides when leaves first appear.

**CURRANT MEASURING- or SPAN-WORM** (*Cymatophora ribearia*).—Larva somewhat over an inch long, with stripes and dotted with yellow or black, feeding upon the leaves.

*Treatment*.—Hellebore, applied stronger than for currant-worm. Arsenicals; hand-picking.

**CURRANT-WORM**, or **CURRANT or GOOSEBERRY SAW-FLY** (*Pteronix ribesii*).—Larva, about  $\frac{3}{4}$  inch long, yellowish green, feeding on leaves of red and white varieties; two to four broods.

*Treatment*.—Hellebore, applied early; arsenicals for the early brood. Treatment should begin while the larvæ are on the lowermost leaves of the bushes. Before the leaves are fully grown, the holes made by the worms may be seen. The second brood is best destroyed by killing the first brood.

**FOUR-STRIPED PLANT-BUG** (*Pæcilocapsus lineatus*).—A bright yellow, black-striped bug about  $\frac{1}{2}$  inch long, puncturing the young leaves and shoots of many plants.

*Treatment*.—Jarring into a dish of kerosene. Kerosene emulsion when the nymphs are young. Cut off the tips of the shoots in early spring to destroy the eggs.

**OYSTER-SHELL SCALE**.—See *Apple*.

**SAN JOSE SCALE**.—See *Apple*.

**Cycas**. **HEMISPHERICAL SCALE**.—See *Citrus*.

**MEALY-BUG**.—See *Citrus*.

**OLEANDER SCALE**.—See *Hedera*.

**RED SCALE**.—See *Citrus*.

**SOFT BROWN SCALE**.—See *Citrus*.

**WHITE PEACH SCALE**.—See *Peach*.

**Dahlia**. **GREENHOUSE THRIPS**.—See *Citrus*.

**TARNISHED PLANT-BUG**.—See *Aster*.

**Date**. **DATE PALM SCALE** (*Parlatoria blanchardii*).—Small elongate gray or black scales with white edges. Male scales are white.

*Treatment*.—Crop close, burn over trunks, after saturating with gasoline and use blast torch.

**MARLATT SCALE** (*Phanicooccus marlatti*).—A soft-bodied, oval, wine-red insect, one twenty-fifth inch in length, partially covered with white wax, found in large colonies at base of leaves.

*Treatment*.—Carbolic acid emulsion poured in large quantities at base of leaves.

**OLEANDER SCALE**.—See *Hedera*.

**RED SCALE**.—See *Citrus*.

**RHINOCEROS BEETLE**.—See *Coconut*.

**Dewberry**.—See *Bramble Fruits*.

**Diospyros**. **WHITE FLY**.—See *Citrus*.

**WHITE PEACH SCALE**.—See *Peach*.

**Dracæna**. **LONG-TAILED MEALY-BUG** (*Pseudococcus longispinus*).—Similar to the common mealy-bug, but has two long white anal appendages.

*Treatment*.—Same as for mealy-bug.



## CATALOGUE OF INSECTS, continued.

- Echinocactus.**—See *Cactus*.  
**Echinocereus.**—See *Cactus*.  
**Echinopsis.**—See *Cactus*.  
**Eggplant.**—See article on *Eggplant*.  
**Elm.**—See *Ulmus*.  
**Eucalyptus.** BLACK SCALE.—See *Citrus*.  
 OLEANDER SCALE.—See *Hedera*.  
 RED SCALE.—See *Citrus*.  
**Eupatorium.** BARNACLE SCALE.—See *Citrus*.  
**Evonymus.** EVONYMOUS SCALE (*Chionaspis evonymi*).—Dark brown, convex scales, about one-twelfth inch in diameter with yellow exuviae. Male scales pure white parallel sides and strongly tricarinated.  
*Treatment.*—Spray with kerosene emulsion every two weeks during the hatching periods until the scale has disappeared.  
 RED SCALE.—See *Citrus*.  
**Ferns.** FLORIDA WAX SCALE.—See *Citrus*.  
 GREENHOUSE THIRPS.—See *Citrus*.  
 HEMISPHERICAL SCALE.—See *Citrus*.  
 MEALY-BUGS.—See *Citrus*.  
 OLEANDER SCALE.—See *Hedera*.  
 SOUTHERN FERN-CUTWORM (*Callopietria floridensis*).—Velvety black or apple-green caterpillars, 1½ inches in length when mature, feeding on the fronds.  
*Treatment.*—Try poisoned baits.  
**Ficus.** COTTONY CUSHION SCALE; GREENHOUSE THIRPS; MEALY-BUG; PURPLE SCALE; RED SCALE; SOFT BROWN SCALE.—See *Citrus*.  
**Fuchsia.** GREENHOUSE THIRPS.—See *Citrus*.  
 MEALY-BUGS.—See *Citrus*.  
 RED-SPIDER.—See *Peach*.  
 WHITE FLY.—See *Tomato*.  
**Gardenia.** CITRUS WHITE FLY.—See *Citrus*.  
 JAPANESE WAX SCALE (*Ceroplastes ceriferus*).—White to creamy waxy masses, ¼ to ¾ inch in diameter.  
*Control.*—Young scales may be killed with kerosene emulsion before the waxy covering is formed.  
 ORTHEZIA.—See *Coleus*.  
**Genista.** GENISTA CATERPILLAR (*Mecyna reversalis*).—Pale yellowish brown caterpillars marked with numerous black spots and setae, feeding on the foliage.  
*Treatment.*—Arsenicals.  
**Geranium.** MEALY-BUGS.—See *Citrus*.  
 RED-SPIDER.—See *Peach*.  
 WHITE-FLY.—See *Tomato*.  
**Gooseberry.** CURRANT-BORER; CURRANT MEASURING- or SPAN-WORM; FOUR-STRIPED PLANT-BUG; GOOSEBERRY- or CURRANT-WORM.—See *Currant*.  
 GOOSEBERRY PLANT-WORM (*Dakruma convolutella*).—Larva about ¾ inch long, greenish or yellowish, feeding in the berry, causing it to ripen prematurely.  
*Treatment.*—Destroy affected berries. Clean cultivation. Poultry.  
**Grape.** GRAPE-CURCULIO (*Craonius inaequalis*).—Larva small, white, with a brownish head. Infests the grape in June and July, causing a little black hole in the skin and a discoloration of the berry immediately around it. The adult is a grayish brown snout-beetle, about one-tenth inch long.  
*Treatment.*—Spray with arsenate of lead while the beetles are feeding on the leaves. The beetles may be jarred down on sheets, as with the plum-curculio. Bag the clusters.  
 GRAPE ROOT-WORM (*Pidia viticida*).—The small white grubs feed upon the roots, often killing the vines in a few years. The adults are small grayish brown beetles that eat peculiar chain-like holes in the leaves during July and August.  
*Treatment.*—Cultivate thoroughly in June, especially close around the vines to kill the pupae in the soil. At the first appearance of the beetles, spray the plants with arsenate of lead at the rate of eight or ten pounds in one hundred gallons of water, to which should be added one gallon of molasses.  
 GRAPE-SLUG or SAW-FLY (*Selandria vitis*).—Larva, about ½ inch long, yellowish green with black points, feeding upon the leaves; two broods.  
*Remedies.*—Arsenicals; hellebore.  
 GRAPEBERRY-WORM (*Polychoris viteana*).—Larva, about ¼ inch long, feeding on the berry, often securing three or four together by a web; two broods.  
*Remedy.*—Spray with arsenate of lead before blossoms open. Repeat after blooming and again in early July. Destroy wormy berries in August.  
 GRASSHOPPERS.—See *Corn*.  
 GRAPE-VINE FLEA-BEETLE (*Graptoidea chalybea*).—Beetle, of a blue metallic color, about ¾ inch long, feeding upon the buds and tender shoots in early spring.  
*Treatment.*—Arsenicals to kill the grubs on leaves during May and June. The beetle can be caught by jarring on bright days.  
 GRAPE-VINE ROOT-BORER (*Memytus polistiformis*).—Larva 1½ inches or less long, working in the roots.  
*Preventive.*—Thorough cultivation during June and July.  
*Treatment.*—Dig out the borers.  
 GRAPE-VINE SPHINX (*Ampelophaga myron*).—A large larva, 2 inches long when mature, green with yellow spots and stripes, bearing a horn at the posterior extremity, feeding upon the leaves, and nipping off the young clusters of grapes; two broods.

## CATALOGUE OF INSECTS, continued.

- Treatment.*—Hand-picking. Arsenicals early in the season. There are other large sphinx caterpillars which feed upon the foliage of the vine and which are readily kept in check by hand-picking and spraying.  
**LEAF-HOPPER** (*Typhlocyba comes*).—These small yellowish leaf-hoppers, erroneously called "thrips," suck the sap from the under side of the leaves, causing them to turn brown and dry up.  
*Treatment.*—Spray the under side of the leaves very thoroughly with one gallon "Black Leaf 40" in 1,000 gallons of water about July 1, to kill the young leaf-hoppers. When using tobacco extract, add about two pounds soap to each fifty gallons to make it spread and stick better. Repeat the application in a week or ten days. In houses, tobacco smoke, pyrethrum poured upon coals held under the vines, syringing with tobacco-water or soapsuds.  
**PHYLLOXERA** (*Phylloxera vastatrix*).—A minute insect preying upon the roots, and in one form causing galls upon the leaves.  
*Preventive.*—As a rule, this insect is not destructive to American species of vines. Grafting upon resistant stocks is the most reliable method of dealing with the insect yet known. This precaution is taken to a large extent in European countries and in California, as the European vine is particularly subject to attack.  
*Remedies.*—There is no reliable and widely practicable remedy known.  
**ROSE-CHAFER** (*Macrodactylus subspinosus*).—The ungainly, long-legged grayish beetles occur in sandy regions, and often swarm into vineyards and destroy the blossoms and foliage.  
*Treatment.*—At the first appearance of the beetles, spray with arsenate of lead at the rate of eight or ten pounds in one hundred gallons of water, to which should be added one gallon of molasses.  
**TREE CRICKET.**—See *Bramble Fruits*.  
**Grapefruit.**—See *Citrus*.  
**Guava.** BLACK SCALE.—See *Citrus*.  
 GUAVA MEALY-BUG (*Pseudococcus nipa*).—Closely resembles the ordinary mealy-bug.  
*Treatment.*—Carbolic acid emulsion.  
 HEMISPHERICAL SCALE.—See *Citrus*.  
 MEDITERRANEAN FRUIT FLY.—See *Citrus*.  
**Hedera.** BLACK SCALE; FLORIDA RED SCALE; HEMISPHERICAL SCALE; MEALY-BUGS.—See *Citrus*.  
 OLEANDER APHIS (*Aphis nerii*).—Deep yellowish plant-lice, marked with black, cluster on the young shoots and buds.  
*Treatment.*—Contact insecticides.  
 OLEANDER SCALE (*Aspidiotus hederae*).—Flat, circular, gray scales, ½ inch in diameter.  
*Treatment.*—Same as for *San José Scale* (apple), which see.  
 SOFT BROWN SCALE.—See *Citrus*.  
**Helianthus.** STEM MAGGOT.—See *Artichoke*.  
**Heliotropium.** RED-SPIDER.—See *Peach*.  
**Hibiscus.** MELON APHIS.—See *Muskmelon*.  
**Hickory.** GALL APHIS (*Phylloxera* sp.).—Yellowish green plant-lice causing hollow galls on the leaves, petioles and small twigs.  
*Treatment.*—Spray with contact insecticides just as the buds are opening.  
 HICKORY BARK BEETLE (*Eccoptogaster quadrispinosa*).—Small brown beetle burrowing into twigs, buds and green nuts in June and July. Early in August the females penetrate the bark of living trees forming longitudinal burrows along the sides of which eggs are deposited. The grubs burrow transversely in the sap-wood, soon killing the trees.  
*Treatment.*—Cut and burn all infested trees before May of each year.  
 NUT WEEVIL.—See *Pecan*.  
 TWIG-GIRDLER.—See *Apple*.  
**Hollyhock.** HOLLYHOCK BUG (*Orthotylus delicatus*).—A small green bug attacking the hollyhock with much damage.  
*Treatment.*—Kerosene emulsion; tobacco extracts.  
 MELON APHIS.—See *Muskmelon*.  
**Horse-Radish.** CABBAGE-WORM.—See *Cabbage*.  
 FLEA BEETLES.—See *Potato*.  
 HARLEQUIN CABBAGE-BUG.—See *Cabbage*.  
**Ipomoea.** SOFT BROWN SCALE.—See *Citrus*.  
**Iris.** WHITE-FLY.—See *Citrus*.  
**Jasminum.** CITRUS WHITE-FLY.—See *Citrus*.  
 SOFT BROWN SCALE.—See *Citrus*.  
**Juglans.**—See *Hickory*.  
**Juniper.** BAGWORM (*Thyridopteryx ephemeraeformis*).—Small caterpillars in curious bag-like shelters defoliating the trees in early summer.  
*Treatment.*—Arsenate of lead, two pounds to one hundred gallons of water.  
 JUNIPER SCALE (*Diaspis carueli*).—Snow-white, circular scales with yellow central exuviae.  
*Treatment.*—Nothing known.  
 JUNIPER WEB-WORM (*Phalonia rutilana*).—Small flesh-colored caterpillar that webs the leaves together.  
*Treatment.*—Arsenicals.  
**Kale.**—See *Cabbage*.  
**Kohlrabi.**—See *Cabbage*.  
**Kumquat.**—See *Citrus*.

## CATALOGUE OF INSECTS, continued.

**Lantana.** GREENHOUSE WHITE-FLY.—See *Tomato*.

MEALY-BUGS.—See *Citrus*.

ORTHEZIA.—See *Coleus*.

**Larix.** CASE-BEARER (*Coleophora laricella*).—A small reddish brown caterpillar mining the leaves when young. In September it constructs a case and feeds on the surrounding leaves for a time, migrates to the branches and there hibernates.

*Treatment*.—Spray with lime-sulfur before the buds open to destroy the hibernating caterpillars.

**LARCH SAW-FLY** (*Lygeonematus erichsonii*).—Grayish green larvæ with black heads feeding on the foliage.

*Treatment*.—Spray with arsenicals.

**Laurus.** BLACK SCALE.—See *Citrus*.

FROSTED SCALE.—See *Apricot*.

SOFT BROWN SCALE, and THRIPS.—See *Citrus*.

WHITE PEACH SCALE.—See *Peach*.

**Lemon.**—See *Citrus*.

**Lespedeza.** SMOKY CRANE-FLY (*Tipula infusata*).—Dirty yellowish maggots,  $\frac{1}{2}$  inch long, feeding on the roots, often in great abundance.

*Treatment*.—Short crop-rotation.

**Lettuce.** APHIS, or GREEN-FLY (*Macrosiphum lactuæ*).—A plant-louse on forced lettuce.

*Preventive*.—Tobacco-dust applied on the soil and plants as soon as the aphid makes its appearance, or even before. Renew every two or three weeks if necessary. Fumigating with tobacco is the surest remedy.

**CABBAGE-LOOPER** (*Autographa brassiæ*).—Larva somewhat over an inch long, pale green, with stripes of a lighter color, feeding on leaves of many plants, as cabbage, celery, and endive.

*Remedies*.—Pyrethrum diluted with not more than three times its bulk with flour; kerosene emulsion; hot water.

GREENHOUSE WHITE-FLY.—See *Tomato*.

**ROOT-LOUSE** (*Rhizobius lactuce*).—Small dull-whitish lice, about one-tenth inch in length, feeding on the roots.

*Treatment*.—Crop-rotation and tobacco dust placed in the soil about the plants.

**Liriodendron.** TULIP TREE SCALE (*Toumeyella liriodendri*).—Large, nearly hemispherical scales clustered in masses on the under side of branches.

*Treatment*.—Scrape badly infested branches. Spray with kerosene emulsion or soap solution.

**Lupine.** LUPINE APHID (*Macrosiphum albigrons*).—Large, green lice covered with fine white powder, infesting the plants.

*Treatment*.—Contact insecticides.

**Lycopersicum.**—See *Tomato*.

**Magnolia.** BLACK SCALE; CITRUS WHITE FLY; GLOVERS' SCALE.—See *Citrus*.

MAGNOLIA SCALE (*Neolecanium cornuparvum*).—Large, convex scales, pinkish in color, and covered with fine powdered wax.

*Treatment*.—Kerosene emulsion or tobacco extract to kill the young scales.

**Maclura.** Treated under *Toxylon*.

**Mangifera.** CITRUS MEALY-BUG.—See *Citrus*.

**FRUIT FLY** (*Anastrepha acidusa*).—Small yellowish maggots infesting the ripening fruit.

*Treatment*.—Try sweetened arsenate of lead to kill the flies.

GREENHOUSE WHITE-FLY.—See *Citrus*.

**MANGO WEEVIL** (*Cryptorhynchus mangiferæ*).—Brown weevils about  $\frac{1}{4}$  inch long, the grubs living within the seeds.

*Treatment*.—Gather and destroy all fallen fruit.

**Mimulus.** *Ceropeto yuccæ*.—Closely resembles the common mealy-bug.

*Treatment*.—As for mealy-bugs.

**Monstera.** SCALE (*Hemichionaspis aspidistra*).—Brownish, oyster-shell-shaped scales, attacking the foliage.

*Treatment*.—Wash the leaves with soapsuds and tobacco extract.

**Mushroom.** MAGGOTS (*Sciara* sp.).—Small whitish or yellowish white maggots with black heads.

*Treatment*.—Exclude flies from house or cellar with fine screens. Sterilize manure by heating to 150° F. Fumigate with tobacco.

**MUSHROOM MITÉ** (*Tyroglyphus lintneri*).—A minute mite preventing growth of spawn by eating the mycelium.

*Control*.—In infested houses remove all compost and disinfect by drenching cellar with boiling water. Use sterilized manure.

**SPRINGTAILS** (*Achoreutes* sp.).—Small black or brown jumping insects which sometimes swarm in on the beds.

*Treatment*.—Fumigate with potassium cyanide, three to six ounces to each 1,000 cubic foot of air-space. Sterilize all manure with heat before using.

**SOWBUGS** (*Armadillidium* sp. and *Porcellio* sp.).—Oval, grayish or slate-colored creatures bearing seven pairs of legs; frequently injure mushrooms. These are commonly known as sowbugs and pillbugs.

*Treatment*.—Mix one quart of cornmeal with sufficient brown sugar to sweeten, then add two tablespoonfuls of paris green. Moisten with water and scatter in places frequented by these sowbugs.

**Muskmelon.** MELON APHIS (*Aphis gossypii*).—Small, dark green, sluggish lice found abundantly on melon vines, causing curling of the leaves and death of the plant.

## CATALOGUE OF INSECTS, continued.

*Treatment*.—Fumigate with tobacco preparations under cloth-covered frames placed over the plants. Cloth should be treated with linseed oil before using, to make gas-proof. In large fields, spray with "Black Leaf 40" tobacco extract, three-fourths pint to one hundred gallons of water, adding four pounds of soap.

**MELON CATERPILLAR** (*Diaphania hyalinata*).—Pale, greenish yellow caterpillar about  $\frac{1}{2}$  inch in length when mature, feeding on the foliage early in the season; later boring in the fruits.

*Treatment*.—Use arsenicals early in the season.

**PICKLE-WORM.**—See *Cucumber*.

STEM-BORER.—See *Squash*.

**Narcissus.** GREEN APHIS.—Tobacco extract, soap solution or fumigation.

**NARCISSUS BULB FLY** (*Merodon equestris*).—Grayish maggots,  $\frac{1}{2}$  to  $\frac{3}{4}$  inch in length when mature, feeding in the bulb. The adult is a large hairy fly.

*Control*.—Examine bulbs and discard infested ones, burning them. If bulbs are placed in water for from two to eight days the maggots will usually leave them.

**Nasturtium.** APHIS. A dark-colored plant-louse.

*Treatment*.—Spray the plants with tobacco extract or soap solution.

**Nectarine.**—See *Peach*.

**Nelumbo.** PLANT-LICE.—Use tobacco preparations for controlling these pests.

**Nepenthes.** MEALY-BUGS.—See *Citrus*.

**Nerium.** OLEANDER SCALE.—See *Hedera*.

**Oak.** BROWN-TAIL MOTH.—See *Apple*.

GIPSY MOTH.—See *Apple*.

**PIT-MAKING OAK-SCALE** (*Asterolecanium variolosum*).—Circular greenish yellow scales with a glassy appearance. Especially destructive to golden oak.

*Treatment*.—Kerosene emulsion or soap solution.

**TENT CATERPILLARS;** TUSsock Moth; TWIG-PRUNER.—See *Apple*.

**Okra.** MELON APHIS.—See *Muskmelon*.

**Olive.** BLACK SCALE.—See *Citrus*.

BLACK CITRUS LOUSE.—See *Citrus*.

**Chrysomphalus rossi**.—Circular or oblong, reddish to dark brown scale with a central black spot.

*Treatment*.—Same as for *Red Scale*.—See *Citrus*.

OLEANDER SCALE.—See *Hedera*.

PINEAPPLE SCALE.—See *Pineapple*.

PURPLE SCALE; RED SCALE; THRIPS.—See *Citrus*.

**Onion.** BLACK ONION FLY (*Tritoza flexa*).—Whitish maggots attacking the bulbs of onions.

*Treatment*.—Same as for cabbage maggot.

**ONION MAGGOT** (*Phorbia cepetorum*).—Small maggot feeding on the bulb and roots; several generations.

*Treatment*.—Use lime, tobacco dust or hellebore as repellents to prevent oviposition. Some of the maggots may be killed by applying carbolic acid emulsion or hellebore decoction to the soil about the plants.

CUTWORMS.—See *Corn*.

**ONION THRIPS** (*Thrips tabaci*).—Minute, elongate, pale yellow insects attack the leaves, causing them to wilt.

*Treatment*.—Tobacco sprays. Spray with paris green one pound in one hundred gallons water sweetened with twenty pounds brown sugar when thrips first appear.

**Orange.**—See *Citrus*.

**Orchids.** HEMISPHERICAL SCALE.—See *Citrus*.

**ORCHIDS ISOSOMA** (*Isosoma orchidearum*).—Small, white larvæ infesting the buds causing them to become unduly enlarged.

*Treatment*.—Cut off and destroy infested buds.

**SCALE INSECTS.**—Several species.

*Treatment*.—Wash plants with nicotine solutions and soapsuds.

**Papaver.** PLANT-LOUSE (*Aphis rumicis*).—Shining black plant-louse that clusters on leaves and stems.

*Treatment*.—Contact insecticides.

**Parsnip.** PARSLEY-WORM (*Papilio asterias*).—Larva,  $1\frac{1}{2}$  inches long, light yellow or greenish yellow with lines and spots; feeds upon leaves of parsley, celery, carrot, and related plants. When the worm is disturbed it ejects from the anterior end two yellow horns, with an offensive odor.

*Remedies*.—Hand-picking. Poultry are said to eat them sometimes. Upon parsnips, arsenicals.

**PARSNIP-LOUSE** (*Hyadaphis pastinacæ*).—Greenish plant-lice.

*Treatment*.—Contact insecticides.

**PARSNIP WEB-WORM** (*Depressaria heracliana*).—Larva, about  $\frac{1}{2}$  inch long, feeding in the flower-cluster and causing it to become contorted.

*Treatment*.—Arsenicals, applied as soon as the young worms appear, and before the cluster becomes distorted. Burn the distorted umbels. Destroy all wild carrots.

**PARSNIP LEAF-MINER** (*Acidia fratria*).—Small, whitish maggots mining the leaves.

*Treatment*.—Hand-pick infested leaves.

**Passiflora.** MEALY-BUGS.—See *Citrus*.

**Pea.** CUT-WORMS.—See *Corn*.

**PEA-WEEVIL, or PEA-BUG** (*Bruchus pisi*).—A small brown-black beetle, living in peas over winter. The beetle escapes in fall and spring, and lays its eggs in young pea-pods, and the grubs live in the growing peas.



## CATALOGUE OF INSECTS, continued.

*Treatment.*—Hold over infested seed one year before planting. Late planting in some localities. Fumigation with carbon bisulfid.

**PEA APHIS** (*Macrosiphum pisi*).—A rather large green plant-louse, often attacking peas in great numbers and causing enormous losses.

*Treatment.*—Rotation of crops, early planting. When peas are grown in rows, the brush-and-cultivator method may be used. The plant-lice are brushed from the plants with pine boughs, and a cultivator follows stirring the soil. This operation should be performed while the sun is hot and the ground dry. Most of the lice will be killed before they can crawl back to the plants. Repeat every three to seven days.

**Peach. BLACK APHIS** (*Aphis persicae-niger*).—A small black or brown plant-louse, which attacks the tops and roots of peach trees. When upon the roots it is a very serious enemy, stunting the tree and perhaps killing it. Thrives in sandy lands.

*Treatment.* Kerosene emulsion; tobacco decoction and extracts.

**CLOVER MITE** (*Bryobia pratensis*).—Small reddish mites attacking the leaves, causing them to turn yellow.

*Treatment.*—Lime-sulfur while trees are dormant. In summer, use self-boiled lime-sulfur, as a dust, or sulfur paste.

**FLAT-HEADED BORER.—See *Apple*.**

**FRUIT TREE BLACK BEETLE** (*Scolytus rugulosus*).—A small beetle similar to the peach tree bark-beetle.

*Treatment.*—Same as for *Peach Tree Bark-Beetle*, which see.

**KATYDID.—This insect is often troublesome to the peach in the southern states in the early spring, eating the leaves and girdling young stems.**

*Remedy.*—Poisoned baits placed about the tree.

**GREEN PEACH-LOUSE or APHIS** (*Myzus persicae*).—A small insect feeding upon the young leaves, causing them to curl and die.

*Treatment.*—Lime-sulfur, kerosene emulsion, or tobacco extract. After the buds open, either the last two.

**PEACH TREE BARK-BEETLE** (*Phloeotribus liminaris*).—A dark brown beetle one-tenth inch in length burrowing under the bark.

*Treatment.*—Burn all brush and worthless trees as soon as the infestation is observed. Keep the trees in healthy condition by thorough cultivation and the use of fertilizers. Apply a thick whitewash to the trunk and branches three times a season: (1) the last week of March, (2) second week in July, (3) first week in October.

**PEACH TREE-BORER** (*Sanninoidea exitiosa*).—A whitish larva, about  $\frac{3}{4}$  inch long when mature, boring into the crown and upper roots of the peach, causing gum to exude.

*Remedies.*—Dig out the borers in June and mound up the trees. At the same time apply gas-tar or coal-tar to the trunk from the roots up to a foot or more above the surface of the ground.

**PEACH TWIG-MOTH** (*Anarsia lineatella*).—The larva of a moth,  $\frac{1}{4}$  inch long, boring in the ends of the shoots, and later in the season attacking the fruit. Several broods.

*Remedy.*—Spray with lime-sulfur just after the buds swell. Spray trunks and larger branches in late spring to kill first brood pupæ in the curls of bark.

**PLUM-CURCULIO** (*Conotrachelus nenuphar*).—This insect may be successfully controlled on peach by spraying with arsenate of lead, four pounds to one hundred gallons of self-boiled lime-sulfur. Spray, first, when the "husks" drop from the fruit; second, ten days or two weeks later. It is unsafe to spray peaches more than twice with arsenate of lead.

**RED-SPIDER, or MITE** (*Tetranychus bimaculatus*).—A small mite infesting many plants, both in the greenhouse and out-of-doors. It flourishes in dry atmospheres, occurring on the under sides of the leaves. In some forms it is reddish, but usually light-colored and two-spotted. Common.

*Remedies.*—Persistent syringing with water will generally destroy them, if the spray is applied to the under surface. Use lots of force and little water to avoid drenching the beds. Sulfur and water. Dry sulfur. On orchard trees, flour paste.

**ROUND-HEADED APPLE TREE BORER.—See *Apple*.**

**WHITE PEACH SCALE** (*Diaspis pentagona*).—Circular gray scales with the exuviae, at one side of the center.

*Remedy.*—Same as for *San José Scale*. See *Apple*.

**Pear. APPLE TREE-BORER; BUD-MOTH; CODLIN-MOTH; FLAT-HEADED BORER.—See *Apple*.**

**MIDGE** (*Diplosis pyripora*).—A minute mosquito-like fly; lays eggs in flower-buds when they begin to show white. These hatch into minute grubs which distort and discolor the fruit. New York and eastward. Prefers the Lawrence. Introduced in 1877 from France.

*Remedies.*—Destroy the infested pears. Cultivate and plow in late summer and fall to destroy the pupæ then in the ground.

**PEAR-LEAF BLISTER-MITE** (*Eriophyes pyri*).—A minute mite which causes black blisters to appear upon the leaves. The mites collect under the bud-scales in winter.

*Remedy.*—Lime-sulfur or miscible oil as a dormant spray.

**PEAR PSYLLA** (*Psylla pyricola*).—These minute, yellowish, flat-bodied, sucking insects are often found working in the axils of the leaves and fruit early in the season. They develop into minute, cicada-like jumping-lice. The young psyllas secrete a large quantity of honey-dew, in which a peculiar black fungus grows, giving the bark a characteristic sooty appearance. There may be four broods annually, and the trees are often seriously injured.

## CATALOGUE OF INSECTS, continued.

*Treatment.*—Clean culture; remove rough bark from trunks and larger branches to discourage adults from hibernating; spray with "Black Leaf 40" tobacco extract, one pint in one hundred gallons of water, adding four pounds soap, on warm days in November or April to kill hibernating adults. Spray with lime-sulfur, winter strength, when the blossom clusters appear, to destroy eggs.

*Summer treatment.*—Spray with "Black Leaf 40" tobacco extract just as the last of the petals are falling to kill young. Repeat if necessary.

**PEAR THRIPS** (*Euthrips pyri*).—Minute insects one-twentieth inch in length, dark brown when adult, white with red eyes when young, that attack the opening buds and young fruits in early spring. They suck the sap from the tender growth, and the females lay eggs in the fruit-stems, causing a loss of the crop. The nymphs hibernate in the ground a few inches from the surface. A serious pest in California and recently introduced into New York.

*Treatment.*—Thorough cultivation during October, November, and December (in California). Make two applications of "Black Leaf" tobacco extract, one gallon in sixty gallons of 2 per cent distillate oil emulsion, the first just as the fruit-buds begin to open, the second just after the petals fall. In the East it may be controlled by timely applications of tobacco extract and whale-oil soap.

**PEAR-TWIG BEETLE** (*Xyleborus pyri*).—Brownish or black beetle, one-tenth inch long, boring in twigs, producing effect much like pear blight, and hence often known as "pear-blight beetle." It escapes from a minute perforation at base of bud; probably two broods.

*Treatment.*—Burn twigs before the beetle escapes.

**PECAN. BUD-MOTH** (*Proteopteryx deludana*).—A brownish caterpillar about  $\frac{1}{2}$  inch in length, feeding on the opening buds in early spring and on the under side of the leaves in summer.

*Treatment.*—Arsenate of lead in summer to kill larvæ of second brood. Lime-sulfur and arsenate of lead in dormant season just before buds open, to destroy hibernating larvæ.

**CASE-BEARER** (*Acrobasis nebulella*).—A small caterpillar living inside a case which it carries with it. It attacks the opening buds.

*Treatment.*—Arsenate of lead as soon as the buds begin to open. Repeat if necessary.

**BORER** (*Sesia scitula*).—A wood-boring caterpillar working in the sap-wood.

*Treatment.*—Digging out.

**PECAN WEEVIL** (*Calaminius caryæ*).—A dull, dark brown beetle with a long and slender snout with which it punctures the husk and shell of the maturing nuts for oviposition. The grubs live within the nut feeding on the kernel.

*Treatment.*—Destroy all infested nuts. This should be as soon as they fall.

**ROSE-CHAFER.—See *Grape*.**

**ROUND-HEADED BORER.—See *Apple*.**

**SLUG.—See *Cherry*.**

**TWIG-GIRDLER** (*Oncideres cingulatus*).—A brownish gray beetle, about  $\frac{1}{2}$  inch long, which girdles twigs in August and September. The female lays eggs above the girdle. The twigs soon fall.

*Remedy.*—Burn the twigs, either cutting them off or gathering them when they fall.

**TWIG-PRUNER.—See *Apple*.**

**Persimmon. TWIG-GIRDLE.—See *Pecan*.**

**WHITE PEACH-SCALE** (*Diaspis pentagona*).

*Remedy.*—Lime-sulfur when the trees are thoroughly dormant.

**Picea. SPRUCE BUD-WORM** (*Tortrix fumiferana*).—Small caterpillar feeding on the young foliage, causing the tips of the twigs to turn reddish, due to the dying of the foliage. Frequently serious in forests.

**SPRUCE GALL APHID** (*Chermes abietis*).—Plant-lice causing cone-shaped, many-celled galls at the bases of young shoots.

*Treatment.*—Spray with whale-oil soap, one pound in two gallons of water, in early spring. Cut off all galls and burn before the lice leave them.

**Pine. PINE LEAF-SCALE** (*Chionaspis pinifoliae*).—Small white scales frequently abundant on the foliage.

*Treatment.*—Kerosene emulsion or tobacco extracts when the young are hatching.

**PINE WEEVIL** (*Pissodes strobi*).—Small grub working in the terminal branch, which is killed, causing distorted trees.

*Treatment.*—Cut out and burn infested branches.

**Pineapple. KATYDID** (*Acanthacara similis*).—A large katydid which attacks, among other plants, the leaves of the pineapple.

*Remedy.*—Arsenicals, before the plants are mature.

**MEALY-BUGS** (several species).—These mealy white insects attack the plant at the base of the leaves, usually underground.

*Treatment.*—Set only clean plants, or dip them in resin wash or kerosene emulsion. In the field apply tobacco dust freely in the bud before the bloom begins to appear, or spray with kerosene emulsion.

**PINEAPPLE SCALE** (*Diaspis bromeliæ*).—Circular, thin, pure white scales with yellow exuviae infesting leaves and fruit.

*Treatment.*—Kerosene emulsion and resin wash.

**RED-SPIDER** (*Stigmaeus floridanus*).—Minute mites occurring in great number at the base of the leaf, where they induce rot.

*Treatment.*—Tobacco dust applied to bud.

## CATALOGUE OF INSECTS, continued.

- Plum. CANKER-WORM.**—See *Apple*.  
**CURCULIO** (*Conotrachelus nenuphar*).—Larva, a whitish grub, feeding in the fruit.  
*Remedies.*—Arsenate of lead, six pounds to one hundred gallons of water; apply as soon as the calyx falls, and repeat two or three times at intervals of about ten days. Jarring the beetles on sheets very early in the morning, beginning when trees are in flower, and continuing from four to six weeks, is probably the most certain procedure. There are various styles of sheets or receptacles for catching the insects as they fall from the tree. Clean culture.  
**FLAT-HEADED BORER.**—See *Apple*.  
**PEAR-TWIG BEETLE.**—See *Pear*.  
**PLUM-GOUGER** (*Coccotorus prunicida*).—A small larva, feeding upon the kernel of the plum. The beetle bores a round hole in the plum instead of making a crescent mark like the curculio.  
*Remedy.*—Catch the beetles in a curculio-catcher.  
**SAN JOSÉ SCALE.**—See *Apple*.  
**EUROPEAN FRUIT SCALE** (*Lecanium corni*).—A large circular scale occurring on plum; occasionally very destructive.  
*Remedy.*—Thorough spraying with kerosene emulsion, one part to five of water, in the winter. More dilute emulsion or tobacco extracts in midsummer, when the young insects are on the leaves and young shoots. Miscible oils when trees are dormant.  
**SLUG.**—See *Cherry*.  
**TENT CATERPILLARS.**—See *Apple*.  
**TWIG-PRUNER.**—See *Apple*.  
**Poinsettia. MEALY-BUGS.**—See *Citrus*.  
**Pomegranate. BLACK SCALE; CITRUS THRIPS; FLORIDA WAX SCALE.**—See *Citrus*.  
**OLEANDER SCALE.**—See *Hedera*.  
**WHITE-FLY.**—See *Citrus*.  
**Pomelo.**—See *Citrus*.  
**Populus. BLACK SCALE.**—See *Citrus*.  
**COTTONWOOD LEAF-BEETLE** (*Lina scripta*).—A striped beetle feeding on the leaves and shoots of poplars and willows.  
*Remedy.*—Arsenicals.  
**OYSTER-SHELL SCALE.**—See *Apple*.  
**POPLAR BORER** (*Cryptorhynchus lapathi*).—A whitish grub burrowing in the wood.  
*Treatment.*—In nurseries, spray thoroughly about the middle of July with arsenate of lead to kill the parent beetles.  
**Potato. COLORADO POTATO-BEETLE** (*Leptinotarsa decemlineata*).—Beetle and larva feed upon the leaves.  
*Remedies.*—Arsenicals, either dry or in spray, about a third stronger than for fruits. Hand-picking the beetle.  
**FLEA-BEETLE** (*Halticini*).—Small, dark-colored jumping beetles that riddle the leaves with holes.  
*Preventive.*—Bordeaux mixture as applied for potato blight acts as a repellent.  
**POTATO TUBER-WORM** (*Phthorimæa operculella*).—A small caterpillar burrowing in the stems and tubers both in the field and in storage.  
*Preventives.*—Clean cultivation, sheep and hogs to destroy the small potatoes left in the field after digging. Crop-rotation over a considerable area. On digging, remove the potatoes at once to an uninfested storeroom. Do not leave them on the field over night.  
**STALK-WEEVIL** (*Trichobaris trinitata*).—A grub boring in the stalk of the potato near or just below the ground. Serious in the West and in some places eastward.  
*Remedy.*—Pull all infested vines as soon as they wilt, and spread them in the sun where the insects will be killed. Burn the vines as soon as the crop is harvested. Destroy all solanaceous weeds.  
**WIRE-WORMS.**—See *Corn*.  
**Primula. WHITE-FLY.**—See *Citrus*.  
**Privet or Prim. PRIVET WEB-WORM** (*Diaphania quadrastigmatis*).—Small larva feeding in webs on the young shoots of the privet, appearing early in the season; two to four broods.  
*Remedies.*—Trim the hedge as soon as the worms appear, and burn the trimmings. Probably the arsenicals will prove useful.  
**Prune.**—See *Plum*.  
**Prunus.**—See *Plum*.  
**Pseudotsuga. SEED CHALCIS** (*Megastigmus spermatrophus*).—Small whitish grub devours the kernel of the seed, often destroying the whole crop.  
 No known remedy.  
**Pyrus.**—See *Apple*.  
**Quince. GREEN APHIS.**—See *Apple*.  
**QUINCE CURCULIO** (*Conotrachelus crataegi*).—This curculio is somewhat larger than that infesting the plum, and differs in its life-history. The grubs leave the fruits in the fall, and enter the ground, where they hibernate and transform to adults the next May, June or July, depending on the season.  
*Treatment.*—When the adults appear, jar them from the tree onto sheets or curculio-catchers and destroy them. To determine when they appear, jar a few trees daily, beginning the latter part of May. Arsenicals. Pick and burn all infested fruits a month before harvest.  
**ROUND-HEADED BORERS.**—See *Apple*.  
**SLUG.**—See *Cherry*.  
**Radish. MAGGOT** (*Pegomya brassicæ*).—Treated the same as the Cabbage Maggot, which see.

## CATALOGUE OF INSECTS, continued.

- Raspberry.**—See *Bramble Fruits*.  
**Rhododendron. BORER** (*Sesia rhododendri*).—Whitish caterpillars burrowing in the trunk and larger branches which are often killed.  
*Treatment.*—Dig out borers or cut out infested branches and burn.  
**LACE BUG** (*Leptobrysa explanata*).—Small, lace-winged bugs on the under side of the leaves, causing them to turn brown and die.  
*Treatment.*—Spray with soap solution.  
**Rhubarb. RHUBARB-CURCULIO** (*Lixus concavus*).—A grub  $\frac{3}{4}$  inch long, boring into the crown and roots. It also attacks wild docks.  
*Remedy.*—Burn all infested plants and keep down the docks. Hand-picking.  
**Rhus. AF. LE TREE-BORER.**—See *Apple*.  
**JUMPING SUMAC-BEETLE** (*Blepharida rhois*).—Larva,  $\frac{1}{2}$  inch long, dull greenish yellow, feeding on leaves; two broods.  
*Remedy.*—Arsenicals.  
**Ribes.**—See *Currant*.  
**Robinia. LEAF-MINER** (*Odontota dorsalis*).—A black and yellowish white grub about  $\frac{3}{4}$  inch in length, mining the leaves, causing blister-like spots.  
*Treatment.*—Arsenate of lead the last of July to first of August.  
**LOCUST-BORER** (*Cyrtene robinia*).—Large, brownish yellow grub burrowing in the trunk, causing large ugly scars. The beetle is black prettily marked with yellow stripes and bands.  
*Remedy.*—None known.  
**Rose. MEALY-BUG.**—Tobacco extracts; syringe the plants in the morning, and two hours later syringe again with clean water.  
**ROSE APHIS** (*Macrosiphum rosæ* and *Myzus rosarum*).—Greenish plant-lice, attacking leaves and buds.  
*Treatment.*—Tobacco extracts and soap solutions.  
**ROSE-CHAFER, ROSE-BEETLE, or "ROSE-BUG."**—See *Grape*.  
**ROSE LEAF-HOPPER** (*Typhlocyba rosæ*).—A very small hopper, white, often mistaken for thrips, living on the leaves of roses.  
*Remedies.*—Whale-oil soap; kerosene; kerosene emulsion; dry pyrethrum blown on bushes when leaves are wet; tobacco extracts.  
**ROSE MIDGE** (*Neocerata rhabdophaga*).—Small maggots, distorting leaf and flower-buds.  
*Treatment.*—No satisfactory treatment known.  
**ROSE SCALE** (*Aulacaspis rosæ*).—Small, whitish circular scales.  
*Treatment.*—Soap solutions or tobacco extracts when young are hatching.  
**WHITE-FLY.**—See *Tomato*.  
**Rubus.**—See *Bramble Fruits*.  
**Salix. COTTONWOOD LEAF-BEETLE.**—See *Populus*.  
**OYSTER-SHELL SCALE.**—See *Apple*.  
**POPLAR-BORER.**—See *Populus*.  
**WILLOW-WORM** (*Euvanesa antiopa*).—Larva nearly 2 inches long, black, feeding upon leaves of willow, elm, and poplar; two broods.  
*Remedy.*—Arsenicals.  
**Salvia. ORTHEZIA.**—See *Coleus*.  
**WHITE FLY.**—See *Tomato*.  
**Scilla. NARCISSUS BULB FLY.**—See *Narcissus*.  
**Smilax. CITRUS WHITE FLY.**—See *Citrus*.  
**Solanum.**—See *Potato*.  
**Sorbus. SAN JOSÉ SCALE; SCURFY SCALE.**—See *Apple*.  
**Spinach. FLEA-BEETLE.**—See *Potato*.  
**LEAF-MINER** (*Pegomya vicina*).—Small maggot mining the leaves.  
*Treatment.*—Clean cultivation to destroy its wild food plant (lamb's quarters). Destroy all infested leaves. By raising spinach as an early or late crop, much of the damage can be avoided.  
**SPINACH APHIS** (*Myzus persicæ*).—Same as green peach aphis.  
*Treatment.*—Spray at first appearance of lice with "Black Leaf 40" tobacco extract, three-fourths pint to one hundred gallons of water, adding four pounds of soap.  
**Squash. CUCUMBER BEETLES.**—See *Cucumber*.  
**MELON APHIS.**—See *Muskmelon*.  
**SQUASH APHIS** (*Nectarophora cucurbitæ*).—Large, light green plant-lice attacking the leaves.  
*Treatment.*—Same as for melon aphis.  
**SQUASH LADY-BIRD.**—See *Cucumber*.  
**SQUASH STINK-BUG** (*Anasa tristis*).—Large, dark brown bug hibernates as adult under rubbish. Female lays large brown eggs in patches on the leaves. The young are greenish, feed in colonies on under side of leaves, causing them to wilt and die.  
*Treatment.*—Trap adults in spring under boards laid on the ground. Destroy eggs by hands. Young can be killed with "Black Leaf 40" tobacco extract, one pint in one hundred gallons of water, adding four to five pounds of soap.  
**STEM-BORER** (*Melittia satyriniiformis*).—Soft, white, grub-like larva which bores inside the stem and causes rot to develop, killing the vine.  
*Preventives.*—Plant early squashes as traps. As soon as the early crop is gathered, burn the vines to destroy eggs and larvae of the borer. Fall harrowing of infested fields will help to expose the pupæ to the elements. Cut out borers whenever found. After the vines have grown to some length, cover some of the joints with earth, so that a new root-system will develop to sustain the plant in case the main root is injured.



## CATALOGUE OF INSECTS, continued.

- Strawberry.** CROWN-BORER (*Tyloclerum fragariae*).—White grub,  $\frac{1}{2}$  inch long, boring into the crown of the plant in midsummer. The mature insect is a curculio or weevil.  
**Preventives.**—Rotation of crops. Isolation of new beds from infested beds. Plant uninfested plants.
- FULLER'S ROSE-BEETLE** (*Aramigus fulleri*).—White grub,  $\frac{1}{2}$  inch long, feeding in the crown. The adult is a grayish brown snout-beetle with a whitish bar on each wing-cover.  
**Treatment.**—Short rotation. Plant on uninfested land.
- LEAF-ROLLER** (*Ancylis comptana*).—Larva less than  $\frac{1}{2}$  inch long, feeding on the leaves, and rolling them up in threads of silk; two broods.  
**Treatment.**—Turn under in the fall all old beds that have become worthless. Spray with arsenate of lead, four pounds in one hundred gallons of water, after the eggs are laid but before the leaves are folded—the first half of May in the latitude of New Jersey.
- ROOT-BORER** (*Anarsia* sp.).—Larva about  $\frac{1}{2}$  inch long, whitish, boring into the crown of the plant late in the season, and remaining in it over winter.  
**Remedy.**—Burn the plant.
- ROOT-BORER** (*Typophorus canellus*).—A whitish grub  $\frac{1}{2}$  inch in length feeding on the roots. The parent beetle is brownish, and appears in great numbers in May.  
**Treatment.**—Arsenicals to kill the beetles. Plant new beds at a distance from old ones.
- ROOT-LOUSE** (*Aphis forbesii*).—From July to the close of the season the lice appear in great numbers on the crowns and on the roots of the plants.  
**Remedies.**—Rotation in planting. Disinfect plants coming from infested patches by dipping the crowns and roots in kerosene emulsion, or tobacco extract. Fumigation.
- SAW-FLY** (*Empyga maculatus*).—Larva nearly  $\frac{3}{4}$  inch long, greenish, feeding upon the leaves; two broods.  
**Remedies.**—Hellebore; arsenicals for second brood.
- WEEVIL** (*Anthonomus signatus*).—Beetle  $\frac{1}{8}$  inch long, reddish black, feeding on flower-buds, particularly those of the polleniferous varieties.  
**Preventives.**—Plant principally profusely flowering varieties. Clean culture. Destroy all wild blackberry and raspberry vines in the vicinity.
- WHITE GRUBS.**—See Corn.
- Sweet Pea.** TARNISHED PLANT-BUG.—See Aster. (They puncture and kill the flower-stems.)
- Sweet Potato.** CUTWORMS.—Poisoned bait; late planting; keep the land free from weeds the previous fall.
- FLEA-BEETLE** (*Chatoceoma confinis*).—Small, dark-colored beetles, which attack the plant as soon after they are reset.  
**Treatment.**—Dip the plant in a strong solution of arsenate of lead before resetting, spray once or twice later with the same. Rotation of crops. Destroy all bindweed and wild morning-glory plants.
- ROOT-BORER** (*Cylas formicarius*).—A whitish grub  $\frac{1}{4}$  inch in length, burrowing through the tubers.  
**Preventive.**—Burn infested tubers and the vines.
- SAW-FLY** (*Schizocerus obnub* and *S. privatus*).—Small larva about  $\frac{1}{4}$  inch long, working upon the leaves. The fly is about the size of a house-fly.  
**Remedies.**—Hellebore and arsenicals.
- TORTOISE BEETLES** (*Cassidini*).—Beetles of brilliant colors and their slug-like larvæ which eat holes in the leaves of newly reset plants.  
**Treatment.**—Same as for next.
- Tamarix.** CANE-BORER (*Schistocerus hamatus*).—Whitish grub,  $\frac{1}{2}$  inch in length, burrowing in the twigs.  
**Treatment.**—Cut and burn all infested branches.
- Theobroma.** CACAO BEETLE (*Steirastoma depressum*).—Large grubs,  $1\frac{1}{2}$  inches long, burrowing under the bark.  
**Control.**—Dig out or kill with a wire.
- CACAO FRUIT FLY** (*Ceratitis punctata*).—A small maggot attacking the pods.  
**Treatment.**—Spray when flies appear with sweetened arsenate of lead, four pounds to one hundred gallons of water.
- CACAO THRIPS** (*Heliothrips rubrocineta*).—Small active insects attacking leaves and pods. In the young the abdomen is banded with red.  
**Treatment.**—Careful cultivation to produce vigorous growth.
- Thuya.** BAGWORM.—See Juniper.
- Tomato.** FLEA-BEETLES.—Dip the young plants in a strong solution of arsenate of lead. Bordeaux mixture acts as a repellent.
- FRUIT-WORM** (*Heliothis obsoleta*).—Larva 1 inch in length, pale green or dark brown, faintly striped, feeding upon the fruit. Also on corn and cotton.  
**Treatment.**—Hand-picking. Avoid planting close to corn or cotton, or after either of these crops or after peas or beans. Practise fall or winter plowing.
- TOMATO-WORM** (*Phlegthontius sexta* and *P. quinquemaculata*).—A very large green worm feeding upon the stems and leaves of the tomato and husk tomato. Seldom abundant enough to be very serious; kept in check by parasites.  
**Remedies.**—Hand-picking; rotation of crops; clean culture; turkeys.
- WHITE-FLY** (*Aleyrodes vaporariorum*).—Tomatoes grown under glass are often badly infested with white flies, the young of which are scale-like and occur on the under side of the leaves.  
**Treatment.**—Fumigation.
- Toxylon.** BAGWORM.—See Juniper.
- SAN JOSÉ SCALE.**—See Apple.

## CATALOGUE OF INSECTS, continued.

- Tropæolum.**—See *Nasturtium*.
- Tsuga.** BAGWORM.—See Juniper.
- Turnip.**—See Cabbage.
- Ulmus.** CANKER-WORM.—See Apple.
- ELM LEAF-BEETLE** (*Galerucella luteola*).—A small beetle, imported from Europe, which causes great devastation in some of the eastern states by eating the green matter from elm leaves, causing the tree to appear as if scorched.  
**Remedy.**—Arsenate of lead, six pounds to one hundred gallons, just as the eggs are hatching.
- ELM SAW-FLY LEAF-MINER** (*Kahlosysphinga ulmi*).—A greenish white larva feeding between the two layers of the leaf, causing large blotches; when abundant, the leaf dies and falls. They sometimes kill the trees in two or three years.  
**Treatment.**—While the blotches are small, spray with "Black Leaf 40," tobacco extract, one gallon in 800 gallons of water, adding four pounds of whale-oil soap to each hundred gallons.
- LEOPARD MOTH** (*Zeuzera pyrina*).—White to pinkish caterpillars boring at first in the smaller twigs and branches. Later the nearly mature caterpillars attack the larger branches and trunk, doing very serious injury. The white moths, beautifully marked with black and blue, have a wing expanse of about  $2\frac{1}{2}$  inches.  
**Treatment.**—Cut off and destroy all infested branches. The spread of the pest is very slow if the branches of the trees do not interlace.
- WILLOW-WORM.**—See Salix.
- Violet.** APHIS.—Fumigation when grown under glass.
- GALL-FLY** (*Contarinia violicola*).—The adult is a minute mosquito-like fly. The whitish or yellowish maggot feeds in folds of the opening leaves, which become deformed, turn brown, and die.  
**Treatment.**—Fumigation is practically of no value. Thorough hand-picking as soon as any sign of injury is noticed. Do not let the pest become established in the house.
- RED-SPIDER** (*Tetranychus bimaculatus*).—Minute mites which cause the leaves to turn paler and become yellowish.  
**Treatment.**—On greenhouse violets there is nothing better than a stiff spray of clear water so applied as not to drench the beds. Repeat the spraying once or twice a week.
- Vitis.**—See Grapes.
- Walnut.**—See Hickory.
- Watermelon.** MELON APHIS.—See Muskmelon.
- Yucca** (*Lonchæa chalybea*).—Small maggot destroying the buds. Very serious pest.  
**Treatment.**—Collect and burn all infested shoots.
- LONG-HORNED BEETLE** (*Logochirus obsoletus*).—A white grub  $1\frac{1}{2}$  inches in length when mature, boring in the trunk and doing great damage. The adult is a large reddish brown beetle and feeds on the foliage.  
**Treatment.**—When beetles are most abundant prune plants to the ground and burn. Spray with arsenicals to destroy beetles.
- SPHINX CATERPILLARS** (*Dilophonota ello*).—Large caterpillar feeding on the foliage. The parent moth is a large hawk-moth rather showily colored.  
**Treatment.**—Arsenate of lead, six pounds to one hundred gallons of water.
- Zea.**—See Corn.

C. R. CROSBY.  
ROBERT MATHESON.

## Spraying.

Spraying is the art of protecting cultivated plants from insect enemies and vegetable parasites by covering them with a material which shall have a toxic or physically injurious effect upon the animal or vegetable organism.

## Historical sketch.

The history of spraying is interesting. The story of its progress in America differs in details from the history of its development in Europe, but the main features in each country are very similar. In both places, insect enemies made the first draft on the ingenuity of man in devising methods by which to hold them in check. Vegetable parasites were studied afterward. It is a curious fact that, in the case of both insects and fungi, in America, some of the most injurious forms came from Europe and were the means of directing attention to wholesale methods of destroying them. Some of these enemies, comparatively harmless in their native home, like the currant-worm and codlin-moth, have done more to forward spraying methods in the United States than anything else.

The first insecticides used in America, as well as in Europe, were not of a poisonous nature. They were

substances that had an injurious effect on the body of the insect. These were of two kinds, mainly: infusions which were astringent, and caustic substances which burned the tissues. Tobacco water and alkaline washes have been used for many years. One of the



1326. Apple cluster ready for the spray. The blossoms have not yet opened.

first poisons to be used was white hellebore. The employment of arsenical poisons may be said to belong to America, and even at the present time has small place in the economy of fruit-growing in Europe. The wide-spread use of arsenical poisons is largely due to the influence of the incursion of the potato-bug. There are no reliable records which give us the exact date of the first use of paris green. It probably occurred about 1865 or 1866. However, towards 1870 paris green was used very generally throughout the western region in which the potato-bug first appeared. At this time it was applied almost exclusively in the dry form diluted with gypsum or flour. From potato to cotton, tobacco and finally to fruit trees, is the development of this poison for destroying leaf-eating insects. So far as records are available, it appears that fruit trees were first sprayed with paris green between 1873 and 1875. Among pioneer sprayers, should be mentioned the names of C. V. Riley, United States Entomologist; LeBarron, State Entomologist of Illinois; William Saunders, London, Ontario, Can.; J. S. Woodward, Lockport, N. Y.; T. G. Yeomans & Sons, Walworth, N. Y.; A. J. Cook, Agricultural College, Mich.

Following paris green came london purple, then white arsenic, and later arsenate of lead. Since that time many different forms of arsenical poisons have been compounded, offered to the public and frequently used. A few years ago paris green was used extensively, but its popularity now is decreasing, probably because it contains a large percentage of soluble arsenic, which increases the danger of foliage injury. London purple has been largely dropped by fruit-growers, owing to its variable quality. White arsenic, in combination with soda and with lime, forms a reliable insecticide and is used by some growers, especially those who make a practice of preparing the home-made solutions. Arsenate of lead is the insecticide used most widely by the growers at the present time. It possesses several advantages, the more important of which are a small percentage of soluble arsenic and better sticking qualities.

The sucking insects presented a more difficult problem of control than the biting insects, and a longer time elapsed before effective methods had been devised for treatment. One of the first efficient sprays for these insects was kerosene in the form of a soap-and-water emulsion, which was recommended by Riley and Hubbard. Among the earlier sprays for these insects was also tobacco and whale-oil soaps, both of which are used rather widely at the present time. Later the



1327. Splint broom for applying spray. An early device.

miscible oils were introduced. These proved to be very effective and are still used. The most important step in the control of the sucking insects is marked by the introduction of the lime-sulfur wash. This mixture, which was originally developed as a dip for the control of scab on sheep, was first used as an insecticide on fruit trees in 1886 by F. Dusey, of Fresno, California. The wash proved very efficient and with modifications came quickly into favor. Now lime-sulfur is the leading insecticide for the control of certain scale insects and also, in a more dilute form, the leading fungicide for the more troublesome diseases of the apple.

The treatment of fungous diseases of plants by liquid applications began with the discovery of bordeaux mixture. Early in the 1880's, diseases of grape-vines threatened the extinction of French vineyards. The situation engaged the attention of French investigators. Notable among them were A. Millardet and his co-workers of the Academy of Science, Bordeaux, France. He, with others, discovered partly by accident and partly by experiment that solutions of copper prevented the development of downy mildew. After much experimentation, "bouillie Bordelaise" was found to be effective in preventing the growth of downy mildew and other plant parasites infesting the grape in that region. The announcement was definitely made in 1885. The following year the European formula for bordeaux mixture was published in several places in the United States, and immediately there began an unparalleled period of activity in economic vegetable pathology. This mixture, though somewhat modified and developed, continues to be a leading fungicide. The value of lime-sulfur as a fungicide applied to the peach during the dormant season to control the leaf-curl has been recognized. About 1907,



1328. A bucket pump.

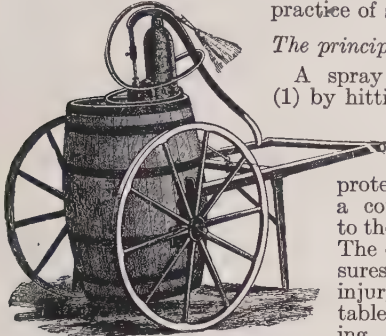


1329. Knapsack pump.

Cordley discovered that lime-sulfur in more dilute form may be applied to the apple and some other tree fruits in foliage without danger of foliage injury, and that in addition to being as effective as bordeaux it produces no spray injury on the fruit. Since then lime-sulfur as a fungicide has practically replaced bordeaux in the case of those fruits for which it can be used on the foliage with safety. The self-boiled lime-sulfur was developed about 1907 as a fungicide for the control of the brown rot of the peach.



The rapidity of the spread of spraying knowledge among fruit-growers is remarkable. Only a few years ago it was an unknown art by the rank and file. Today agricultural clubs and granges purchase their spraying materials by the carload direct from the manufacturer. The American farmer leads his fellow-workers in all parts of the world in the practice of spraying.



1330. A garden barrel pump.

trees are not blossoming." "Certainly," we answer, "spray to protect the foliage from possible injury by insect or fungous disease." Healthy foliage is essential to the protection of health and vigor and fruit-buds. Spray this year for next year's crop.

Insecticides kill by contact or by means of a poisonous principle; their efficiency depends largely on the time and thoroughness of the application. If applied too soon they may be dissipated before the insects appear; if applied late the injury is only partly prevented, because insects feed less voraciously and are harder to kill as they approach maturity in the larval stage. With the vegetable parasite, the case is not essentially different. The tree is covered with a thin coating which destroys spores of fungi resting there and prevents other spores from germinating. Fig. 1326 shows the stage of development of fruit-bud calling for bordeaux mixture and paris green. The keynote to success is thoroughness. Hasty sprinklings are worse than useless; they discourage and disappoint the beginner. Full protection is not afforded unless each leaf, twig and branch has been covered. Time is the next most important factor bearing on success. The early spray is most effective. This applies particularly to the treatment of fungous diseases. Spray before the buds open. Get ahead of the enemy.

#### *Spraying machinery.*

Bordeaux mixture was first applied with a broom (Fig. 1327). Poison distributors were first made in America for the protection of cotton, potato and tobacco. There are five general types of pumps: (1) The

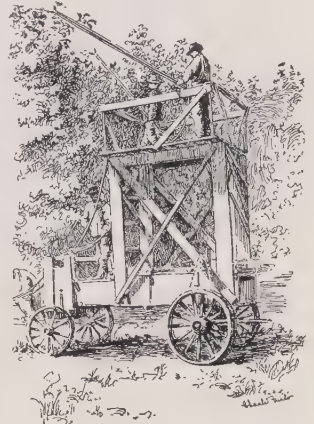


1331. An orchard barrel pump.

#### *The principles of spraying.*

A spray may be effective (1) by hitting the enemy, (2) by placing poison before the depre-dator, and (3) by protecting the plant with a covering unfavorable to the growth of the pest. The cautious farmer insures his crop against injury by insect or vegetable parasites by spraying. The fruit-grower asks, "Do I need to spray this year? My

Excellent for spraying small vineyards and vegetable-gardens. (3) A barrel pump; a strong force-pump fitted to a kerosene barrel or larger tank suitable for spraying young trees; may be mounted on a cart, wagon, or stone-boat, depending on the character of the ground and size of trees. (4) A gear-sprayer; being a tank provided with a pump and mounted on wheels. The pump is operated by power borrowed from the wheels as they revolve, and transferred by means of chain and sprockets. Suitable for vineyards and field crops, which may be satisfactorily covered by the spray as the machine moves along. For this reason it is not adapted to orchard work. (5) The power sprayer; power being furnished generally by gasoline, sometimes by compressed air. When the trees are large and the orchard over 5 acres in extent, a power sprayer will usually pay. Some of these various types of machinery are shown in Figs. 1328-1335. In recent years the spraying of field crops and shade trees has developed rapidly. The spray pumps have been adapted to this work by the use of special attachments. For the field crops, nozzles are distributed along a horizontal arm, which makes it possible to cover a wide strip. The sprayers for shade trees are equipped with a more powerful pump, which is usually multiple-cylinder. The pump must be capable of delivering a large quantity of material each minute under a pressure of 200 to 300 pounds. The nozzles for this work are of the solid stream type and are usually fitted with interchangeable tips varying from  $\frac{1}{8}$ - to  $\frac{1}{4}$ -inch aperture. In order that the tops of high trees may be reached by the spray mixture, it is necessary to use a long extension rod, as well as very high pressure.



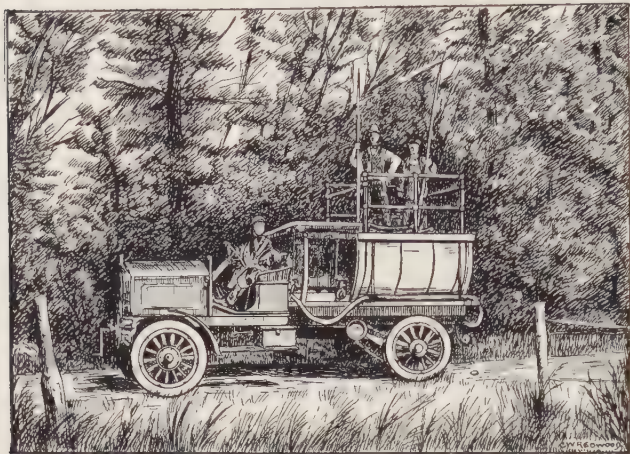
1332. Square tower, giving more working space for the nozzle-men than the conical form.



1333. A power sprayer for orchard use.

hand portable pump, often attached to a pail or other small reservoir, suitable for limited garden areas. (2) The knapsack pump carried on a man's back and operated by the carrier. The tank is made of copper, holds five gallons and is fitted with a neat pump which may be operated with one hand while the nozzle is directed with the other. This pump has been modified recently so that all the pumping is done when the sprayer is filled and before it is placed on the shoulders.





1334. A traction power sprayer, for street and park trees.

The essentials of a good pump are (1) durability: secured by having working parts made of material least susceptible to the action of the various spray solutions, friction considered; (2) strength: obtained by a good-sized cylinder, substantial valves, wall and piston; (3) easily operated: found in a pump with a long handle, large air-chamber and smoothly finished working parts. A pump should be strong enough to feed two leads of hose and throw a good spray from four nozzles. Nearly all spray mixtures require constant stirrings to prevent settling and insure uniformity, and an agitator is a necessary part of the equipment.

**Nozzles.**—Much of the efficiency of a spraying machine depends upon the nozzle. It should be chosen for the particular work to be done, rather than for any special design. The development of nozzle construction has been rapid, new features being embodied as necessity demanded, until today there are four main types, each of which is intended for specific work: (1) The Bordeaux nozzle is the oldest of the modern types. It came into general use about 1890 and was at first universally adopted for all spray work. It throws a stream which may be regulated from a solid jet to a coarse fan-shaped spray, both of which are too coarse for general use. The Bordeaux has, however, one place in the list of modern spray nozzles and that is for the codlin-moth spray. For this application it is desirable to force the material into the calyx cups of the developing fruit and no nozzle does this quite so efficiently as the Bordeaux. (2) The Vermorel was the next step in development after the Bordeaux. It was very much superior to the latter, breaking the material up into finer particles, and was generally used until about 1906. This nozzle, however, does not possess any desirable features not found in the disc types and therefore has no special uses in modern spraying. (3) The disc nozzles are standard for general spraying work. They are represented by a large number of sorts, each made by different manufacturers, but all working on the same principle. The material is whirled inside of the nozzle before it reaches the final outlet, thus breaking it up into finely divided parts and producing the desired mist. The material is lastly passed through a disc, which may have either a large or small opening. For orchard and small crop spraying, the small opening is used, in which case the nozzle should be 3 to 7 feet from the object to be sprayed. For taller orchard trees and for small ornamental trees, the large opening is used. This produces a solid jet which breaks into finer particles at a distance from the

nozzles, depending upon the pressure used. (4) Shade tree nozzles, to be used only for spraying very tall ornamental trees, and in connection with at least 300 pounds pressure. They throw a solid stream 30 or more feet in the air, at which point the material is broken into a coarse mist. This type came into use at the time of the introduction of the brown-tail and gypsy moths in the New England states, and has since been widely used for parks, estates and forest spraying.

C. S. WILSON.

DISÉMMA: *Passiflora*.

**DISOCÁCTUS** (*two-shaped Cactus*). *Cactaceæ*. Bushy cactus, 2-3 ft. high, sometimes seen as a pot-plant in collections.

Stems terete, usually erect: branches flattened as in *Epiphyllum*: fls. regular, with very short tube; petals few, elongated, spreading; ovary nearly naked, small.

*bifórmis*, Lindl. (*Phyllocactus bifórmis*, Lab.).

Soon pendulous, the branches cylindrical: short branches lf.-like, the lower egg-shaped, the upper more lengthened: fls. small, purple-red, less than 2 in. expansion; ovary without angles and with minute scales. Honduras. B.M. 6156. V. 2:159.

J. N. ROSE.

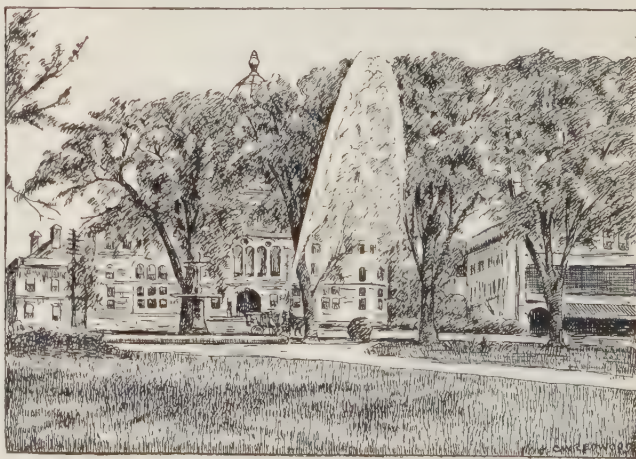
**DÍSPORUM** (Greek, *double one-seeded*). Syn. *Prosartes*. *Liliaceæ*. FAIRY BELLS. Small perennial rhizomatous herbs, sometimes planted in the wild garden.

Allied to *Smilacina* and *Streptopus*, being leafy-stemmed, but fls. in umbels (or solitary): perianth 6-parted, with narrow deciduous segms.; stamens 6, the filaments filiform or slightly flattened and longer than the extrorse anthers; ovary 3-celled, the ovules 2 or more in each cell, the stigma 3-cleft or entire: fr. a red or reddish few-seeded berry.—About 20 species, in N. Amer. and in the Himalayan region, Java to China and Japan. Little known to horticulturists; probably require no particular skill in cult.

A. Lvs. rarely cordate at base.

B. Style 3-cleft.

**Ménziesii**, Nichols. (*Prosartes Ménziesii*, Don). More or less soft-pubescent: st. 2-3 ft. long, forking, arching above: lvs. ovate to ovate-lanceolate, narrowly acuminate or the lowest acute, sessile, 2-3 in. long, often resin-dotted: fls. 1-3, greenish, cup-shaped, from the topmost axils, nodding, 9-12 lines long; pedicels puberulous; perianth-segms. nearly erect, acute, 6-11 lines long; stamens a third shorter; anthers included, 1½-2 times shorter than the filaments: fr. oblong-



1335. Spraying park trees with the machine shown in Fig. 1334.



obovate, narrowed to a short beak, salmon-colored. Calif. to Brit. Col.

**lanuginosum**, Nichols. Woolly-pubescent: lvs. oblong-lanceolate, narrowly acuminate: perianth-segms. greenish, linear-lanceolate, acuminate, spreading, 6-9 lines long, stamens a third shorter; style and narrow ovary glabrous: caps. oblong-ovate, obtusish or with a very short, stout beak, glabrous; cells 1-2-seeded. Ont. to Ga. and Tenn. B.M. 1490. (as *Streptopus*).

BB. *Style entire.*

**trachycarpum**, Benth. & Hook. (*Prosartes trachycarpa*, Wats.). More or less pubescent: st. 1-2 ft. high, forking, with foliage on the upper half: lvs. ovate to oblong-lanceolate, acute or rarely acuminate, 2-4 in. long: pedicels pilose; perianth-segms. whitish, slightly spreading, more narrowly oblanceolate than in *D. Menziesii*, acute, 6-7 lines long, about as long as the stamens: fr. obtuse, rather deeply lobed, papillose. Neb. to Manitoba and Ore. and Wash.

AA. *Lvs. mostly cordate-clasping.*

**oregànum**, Benth. & Hook. (*Prosartes oregana*, Wats.). More or less woolly-pubescent: lvs. ovate to oblong-lanceolate, long-acuminate: perianth-segms. spreading, acute, narrowed below, very distinctly net-veined, 5-7 lines long, as long as or shorter than the stamens: fr. ovate, acutish, somewhat pubescent. Ore. and Idaho to Brit. Col.

*D. Hookeri*, Nichols. (*P. lanuginosa* var. *Hookeri*, Baker). More or less rough-pubescent, with short, usually spreading hairs: lvs. ovate or sometimes oblong: perianth rather broad at the base: fr. obovate, obtuse, red. Calif.—*D. Leschenaultianum*, D. Don, differs from the others here described by having white fls. India, Ceylon. B.M. 6935.—*D. pullum*, Salisb. Readily told from American forms by its brown or purplish green fls. India, Java, China. B.M. 916.

WILHELM MILLER.  
L. H. B.†

**DISSOTIS** (of two kinds, referring to the unlike anthers). *Melastomaceæ*. Some 60 or more species of bristly-hairy or villous shrubs, sub-shrubs or herbs of Trop. and S. Afr., some of which may occur sparingly in choice collections of coolhouse and warmhouse plants: lvs. opposite, short-stalked, linear, ovate or orbicular, usually entire, 3-5-nerved, more or less strigose above: fls. bracted, about 1 in. or more across, purple or violet, solitary, or capitate or paniculate at the ends of the branches; calyx 4-5-lobed; petals 4 or 5, obovate; stamens 8 or 10, very unequal, the anthers linear-subulate, usually beaked, with 1 pore, the larger set being joined to the filament by a long connective and the other set with much shorter or nearly obsolete connective: fr. an included coriaceous caps. 4- or 5-valved at the apex. Apparently none is in the American trade. *D. Irvingiana*, Hook. f. Annual from upper Guinea, 1-3 ft.: lvs. linear-oblong to lance-oblong, acute, 3-nerved: fls. reddish purple, to 1¼ in. across; petals obovate. B.M. 5149. *D. incana*, Triana, of Trop. and S. Afr., shrub, 2-3 ft.: lvs. linear to linear-oblong, obtuse: fls. rose-purple, to 1½ in. across. B.M. 3790. *D. plumosa*, Hook. f. Shrubby, with long and slender shoots which are densely covered with small deep green lvs.: fls. bright magenta-rose, 1½ in. across. Trop. Afr. *D. Mahonii*, Hook. f. Prostrate, the sts. 6-8 in. long: lvs. short-stalked, nearly or quite orbicular: fls. rose-purple, 2 in. across, solitary. Uganda. B.M. 7896. *D. modesta*, Stapf. Slender: lvs. oblong, minutely serrulate: fls. few, crowded at ends of branches; petals obovate-elliptic; stamens blue-purple, reddish and yellow; style purple. Uganda. L. H. B.

**DISTÍCHLIS** (Greek, *two-ranked*). *Gramineæ*. SALT-GRASS. MARSH SPIKE-GRASS. Rigid erect perennials, with extensively creeping wiry rootstocks: spikelets several-fld., compressed, diœcious; lemmas coriaceous, rigid, faintly many-nerved.—Species about 6, in salt marshes on the coastal regions of Amer. and in alkaline

soil of the interior. One species, *D. spicata*, Greene, with stiff, distichous involute blades and small narrow panicles is found in alkaline soil throughout the U. S. (Dept. Agric., Div. Agrost. 20:143). It is a good grass for binding soils subject to wash. Probably not in cult.

A. S. HITCHCOCK.

**DÍSTICTIS** (Greek *dis*, twice and *stiktos*, dotted; meaning obscure). *Bignoniaceæ*. Five or 6 species in Cent. and S. Amer., very similar in fl. to *Pithecoctenium*, but caps. smooth, oblong, curved, and branchlets not angular: lvs. 2- or 3-foliolate, with simple or 3-fid. tendrils: fls. large in ample terminal panicles; calyx tubular-campanulate, truncate, often splitting; corolla funnel-form-campanulate, leathery, curved; stamens inclosed; ovary with the seeds in many rows. Adapted for cult. in subtropical regions only; treatment and prop. like *Bignonia*, which see. The following species is cult. in S. Calif. *D. cinerea*, Greenm. (*Pithecoctenium cinereum*, DC.). Tall climber, grayish tomentose throughout: tendrils 3-fid.: lfts. 2-3, ovate or oval, obtuse and mucronulate or acutish, entire, 1-2 in. long: corolla purple, tomentulose outside, 2-3½ in. long and 1½-2½ in. across at the mouth. Mex.—The plant cult. under this name in Calif. is said to have white fls. and may not be the plant described above.

ALFRED REHDER.

**DISTÝLIUM** (Greek, *dis*, twice, *stylos*, style; in reference to the two slender styles). *Hamamelidaceæ*. Ornamental woody plants grown for their handsome evergreen foliage.

Evergreen trees or shrubs: lvs. alternate, short-petioled, entire, or dentate, penninerved; stipules deciduous: fls. polygamous or diœcious, apetaious, in axillary racemes, subtended by small bracts; sepals 1-5, or wanting; stamens 2-8 with short filaments; pistillate fls. with a superior stellate-tomentose ovarv. with 2 slender styles, with several stamens or without stamens: fr. a woody dehiscent caps., 2-celled, with 1 seed in each cell.—Six species in Japan, China, Himalayas and Java. Hardy only in warmer temperate regions. Prop. is by seeds and layers.

**racemòsum**, Sieb. & Zucc. Tall tree, in cult. usually shrubby: lvs. elliptic to elliptic-oblong, sometimes obovate, acute or obtusish, narrowed at the base, dark green and lustrous above, paler beneath, glabrous, 1¼-3 in. long: racemes stellate-pubescent; anthers red: caps. ovoid, 2-pointed, tomentose, ½ in. long. March, April. Japan. S.Z. 1:94. S.I.F. 2:25. I.T. 3:113.—The staminate fls. are conspicuous by the red color of their anthers. Var. *variegatum*, Carr. Lvs. bordered with yellowish white.—*D. chinense*, Hemsl. (*D. racemòsum* var. *chinense*, Franch.), a shrub with oblong-obovate lvs. ¾-1½ in. long and usually sparingly toothed above the middle from Cent. China is now possibly also in cult. H.I. 29:2835. ALFRED REHDER.

**DITTANY** is an old English word which in England often means *Dictamnus albus*, a plant of the rue family. The name is supposed to be derived from Mt. Dicte, in Crete, where the ancient dittany grew. The Cretan dittany is supposed to be *Origanum Dictamnus*, a plant of the mint family, and of the same genus with the wild marjoram. The plant commonly called dittany in the eastern United States is *Cunila origanoides*, Brit. (*C. Mariana*, Linn.), another mint, native in dry lands. See *Cunila*. It has been used as a substitute for tea, and is a gentle aromatic stimulant. All these plants yield an oil used as a mild tonic.

**DIÛRIS** (Greek, *double-tailed*, alluding to the sepals). *Orchidaceæ*. Twenty or more glabrous terrestrial orchids of Austral., rarely seen in collections in cool or warm glasshouses. The lvs. are at or near the base of the bracted st. (which is usually 1-2 ft. high), few, narrow: fls. 1 to several in a terminal raceme, conspicu-

ous from the elongated tail-like lateral green sepals; remainder of perianth yellow, purple or white, sometimes purple-blotched or -spotted; dorsal sepal remaining close to and over the column; lip 3-parted. The species are attractive or even handsome. *D. longifolia*, R. Br., has fls. several, yellow and purple, moderately large; dorsal sepal broadly ovate, the lateral long and narrow; lip as long as dorsal sepal, lobed from the base; lvs. linear, one of them often very long. *D. maculata*, Smith, is rather slender, usually under 1 ft. tall, with long-pediceled yellow much-spotted fls.; dorsal sepal erect and rigid, embracing the column at the base but open at the top; lip shorter than dorsal sepal, lobed from base: lvs. narrow. B.M. 3156. *D. punctata*, Smith. St. 1-2 ft. or more: lvs. usually 2, and 3-6 in. long; fls. 2 or 3, blue or purplish, often dotted but not blotched; dorsal sepal typically broadly ovate-oblong; lip about as long as dorsal sepal, divided to base.

L. H. B.

**DIZYGOTHECA** (Greek, in allusion to the anthers having double the usual number of cells). *Araliaceæ*. Graceful hothouse plants, grown practically exclusively for foliage; usually known as Aralia.

Usually shrubs, sometimes small trees, entirely unarmed, and differing in this from some hardy aralias: lvs. always digitate, of 5-9 lfts., varying much in adult and juvenile characters, sometimes slender and threadlike, again broad and leathery, usually long-stalked; calyx and corolla 5-parted; stamens 5, with thick anthers; ovary 10-celled; styles 10. All these fl.-characters are drawn from wild plants, as the cult. specimens are not known to flower.—Only 3 or 4 species are known in the wild state, all from the tropical isls. of the Pacific. The many names in horticultural literature are probably referable, ultimately, to some of these species, but their true position will be settled only when they flower. Here must be sought all the digitate-lyd. tender aralias of the first edition of this cyclopedia, the pinnate-lyd. species going to Polyscias. R.H. 1912, p. 491.

Dizygothecas require light rich soil, made up of equal parts of sandy loam and peat or leaf-mold. They require plenty of water and a moist warm atmosphere. Scale pests are numerous and must be kept down by frequent sponging with weak solutions of whale-oil soap, fir-tree oil or other insecticide.

The names here used are retained in the absence of specific information as to what wild species of Dizygotheca they are to be associated with. Only complete flowering material can settle this much-vexed question. All of the following are distinct horticulturally.

**Kerchoveana**, Hort. Lvs. the shape of a Ricinus, the 7-11 lfts. elliptic-lanceolate or oblong-lanceolate, with undulate and serrate margins and a pale midrib. S. Sea Isls. Certificated in England in 1881 (Gn. 19, p. 457). R.H. 1891, p. 225.—Slender-stemmed, of beautiful habit. According to Harms, perhaps better put in Pseudopanax.

**Veitchii**, Hort. Lfts. 9-11, very narrow or almost filiform, undulate, shining green above and red beneath. New Caledonia.—One of the best and handsomest species. Var. **gracillima**, Hort. (*Aralia gracilina*, Lind.). Lfts. still narrower, with a white rib. R.H. 1891, p. 226. Gn. 39, p. 565. I.H. 22:225.—Very desirable. Originally described as *Aralia gracilina* (*thin-lined*), which name has been mistaken for *gracillima* (*very graceful*).

**elegantissima**, Veitch. Petioles mottled with white; lfts. 7-11, filiform and pendulous. New Hebrides. G.Z. 21, p. 28.—Excellent. Thought by Guillemin to be the juvenile form of some Dizygotheca. Many of the greenhouse aralias have a permanent juvenile condition.

**leptophylla**, Hort. Slender plant: lfts. filiform and drooping, broadened at the extremities, deep green. Australasia.

**Reginae**, Hemsl. (*Aralia regina*, Hort.). Graceful: petioles olive, pink and brown; lfts. drooping, very narrow, not undulate. New Hebrides. I.H. 26:337.

The following greenhouse aralias, with showy lvs., probably belong to Dizygotheca, unless otherwise noted:

*A. Chabrieri*, Hort. See Polyscias.—*D. crassifolia*, Soland. See Pseudopanax.—*D. longipes*, Hort. Lvs. digitate, the lfts. oblong-lanceolate, acuminate, wavy. N. Austral.—*D. nobilis*, Hort. "A theophrasta-like plant, with closely packed, bold foliage; the lvs. oblong obovate-acuminate, undulate at the margins." Not certainly referable to Dizygotheca.—*D. Oryana*, Hort. Like *A. leptophylla*, but lfts. deeply bifid, and nerves and veins brown. S. Sea Isls.—*D. quercifolia*, Hort. Lfts. 3, sinuate: lvs. opposite. New Britain. Perhaps not of the Araliaceæ. The plant has opposite lvs.—*D. rotunda*, Hort. Lf. of a single orbicular-cordate lft. or sometimes 3-foliolate, white-toothed. Polynesia. Not certainly referable to Dizygotheca.—*D. spectabilis*, Hort.—*D. splendens*, Hort. Lvs. pinnate, the lfts. shiny green. New Caledonia.—*D. ternata*, Hort. Lvs. opposite, ternate, or 3-lobed, the lfts. oblong-lanceolate and sinuate. Not certainly referable to Dizygotheca.—*D. Victoriae*, Hort.—Polyscias. N. TAYLOR.

**DOCK.** A name applied to various species of Rumex (*Polygonaceæ*). The commonest species—growing in fields and yards—are the curled or narrow-leaved dock (*R. crispus*, Linn.) and the bitter or broad-leaved dock (*R. obtusifolius*, Linn.). These are introduced from the Old World. Several species are native. See *Rumex*.

Various species of docks and sorrels have long been cultivated as pot-herbs. Some of them are very desirable additions to the garden because they yield a pleasant food very early in spring, and, once planted, they remain for years. The Spinage dock and the Large Belleville are amongst the best kinds. The former (Fig. 1336) is the better of the two, perhaps, and it has the advantage of being a week or ten days earlier. The crisp leaves (blade 1 foot long) appear early in April, when there is nothing green to be had in the open, and they can be cut continuously for a month or more. This dock is the herb patience (*Rumex Patientia*, Linn.). It has long been an inhabitant of gardens, and it has sparingly run wild in some parts of this country. It is a native of Europe.

The Belleville (Fig. 1337) is also a European and northern North American plant. It has also become spontaneous in some of the eastern portions of the country. It is really a sorrel (*Rumex Acetosus*, Linn.). It has thinner, lighter green and longer-stalked leaves than the Spinage dock, with spear-like lobes at the base. The leaves are very sour, and will probably not prove to be so generally agreeable as those of the Spinage dock; but they are later, and afford a succession. In some countries this sorrel yields oxalic acid sufficient for commercial purposes. The round-leaved or true French sorrel (*Rumex scutatus*, Linn.) would probably be preferable to most persons.

All these docks are hardy perennials, and are very acceptable plants to those who are fond of early "greens." Some, at least, of the cultivated docks can be procured of American seedsmen. They are readily grown from seeds, and give a good produce the second year and subsequently, and often yield good leaves the first season.

L. H. B.



1336. Spinage dock.



1337. Belleville dock.



**DOCYNIA** (derivation unknown). *Rosaceæ*, subfamily *Pomeæ*. Ornamental woody plants grown for their handsome foliage and white flowers appearing in spring.

Evergreen or half-evergreen trees: lvs. alternate, entire, or serrate, sometimes slightly lobed: fls. short-stalked, in umbels before or with the lvs.; calyx densely tomentose, with lanceolate lobes; petals 5; stamens 30-50; styles 5, connate at the base and woolly; stigma 2-lobed; ovary 5-celled with 3-5 ovules in each cell: fr. a subglobose, ovoid or pyriform pome with persistent calyx.—Four species in China, Himalayas and Annam. Closely related to *Malus*, chiefly distinguished by the 3-5-ovuled cells and the 2-lobed stigma.

The species are very little known in cultivation and none of them seems to be in the trade. *D. Delavayi* has been introduced only very recently; *D. Doumeri* has been recommended as a stock for apples in tropical and subtropical countries and tried in Annam (R.H. 1904, p. 246); *D. indica*, though known for about 100 years, does not seem to be at present in cultivation either in Europe or in this country. They are adapted only for warmer temperate or subtropical regions. The fruits are more or less acid and are used for cooking; possibly they could be improved by selection and hybridization and might be developed into valuable fruit trees for warmer climates. Propagation is by seeds and possibly by grafting on apple stock.

*D. Delavayi*, Schneid. (*Pyrus Delavayi*, Franch.). Spiny tree, to 30 ft.: lvs. evergreen, ovate-lanceolate, rounded or broadly cuneate at the base, entire, glossy above, white-tomentose below, 2-4 in.: fr. ovoid, about 1 in. long. S. W. China. Franchet, Plant. Delavay. 47.—*D. Doumeri*, Schneid. (*Pyrus Doumeri*, Bois). Unarmed tree: lvs. ovate to ovate-lanceolate, entire or sparingly serrulate, white-tomentose below, 1-2½ in. long: fr. subglobose, about 2 in. across. Annam. Jour. Soc. Bot. France, 51:114, 115.—*D. indica*, Decne. (*Pyrus indica*, Wall. *D. Griffithiana*, Decne.). Small tree: lvs. ovate to oblong-lanceolate, entire or serrulate, lobed in young plants, woolly while young, finally glabrescent, 2-4 in. long: fr. subglobose, 1-1½ in. across. E. Himalayas. Wallich, Pl. As. Rar. 2:173.—The closely related *D. Hookeriana* has larger lvs. and elongated fr. Nouv. Arch. Mus. Hist. Nat. Paris. 10:15.



1338. *Dodecatheon Meadia*, the common shooting-star. (×¼)

ALFRED REHDER.

**DODÁRTIA** (Denis Dodart, physician and botanist, born in Paris in 1634). *Scrophulariææ*. One erect perennial herb related to *Mimulus*. *D. orientalis*, Linn., grows in S. Russia and W. Asia, and may be found in choice collections of outdoor herbs: fls. purplish, in terminal racemes: plant with rush-like few-lvd. branches: lvs. opposite below, alternate above, linear and entire or broader and somewhat dentate: corolla with a cylindrical or flaring tube, 2-lipped; stamens 4, didynamous, included, the anther-cells distinct: caps. subglobose, dehiscent, the many seeds somewhat immersed in the more or less fleshy placenta. July, Aug. B.M. 2199.—Apparently of minor horticultural value.

DODDER: *Cuscuta*.

**DODECÂTHEON** (Greek, *twelve gods*, old name of no application here). *Primulææ*. SHOOTING-STAR. AMERICAN COWSLIP. Small perennial herbs with cycla-

men-shaped flowers on scapes, sometimes grown in wild or hardy gardens.

Glabrous, with a tuft of ovate or oblong entire or dentate lvs. at the base, and a slender single naked scape: fls. few or many in an umbel, nodding, white, rose or purple; corolla-lobes (5) and calyx reflexed; stamens 5, attached in the throat of the short corollatube, the short filaments more or less conjoined at base and the long slender anthers connivent into a cone: fr. an oblong or somewhat cylindrical 5- or 6-valved caps.

—*Dodecatheon* is a puzzling genus to systematic botanists. It is found from Maine to Texas and from the Atlantic to the Pacific; and along the Pacific slope, from the islands of Lower Calif. to those of Bering Stra.t. In this vast region, it varies immensely. It is also found in Asia, especially northeastward. This wonderful distribution and variability is all the more remarkable if, as Gray once thought, it is all one species, because monotypic genera are considered, as a rule, to be comparatively inflexible or invariable. Pax & Knuth, on the other hand (Engler's Pflanzenreich, hft. 22, 1905), recognize 30 species. There is singular lack of agreement in the characterization of accepted species. *Dodecatheon* belongs to the same family with *Primula* and *Cyclamen*, but in a different tribe from the former, while its reflexed corolla-lobes distinguish it from most genera of its family. Many species and varieties may be expected to appear in the lists of dealers in native plants.

Shooting-star is an appropriate name. The flowers have been compared to a diminutive cyclamen, for they are pendulous and seem to be full of motion (see Fig. 1338). The stamens in *D. Meadia* and all eastern species come to a sharp point and seem to be shooting ahead, while the petals fall behind like the tail of a comet. The flowers represent every shade from pure white, through lilac and rose, to purple, and they all have a yellow circle in the middle, i.e., at the mouth of the corolla. After the flowers are gone the pedicels become erect. Some forms have all their parts in fours. There are a number of good horticultural forms offered abroad.

They require an open well-drained soil, not too dry, and moderately rich, and a shady or partially shady position. They are propagated by division or by seeds, the latter method being rather slow.

**Mèadia**, Linn. (*D. ellipticum*, Nutt. *Mèadia Dodecathea*, Crantz. *M. Dodecatheon*, Mill. *M. caroliniana*, Kuntze). Fig. 1338. Erect and strong, to 2 ft.: lvs. ovate-oblong or oblong-linear, nearly or quite obtuse, dentate-crenate or nearly entire, 1-2 in. wide, tapering into a more or less margined petiole: scape smooth, usually purple-spotted; fls. 10-20; calyx deeply parted, the parts lanceolate; corolla-lobes linear-oblong, somewhat obtuse, rose-colored and whitish at base; anthers reddish yellow, the connective body purple and broadly ovate: caps. scarcely longer than calyx, with persistent style. May, June. Woods and prairies, Pa., W. and S. B.M. 12.—This species runs

into many forms, some of which may be specifically distinct. Var. *splendendum*, Hort., is an improved form, crimson with a yellow circle. Var. *gigantæum*, Hort., is larger in all its parts: lvs. paler: fls. somewhat earlier, in some forms white. Var. *élegans*, Hort. Lvs. wider and shorter than the type: scape shorter; fls. more numerous, dark-colored. (The old generic name *Mædia* commemorates Dr. Richard Mead, 1673–1754.)

*Jeffreyi*, Van Houtte (*Mædia Jeffreyi*, Kuntze). Plant somewhat glandular-viscid: rhizome vertical and short, strong: lvs. oblanceolate, erect, entire, somewhat acute, mucronulate: scape 12–24 in. or more, bearing a many-fld. umbel; calyx-lobes lanceolate; corolla deep red-purple; connective-body of anthers very narrow or subulate at apex, colored same as stamens. Mts., Calif. and Ore. F.S. 16:1662.

*tetrandrum*, Suksdorf, has the general aspect of *D. Jeffreyi*, but the lvs. are ampler and relatively broader: roots, as in *D. Jeffreyi*, are abundant, fleshy, fibrous, persistent: roots, lvs. and scapes form a short, vertical crown: whole plant glabrous: corolla purplish, with a yellow ring near the base; segms. and stamens usually only 4: caps. circumscissile very near the apex. Mts., Wash. and Ore.

*frigidum*, Cham. & Schlecht. Plant 1 ft. or less: lvs. obovate to ovate or oblong, acutish, entire or somewhat dentate: scape much exceeding the lvs., 2–3-fld.; calyx-lobes longer than the tube; corolla-lobes oblong-linear, violet: caps. oblong, twice longer than calyx. Bering Strait to Rockies and Sierras. B.M. 5871.

*latilobum*, Elmer (*D. dentatum*, Hook. *D. Mædia* var. *latilobum*, Gray). Larger than the last: lvs. with blade 1–4 in. long, oval or ovate to oblong, repand or sparingly dentate, abruptly contracted into long-winged petioles, obtuse: fls. 2–4; calyx-lobes deltoid; corolla-lobes oblong, yellowish white: caps. but little longer than calyx, opening from the apex by valves. Wash., Ore., Idaho.

*Hendersonii*, Gray. About a foot high, glabrous, deep green: lvs. small, obovate or elliptic, 1 in. or more long, narrowed to a short petiole: fls. rather few; calyx-lobes triangular, acuminate, twice exceeding the tube; corolla-lobes dark purple with a yellow base, the staminal tube dark purple; anthers oblong, obtuse, short-apiculate; connective-body deep purple: caps. ovoid, much exceeding the calyx, dehiscent by a circumscissile apex and splitting into 10 valves. Calif. to Wash. G. 33:391.

*Clavelandii*, Greene. One to 1½ ft. tall, glabrous: lvs. pale green, thickish, spatulate-ovate, petioled: fls. 2–10; calyx-lobes ovate-lanceolate, acute, glandular; corolla-lobes purple with yellow base and a few purple spots in throat; anthers purple, the connective-body yellow: caps. oblong, circumscissile at apex. Feb.–May. S. Calif.—Fls. said to vary to pure white. Fragrant.

*radicatum*, Greene. Glabrous: root short and corm-like with fibrous rootlets: lvs. 3–5, thin, light green, oblong-spatulate, crenate or nearly entire, blade attenuate into petiole of about equal length: fls. 3–5 or more on a stout scape 8–16 in. tall; calyx-lobes lanceolate, about as long as the tube; corolla pinkish or bluish violet, the lobes oblong-linear and erect-spreading; staminal tube short; anthers purple, acute: caps. narrow-ovate, only slightly surpassing calyx-lobes. April. Wyo. to New Mex.—Recommended for alpine and rock-gardens.

L. H. B.†

**DODONÆA** (Rembert Dodoens, or Dodonæus, about 1518–1585, royal physician and author). *Sapindaceæ*. Trees and shrubs, somewhat planted in S. Fla. and S. Calif. for ornament.

Leaves alternate, without stipules, simple or pinnate: fls. small, polygamous, unisexual, often diœcious,

terminal or axillary, solitary or in racemes or panicles; sepals 5 or fewer; petals wanting; stamens mostly 8 (5–10) with very short filaments; ovary 3–6-celled, each cell 2-ovuled: caps. winged on the back of each valve.—About 50 species, mostly in Austral., a few in Afr. and in Hawaii and N. Amer. Lvs. sometimes glandular and exuding resin-like or varnish-like substance.

*viscosa*, Linn. Shrub, to 15 ft., viscid: lvs. mostly oblong, cuneate at base, entire, with resinous dots on both surfaces; fls. greenish, in short terminal or axillary racemes; sepals ovate: caps. about ¾ in. long and somewhat broader, broadly 3-winged, notched at apex, more or less cordate at base. B.R. 13:1051 (as *D. oblongifolia*).—A poorly defined plant, widely distributed in warm countries, occurring in Austral., S. Afr., in Mex., and forms of it in Fla. and Ariz. Lvs. varying from broadly spatulate to oblong to nearly or quite linear.

*Thunbergiana*, Eckl. & Zeyh. Shrubs, 6–10 ft., glabrous, much branched: lvs. lanceolate or linear-lanceolate, narrowed at base, somewhat denticulate



1339. Leaves of Dolichos. A, *D. Lablab*; B, *D. lignosus*.

and somewhat viscid: fls. green, polygamous, racemose: caps. ½ in. long, resinous and shining, 2–3-winged, as long as the stalk or longer. S. Afr.

*triquetra*, Andr. Erect shrub, the young branches flattened or very angular: lvs. oval-elliptic to oblong-lanceolate, acuminate, to 4 in. long, entire or very nearly so: fls. in short oblong compact panicles or racemes; sepals minute: caps. of *D. viscosa*, middle-sized. Austral.

*cuneata*, Rudge. Much-branched bush, usually viscid: lvs. small (usually under 1 in. long) obovate or cuneate, at the end rounded or truncate or toothed, on the sides entire or rarely obscurely toothed, short-petioled: fls. in short terminal scarcely branched racemes, or sometimes few in axillary clusters; sepals ovate-oblong: caps. of *D. viscosa*, the wings usually not very broad. Austral.

L. H. B.

**DOGBANE:** *Apocynum*.

**DOG'S-TAIL GRASS:** *Eleusine indica*.

**DOGTUOTH VIOLET:** *Erythronium*.

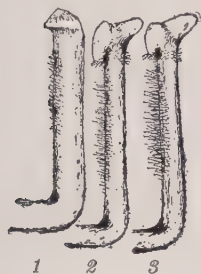
**DOGWOOD:** *Cornus*

**DOLICHANDRA:** *Macfadyena*.



**DOLICHODEIRA:** *Sinningia*.

**DOLICHOS** (old Greek name). *Leguminosæ*. Tropical twiners (a bush variety of *D. Lablab* is now being offered by seedsmen), of which a few forms are in cultivation, some for ornament and some for forage.



1340. Types of styles. 1, *D. Lablab*; 2, *Vigna sinensis*; 3, *V. sesquipedalis*.

Keel of the corolla narrow and bent inward at right angles, but not distinctly coiled; style bearded under the stigma, which is terminal; stipules small. For botanical distinctions between *Dolichos*, *Phaseolus* and *Vigna* see *Vigna*. The styles are points of difference (Fig. 1340). *D. japonicus*, a most worthy ornamental vine, will be found under *Pueraria*. For *D. sesquipedalis*, see *Vigna*—Perhaps 50-60 species, widely distributed. Three species of *Dolichos* are now grown in Amer.

A. Style bearded only on a ring surrounding and just below the stigma.

*biflorus*, Linn. This species is now being intro. from India, where it is frequently used as a forage plant. It differs from *D. Lablab* in having the upper lip of the calyx 2-toothed and from *D. Lablab* and *D. lignosus* in having only a ring or brush of hairs just beneath the stigma, whereas the styles of the other species are bearded on a line extending down the inner face. The seeds are small (average weight .035 gram) and rather strongly flattened. Their approximate dimensions are length  $\frac{1}{5}$ – $\frac{1}{4}$  in., width  $\frac{1}{8}$ – $\frac{1}{16}$  in., thickness  $\frac{1}{12}$  in. (2–2½ mm.).

AA. Style bearded along the inner side.

B. Seeds small,  $\frac{1}{16}$ – $\frac{1}{8}$  in. long by  $\frac{1}{16}$ – $\frac{1}{8}$  in. broad, average weight .02 grams.

*lignosus*, Linn. AUSTRALIAN PEA. Fig. 1339. Evergreen: fls. white or rosy purple: lvs. much smaller than in *D. Lablab*. A perennial rapidly growing vine, suitable for covering fences and outbuildings in warm countries; highly recommended in S. Calif. and Ariz. B.M. 380.—A form with white fls. is offered by seedsmen as *D. alba*.

BB. Seeds large,  $\frac{1}{8}$ – $\frac{1}{2}$  in. long by  $\frac{1}{4}$ – $\frac{3}{8}$  in. broad, average weight .10–.30 grams.

*Lablab*, Linn. (*D. cultratus*, Thunb. *D. purpureus*, Lindl. *Lablab cultratus*, DC.). HYACINTH BEAN. Figs. 1339, 1340, 1341. Tall-twinning (often 10–20 ft.): lfts. broad-ovate, rounded below and cuspidate-pointed at the apex, often crinkly: fls. purple or white, rather large, 2–4 at the nodes, in a long erect raceme: pods small (2–3 in. long) and flat, usually smooth, conspicuously tipped with the persistent style; seed black, mahogany or gray, in the white-fl. varieties, white, small (average weight about  $\frac{1}{4}$  gram). Tropics. B.M. 896. B.R. 830. A.G. 14:84.—Cult. in this country as an ornamental climbing bean, but in the tropics the pods and seeds are eaten. Annual. It is easily grown in any good garden soil. Like common beans it will not endure frost. It is very variable. White-fl. and dwarf bush forms are now offered by seedsmen. A form with white fls. and very large growth is known among horticulturists as *D. giganteus* (Fig. 1342).



1341. Calyx cups and styles of *Dolichos*. 1, *D. lignosus*; 2, *D. Lablab*.

*D. pseudopachyrhizus*, Harms, recently intro. into some of the European gardens from Trop. Afr., is a perennial form with a large tuberous rootstock: sts. long, round or angular: lvs. long-stalked, 3-foliolate: lfts. very variable in shape, the lateral often ovate or elliptic and the terminal broadly rhomboid,  $3\frac{1}{4}$ –8 in. long,  $2\frac{1}{2}$ –7 in. broad: fls. small, chiefly violet-blue, in racemes  $\frac{1}{2}$ –1½ ft. long.

GEO. F. FREEMAN.

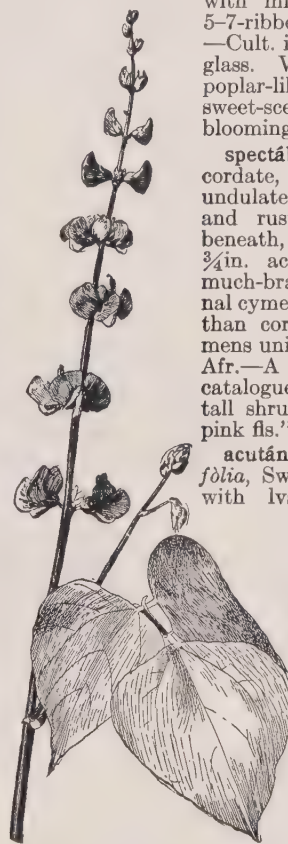
**DOMBEYA** (after Joseph Dombey (1742–1795)

French botanist and companion of Ruiz and Pavon in Peru and Chile). Syn. *Assonia*, *Astrapæa*, *Sterculiaceæ*. Shrubs or small trees of continental Afr., Madagascar and Seychelles, sometimes plan. in Afr. and Calif.: lvs. often cordate, palmately nerved, frequently lobed: fls. rosy or white, numerous, in loose axillary or terminal cymes, in umbels, or crowded into dense heads, often very showy; calyx 5-parted, persistent; petals 5; stamens 15–20, 5 sterile, the remainder shorter, united into a tube or cup; ovary 2–5-celled; stigmas 5: fr. a loculicidal caps.—Probably 100 species, many new kinds having been made known recently with the opening of Trop. Afr. The dombeyas are yet little known in this country, although some of them promise well for lawn and park planting far south.

*natalensis*, Sond. Distinguished by its cordate, acute lvs. and the narrowly awl-shaped lfts. of the involucre: lvs. long, petioled, somewhat angular, toothed, with minute stellate pubescence, 5–7-ribbed: umbels 4–8-fl. Natal.—Cult. in S. Fla. and North under glass. Very rapid-growing, foliage poplar-like: fls. pure white, large, sweet-scented; a very good winter-blooming plant in S. Calif.

*spectabilis*, Bojer. Small tree: lvs. cordate, orbicular or oblong, acute, undulate, 5–9-nerved, rough above and rusty or whitish pubescent beneath, the petioles downy: fls.  $\frac{3}{4}$  in. across, white, in many-fl. much-branched axillary and terminal cymes; sepals lanceolate, shorter than corolla; petals roundish; stamens united only at base. E. Trop. Afr.—A plant under this name is catalogued in this country as “a tall shrub with straw-colored and pink fls.”

*acutángula*, Cav. (*Astrapæa tilix-folia*, Sweet). Low tree or shrub, with lvs. crowded at ends of branches: lvs. thin, round-cordate, nearly glabrous, palmately 3–5-lobed: fls. in 2-parted cymes; bracteoles large, ovate, falling; sepals  $\frac{1}{3}$  in. or less long, reflexing; petals white or reddish,  $\frac{1}{2}$  in. long, oblique-obovate; stamens 18, being exceeded in length by the staminodia; ovary densely tomentose, and styles free at top only. Mauritius and Bourbon. B.M. 2905 (form with entire lvs.).



1342. *Dolichos Lablab* (form *giganteus*). (×½)

*punctata*, Cav. Tree, the young parts hairy: lvs. smooth and firm, orbicular and deeply cordate, acute, 3–4 in. long, obscurely crenate: fls. 10–20 in a simple umbel that has a peduncle 2–3 times the length of the petiole; sepals linear-lanceolate, reflexed; petals rather longer than sepals, obdeltoide; ovary tomentose. Mauritius and Bourbon. Intro. in S. Calif.

*nairobensis*, Engler. Shrub or tree with terete branches that become glabrous or nearly so: lvs. ovate-cordate, acuminate, somewhat 3-lobed, irregularly crenate, 7-nerved, hairy, and tomentose beneath: fls. on long hispid pedicels in an umbel; bracteoles ovate-lanceolate; sepals lanceolate, becoming reflexed, tomentose outside; petals oblique and obtuse, scarcely

exceeding petals; staminodia narrowly spatulate; ovary tomentose. Nairobi.

**Wallichii**, Benth. & Hook. (*Astrapæa Wallichii*, Lindl.). Tree, to 30 ft.: lvs. large, velvety, cordate, angularly lobed, with leafy stipules: fls. scarlet (pink?), in drooping umbels, the peduncles long and hairy. Madagascar.—A very showy plant when in bloom.

*D. Burgessii*, Gerrard. Lvs. pubescent, cordate, but with 2 deep, wide cuts, and 2 shallow ones besides the basal one: fls. numerous, large, white, rosy at center and along veins; petals rounded. S. Afr. B.M. 5487.—*D. calantha*, Schum. Shrub, 10-12 ft.: lvs. large (1 ft. across), 3-5-lobed, coarsely toothed, cordate at base, pubescent above and tomentose beneath, with long petioles: fls. rose-colored, 1½ in. across. British Cent. Afr. B.M. 8424.—*D. Cayeuxii*, Hort., is a hybrid of *D. Mastersii* and *D. Wallichii*: fls. beautiful pink in pendulous, many-fl. umbels: lvs. cordate, acute, dentate, with long petioles.—*D. Côtia*, Baill. Tall tree: lvs. cordate or somewhat 3-lobed, 6 in. long and nearly as broad, toothed or crenulate, pubescent beneath: fls. lilac-rose, 2½ in. across. Madagascar. R.H. 1911:84.—*D. Davaei*, Hort., is a hybrid of *D. spectabilis* and *D. natalensis*: fls. rose-colored; also a white-fl. form (var. alba). R.H. 1912, p. 178-9.—*D. Mastersii*, Hook. Shrub, 4-5 ft. high: lvs. velvety, heart-shaped, serrate: fls. fragrant, white, with thinner veins of rose than in *D. Burgessii*; petals acute. Trop. Afr. B.M. 5639.—*D. viburniflora*, Bojer, has very numerous white fls. with narrower petals than any here described: lvs. cordate, 3-lobed, the cuts not so wide as in *D. Burgessii*. Comoro. B.M. 5458.

L. H. B.†

**DÓNDIA**: *Hacquetia*.

**DOÛDIA** (after Samuel Doody, London apothecary). *Polypodiaceæ*. Greenhouse ferns.

Sori curved, placed in one or more rows between the midribs and the margins of the pinnæ: lvs. rigid. A genus of diminutive ferns related to Woodwardia.—Species 4 or 5. Ceylon to New Zealand.

All doodias, except *D. blechnoides*, are of dwarf habit, and are useful for fern-cases and for edgings of window boxes. Cool and intermediate temperatures are best. They are excellent for forming an undergrowth in coolhouses, as they seldom are infested with insects, and endure fumigation. Schneider recommends three parts of peat and one of silver sand. Loam does not help, but a little chopped sphagnum does. They are very sensitive to stagnant water, and do not like full exposure to sunlight. Always propagate by spores, but division is possible.

A. *Lvs. pinnatifid.*

**áspera**, R. Br. Lvs. 6-18 in. long, 2-4 in. wide, pinnatifid, narrowed gradually below; sori in 1 or 2 rows. Temp. Austral.—Crested varieties occur in cult.

AA. *Lvs. pinnate in the lower half.*

**mèdia**, R. Br. Lvs. 12-18 in. long, with pinnæ 1-2 in. long, the lower one gradually smaller. Austral. and New Zealand.—*D. Kunthiana*, Gaud., from the Hawaiian Isls. has close median pinnæ. *D. superba*, Hort., is a larger garden form.

**caudata**, R. Br. Lvs. 6-12 in. long, with pinnæ about an inch long, the spore-bearing ones shorter; apex often terminating in a long point. Austral. and New Zealand.

**blechnoides**, Cunn. Lvs. 18 in. long; lf.-blades 15 in. long, 6 in. broad, broadest at the middle, the lowest pinnæ considerably narrowed; margins serrate: sori in an irregular row near midrib. New S. Wales.

L. M. UNDERWOOD.

R. C. BENEDICT.†

**DORÈMA** (*dorema*, a gift, an allusion to the gift of gum ammoniac). *Umbelliferae*. About 4 odd large perennial herbs of S. W. Asia, yielding gum-resins, likely to be met with in collections of economic plants. Usually glaucous, with pinnately decomposed lvs., and small white or yellow fls. in close woolly umbels: calyx-teeth wanting or nearly so; petals ovate: fr. ovate, plano-compressed. *D. Ammoniacum*, D. Don, an erect fleshy-stemmed herb to 7 ft., with a few lvs. near the base and bracts above, yields gum-ammoniac, a medicinal product. This resin exudes on the sting of insects, occurring in yellowish brown "tears" or drops;

it has a balsamic odor and bitter unpleasant taste. The plant is native in Persia and Afghanistan. Other species yield similar exudation.

**DORONICUM** (Latinized Arabic name). *Compósitæ*. LEOPARD'S BANE. Hardy herbaceous plants, 1-2 feet high, with yellow many-flowered heads.

Stems little branched or not at all: lvs. alternate, radical ones long-stalked, st.-lvs. distant, often clasping the st.: heads mostly one on a st. and 2-3 in. across, borne high above the basal crown of foliage, from April to June.—From 20-30 species, natives of Eu. and Temp. Asia. The genus is allied to *Arnica* and distinguished by the alternate lvs. and by the style.

The plants are of easy culture in rich loam except *D. cordifolium*, which is an alpine species. The flowers are numerous and good for cutting. *Doronicums* have been strongly recommended for forcing.

A. *Root-lvs. not notched at the base, ovate.*

**plantagineum**, Linn. Glabrous, but woolly at the neck, with long, silky hairs: root-lvs. ovate or oval, wavy-toothed; st.-lvs. nearly entire, the lower ones narrowed into a petiole and not eared, the upper ones sessile, oblong, acuminate: rhizome tuberous, roundish, or creeping obliquely: stalk of the root-lvs. about 3 in. long: typically about 2 ft. high. Sandy woods of Eu. G.C. III. 17:229. J.H. III. 55:109. Gn. 60:151. Var. **excelsum**, Hort. (*D. excelsum*, Hort. *D. "Harpur Crew,"* Hort.), is more robust, grows about 5 ft. high and is probably more cult. than any other kind of *doronicum*. Fls. sometimes 4 in. across. Gn. 47, p. 269; 28:512; 38:437. G.C. II. 20:297. G. 19:441; 27:225. Gn. W. 24:221.

**Clusii**, Tausch. (*Arnica Clusii*, All.) Lvs. ovate or oblong; st.-lvs. half clasping, with distant teeth or many small ones. One subvariety has long, silky hairs on its lvs., while another has none. Swiss and Austrian Alps.—"Soft, downy foliage," J. W. Manning. "Grows 2 ft. high," Woolson. "Larger and later fls. than *D. caucasicum*," Ellwanger and Barry.

AA. *Root-lvs. notched at the base, heart-shaped.*

B. *Root tuberous.*

**Pardaliánches**, Linn. Hairy: lvs. toothed; lower st.-lvs. eared at the base of the stalk, subovate, upper ones spatulate-cordate, highest ones cordate-clasping, acute. Woods of lower mountains of Eu. G. 22:499.—While all species are typically 1-fl., any of them may have now and then more than 1 fl. on a st., and this species particularly may have 1-5 fls.

BB. *Root not tuberous.*

**caucasicum**, Bieb. Glabrous except as noted above: lvs. crenate-dentate, lower st.-lvs. eared at the base of the stalk, the blade subcordate, highest ones cordate to half-clasping; lvs. near the infl. linear-lanceolate. Shady woods of Caucasus, Sicily, etc. B.M. 3143. Gn. 28 p. 512., which shows sts. with 1 fl. and 1 lf.—Fls. 2 in. across.

**cordifolium**, Sternb. (*D. Columnæ*, Tenore). Glabrous, the st. very fibrous toward the base, scarcely 5 in. tall: radical lvs. cordate-kidney-shaped, the upper lvs. st.-clasping: heads solitary on the sts., the small lvs. near it ovate-lanceolate, acuminate. An alpine species from S. E. Eu. and adjacent Asia.

**austriacum**, Jacq. A trifle hairy: lvs. minutely toothed, lower st.-lvs. spatulate-ovate, abruptly narrowed at the base, half-clasping, highest ones cordate-clasping, lanceolate. Subalpine woods, Eu.

*D. draytonense*, Hort., is a list name, not referable to any known species. It seems not to occur in horticultural or botanical literature.—*D. magnificum*, Hort., described as a "very attractive perennial with large yellow fls. somewhat like a single sunflower," is also doubtful. It may be *D. plantagineum* var. *excelsum*.

WILHELM MILLER.  
N. TAYLOR.†



**DORSTÈNIA** (Theodor Dorsten, professor of medicine at Marburg, died 1539). *Moraceæ*. About 50 tropical herbs or small shrubs, remarkable for the dilated receptacle in which the unisexual fls. are borne, being imbedded in the surface. Both staminate and pistillate fls. are without perianth; stamens 1-4; ovary 1-loculed; stigma 2-lobed. Dorstenias are easily grown in warm shady glasshouses. The plants are not in the American trade, but they are often grown in botanical establishments to illustrate morphology. The fig is a hollow receptacle formed of the axis of the fl.-cluster; the dorstenia bears a flattened or cup-like receptacle, and is an intermediate stage between the fig and other plants. One of the common species is *D. Contrajerva*, Linn. (Fig. 1343), which is native to Trop. Amer.: fls. on a scape; lvs. round-cordate, palmately lobed or parted; the segms. ovate or oblong and more or less toothed: receptacle irregularly rectangular, peltate: rhizome cylindric, nodose. Mex., W. Indies, Venezuela, Colombia.

L. H. B.

**DORYÁLIS:** *Aberia*.

**DORYÁNTHE** (Greek, *spear-flower*; the flowering stem 8 to 25 feet high, crowned by a spike of flowers 3 feet high). *Amoryllidaceæ*. Great desert plants from Australia, with 100 or more leaves 6 feet long when full grown, being impressive for large conservatories, or for open ground in the South, where they will stand slight frost.

The representative in Austral. of the American *Furcraea* and *Agave*: lvs. in a dense basal rosette, those on the st. much reduced: fls. large, bright red (often replaced by bulblets), in a large thyrselike or paniced infl.; perianth with little or no tube, the segms. long and falcate; stamens 6, attached at base of perianth, the filaments filiform: fr. a turbinate caps., 3-valved.—Three or 4 species. Little known under glass, as they require too much room. A plant of *D. Palmeri* remained at Kew 16 years before flowering. Plants of doryanthes are propagated by suckers, which are produced only after flowering. The process is very slow. The young plants must be repotted for several years until they have attained a large size. They are said to do best in a compost of loam and leaf-mold in equal parts.

**excelsa**, Correa. **SPEAR-LILY**. Lvs. sword-shaped, not ribbed, smooth, entire, with a very narrow cartilaginous margin, lower ones recurved, others erect: scape clothed with lanceolate lvs., which sheath the st. at their base; fls. in a globular head, deep crimson or maroon inside and out (there is a white-fl. form). B.M. 1685. R.H. 1865, pp. 466, 471; 1891, p. 548. G.C. II. 11:339. Gn.W. 16:681. G.W. 9, p. 521. H.F. II. 7:136.

**Pálmeri**, W. Hill. Even more gigantic than *D. excelsa*: lvs. longer and broader, slightly ribbed and a longer brown point: fls. in a thyrsoid panicle, bright scarlet outside, whitish within. B.M. 6665. F.S. 20:2097. R.H. 1891:548. G.C. II. 17:409. G.W. 12, p. 222. New shoots are said to be produced at the base, which bloom in one or more years.

*D. Guilfoylei*, F. M. Bailey, **QUEENSLAND-LILY**, is a large and fine species from N. Queensland, perhaps a form of *D. Palmeri*:

lvs. 9 ft. long, over 8 in. wide: fls. rich crimson, 4 in. long. It yields a good fiber. Gn. 44, p. 69. G.C. III. 45:383.

WILHELM MILLER.

L. H. B.†

**DORYÓPTERIS** (Greek, *lance-fern*). *Polypodiaceæ*. Small pot ferns with oddly pretty leaves.

Leaves with continuous marginal sori and copiously anastomosing veins.—About 20 species, in warm countries. Sometimes joined to *Pteris*, which see for culture. Not to be confused with *Dryopteris*.

**palmata**, J. Smith. Lvs. 4-9 in. each way, with 5 or more triangular lobes or the fertile still more divided; ribs black. W. Indies to Brazil.—Sometimes considered to be a variety of *D. pedata*, Fée.

**nóbilis**, J. Smith. Larger: lvs. sometimes 1 ft. long, pedately bipinnatifid; ribs chestnut. S. Brazil.

*D. decipiens*, with lvs. resembling a geranium lf., 3-6 in. each way, is sometimes cult., as is *D. decora*, with more divided lvs. Both are natives of the Hawaiian Isls.

L. M. UNDERWOOD.

**DOSSINIA** (E. P. Dossin, Belgian botanist, 1777-1852). *Orchidaceæ*. One species of terrestrial orchids, allied to *Anæctochilus*, but lacking the bearded fringe on the lower part of the labellum. This species may possibly be cult. by a few amateurs who are skilled in the cult. of dwarf greenhouse foliage plants.

*D. marmorata*, C. Morr. (*Anæctochilus Lowei*, Hort.). Lvs. golden-veined or marbled, 4-5 in. long, elliptic: scape pubescent, 10 in. high; spike 5 in. long, with many white, pubescent fls. Java. F.S. 4:370.—There is a stronger-growing var., with foliage better colored.

**DOUGLÁSIA** (after David Douglas, the Scotch botanist, who explored California, Oregon and British Columbia in 1823 and 1829). Incl. *Arètia*. *Primulaceæ*. Low tufted perennial herbs, one of which is used in alpine gardening.

The genus is closely allied to *Androsace* and *Primula*, but in those two genera the lvs. come from the root, while *Douglasia* has branches, though very short ones, which are densely clothed with lvs. *Douglasia* has a corolla-tube equaling or exceeding the calyx, somewhat inflated toward the top, with 5 scales or crests beneath the sinuses; calyx 5-lobed, persistent; stamens 5, included; ovary 5-ovuled: fr. a turbinate 1- or 2-seeded caps.—Seven or 8 species in mountains of Eu., and W. N. Amer., considered to be 6 by Pax & Knuth in Engler's

*Pflanzenreich*, hft. 22 (1905). The fls. are yellow in *D. Vitaliana*, which is the cult. species, but otherwise rose-purple. The plants require the treatment accorded to other alpine; see *Alpine Plants*, Vol. I.

**Vitaliana**, Hook. f. (*Primula Vitaliana*, Linn. *Androsace Vitaliana*, Reichb. *Arètia Vitaliana*, Lodd. *Gregoria Vitaliana*, Duby). Height 2 in.: sts. numerous, prostrate, somewhat woody: branches denuded of lvs. at the base, but at the tips clothed with overlapping linear entire pilose lvs.: fls. nearly stalkless, solitary or 2 or 3, yellow, rather large; corolla-tube 2 or 3 times longer than the calyx, the lobes ovate-lanceolate, obtuse. Alps, Pyrenees. L.B.C. 2:166.

Some of the American douglasias, all with rose or purple fls. are sometimes listed by foreign specialists in alpine.—*D. arctica*, Hook. Glabrous: lvs. ciliate with short and simple hairs, apex obtuse: fl. 1 on a scape; corolla-tube about equaling calyx: plant loosely caespitose. High arctic Amer.—*D. dentata*, Wats. Like *D. nivalis* and by some considered to be a form of it, but coarser and



1343. *Dorstenia Contrajerva*. (×¼)

with broader often spatulate lvs. which are entire and sparingly denticulate. Cascade Mts., Wash.—*D. laevigata*, Gray. Mature lvs. coriaceous, the margin smooth or rarely minutely ciliate, blade oblong or oblong-lanceolate and obtuse: fls. 2-5; corolla-tube almost twice as long as calyx. Ore., Wash.—*D. montana*, Gray. Mature lvs. prominently ciliate on the margins, destitute of forked hairs, the blade very small and linear or lanceolate: fls. single, the corolla-tube less than the calyx or just equaling it. Mts., Wyo., Mont. Runs into several forms, 2 of which have been described as species (*D. biflora*, Nelson and *D. or Androsacea uniflora*).—*D. nivalis*, Lindl. Mature lvs. covered with minute 2-3-forked pairs, margins not ciliate, blade linear and usually entire: fls. 3-7, the corolla-tube hardly exceeding the calyx. Columbia River.

L. H. B.†

DOUGLAS SPRUCE: *Pseudotsuga Douglasii*.

**DOWNÍNGIA** (after Andrew Jackson Downing, famous American pomologist and landscape gardener). *Campanulacæ*; or *Lobeliacæ* when this family is kept distinct. Low herbs, much branched, sometimes grown as garden annuals; flowers blue with white or yellow markings or blotches.

Leaves alternate, entire, passing above into bracts: fls. in the axils of the lvs. or upper sessile bracts; corolla 2-lipped, the upper lobes much narrower than the 3 lower ones; tube of stamens free from the corolla: seeds numerous, small, oblong to spindle-shaped, in a very long linear caps. that bears at its apex the leafy linear calyx-lobes and is dehiscent lengthwise by 1-3 valves or fissures.—Six to 8 species, mostly in Calif. (1 in Chile), usually in moist places and margins of spring pools, sometimes in salty marshes or in mountains. Rafinesque's name *Bolelia* (anagram of *Lobelia*) is older, but is discarded by the list of "nomina conservanda" of the the Vienna code. The plants are little known in American gardens. They are easily grown annuals, and are said to make interesting pot-plants. The species are often not well distinguished, and some of them may be color forms. The plants grow about 6 in. high, and have been recommended for edgings.

**pulchélla**, Torr. (*Clintònia pulchélla*, Lindl.). Erect or ascending, 2-10 in., usually simple: lvs. oblong-ovate to linear,  $\frac{1}{2}$  in. long, obtuse: fls. deep blue, the center of lower lip yellow with a white border, and marked with violet and yellow in throat; lower lip with 3 roundish apiculate lobes; upper lip deeply 2-cleft with spreading oblong-lanceolate segms. May, June, in Calif. B.R. 1909. R.H. 1861: 171. G.W. 15, p. 213. R.H. 1895, p. 19, shows its straggling habit as a pot-plant. Many of the branches fall below the top of the pot.

**élegans**, Torr. (*C. elegans*, Douglas). St. usually simple, 4-7 in.: lvs. ovate to lanceolate: the broad lip moderately 3-lobed; the 2 divisions of the smaller lip lanceolate, parallel; lower lip sky-blue with darker veinlets and the main part white with 2 green or yellowish spots; the throat often purple-spotted and yellow-lined. May. Calif. B.R. 1241.

L. H. B.†

DOXÁNTHA CAPREOLÁTA, Miers: *Bignonia capreolata*.

**DRÁBA** (Greek name for a cress). *Cruciferae*. **WHITLOW-GRASS**. One of the important groups of spring-flowering plants for the alpine garden.

A large and widely scattered genus of tufted hardy annual or perennial herbs, with stellate hairs: lvs. often in a rosette, mostly uncut: scapes or sts. leafy or not; racemes short or long; fls. without bracts, small, white, yellow, rosy or purple; stamens 6; fr. an oval, orbicular or linear flat pod with several to many marginless seeds in 2 rows in each cell; cotyledons accumbent.—Some 150 species in temperate and arctic regions of the world, many of them in mountains. Many species occur in the lists of alpine gardeners. They are more or less alyssum-like.

Drabas are very pretty dwarf compact alpine plants, with small but numerous flowers admirably adapted for the rockery or front part of a sunny border. They require a sunny position and an open soil. It is important that they be well matured by the autumn sun. The

plant forms a dense little rosette of lvs., and has a neat appearance at all times. In spring, drabas are thickly covered with their little flowers and when planted in masses are decidedly effective. Propagation is chiefly by division; also by seed, which may be sown in the fall if desired. (J. B. Keller.)

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A. Fls. rose or purple.

1. **pyrenaica**, Linn. **ROCK BEAUTY**. Height 2-3 in.: lvs. wedge-shaped, 3-lobed at apex: fls. white at first, changing to rosy pink. May. Mts., S. Eu. B.M. 713.—Said to be easily prop. by cuttings. This is *Petrocallis pyrenaica*, R. Br., under which name it will be found again.

2. **violacea**, DC. St. woody at base, branched: 6-12 in.: lvs. obovate-oblong, obtuse, equally woolly

1344. *Draba Dedeana*.

on both sides: scapes leafy; petals obovate, dark purple. Andes of Ecuador at elevations of 13,000-15,000 ft. B.M. 5650.

AA. Fls. white (sometimes yellowish in No. 6).

B. Plants biennial or annual.

3. **cinerea**, Adams. St. nearly simple: lvs. oblong-linear, stellate pubescent: petals twice longer than calyx: pods oblong, pubescent, shorter than the pedicel. Early spring. Siberia.

BB. Plants perennial.

c. Lvs. rigid.

4. **Mawii**, Hook. Forming low, densely tufted, bright green patches: st. much branched, densely clothed with spreading, rosulate lvs.: lvs. linear-oblong, obtuse, bristly, with a prominent midrib below: scape very short, woolly, 2-4-fl., very short-pedicelled; petals thrice as large as the sepals, obcordate, white: pods ellipsoid, compressed. Spain. B.M. 6186.

5. **gigas**, Stur (properly *Árabis Carduchorum*, Boiss.). Lvs. rosulate and rigid, linear and obtusish, ciliate: scape 1 in. or less, the fruiting raceme short and contracted; fls. white: fr. glabrous, elliptic-linear, the style very short, the valves 1-nerved and keeled. Armenia.

cc. Lvs. not rigid.

6. **fladnizensis**, Wulf. (*D. androsacea*, Willd. *D. Wahlenbergii*, Hartm. *D. lappónica*, Willd.). Plant 2-3 in., much branched at base: lvs. rather loosely rosulate, oblong-linear to lanceolate, ciliate, usually somewhat villous or stellate-pubescent, less than  $\frac{1}{2}$  in. long: scape usually glabrous or only slightly villous; fls. sometimes yellowish: pods elliptic-oblong to ovate-lanceolate, not hairy. Arctic regions and Cent. Eu.







XXXVII. *Dracæna Goldieana*, a "foliage plant" from tropical Africa.



## AAA. Fls. yellow.

## B. Lvs. rigid, keeled, ciliate.

7. *aizoides*, Linn. Cespitose, 2-3 in.: lvs. linear and acutish; scape glabrous, the raceme elongating in fr.; petals yellow, twice exceeding the calyx; anthers about equaling the petals: fr. oblong-elliptic, glabrous or setulose; style as long as the ptd is wide. March. Cent. and S. Eu.—B.M. 170. Variable.

8. *Aizodon*, Wahl. About 3 in. high: lvs. broad-lanceolate, strongly ciliate: scape hairy, with sulfur-yellow fls., the filaments being paler or greenish. April. Eu.—Diverse in habit.

9. *Dedeana*, Boiss. & Reut. Fig. 1344. Densely cespitose: scape and pedicels pubescent: lvs. oblong-linear, attenuate at base: petals broadly obcordate-cuneate; stamens scarcely longer than calyx: fr. ellipsoid or ovoid. Spain.—In habit like *D. aizoides*; fls. paler yellow.

10. *cuspidata*, Bieb. Cespitose: lvs. linear-acute: scape villous or woolly, the fruiting raceme short; petals yellow, twice exceeding the calyx; anthers equaling the petals: fr. lanceolate and somewhat turgid, setulose. Asia Minor.—Aspect of *D. aizoides*, but scape shorter and pod somewhat inflated.

11. *olympica*, Sibth. (*D. bruniaefolia*, Stev.). Densely and broadly cespitose, about 4 in. high: lvs. narrowly linear, somewhat keeled: petals deep golden, twice as long as the calyx and stamens: fr. small, turgid-compressed; style very short. June. Greece, Orient.—Runs into many forms.

12. *rigida*, Willd. (*D. bryoides*, DC.). Powdered: lvs. minute, and very short, oblong-linear and keeled, obtusish, the margin more or less ciliate: scape glabrous, bearing a rather long raceme; petals deep golden yellow, much exceeding calyx: fr. elliptic or nearly linear. Caucasus, Armenia.

13. *imbricata*, Meyer. Very dwarf, much powdered: lvs. very small, oblong, obtuse, 3-sided, ciliate, densely imbricate: raceme nearly sessile, glabrous, 3-5-fld.; petals deep golden, twice exceeding the calyx; filaments exceeding calyx: fr. ovate-orbicular, glabrous, nearly plane; style very short. Caucasus.—An excellent little rock alpine.

## BB. Lvs. not rigid or keeled.

14. *hispida*, Willd. (*D. tridentata*, DC.). About 3 in. high: lvs. obovate, narrowed into a long petiole, obscurely 1-3-toothed at the apex, somewhat bristly: scape not hairy; petals yellow, cuneate, retuse, twice longer than calyx: fr. oblong-linear, not hairy. Russia, Caucasus.

15. *alpina*, Linn. Densely cespitose, with a much-branched caudex: lvs. lanceolate or oblong, obtuse or acute, pubescent: flat: scape more or less hairy: pods oblong to ovate; style very short. April. Greenland, N. Eu., Asia.

16. *aurea*, Vahl. Doubtfully perennial or biennial, pubescent throughout with stellate hairs, the caudex simple or little branched: lvs. oblanceolate to lanceolate, to 2 in., entire or remotely serrate: petals bright yellow to almost white: pods lanceolate to linear, acute, often twisted. New Mex., and Ariz. in mountains and north. B.M. 2934.

*D. borealis*, DC. Fls. white: stellate-pubescent, more or less cespitose, st. 2-12 in., simple or sparingly branched: lvs. ovate to oblong-ovate, flat,  $\frac{1}{2}$  in. or less: style short and stout. Brit. Col. to the high N., Japan.—*D. elata*, Hook. f. Fls. yellow: tall biennial, the st. about 1 ft. high from the previous year's rosette of spatulate lvs. Himalayas.—*D. frigida*, Saut. Fls. white: scape about 2-lvd., loosely pubescent: lvs. lanceolate or elliptic, stellate-tomentose: fr. oblong, glabrous, the style very short or almost none. Alps.—*D. Gilliesii*, Hook. & Arn. Fls. white,  $\frac{1}{2}$  in. or less across: tufted perennial, 1-10 in., variable: lvs. ovate-oblong, coarsely toothed: fls. few to many in an erect raceme. Chile. B.M. 7913. Gn. 63, p. 243.—*D. grandiflora*, Hook. & Arn. Fls. white, in racemes: plant small and tufted, with tomentose lvs. oblong-spatulate. High Andes. Gn. 63, p. 242. Showy; hardy in England.—*D. Salamoni*,

offered abroad, is described as "very close, compact tufts, white fls."—*D. verna*, Linn. WHITLOW-GRASS. A winter annual, widely naturalized from Eu., with white fls., bifid petals, oblong-obovate to oblanceolate rosette lvs., slender scapes 2-6 in., and glabrous round-oval to oblong pods.

L. H. B.†

DRACÆNA (*femalé dragon*; the dried juice supposed to resemble dragon's blood). *Liliacæ*. DRACENA. Ornamental hothouse or stove plants, frequently with variegated leaves.

Often arborescent, with sword-shaped or broad lvs. mostly crowded at the summit of the st.: fls. clustered in panicles or heads, greenish-white or yellowish; perianth salver-form or campanulate; lobes 6, spreading; stamens 6: fr. a 3-celled berry. Differs from *Cordyline* in having larger fls., and solitary instead of many ovules in each cell of the ovary.—About 40 tropical woody plants, a few being in cult. See Baker, Journ. Linn. Soc., vol. 14, for a monograph of the genus.

*Dracena Draco*, of the Canaries, is the dragon tree. It reaches a height of 30 to 60 feet, branching when of great age. The dragon tree of Teneriffe, famous for centuries, was 70 feet high, and one of the oldest of known trees. See *Cordyline* for other names not found in this article; also for culture.

The following key to the cultivated species of both *Dracena* and *Cordyline* is based upon the lvs.

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## KEY TO THE SPECIES.

- A. Lvs. long and sword-shaped, sessile.
  - B. The lvs. glaucous beneath, 2-5 in. wide.....C. indivisa
- BB. The lvs. with both faces similar, narrower.
  - C. Of mature plants narrow (6-15 lines broad).....C. stricta
  - CC. Of mature plants broader (1-2 in.).
    - D. Margins green.
      - E. Color of lvs. glaucous-green, costate,  $1\frac{1}{2}$ -2 ft. by 15-21 lines.....D. Draco
      - EE. Color of lvs. green, costate, undulate below, 2-3½ ft. by 1½-2 in.....D. umbraculifera
      - EEE. Color of lvs. green, costa obscure, 3-4 ft. by 18-18 lines.....C. australis
    - DD. Margins white-pellucid.....D. Hookeriana
- AA. Lvs. oblanceolate, broadly petioled or sessile.
  - B. Size of lvs. 3-4 in. by 1½-2 in., opposite or whorled.....D. Godseffiana
- BB. Size of lvs. 12-15 in. by 18-21 lines, alternate.....C. rubra
- BBB. Size of lvs. 1½-3 ft. by 2-4 in., alternate.
  - C. Pedicels 1-1½ lines long; perianth 5-7 lines long.....D. fragrans
  - CC. Pedicels 1½-2 lines long; perianth 7-8 lines long.....D. deremensis
- AAA. Lvs. ovate, lanceolate, or elliptical; petioles narrow.
  - B. The lvs. 4-8 in. by 2-2½ in., oblong-falcate, green.....C. Haageana
- BB. The lvs. 7-8 in. by 4-5 in., oblong, white-spotted.....D. Goldieana
- BBB. The lvs. 7-10 in. by ½-1½ in., lanceolate, white-margined.....D. Sanderiana
- BBBB. The lvs. 10-18 in. by 1-3½ in., elliptical.....C. terminalis

1. *Draco*, Linn. DRAGON-TREE. Arborescent (60 ft. high), branched: lvs. very numerous, crowded, sword-shaped, erect or the outer recurved ( $1\frac{1}{2}$ -2 ft. x  $1\frac{1}{4}$ -1¾ in.), scarcely narrowed below, long-attenuate at the apex, glaucous-green: pedicels 3-6 lines long; bracts minute, lanceolate: perianth 4 lines long, green-

ish; filaments flat; berries orange. Canary Is. B.M. 4571. R.H. 1869, p. 416; 1880, p. 196. G.C. II. 14:749. G.W. 12:233. J.F. 2, pl. 124.—Fine for conservatory. *D. Boerhavi*, Tenore, is a garden form, with elongated lvs., all recurved.

2. *umbraculifera*, Jacq. Arborescent (3–10 ft. high), simple; lvs. very numerous, crowded, sword-shaped (2–3½ ft. x 1½–2 in.), outer recurved, all green and shining, attenuate at the apex, scarcely narrowed toward the conspicuously undulate base, costa distinct on both faces; pedicels 4–6 lines long; bracts minute, deltoid; perianth large, 2 in. long, white, tinged with red; filaments filiform. Mauritius. L.B.C. 3:289.

3. *Hookeriāna*, Koch (*C. Rumphii*, Hook. *D. Rumphii*, Regel). Trunk 3–6 ft. high, sometimes branched; lvs. numerous, densely clustered, sword-shaped (2–2½ ft. x 1½–2 in.), outer reflexed, all long-attenuate at the apex, scarcely narrowed below, margin white-pellucid, lower face concave, indistinctly costate beneath; bracts 1½–3 in. long, white; pedicels 3–4 lines long; perianth greenish, 12–15 lines long; filaments filiform; berries orange. Cape of Good Hope. *D. latifolia*, Regel, is a horticultural variety, with lvs. 3–3½ in. wide. G.C. III. 20:305 (var. *latifolia*). B.M. 4279 (as *Cordylina Rumphii*.) Var. *variegata*, Hort. Variegated foliage.

4. *frāgrans*, Ker-Gawl. (*Āletris frāgrans*, Linn. *Sanseviēria frāgrans*, Jacq.). Arborescent (20 ft. high or more), sometimes branched; lvs. (1½–3 ft. x 2½–4 in.) sessile, oblanceolate, lax and spreading or recurved, flaccid, green and shining, acute, indistinctly costate:



1345. *Dracena fragrans* var. *Lindenii*.

bracts minute, scarious, deltoid; pedicels 1–1½ lines long; fls. glomerate; perianth 6–8 lines long, yellow; berry orange-red. Guinea. B.M. 1081. A.G. 18:389. F.R. 4:189. Gn. M. 8:270. G.W. 12:232. G. 2:286.—Much used for greenhouse and table decoration. *D. Knérkii*, Hort. Form with glossy light green, less pendulous lvs. *D. Rothiāna*, Hort. A garden form. I.H. 43, p. 97. R.H. 1877, p. 68. *D. Victōria*, Hort. A garden form. Gn. 63, p. 77. Var. *Lindenii*, Hort. (*D. Lindenii*, Hort.). Fig. 1345. Lvs. recurved, traversed from base to apex by creamy white bands. Very decorative. I.H. 27:384. F.R. 4:191. G.W. 14:321. A.F. 35:1241. G.C. III. 30:176. Var. *Massangeāna*, Hort. (*D. Massangeāna*, Hort.). A broad yellow stripe along the center of the lf. throughout its entire length. F.R. 4:193.

5. *deremēnsis*, Engler. Plant 9–15 ft. high, branched; lvs. 1½ ft. long, 2 in. wide, narrowed into a broad petiole-like base; infl. large; fls. on pedicels 1½–2 lines long; perianth 7–8 lines long, with tube 4 lines long, dark red without, white within, unpleasant scented. Afr. G.C. III. 50:23. G.M. 54:523. G.W. 11:505 (all as var. *Warneckii*).

6. *Goldiēana*, Hort. Plate XXXVII. Trunk simple, slender; lvs. distant, spreading, thick-oblong (7–8 in. x 4–5 in.), cuspidately pointed, base broadly rounded or cordate, glossy green, conspicuously white-spotted and banded, young lvs. often tinged with red; petioles erect (2–3 in. long), deeply grooved; fls. unknown. W. Trop. Afr. B.M. 6630. R.H. 1878, p. 15. I.H. 25:300; 42, p. 257. G.C. II. 17:49. G.Z. 22:1. G. 2:271; 14:239. G.W. 12:235.—A fine foliage plant.

7. *Sanderiāna*, Hort. (*D. thaloides* var. *variegata*, Hort.?). Slender; lvs. distant, alternate, spreading or recurved (7–10 x ½–1½ in.), narrowly lanceolate, acuminate, on rather broad petioles (1–3 in. long), glossy-green, broadly margined with white. Congo. A.F. 8:1281; 11:235. I.H. 40:175. G.C. III. 13:445. G.W. 14:322. Gn.W. 14:617. G. 23:533. G.L. 16:235.—Intro. in 1893.

8. *Godseffiāna*, Hort. Woody, but very slender, rather diffuse; lvs. at many nodes small, erect, scale-like and lanceolate, the others opposite or in whorls of 3, oblong or obovate, spreading, cuspidate, sessile (3–4 x 1½–2 in.), firm, green, with copious white spots; raceme short-peduncled; bracts small; fr. globular, greenish yellow or red, nearly 1 in. diam. Congo. G.C. III. 21:347. Gn. 50, p. 276; 51:298, and p. 299. A.F. 13:1340. F.E. 10, supp. 2:12. Gng. 6:294. G. 19:388.—Fine for decorative purposes.

The following are apparently not in the American trade: *D. americanā*, Donnell Smith. Twenty to 40 ft. high; lvs. linear-sword-shaped, 8–15 in. long, green; fls. white, small, in dense panicles. Allied to *D. Draco*. Cent. Amer. S.T.S. 1:207. New.—*D. arborea*, Link. Lvs. green, sword-shaped, dense, sessile. Gt. 46:1438; and p. 226. G.W. 8:260; 12:232.—*D. Brodmfieldii*, Hort. Lvs. spreading or recurved, strap-shaped, undulate, sessile, deep green bordered with broad white margins. J.H. III. 33:541. G.C. III. 20:667; 23:249; 33:249 (var.) G. 27:597. G.W. 13:4.—Botanical status obscure.—*D. concinna*, Kunth. Lvs. oblanceolate, green, purple on the margin, green-petioled.—*D. cylindrica*, Hook. Lvs. linear-lanceolate, or obovate-lanceolate, bright green, spreading. B.M. 5846.—*D. Eeckhantii*, Hort. F.R. 4:46. Gn.W. 16:697.—*D. elliptica*, Thunb. Lvs. spreading, petioled, thickish, elliptic-lanceolate, glossy, acute, longitudinally striate. B.M. 4787. G.C. II. 17:261 (var. *maculata*).—*D. ensifolia*, Hort. Amer.—*Dianella ensifolia*.—*D. kewensis*, Hort. Lvs. dark green, broadly oblong-lanceolate; petiole red, half as long as the blade. New Caledonia. New. May be a form of *C. terminalis*. G.C. III. 33:265. F.E. 15:619.—*D. marginata*, Lam. Lvs. sword-shaped, dense, spreading, green, margined and veined with red. G.W. 12:235.—*D. marmorata*, Hort. B.M. 7078.—*D. phrynoides*, Hook. Lvs. petioled, mostly oval, acuminate, coriaceous, spotted with yellowish white, pale beneath. B.M. 5352.—*D. reflexa*, Lam. Lvs. lanceolate or sword-shaped, acute, contracted into a petiole.—*D. Saposchnikovi*, Regel. Lvs. sword-shaped, crowded, green. Gt. 705.—*D. Smithii*, Baker. Lvs. large, narrowly sword-shaped, crowded, bright green. B.M. 6169.

Some trade names, the botanical status of which is in doubt, are the following: *alba-marginata*, *albanensis*, *Alexandria*, *angustifolia*, *angustata*, *argenteo-striata*, *DeSmetiana*, *edmontoniensis*, *elefantissima*, *Elzabethia*, *Frederica*, *Hendersonii*, *imperator*, *Jamesii*, *Jansesii*, *Lacourtii*, *Mayi*, *Mandana*, *Offeri*, *perelyares*, *recurva*, *Salmonia*, *Shepherdii*, *spectabilis*. *D. nova-caledonica* is probably *Cordylina neocaledonica*, Lindl., with bronze lvs.

K. M. WIEGAND.

**DRACOCÉPHALUM** (Greek, *dragon's head*, from the shape of the corolla). *Labiātæ*. Hardy herbaceous annual and perennial plants of easy culture and of minor importance.

Allied to *Nepeta*, differing in having the calyx mostly straight rather than curved and unequally toothed: mostly erect herbs, with opposite entire, toothed or deeply cut lvs., the upper ones passing into bracts; fls. in many-fld. verticils which are axillary or terminal, blue or purple or rarely white; calyx tubular, about 15-nerved; corolla, upper lip somewhat notched and arched, the lower one 3-cleft and the middle part notched or 2-cleft; stamens 4, didynamous, the 2



anther-cells divaricate.—Forty species in Eu. and Asia and very sparingly in N. Amer.

Sandy loam, moderately rich, and a rather moist, partially shaded situation will suit these plants best. In a sunny dry border they are never very showy; the flowers are of short duration, and are seldom at their best except in very moist seasons. Propagation is by division or seeds. The species described below are erect-growing.

A. *Lvs. entire, not cut in any way.*

**Ruyschiàna**, Linn. (*Ruyschiàna spicàta*, Mill.). Perennial, 2 ft.: sts. slightly pubescent: lvs. linear-lanceolate, glabrous: bracts ovate-lanceolate, entire: whorls in somewhat interrupted spikes; fls. 1 in. long, purplish blue or purple; anthers villous. Siberia. Var. **japònicum**, Hort., has white fls. shaded with blue, and is a distinct improvement. G.C. II. 12:167.—According to Vilmorin, this species has been sold as *D. altaïense* (see *D. grandiflorum*).

AA. *Lvs. deeply 3-5-cleft.*

**austriacum**, Linn., has the habit of the above, and belongs to the same subgenus *Ruyschiàna*, but the lvs. are divided and more distinctly revolute at the margin. About 1-1½ ft. high: fls. blue, 1½ in. long and more: perennial. July, Aug. Eu., Caucasus.

AAA. *Lvs. cut only at the margin, mostly crenate.*

B. *Whorls crowded together into spikes or heads.*

**grandiflorum**, Linn. (*D. altaïense*, Laxm.). Perennial, about 1 ft. high: root-lvs. long-stalked, oblong, notches at base; st.-lvs. few, short-stalked, ovate, not notched at base, the uppermost still more rounded: whorls in spikes 2-3 in. long, the lowest whorl usually at some distance: fls. 2 in. long, blue. June, July. Siberia. B.M. 1009. P.M. 13:51.

**speciosum**, Benth. Allied to *D. grandiflorum*, but st. pubescent instead of pilose above: root-lvs. more broadly heart-shaped, and all lvs. pubescent beneath instead of nearly glabrous, and wrinkled: fls. purplish to deep purple. June, July. Himalayas. B.M. 6281.

BB. *Whorls distant, in long racemes.*

**Moldávica**, Linn. (*Moldávica punctàta*, Moench). Lvs. lanceolate, incise-crenate, the floral ones narrower and pectinate: fls. in few-fl. loose clusters; corolla 2 or 3 times as long as calyx, blue or white. European annual, 1-2 ft., sparingly run wild in N. Amer. Eu., N. Asia.

**Rèprechtii**, Regel. Perennial: dwarf or compact, 1-1½ ft.: lvs. ovate-lanceolate, incised and toothed: fls. rosy purple or lilac, about 1 in. long, in axillary clusters. Turkestan. Gt. 1018.

**nùtans**, Linn. Perennial, 1 ft.: lvs. ovate-crenate, the floral ones oblong-lanceolate and more nearly entire: fls. blue. May-July. N. Asia. Mn. 4:137. B.R. 841. Var. **alpina**, Hort., is advertised.

*D. canariense*=*Cedronella triphylla*.—*D. canescens*, Linn.=*Lallemantia*.—*D. virginianum*, Linn.=*Physostegia*.

WILHELM MILLER.

L. H. B.†

**DRACONTIUM** (derived from the Greek word for dragon). *Aracæ*. Greenhouse or hothouse plants, grown more for curiosity than for beauty.

Herbs with long-petioled lvs.: petioles verrucose; blades deeply 3-parted, these again parted: spathe oblong, convolute below; spadix short-stalked, short, cylindric, free, densely many-fl.; fls. perfect, with a perianth: fr. a 2-3-celled berry, each cell 1-seeded.—About a half-dozen species in Trop. Amer. Cult. as for *Amorphophallus*.

**ásperum**, Koch (*Amorphophallus nivòsus*, Lem.). Petioles up to 9 ft. long and over 1 in. thick, roughened toward base with small warts conjoined in series, marked with large livid green and brown spots; blades

up to 3 ft. broad, 3-parted, the divisions bipinnate, the ultimate segms. oblong to lanceolate: peduncles 4 in. or more long; spathe up to 10 in. long; spadix 1½-2 in. long. Brazil. I.H. 13, p. 14; 12:424.

GEORGE V. NASH.

**DRACUNCULUS** (Latin, a little dragon). *Aracæ*. Odd tuberous plants sometimes grown under glass.

This plant has interesting dragon-fingered lvs. and a terrifying odor when in flower. Its tubers are sold by bulb dealers under the name of *Arum Dracunculus*. The monographer of this order (Engler, in DC. Mon.



1346. *Dracunculus vulgaris*.

Phan., vol. 2, 1879) puts this plant into the genus *Dracunculus* because the ovules are attached to the base of the ovary, while in *Arum* they are attached to the side. The lvs. of the true arums are always arrow-shaped, while in *Dracunculus* they are sometimes cut into finger-like lobes. There are only 2 species. The common one is an entertaining, not to say exciting, plant. It is well worth growing for the experience, though its stench is not quite so bad as that of a *heliconia*, sold as *Arum crinitum*, which makes any house unbearable in which it flowers. Nearly all arums are ill-smelling. For cult., see *Arum*.

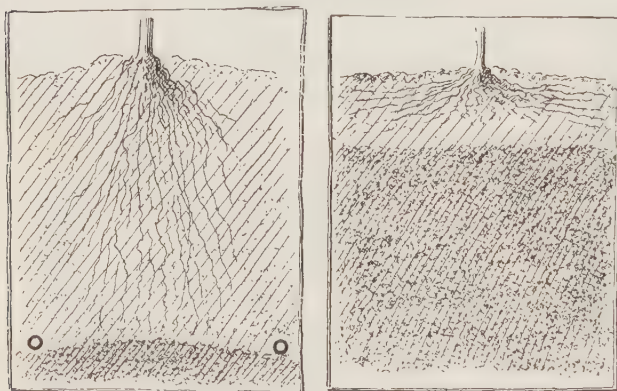
**vulgaris**, Schott. Fig. 1346. Sheath of lvs. livid, spotted; stalks green; blades with 10 fingers projecting from a bow-shaped base: tube of spathe streaked with purple except at the bottom; spathe purple all over and much darker along the wavy border. Medit. regions. G.C. III. 47:198.

WILHELM MILLER.

**DRAGON PLANTS.** The dragon arum, dragon root or green dragon, is the native *Arisæma Dracontium*. The dragon plant of Europe is *Dracunculus vulgaris*. The dragon's head is not an aroid, but a *Dracocephalum*, a genus of mints. False dragon's head is *Physostegia*. The dragon's blood of commerce is a dark red, astringent, resinous secretion of the fruits of a palm,

*Dæmonorops Draco*. Other kinds of dragon's blood are produced by *Dracæna Draco* and *Ecastophyllum monetaria* (now referred to *Dalbergia*). "Sticks," "reeds," "tears" and "lumps" of dragon's blood are known to commerce. The resin is used in coloring varnishes, dyeing horn in imitation of tortoise shell, and in the composition of tooth-powders and various tinctures. The dragon tree is *Dracæna Draco*.

**DRAINAGE.** Underground or sub-drains serve to relieve the land of free water, which is harmful to most plants if left to stagnate in the surface soil or subsoil. They serve not only to dry the land in early spring, but indirectly to warm it, for if the water is removed the sun's heat warms the soil instead of cooling it by evaporating the surplus water. Tenacious lands devoted to gardening and small-fruits are made more productive, warmer and earlier by sub-drainage. Drains promote nitrification, assist in liberating mineral plant-food and cheapen tillage. They serve not only to remove deleterious stagnant water, but they promote aëration as well, and this hastens beneficial chemical changes in the soil. Drainage promotes the vigor, healthfulness and fruitfulness of plants. Tenacious soils are made more friable by drains, thereby giving



1347. Diagrams to explain the effect of lowering the water-table by means of under-drainage. On the undrained soil, the roots do not penetrate deep; and when droughts come, the plants suffer.

easier access to plant roots, while the percolation through the soil of rainwater, which carries some plant-food, is hastened. Rain-water in the spring is warmer than the soil; in midsummer it is cooler than the soil; therefore, percolation of rain-water warms the soil in the spring and cools it in extremely hot weather. Drains serve not only to relieve land of free water, but they impart to it power to hold additional available moisture, which materially benefits plants during droughts.

Drainage is of two kinds, surface and sub-drainage. On land on which large outlays of money are to be expended, as in horticultural plantations, it is of the utmost importance that the soil be freed to considerable depths from stagnant water. Trees, many shrubs, and even some garden crops send their roots deeper into the subsoil than most of the cereals, hence they require a greater depth of drained feeding-ground. In horticulture the planting may often precede the harvest by five to ten years, while with many farm crops the harvest follows the planting in a few months. If the grain-raiser loses one crop, an annual, by planting on wet land, the loss is not great, but if the orchardist loses fifteen to twenty years of labor by planting on undrained lands, before the mistake is discovered, the losses are serious. Some lands require little more than to be relieved from surplus surface water in early spring. This may be accomplished by forming ridges and open

furrows as far asunder as the rows of trees are to be placed. But it is only rarely that surface drainage fully prevents serious damage from surplus moisture. Surface drainage may be considered a cheap way of temporarily alleviating undesirable conditions. It does not always eradicate them. Fig. 1347 illustrates how sub-drainage lowers the water-table (or the area of standing water), and thereby ameliorates the soil.

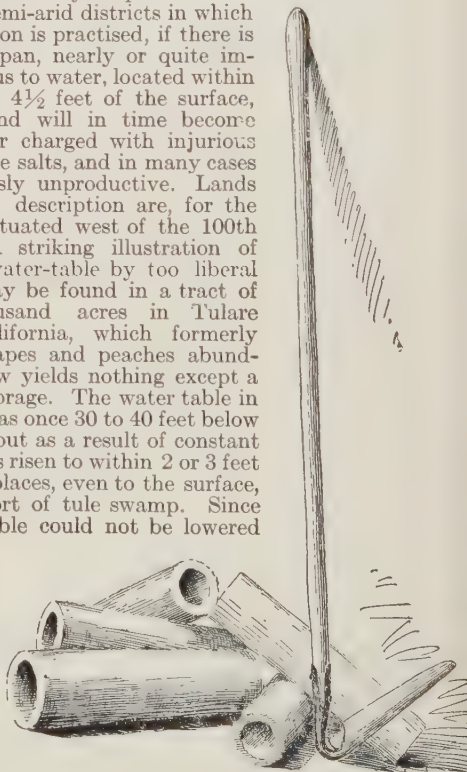
Sub-drainage consists in placing conduits of tile or other material in the ground at depths varying from 2½ to 4 feet, and at such distances apart as



1348. Old-fashioned drain-tile.

will serve to relieve the subsoil of deleterious stagnant water. When suitable stones are at hand, they are sometimes used instead of tile for forming drainage conduits. If such use is made of them, the drains should be somewhat deeper than tile drains, since the stones which form the drain occupy nearly a foot of the depth of the ditch and are more likely to become obstructed, especially if placed near the surface, than are tile drains. The throats or openings of stone drains are irregular in size, while those of tile drains are smooth and uniform in size, and are, therefore, most desirable. Years ago, various flat-bottomed tiles (Fig. 1348) were employed, but the style in general use at present is the cylindrical unglazed tile shown in Fig. 1349. They should be hard-burned. Because of the low cost of cement, tiles made of sand and hydraulic cement have recently come into use; they require no burning, are stronger than tiles made of clay and are just as efficient, except in alkali and where frost penetrates very deep.

In semi-arid districts in which irrigation is practised, if there is a hardpan, nearly or quite impervious to water, located within 3½ to 4½ feet of the surface, the land will in time become sour or charged with injurious alkaline salts, and in many cases ruinously unproductive. Lands of this description are, for the most part, situated west of the 100th meridian. A striking illustration of raising the water-table by too liberal irrigation may be found in a tract of several thousand acres in Tulare County, California, which formerly produced grapes and peaches abundantly but now yields nothing except a little hardy forage. The water table in this region was once 30 to 40 feet below the surface, but as a result of constant irrigation has risen to within 2 or 3 feet and, in low places, even to the surface, forming a sort of tule swamp. Since the water-table could not be lowered enough to restore the land by under-drainage, for lack of an outlet within reasonable distance, it is probable that the only way to reclaim it



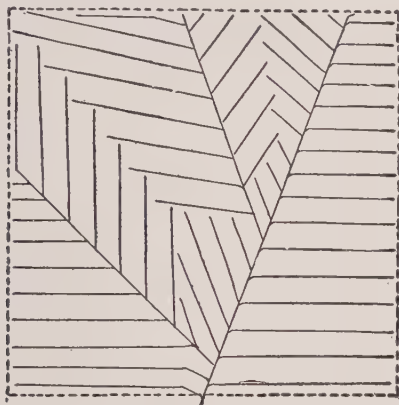
1349. Common cylindrical drain-tile; and a scoop for preparing the bed for the tile.



would be to sink a well and pump the surplus water into a surface ditch. Irrigation with pure water would then sweeten the soil and render it again productive; and the whole process of restoration need not be excessively expensive.

If the hardpan is less than 2 feet in thickness, the land may be improved greatly for orchard and vineyard purposes by the use of dynamite. Blasting should be deep enough to allow the surplus water to escape into the porous earth or gravelly soil beneath the hardpan. On the Pacific coast this method of draining orchard and vineyard land has been quite successful. In any case, unless the soil has good natural sub-drainage, it is both wise and economical to blast out holes for trees and vines; for the cost of digging holes, if they are as large and deep as they should be, is lessened by an amount almost equal to the cost of blasting.

Recently, powerful tractors have solved, to some extent, the problem of drainage in many cases by making deep plowing possible before planting and during the first few years of subsequent tillage of the orchard or vineyard. This machine with the tillage implement turns easily at the ends of the field within the space allowed for turning a span of horses and a plow; it can pass under limbs where a 14-hand horse (56-inch) can



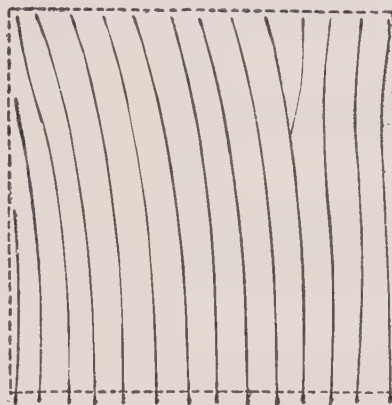
1350. Improper method of draining a field.

pass, and as close to the plants as a span of horses can. It furnishes also power and locomotion for spraying and for opening trenches to a considerable depth (18 to 44 inches) for the reception of drain-tile.

In some regions, drains are placed 200 to 300 feet apart, and serve their purpose well. In others they should not be placed farther apart than 20 to 30 feet. Wherever the subsoil is composed of tenacious fine clay, through which the water moves upward or downward with difficulty, the narrower intervals are necessary. In some instances the surplus water in the subsoil is under pressure by reason of water which finds its way into it from higher levels, and if this is not removed, the water has a constant tendency to rise to the surface. In many such cases drains placed at wide intervals may serve to relieve the pressure and drain the land. Since sub-drains are designed to be permanent, are expensive to construct and difficult to repair, the principles of drainage should be well understood, and the work should be undertaken only after a most careful inspection of the land and after the fundamental principles of the subject have been mastered.

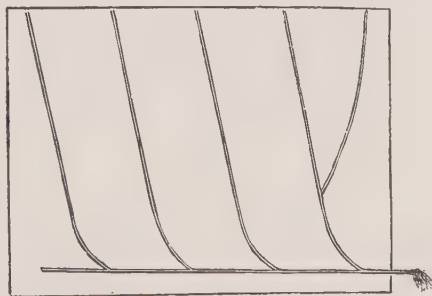
Mains and sub-mains should be avoided so far as possible, since they greatly increase cost, tend to become obstructed, and are often unnecessary. The three long mains in Fig 1350 are not drains, strictly speaking, since the land may be as fully drained without them, as shown in Fig. 1351; therefore, they serve

only to conduct the water of the drains proper. Tiles of 3 to 4 and 5 inches diameter should be used when the drains are infrequent and the flow of water considerable. Smaller ones, 2 to 3 inches in diameter, will suffice when the intervals between the drains are narrow.



1351. Best method of draining a field.

Drains should have as uniform a fall as possible, and no abrupt lateral curves or sharp angles should occur as are seen in many places in Fig. 1350. If the drain has a rapid fall in its upper reaches, as is often the case, and but slight fall in the lower, a silt basin should be constructed at the point at which the rapid changes into the slight fall, if obstructing silt is present. All drains which may be necessary should be placed before the planting occurs. Orchard lands may be drained in the spring, fallowed in the summer, and planted in the fall or the following spring. Drains placed at frequent intervals because of the tenacity of the soil should be comparatively shallow, for if placed deep or at wide intervals, the water will be too long reaching them. If drains are placed at wide intervals they should be at least  $3\frac{1}{2}$  feet deep to be most efficient. If the parallel system is adopted (Fig. 1351), there may be more outlets to construct and maintain than is desirable; if so, the system might be modified by constructing a sub-main, one side of which will serve also as a drain, and but one outlet will be required (Fig. 1352). Drains through which water runs for the greater part of the year are likely to become obstructed by roots, if water-loving trees, such as the willow, soft maple, and elm, are



1352. Showing how the drains may be gathered into one when there is only one place at which an outlet can be secured.

allowed to grow near them. If floating silt is present, the joints of the tiles should be protected for two-thirds of their upper circumferences by a narrow strip of tarred building paper (Fig. 1353), or collars should be used. Stone drains should receive a liberal covering of straw or some similar material before they are filled.

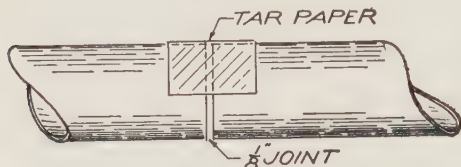
I. P. ROBERTS

### Drainage for landscape work.

The value of a thorough knowledge of the possibilities of drainage in landscape work has been overlooked until recent years as a definite field entirely apart from general drainage for agricultural purposes.

Drainage under the headings of this article is installed with the following objects in view:

1. Maintaining well-drained areas for firm lawn surfaces.
2. Maintaining well-drained and firm surface conditions for recreation areas.



1353. Covering a joint.

3. Draining of surface water and ground water from roads.
4. Draining foundations for walks.
5. Preserving the normal soil conditions for newly planted trees.
6. Draining swamp and marsh areas to prevent breeding of mosquitos.

#### 1. Drainage for lawns.

The secret of a perfect lawn is attributed to drainage conditions which provide a well-drained subsoil and a firm surface that may be readily freed from any excess water during heavy rains. The installation of drainage for this purpose is required only in the more compact soils that do not drain naturally. Sandy soils seldom require artificial drainage unless immediately underlaid with a stratum of impervious clay. On any lawn the topography of which does not permit the ready surface run-off and the subsoil of which is compact clay, the necessity of installing sub-surface drainage is strongest.

A drainage system for providing ideal soil conditions for perfect lawns must be installed carefully. Four-inch tile, is often used in the lateral systems while either 6-inch vitrified pipe, or the No. 2 quality of 6-inch round tile, is used for the main lines. All drains should be laid on an even grade of not less than  $\frac{1}{8}$  of an inch fall to each linear foot of drain, and preferably not less than  $\frac{1}{4}$  of an inch fall for each foot of drain. If perfect drainage is desired, the distance apart of these drains should not exceed 20 feet. In accordance with the general laws of drainage, tile should be laid at a more shallow depth in the heavy soils than in the lighter soils, and should be spaced at closer intervals than 20 feet, this space varying largely with the desire to free the lawn immediately of any excess surface water.

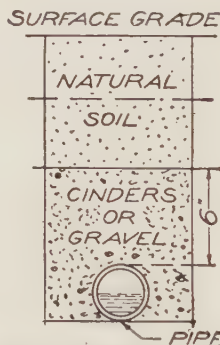
In all tile drainage whether for lawns or other purposes, a space of approximately  $\frac{1}{8}$  inch should be allowed between the ends of the pipes. The covering of tar paper and cinders should be placed over each joint as shown in Fig. 1353. The tile should be placed on a firm bottom of clay or other natural soil, and surrounded on all sides, and covered to a depth of not less than 6 inches with cinders, crushed stone, or washed

gravel (Fig. 1354). In very heavy clay, the trench excavated for the tile should be filled with cinders, crushed stone or gravel to a line separating the looser top soil from the clay subsoil (Fig. 1355). In heavy soil and for perfect lawn drainage, the lines of tile ought not to be laid deeper than  $2\frac{1}{2}$  feet and the cinder fill should not be less than 15 inches in depth. In the lighter sandy loam soils, the tile may be laid to a depth of 3 to  $3\frac{1}{2}$  feet.

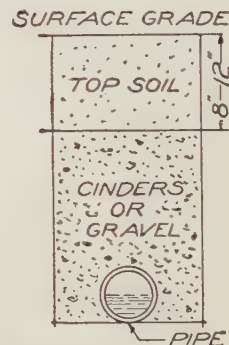
It is often found necessary when lawns are constructed on sandy soil to prevent excessive drainage, rather than to encourage drainage conditions. In these extreme sandy soils, the surface water seeps away so readily that the lawns become exceedingly dry during the warm and dry months. To prevent this condition a layer of clay 4 inches deep should be distributed over the sandy sub-grade prepared for the lawn, at a depth varying between 10 and 18 inches below the proposed finished surface of the lawn. This clay is thoroughly compacted and serves as a partial barrier against abnormal seepage which would otherwise occur, and thereby retains the moisture necessary for the capillary attraction to feed the roots of the lawn grasses.

#### 2. Recreation areas.

Areas naturally falling under this heading are tennis-courts (clay and turf), bowling-greens, clock-golf areas, and croquet-lawns. All of these require a more careful study of drainage conditions than is



1354. The filling of a drain.



1355. Applying good top soil.

given to the average lawn. It is essential that such areas be so completely drained that the surface condition is always firm, even after the average continuous heavy rains.

**Tennis-courts.**—These areas require the most careful study of drainage conditions. The average tennis-court requires two types of drainage,—surface and sub-surface. Surface drainage is cared for in two ways, (1) either by giving the court a gradual slope to one end, or (2) as shown in Fig. 1356, where the surface of the court is sloped from either end toward the middle line. This method, shown in Fig. 1357, gives probably the most satisfactory results, because, in this way, if surface conditions at the middle of the court are correct, the surface water is cared for most readily and with the shortest possible run-off. This drain across the middle of the court may be either an open concrete drain with a plank laid over the top and flush with the surface of the court, or a blind drain filled with a



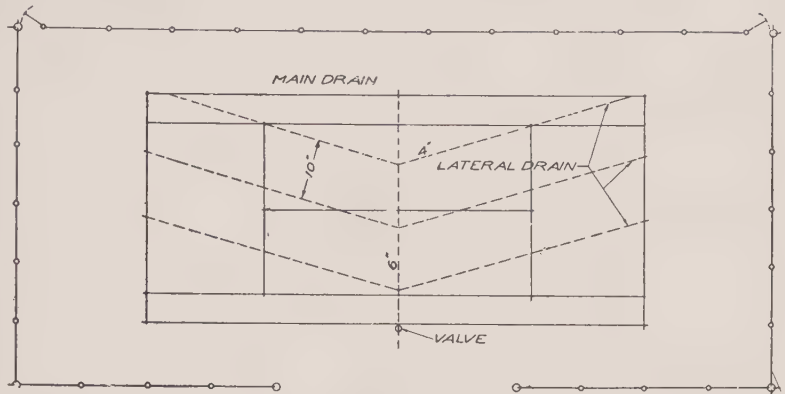
1356. Draining a tennis-court.



coarser crushed stone and fine crushed stone, over which is spread a thin layer of washed sand. The bottom of the drain ought to be approximately 6 inches lower, at the point where the outlet to the sub-drain is located, than the elevation at the extreme high points of the drain. The method of establishing these grades varies largely with the requirements of this particular problem. The water, as it reaches the low point in the drain, is conducted at once into the main 6-inch drain, which also takes ground-water from the underground system of drains. When the court is so constructed that one end is lower than the other, in order to assist surface-drainage conditions the courts should be level from side to side. Fig. 1357 shows the general distribution of the system of tile to care for the sub-surface water in tennis-court construction. This would apply equally well to the construction of other recreation areas, including clock-golf-greens, bowling-greens and croquet-lawns. In the construction of all tennis-courts, the trenches excavated for the tile should be filled with cinders or an equally porous material to a height not less than 6 inches below the proposed finished grade of the court.

*Clock-golf-greens, bowling-greens, and croquet-lawns.*—A thorough distribution of tile drains installed as outlined below, should meet all the requirements commonly imposed from the drainage standpoint upon the construction of these recreation areas. Lines of 4-inch tile should be placed, at intervals of not more than 10 feet. For the most thorough and ideal drainage of these areas, provided the cost is not prohibitive, the construction would be as follows: A neat sub-grade should be made at a depth not exceeding 15 to 18 inches below the proposed finished surface of the recreation area. The necessary lines of tile should be laid in trenches at a depth varying between 2 and 2½ feet below the finished grade, these trenches to be filled with cinders, crushed stone or gravel (Fig. 1355). On this sub-grade, thus completed, the entire recreation area should be filled to a point approximately 6 inches below the proposed finished grade, with cinders, or some equally porous material. On this finished surface, the remaining 6

middle of the road is used in soils in which the ground-water level is abnormally high. Such drains should range in depth from 2 to 3½ feet below the finished surface of the road, and the trenches should be filled with a porous material and not with the natural soil. The method of installing drainage under the sides of the

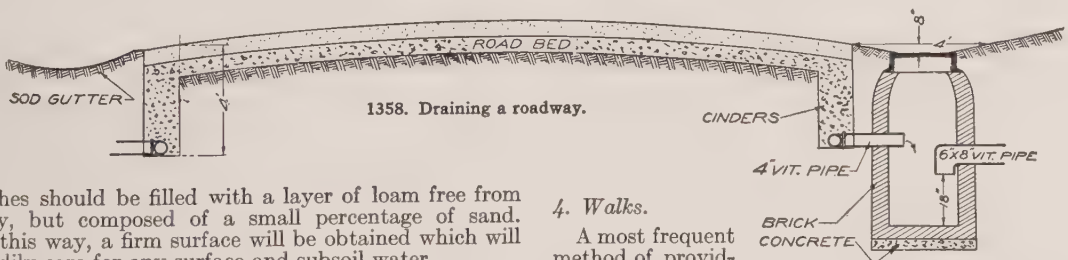


1357. Draining a tennis-court.

road, as shown in Fig. 1358 is used in heavy clay soils, and serves to keep the foundation of the road on well-drained soil. These drains are installed at a depth varying from 2 to 3 feet in trenches filled with cinders or equally porous material.

Turf pleasure roads, so frequently constructed on private estates, should be thoroughly drained with a line of tile placed under the middle of the road, unless the road is constructed on a heavy foundation of field-stone or gravel which forms a natural drain path for surface-water and soil-water.

In providing drainage along the sides of roads constructed on clay soils through virgin woods, it is sometimes necessary to carry these drainage lines a considerable distance through the woods to suitable outlet points. The joints of all such lines of drainage should be cemented, otherwise the artificial conditions produced by the increased drainage will work serious injury to many large trees growing on either side. In general it is very unsafe to install drainage lines through virgin woods, without this precaution. Roads constructed through such woods would better be drained by laying a line of tile under the middle of the road as shown in Fig. 1359.



1358. Draining a roadway.

inches should be filled with a layer of loam free from clay, but composed of a small percentage of sand. In this way, a firm surface will be obtained which will readily care for any surface and subsoil water.

### 3. Roads.

The secret of a perfect road surface lies (1) in the proper crown of the road, and (2) in the adequate drainage of the subsoil or foundation. The first provision cares for the surface water, and the second provision eliminates any surplus ground-water.

On all private estates on which roads are constructed on heavy clay soils and not on grades greater than 4 per cent, the secret of success depends upon drainage installed in either of the two ways shown in Fig. 1358 or Fig. 1359. Installing a line of drains under the

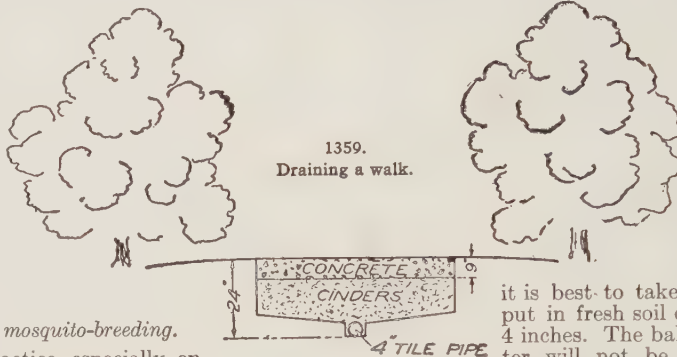
### 4. Walks.

A most frequent method of providing drainage for walks is that shown in Fig. 1359. A line of 4-inch tile is laid at a depth varying between 18 inches and 30 inches below the finished grade of the walk and following the middle line of the walk. The trench for the tile is filled with a porous material to a height even with the bottom of the cinders used for the foundation of the walk, or laid as shown in Fig. 1359.

### 5. Newly planted trees.

All trees planted in clay soil require drainage. If the pockets in which such trees are planted are not

thoroughly drained, the area excavated and re-filled with soil when the trees are planted becomes a pocket for ground-water. This pocket or reservoir collects the water, which, if not carried off by means of drains, will very likely cause the death of the trees. All large trees, especially those which do not grow best with their roots in the water, must be provided with drainage. The common method of drainage is to install a line of 4-inch tile leading from the bottom of the excavated hole to a main line of tile which may have been installed for other drainage purposes, or to the nearest outlet if no such line exists.

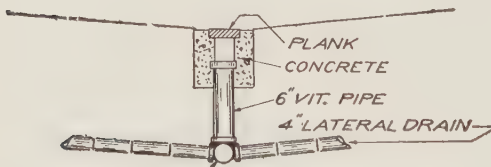


#### 6. Drainage to prevent mosquito-breeding.

It is a frequent practice, especially on large estates, to install open ditches from 50 to 100 feet apart in swamps and in salt marshes, in order to provide a means for draining such areas, and thus preventing the presence of stagnant water, which is conducive to the breeding of mosquitos. These trenches are excavated at depths varying from 2 to 3½ feet. The more frequent the trenches, the shallower they may be made and still provide adequate drainage.

The foregoing article pertains only to the particular phases of drainage especially to be considered in connection with landscape work. For additional information on the general details concerned with drainage, refer to the main article upon drainage, p. 1072.

A. D. TAYLOR.



1360. Detail of drain connections. (See Fig. 1356.)

#### Drainage and watering for newly transplanted trees.

Drainage is an essential in all retentive soils and is a safeguard even on sandy gravelly subsoils against overwatering. Drainage is likely to be vetoed on the score of expense or on the excuse that the subsoil is gravelly; whereas, there are only gravel stones in hardpan which holds water. A drain made by filling a pit with stones is frequently inadequate as it fills with water, which backs up into the hole, saturates the soil around the roots and rots them. Rotting of only a part of the roots may injure the tree more than the cutting off of that amount of roots.

The soil in which to plant should be open, porous and aerated. Soil which has been piled up as in grading operations is likely to be sour from the decay of the sod and from the packing by teams and scraper. Muck from ponds which has been piled and mixed with lime for a year may still be sour. Clay soil packed by the water and packing-sticks may remain too compact and not aerated enough, may be too much saturated with water and, therefore, rot the roots. Manure should not be mixed in the soil around the roots on account of the danger of souring and rotting the roots. This rotting is determined by digging down to the

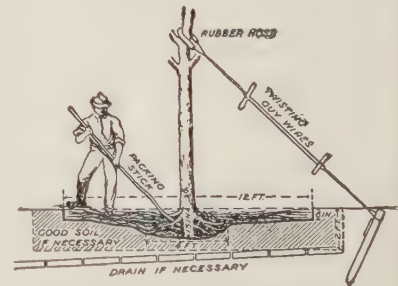
roots and finding them of blue-black color with a sour smell. Sometimes this decay has not reached through the bark of the roots and other times it has penetrated the bark and turned the cambium blue-black. Sour soil is likely to be of bluish or greenish color rather than chocolate-brown, and have a sour smell like that under-

neath a manure heap. The smell is most readily detected by breaking open a lump of soil. In digging into sour soil and soil that is over-saturated, the spade makes a peculiar sucking noise as in digging in a bog. If at the time of examination the soil is already become sour,

it is best to take out this sour soil and put in fresh soil covering the roots only 4 inches. The ball of earth in the center will not be so liable to get sour because it has not been disturbed. As brought out by Stringfellow in the "New Horticulture," soil that is dug over will take in water and become saturated; whereas, soil that has not been disturbed will retain air in the soil-spaces even if submerged. The ball of earth is also prevented from becoming saturated by the undisturbed feeding-roots which absorb the moisture.

Watering cannot be by rule, but must depend on examination of both ball of earth in the center and the outer roots. The difficulty will be to keep the ball of earth sufficiently damp on account of the rapid withdrawing of moisture by the roots. The danger will be that the soil outside the ball of earth will take up the water too rapidly, remain saturated several days and rot the roots. Examination is best done by shovel and fork, digging down 1½ feet both in the ball and outside. An easier way is to bore into the soil with an auger. It will usually be found that the central ball of earth is dry and dusty in the summer even if the surface and outer soil is damp. The growth of weeds and grass will indicate the same. A good way to water is to make a basin around the width of the ball of earth, fill it with water 6 inches deep, make crowbar holes into the ball for it to soak in. Many mistakes are made in overwatering—letting the hose run all night or watering every day, thereby rotting the roots.

Mulching is frequently neglected, the tree starving for lack of humus. A close-



1361. Setting a newly transplanted large tree.

cut lawn around a newly planted tree may be the ideal of neatness, but it means starvation and thirst for the tree and is the principal cause of slow growth over several years, making new, bare and ugly landscapes. The mulch should extend as wide as the roots and be from 3 to 6 inches deep, of strawy manure, leaves, grass, salt hay or similar organic matter. Too much manure may sour the soil and rot the roots, if it lies heavy and compact and keeps out the air. Light strawy manure is better. If the mulch blows about and is untidy, it may be kept in position by wire netting, earth, or the planting of small shrubs.

HENRY HICKS.



**DRĪMIA** (name refers to the acidity of the roots). *Liliaceæ*. Bulbous S. African and Trop. African plants of the Scilla tribe, with gamophyllous perianth and a campanulate tube, the segms. linear-oblong and reflexing: stamens 6, shorter than the segms., and inserted at the throat of the perianth-tube; ovary sessile, ovoid, 3-celled, becoming a loculicidally 3-valved membranous caps.: lvs. either broad and rather fleshy or narrow and rigid, often appearing at a different season from the bloom: fls. on a naked peduncle or scape, in a simple raceme.—About 30 species, none of which appears to be regularly in cult. *D. oligosperma*, C. H. Wright. Probably from S. Afr., and very recently described: fl.-clusters over 6 ft. high, much branched, the beautiful white fls. with 3 green nerves on the oblanceolate spreading petals opening late in the afternoon: bulb elliptic, 6 in. long: lvs. 12–14, rosulate, 1½ ft. long, linear-acuminate, glabrous. Likely to come into commercial cult.

**DRĪMYS** (from a Greek word, used in allusion to the sharp or acrid taste of the bark). *Magnoliaceæ*. About 10 evergreen trees or shrubs, allied to *Illicium*, distributed from Mex. to the Straits of Magellan, and in Austral., New Zeal., and islands. Glabrous and aromatic plants with pellucid-punctate lvs., and polygamous diclinous or perfect fls. on 1- to many-fl'd. peduncles, white, yellowish or rose-colored and showy; sepals 2–4; petals 6–∞, in 2 or more series; stamens ∞, on thickened filaments; ovaries usually 2–∞, with sessile stigma and many seeds. *D. Winteri*, Forst. (*Wintera aromatica*, Murr.), is a S. American small tree (to 50 ft.), with milk-white fls. 1 in. or more across, jasmine-scented; petals 8–12, pale cream-yellow: lvs. alternate, evergreen, elliptical or lanceolate, coriaceous, somewhat acuminate, entire, glabrous, very aromatic: branches with reddish bark: umbels (3–9-fl'd.) often nearly equaling the lvs.: scarcely known either as a glasshouse subject or for outdoor cult. in warm countries. B.M. 4800.

L. H. B.

**DRÓSERA** (Greek *droseros*, dewy, from the dew-like excretions on the tips of the leaf-hairs). *Droseraceæ*. A group of carnivorous plants popularly known as the SUNDEWS or DEW-PLANTS.

The sts. usually short, slender or compressed, rarely elongate and upright in such types as *D. peltata*: lvs. varying from linear through lanceolate to circular, often arranged in a rosette, and beset over their upper surfaces with fine often irritable hairs, that excrete a clear neutral viscid fluid which entangles and catches insect prey; the hairs then bend inward toward the lf.-center, the fluid becomes acid and also excretes a proteinaceous ferment by which the animal tissues are digested, the dissolved products being then absorbed for the plant's nutrition: fl.-scapes slender, ending in curved scorpioid cymes of blooms, ¼–1½ in. across, and varying from white through pink to scarlet or crimson; sepals, petals and stamens 5 each, while the carpels vary from 5–3, are syncarpous with parietal placentation, and bear as many style-arms or lobes: fr. a caps.—About 90 species scattered over the world, though most abundantly in Austral. Monograph by Diels in Engler's *Pflanzenreich*, hft. 26. The species usually grow in moist muddy soil, at times almost floating in water, as in the common N. J. species, *D. intermedia*. Some Australian kinds form tubers, and can then survive through dry periods. The lvs. in our native species wither in autumn, and a small winter bud-rosette is formed, which unfolds its lvs. in the succeeding spring.

The native and exotic species all grow well if treated as greenhouse plants, and grown in fine muddy loam topped by a little sphagnum. They should also be

kept constantly moist in their root extremities, and exposed to bright light. The following native and exotic species are now often grown in collections. They can be propagated by seeds, by division of the shoots, or by cutting the slender rhizomes into short lengths of ½–1 in. The last, when placed in moist soil, root and form buds in two to three weeks.

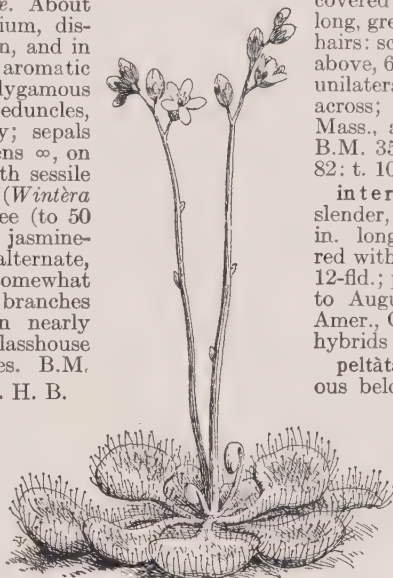
*binata*, Labill. (*D. dichotoma*, B. & S.). Sts. short: lvs. long-stalked, 6–16 in. high, once- to twice-forked into long-linear reddish green segms. that are covered with viscid hairs: scape branched above; fls. white, ½–¾ in. across; fls. June, July. Austral. and N. Zeal. B.M. 3082.—Intro. in 1823. Easily grown and prop. by division of the crowns.

*capensis*, Linn. St. slightly elongate: lvs. in a terminal rosette, linear to spatulate, tapered into petiole, obtuse at apex: scapes 6–10 in. long with 5–20 secund purple fls.; fls. June, July. Afr., southwestern part of Cape Colony. B.M. 6583.—Intro. in 1875.

*filiiformis*, Raf. St. short, hair-covered: lvs. linear, erect, 6–8 in. long, greenish with abundant purple hairs: scape equal to or longer than above, 6–15-fl'd.; fls. rather crowded, unilateral; petals pink-purple, ¾ in. across; fls. June, July. Del. to Mass., along sandy coastal places. B.M. 3540. Torrey, Fl. N. York, 82: t. 10.

*intermedia*, Hayne. Rhizome slender, 1–4 in. long: lvs. 1½–2½ in. long, long-petioled, spatulate, red with glandular hairs: scape 6–12-fl'd.; petals white; fls. April (Fla.) to August (New Bruns.). E. N. Amer., Cuba, and Eu.—Forms wild hybrids at times with other species.

*peltata*, Smith. St. 6–10 in., bulbous below, slender elongate above ground, with scattered peltate glandular lvs., and terminating in delicate 6–10-fl'd. stalks: petals white to pink. From India through China, Japan and the Philippines to Austral. G.C.H. 19: 436.—A pretty, delicate and striking species now not uncommon in cult.



1362. *Drosera rotundifolia*. (×½)

*rotundifolia*, Linn. Fig. 1362. St. short, slender: lvs. ¾–2 in., with elongate non-glandular petiole and circular red-glandular blade: scape slender, 5–12-fl'd.; petals white, expanding in bright sunshine; fls. May (Carolinas) to Sept. (Newfoundland).—A classic plant, owing to Darwin's studies in "Insectivorous Plants."

*Tracyi*, Macfarlane. Habit of *D. filiformis*. Lvs. 12–16 in., pale green with light green glandular hairs: scape 15–24 in.; fls. purple, ¾ in. across. Abundant over the coastal area of the Gulf states from mid-Fla. to La. Fl. April, May.—One of the largest species of the genus. J. M. MACFARLANE.

**DROSOPHYLLUM** (*dew-leaved*). One of the 6 genera of the *Droseraceæ*, comprising a single species in S. Spain, Portugal and Morocco, sometimes seen in collections of insectivorous plants, and for the interesting morphology, the lvs. being revolute rather than involute as in the *droseras* and other plants. *D. lusitanicum*, Link, is a sub-shrubby little plant, the simple st. 2–6 in. high bearing at the top long-linear glandular insect-holding lvs.: fls. 1½ in. across, on an elevated stalk (1 ft. high), bright yellow, with 10–20 stamens, alternating in length, bearing short yellow anthers; petals

5, obovate, thin, twisted after anthesis; styles 5, filiform: fr. a narrow caps.,  $\frac{3}{4}$  in. long, 5-valved. B.M. 5796.—The glands of this interesting plant are purple, some stalked and some sessile, viscid, not motile. See Diels, in Engler's *Pflanzenreich*, hft. 26 (1906) for monographic treatment, where the *Droseraceae* is reduced to 4 genera, *Byblis* and *Roridula* being removed from the family; and Darwin studied it and described it in Chap. XV of "Insectivorous Plants." L. H. B.

**DRÛAS** (Greek, *wood-nymph*). *Rosaceae*. Dwarf hardy tufted evergreen somewhat shrubby plants, sometimes transferred to gardens.

Leaves alternate, petioled, simple, entire or crenate, tomentose: fls. large, white or yellow, borne singly on slender scapes; sepals 8–10, persistent; petals 8–10, obovate or oval; stamens many, with subulate filaments; pistils many, sessile, with a terminal style that persists and elongates on the achene. High northern or mountain plants, of N. Amer., Eu. and Asia, of which 4 species are recognized by Rydberg (N. Amer. Flora, xxii, part 5, 1913); allied to *Geum*.

The best known cult. species, *D. octopetala*, requires a well-drained porous soil, a sunny but not dry position. It is well to shade the foliage from bright sun during the winter months with evergreen branches to prevent the foliage from having a scorched appearance. A capital plant for the rockery. Propagated by cuttings, division, or by seed. (J. B. Keller.)

**octopétala**, Linn. Densely caespitose with a woody caudex or st.: lvs. rugose, elliptic, oval or oblong, deeply and regularly crenate, white-tomentose beneath: scapes 2–8 in. long; fls. white, the petals elliptic or obovate-elliptic, and the sepals linear or linear-lanceolate: seeds with a feathered awn 1 in. long. North temperate and arctic regions.

**Drummondii**, Rich. Caespitose perennial with decumbent caudex: lvs. elliptic or obovate, white-tomentose beneath but nearly or quite glabrous above, somewhat rugose, coarsely crenate: fls. yellow, the petals elliptic-spatulate or obovate and almost erect, the sepals ovate or ovate-lanceolate. Que. to Ore. and N. B.M. 2972.—A good rockery plant; 4 in., more or less.

*D. integrifolia*, Vahl. Fls. white; sepals linear or linear-lanceolate: lvs. lanceolate or lance-elliptic, the margins mostly revolute. High northern N. Amer.—*D. tomentosa*, Farr. Fls. yellow; sepals ovate or ovate-lanceolate: lvs. obovate or elliptic, coarsely crenate, tomentose on both surfaces. Canadian Rockies. L. H. B.

**DRYMOGLÓSSUM** (Greek, *wood and tongue*, of no direct significance). *Polypodiaceae*. Small ferns, 5 to 10 species, occurring wild in both tropics, with wide creeping rootstalks, and small, entire lvs.: sori resembling those of *Polypodium*. None is advertised in Amer. Three or 4 kinds are mentioned in horticultural literature abroad, but are not cult. here. L. M. UNDERWOOD.

**DRYMÒNIA** (from Greek for an oak wood: growing on trees). *Gesneriaceae*. Prostrate or climbing woody plants, sometimes grown under glass, but apparently not offered in this country. Fls. white or yellowish, mostly large, on short axillary usually solitary pedicels; calyx large, oblique, 5-parted; corolla-tube prominently ventricose, declinate, gibbous or saccate at base, the 5 lobes broad and spreading and only slightly unlike; stamens affixed in the base of the corolla, 4 perfect; disk-glands large at rear, small or wanting in front; style elongated: fr. fleshy, ovate, becoming 2-valved: lvs. opposite, thickish.—Some 15 species in Cent. and S. Amer., closely allied to *Episcia*. Warmhouse plants, requiring the treatment of other gesneriads. One species is offered abroad: *D. Turriallux*, Hanst., from Costa Rica: tall shrub: lvs. broadly ovate, blistered, metallic-colored: fls. large, white, pendulous, the lower lobe toothed, calyx red. *D. punctata*, Lindl. = *Episcia punctata*. L. H. B.

**DRYMOPHLEÛS** (Greek words meaning oak and smooth inner bark). *Palmaceae*, tribe *Areceae*. Spineless pinnate palms, with slender medium caudices.

Leaves terminal, equally pinnatisect, the segms. cuneate-oblong or linear, broadly oblique, submembranaceous, 3- to many-nerved, the margins recurved at the base; rachis scaly, 3-sided; sheath long: spadix with a short peduncle and slender branches; spathes 2 or many, the lower one 2-crested. This genus contains a tropical palm, with very distinct wedge-shaped lfts. and ornamental scarlet frs., borne every year. It flowers when only a few feet high, and is suitable for pot culture.—Species 12. Australasia and the Pacific isls.

The chances are that most of the plants now known to the American trade as *D. olivæformis* are really *D. appendiculata*. The true *D. olivæformis* is said to have been offered by a few dealers as *Ptychosperma Rumphii*. *D. appendiculata* was described and figured by William Watson, in Garden and Forest, mistakenly as *D. olivæformis*, as explained in B.M. 7202. He adds, "Like all the palms of this section of the border, *Drymophloeus* requires a tropical moist house with abundance of water at all times." G.C. II. 24:394. The plant figured was about fourteen years old, 3 feet high, with leaves about 3 feet long. The plant takes about six months to mature its fruits.

**appendiculatus**, Scheff. (*Arèca grácilis*, Giseke, not Roxbg. or Thouars). St. 6–10 ft.: lvs. terminal, 5–6 ft. long, arching; lfts. 14–20, wedge-shaped, raggedly cut, serrate: spadix from between the lvs., short-stalked, about a foot long; the yellow buds and white fls. make an attractive contrast at the flowering season (June). Moluccas, New Guinea. B.M. 7202. G.F. 4:331.—The *D. olivæformis* of most dealers not of Martius.

*D. Mooreanus*, Hort. "An erect-growing palm with grayish green lvs."—*D. olivæformis*, Mart., not the trade plant of that name, has narrower lfts. than the above, and the fr. half immersed in the greatly enlarged perianth.

JARED G. SMITH.  
N. TAYLOR.†

**DRYNÀRIA** (Greek, *oak-like*). *Polypodiaceae*. Some 10 or more E. Indian ferns, with round naked sori, as in *Polypodium*, but with a fine network of netted veins which are arranged in distinctly rectangular meshes. The most distinctive feature is in the shape of the lvs. which are either of 2 sorts, as in *Platynerium*, the cup lf. having the shape of an oak lf.; or the base of each lf. is separately lobed and oak-like. *D. quercifolia*, with 2 sorts of lvs., the spore-bearing 2–3 ft. long, is the commonest species. *D. rigidula*, Swartz (*D. diversifolia*, R. Br.), a similar but larger species from the same region also appeared at one time in the American trade, but the species are seldom seen in cult. in this country. *D. muscifolia* is occasionally seen in fine collections, where it is grown for its striking simple foliage, which reminds one of the bird's nest fern (*Asplenium nidus*). It is really a *Polypodium*, which see for description. R. C. BENEDICT.†

**DRYOPTERIS** (Greek, *oak-fern*). *Polypodiaceae*. WOOD-FERN. A widely distributed genus of handsome ferns with dissected foliage, the native species sometimes grown in the hardy border and the tropical kinds under glass.

Plants bearing round sori either naked or covered with heart-shaped or reniform indusia, which are fixed at the center or along the sinus: veins either wholly free or the lowest united.—Several hundred species have been referred to this genus. A considerable number of our common woods ferns belong to this genus. The species have been variously known under the names *Lastrea*, *Aspidium*, and *Nephrodium*. Other species sometimes referred to under this genus may be found under *Polystichum* and under *Lastrea*. For *D. acrostichoides*, see *Polystichum*; for *D. decurrens*, see



*Tectaria*. In N. Amer., known to many as *Aspidium*. For cult. see *Ferns*. Not the same as *Dryopteris*.

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A. Veins entirely free.

B. Pinnæ lobed less than one-third to midrib.

1. *hirtipes*, Kuntze (*Nephrodium hirtipes*, Hook.). Lvs. rather rigid, 2-3 ft. long, 8-16 in. broad, on stalks clothed with dense black scales; pinnæ with broad, blunt lobes, the lower ones not reduced in size; sori medial on the lobes. India.

BB. Pinnæ cleft nearly to midrib, or lvs. bipinnate or tripinnatifid.

C. Texture thin, membranous; veins simple or once forked.

D. Lower pinnæ gradually reduced to mere lobes.

2. *noveboracensis*, Gray (*Aspidium noveboracense*, Swartz). NEW YORK FERN. Lvs. somewhat clustered from creeping rootstocks, pale green, 1-2 ft. long, tapering both ways from the middle. Canada to N. C. and Ark.

3. *Fischeri*, Kuntze (*Lastrea opaca*, Mett.). Lvs. 6-8 in. long, 2-3 in. wide, bipinnatifid, cut into close, entire lobes, the lowest much reduced; surfaces smooth. Brazil.

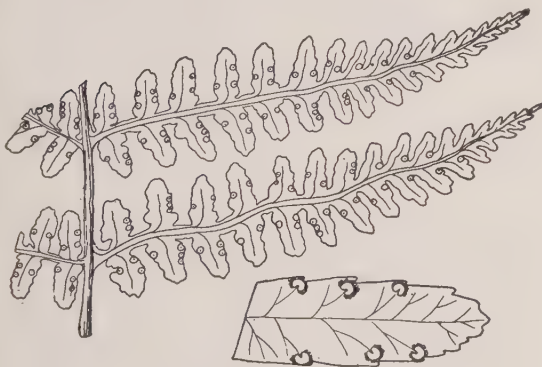
DD. Lower pinnæ scarcely smaller than those above.

E. Veins forked.

4. *Thelypteris*, Gray (*Aspidium Thelypteris*, Swartz). MARSH FERN. Rootstock creeping; lvs. scattered, clear green, 1-2 ft. long; margins of the spore-bearing pinnæ often strongly convolute; sori 10-12 to each segm. Canada to Fla. and Texas.—A form with pinnæ variously forked at tip is known as *Puffææ*.

EE. Veins simple.

5. *simulata*, Davenp. Rootstock creeping; lvs. yellowish green, scattered, 8-20 in. long, 2-7 in. wide, with 12-20 pairs of lanceolate pinnæ: sori rather large, some-



1363. *Dryopteris marginalis*. (Detail  $\times 1$ )

what distant, 4-10 to each segm. Native in N. Y. and New England, where it may be confused with *D. Thelypteris*. G.F. 9:485.

6. *patens*, Kuntze. Lvs. clustered at the end of a thick rootstock, 2-3 ft. long, 4-10 in. wide, soft-hairy beneath; pinnæ cut three-fourths to the midrib, the basal segms. usually longer. Fla. to Texas and Calif. and Trop. Amer. A.G. 20:25.

CC. Texture firm or subcoriaceous; veins 2-4 times forked.

D. Lvs. bipinnatifid or nearly bipinnate: indusia large, mostly flat.

7. *cristata*, Gray (*Aspidium cristatum*, Swartz). Lvs. 1-2 ft. long, with short, triangular pinnæ 2-3 in., long, are much wider at base. Var. *Clintoniana*, Underw. (probably a distinct species), is larger, with pinnæ 4-6 in. long, and with the sori rather near the midvein. Canada to Ark.; also in N. Eu.—Hybrids are described with *D. marginalis* and other species. G.F. 9:445.

8. *Goldieana*, Gray (*Aspidium Goldieanum*, Swartz). Lvs. growing in large crowns, 2-4 ft. long, 12-18 in. wide, the pinnæ broadest at the middle: indusia very large. Canada to Ky.—One of our largest and most stately native species.

DD. Lvs. mostly bipinnate: indusia convex, rather firm.

9. *Filix-mas*, Schott (*Aspidium Filix-mas*, Swartz). MALE FERN. Lvs. growing in crowns, 1-3 ft. long; sori near the midvein. Used as a vermifuge, as is also the next species. Eu., Canada and Colo.

10. *marginalis*, Gray (*Aspidium marginale*, Swartz). Fig. 1363. Lvs. 6 in. to 2 ft. long, growing in crowns, mostly in rocky places: sori close to the margin. Canada and southward.—One of our commonest ferns, and gathered with *D. spinuloso intermedia* for use with cut-fls.

DDD. Lvs. mostly tripinnatifid; segms. spinulose-toothed: indusia shriveling at maturity.

E. Lf.-stalks naked, polished.

11. *viridescens*, Kuntze. Lvs. 18-24 in. long, on stalks two-thirds as long; lower pinnæ largest: sori near the midribs. Japan.

EE. Lf.-stalks scaly.

12. *spinulosa*, Kuntze (*Aspidium spinulosum*, Swartz). Lvs. ovate-lanceolate, with a few pale, deciduous scales at the base; indusia smooth, without marginal glands. Var. *intermedia*, Underwood. Lvs. evergreen, the scales more persistent, with brown centers, and the margins of the indusia with stalked glands. One of our commonest wood ferns in the northern states. Extensively gathered for use with cut-fls. Probably a distinct species. Var. *dilatata*, Underwood, has similar scales to the last and tripinnate lvs. In woods at altitudes of 1,500 ft. upward, from Canada to Ore.; also in Eu. Probably a distinct species.

13. *Boottii*, Underwood (*Aspidium Boottii*, Tuckerm.). Lvs. elongate-lanceolate, with broadly oblong pinnules: indusia minutely glandular. Intermediate between *D. cristata* and *D. intermedia*. Probably a hybrid. Canada, N. Y. and New England.

DDDD. Lvs. ample, 4-5-pinnatifid.

14. *effusa*, Urban. Lvs. 3-4 ft. long, 2 ft. or more wide, with polished stalks and from short, creeping rootstocks: sori abundant, scattered, often without indusia. Cuba to Brazil.



1364. *Dryopteris parasitica*. ( $\times \frac{1}{2}$ )

15. *dissècta*, Kuntze (*Lastrea membranifolia*, Hort.). Lvs. 1-5 ft. long, 1-3 ft. wide, membranous, decompound; segms. broad and blunt; surfaces nearly naked: sori near the margin, abundant. India and Madagascar to Austral.

AA. Veins not entirely free, the lower veinlets of adjoining segms. united.

16. *Otària*, Kuntze (*Lastrea aristata*, Hort.). Lvs. 1 ft. long, with a long terminal pinna an inch or more wide, with lanceolate lobes, and 6-12 similar lateral pinnæ; texture thin; surfaces naked; veins united half-way from the midrib to the edge. Ceylon to the Philippines.—Good for table ferneries, but slow of growth.

17. *parasitica*, Kuntze (*Nephrodium môle*, R. Br. *D. môle*, Underwood, in preceding edition). Fig. 1364. Lvs. 1-2 ft. long, 8-12 in. wide, bipinnatifid, the pinnæ cut into blunt lobes; lower pinnæ distant from the others and somewhat shorter; surfaces finely villose. Tropical regions of both hemispheres.—Often grows as a weed in greenhouses.

18. *basilàris*, C. Chr. (*Nephrodium philippinense*, Baker. *D. philippinensis*, Underwood, in Cyclo. Amer. Hort.). Lvs. 2-3 ft. long, 12-18 in. wide, bipinnatifid, smooth, with a naked rachis; lower pinnæ scarcely smaller: sori midway from midrib to margin, with firm, smooth indusia. Philippines.

19. *crenàta*, Presl. Lvs. 1-2 ft. long, on stalks nearly as long, with a terminal pinnæ 6-8 in. long, often 2 in. wide, and 4-8 similar lateral pinnæ; margins bluntly lobed: sori near the main veins. Cuba and Mex. to Brazil.

L. M. UNDERWOOD.  
R. C. BENEDICT.†

**DRYPÈTES** (probably from Greek for *drupe*, from the character of the fruit). GUIANA PLUM. WHITEWOOD. *Euphorbiaceæ*. Tropical evergreen greenhouse shrubs. Glabrous: lvs. leathery, alternate, simple, mostly entire: fls. dioecious, in axillary clusters or pistillate single, apetalous, staminate fls. with calyx imbricate and a rudimentary pistil; stigma broad, nearly sessile; pistil 1-celled, 2-ovuled.—About 10 species in Trop. Amer., 2 native in S. Fla. They do well in light loam. Prop. from cuttings in sand with heat. *D. lateriflora*, Urban (*D. crœcea*, Poit. *Schæfferia lateriflora*, Swartz), of W. India region, 6 ft. high, lvs. elliptical, pointed, has been in cult.

J. B. S. NORTON.

**DUCHÉSNEA** (A. N. Duchesne, monographer of *Fragaria* in 1766). *Rosaceæ*. Strawberry-like perennial trailing herbs, differing in the calyx being 5-parted and the lobes alternating with larger leafy 3-5-toothed bracts, the petals yellow, and the receptacle dry and spongy rather than becoming fleshy or pulpy as in the strawberry: lvs. ternate, with short-stalked lflets: fls. solitary, on the runners; stamens 20-25, short.—Two species in S. Asia, one of which has run wild in this country, and is useful as a basket-plant and as a low ground-cover.

*indica*, Focke (*Fragaria indica*, Andr.). **YELLOW STRAWBERRY**. A neat plant trailing close on the ground, with leafy runners, pubescent: lflets rhombic-ovate, more or less petioled, coarsely crenate, obtuse: fls. about  $\frac{3}{4}$  in. across, on peduncles equaling or exceeding the lvs.: fr. usually less than  $\frac{1}{2}$  in. diam., red, insipid. In waste grounds, N. Y., west and south.

L. H. B.

**DUCKWEED**: *Lemna*.

**DUCKWHEAT**: *Fagopyrum*.

**DUDAIM MELON**: *Cucumis*.

**DUDLEYA** (named for the late Wm. R. Dudley, professor of botany in Stanford University). *Crassulacææ*. Shortly caulescent or acaulescent perennials, with flat, linear to ovate, acute basal lvs.: fls. in short

or elongated panicles, orange-yellow or red, rarely white: lvs. on flowering branches much shorter and relatively broader than the basal ones, sessile or clasping: corolla nearly cylindrical or slightly angled, the segms. united below the middle; stamens twice as many as the calyx-lobes: carpels erect, many-sided.—Some 60 species have been described, all from the west coast of N. Amer. None of them has proved very satisfactory as a bedding plant, and as a rule the species do not compare with the *echeverias* in horticultural value. The following species are described in this work under *Cotyledon* (p. 868):

*D. Cotyledon*, Brit. & Rose, as *C. californica*.  
*D. pulverulenta*, Brit. & Rose, as *C. pulverulenta*.  
*D. Purpusii*, Brit. & Rose, as *C. Purpusii*.  
*D. lanceolata*, Brit. & Rose, as *C. lanceolata*.

J. N. ROSE.

**DUGUËTIA** (named in honor of J. J. Duguet, who in 1731 wrote a work on plants). *Aberemôa*, R. E. Fries, not Aubl. *Annonacææ*. A genus of Trop. American shrubs and trees, about two dozen species, differing



1365. *Duguëtia quitarensis*. (Branch  $\times \frac{1}{2}$ )

from *Annona* in technical characters, particularly in imbricating petals and distinct angular rigid carpels becoming detached from the alveolate receptacle when mature, and usually with stellate-pubescent or scurfy indument. *D. lanceolata*, St. Hil., the type of the genus, is a Brazilian tree. *D. quitarensis*, Benth., Fig. 1365, with very similar fr. which turns red when ripe, has recently been collected on the Isthmus of Panama by Henri Pittier; and *D. furfuracea*, Benth. & Hook. f., a low plant with edible orange-colored fr. as large as an apple, in the province of Minas, Brazil, by Shamel, Popenoe, and Dorsett, of the Bureau of Plant Industry. From this genus must be separated *Fusæa longifolia*, Safford (*Annona longifolia*, Aubl.), the fr. of which is a solid globose syncarpium, and the outer circles of stamens sterile and petal-like, while the indument is composed of simple silky hairs. See *Fusæa*.

W. E. SAFFORD.



**DULÍCHIUM** (old Latin name). *Cyperaceæ*. One perennial species, *D. arundinaceum*, Brit. (*D. spathaceum*, Pers.), in E. N. Amer., which has been offered by collectors as a bog-plant. It is grass-like, with terete leafy culms which are hollow and unbranched, 2-3 ft. tall; it has linear flattened spikelets sessile in 2 ranks on peduncles that arise from the lf.-sheaths. It is distributed in swamps about ponds from Newfoundland across the continent and to Fla. and Texas; of no special value.

**DURÁNTA** (after Castor Durantes, physician in Rome and botanist, died about 1590). *Verbenaceæ*. Tropical American woody plants, some of which are cultivated outdoors in Florida and California, and in a few northern greenhouses.

Shrubs or trees, glabrous or woolly, often armed with axillary spines; lvs. opposite or in whorls, entire or toothed; racemes long and terminal or short and axillary; fls. small, short-pedicelled in the axis of a small bract; corolla-limb of 5 spreading oblique or equal lobes, the tube usually curved; stamens 4, didynamous; calyx enlarging and inclosing the fr.; stigma 4-lobed: fr. an 8-seeded juicy drupe.—Eight or 10 species, Mex., W. Indies, S. Amer., one reaching Key West.

**Plumieri**, Jacq. (*D. spinosa*, Linn. *D. inermis*, Linn. *D. repens*, Linn. *D. Ellisia*, Jacq. *Ellisia acuta*, Linn.). **GOLDEN DEWDROP**. A variable shrub or small tree, minutely pubescent or becoming glabrous: branches 4-angled: lvs. obovate, oblong, ovate or elliptic, mostly entire, contracted into short petiole: fls. in paniced loose racemes; calyx-teeth subulate; corolla lilac, the limb less than  $\frac{1}{2}$  in. across, the lobes ciliate; calyx yellowish, closed into a beak and covering the yellow drupe (which may reach about  $\frac{1}{2}$  in. diam.). Key West, W. Indies, Mex., to Brazil. B.M. 1759. B.R. 244.—Branches either armed or unarmed. Attractive forms with white fls. and with variegated lvs. are reported in cult.

**Loréntzii**, Griseb. Spineless, the branchlets 4-angled: lvs. small, coriaceous, ovate or elliptic, obtusish, strongly serrate toward apex, petioled: fls. in terminal interrupted racemes (white?); calyx tubular, 5-ribbed, short-toothed; corolla-tube exserted, cylindrical; corolla-limb unequally 5-parted, the lobes oval-orbicular; stamens included, didynamous: fr. a 2-pyrenous berry. Argentina; offered in S. Calif.

**stenostachya**, Tod. Closely allied to *D. Plumieri*. Spineless, to 15 ft. high, branchlets 4-angled: lvs. oblong-lanceolate, acuminate, serrate or entire, pubescent on the veins beneath, 3-8 in. long: fls. lilac, less than  $\frac{1}{2}$  in. across, pendulous in slender racemes, 3-4 at the end of the branches, in fr. 6-12 in. long: fr. yellow, about  $\frac{1}{3}$  in. across. Brazil. Offered in S. Calif.

L. H. B.

**DURAZNILLO**: *Jatropha*.

**DÛRIO** (from a Malayan vernacular). *Bombacaceæ*. Trees of the Indian archipelago and Malaysia, one of which yields the durian (*D. zibethinus*, Linn.), a much-prized fruit of the East. Fig. 1366. There are probably a dozen other species of Durio, mostly Bornean and recently described.

The durian is a tall tree (to 80 ft.), with oblong acuminate entire lvs., colored and scaly beneath, pinnately veined, coriaceous: fls. large, whitish, in lateral cymes or fascicles; calyx bell-shaped, 5-lobed, subtended by an involucre; petals 3; staminal column divided above into many filaments in 4-6 groups, the anthers twisted; ovary 5-celled, each cell many-ovuled, bearing a long style with a capitate stigma: fr. ovoid or globular, often 10 in. long, very spiny, somewhat woody, mostly indehiscent, the large seeds and carpels surrounded by a firm cream-colored edible pulp. The fr. has a strong offensive odor.

The durian is discussed as follows by O. W. Barrett in the Philippine Agricultural Review:

"The durian has an odor that can be compared only to a mixture of old cheese and onions, flavored with turpentine; but those who eat it love it so dearly that the smell does not bother them. . . . The fruit weighs about five pounds, nearly one-third of which is edible pulp and about one-sixth of which is edible seeds; the sugar-content is over 12 per cent, and it contains the same amount of starch besides. The tree is



1366. The durian—*Durio zibethinus*. ( $\times \frac{1}{4}$ )  
(From an early representation of the fruit.)

magnificent and stately, and grows usually in open country, in the edges of forests, around native villages, and in clearings.—It can hardly be called a cultivated tree; at least, it is hardly ever grown in orchards, although on the other hand it could hardly hold its own in the real wild. Throughout Malaysia it is considered the most delicious fruit. Europeans, of course, generally revolt at the unpleasant odor; a fair proportion, however, of the foreign residents soon grow to relish the durian. Although it would not be wise, perhaps, for one unaccustomed to the fruit to eat a large quantity of the pulp at one sitting, there is apparently no substance in it that would cause indigestion or any other result than a rather unpleasant breath for a few hours after eating. The chemical body which is responsible for the very pronounced odor is probably one of the sulfur compounds with some base perhaps similar to that of butyric acid.—Harvesting the durian is not attended with danger, for soon after it becomes mature the heavy fruit falls, and occasionally kills or severely injures the unlucky individual underneath."

The seeds are eaten roasted, and the unripe fruit boiled as a vegetable. The tree has been successfully introduced into Jamaica, but is not in general cultivation in that island.

The specific name, *zibethinus*, is said to be derived from the practice of using the decomposed fruit as a bait for the civet-cat or zibet. Fig. 1366 is reduced from Vol. 7 of the Trans. of the Linn. Soc., 1804, illustrating König's historic account of the fruit.

L. H. B.

**DUSTY MILLER**: *Lychnis Coronaria*; also species of *Centaurea* and *Senecio*.

**DUTCHMAN'S BREECHES**: *Dicentra Cucullaria*.

**DUTCHMAN'S PIPE**: *Aristolochia*.

**DUVÀLIA** (for Duval, an early botanist). *Asclepiadaceæ*. About 20 succulent very dwarf leafless herbs, mostly of S. Afr., rarely seen in cult.: sts. decumbent or erect, sometimes subterranean and with the tips appearing above the surface, 4-6-angled and with spreading teeth, each of which bears a minute rudimentary lf.: fls. solitary or in small clusters or cymes, usually borne near the middle of the young sts.; corolla rotate, deeply 5-lobed, with a cushion-like ring around the outer corona and supporting it; corolla-lobes linear-

lanceolate to ovate, folded longitudinally backward; corona double, from near the top of the staminal column, the outer one flat and entire and angled, the inner one with turgid more or less pointed lobes; stamens affixed in the base of the corolla, united into a tube around the ovary: fr. erect smooth follicles. Cult. of Stapelia and similar succulents. The species are essentially fancier's plants and apparently not in the trade.

**DUVERNØIA** (J. G. Duvernoy, pupil of Tournefort, or G. L. Duvernoy, of Strassburg, writer on natural history). *Acanthaceae*. By some authors united with *Adhatoda*, which genus is by some included in *Justicia*. The genus comprises 15 or more herbs or shrubs: fls. single or in short spikes; calyx short, 4-toothed, the back lobe toothed or parted; corolla-tube short; limb labiate, the upper lip helmet-shaped and 2-toothed, the lower lip flat. The species seem not to be in the trade, although *D. Dewèvrei*, DeWild, has been cult. in Belgium: it is a tufted herb, about 2 ft. high: lvs. oblong, petiolate; fls. paniculate; upper lip of corolla white with red stripes and the lower greenish white; corolla about  $\frac{1}{2}$  in. long. Congo.

**DWARFING.** Dwarf plants are those that never attain the height or size of the usual or representative individuals of the species. Some dwarfs are "natural," being represented by varieties of prevalingly small size; and these varieties usually reproduce more or less true from seed or cuttings. Thus there are dwarf petunias, lobelias, asters, cannas, peas, beans. Such dwarfing comes within the field of breeding.

The "artificial" dwarfs are produced by more or less arbitrary manipulation, as by grafting on stocks of small growth, heading-in the top or the root or both, by confining the roots, by withholding food and water, and by various forms of contortion and constriction.

Plants are dwarfed to keep them within bounds in small areas, to increase flower-bearing and fruit-bearing in proportion to the size of the subject, to bring all parts within reach and control, to express the skill and satisfy the conceit of the gardener, and to extend the range of interesting plant forms; and plants may be adapted to adverse soils or conditions by grafting on hardy or more reliable roots that may chance to have a dwarfing tendency. Dwarf plants are very useful in flower-gardens and in landscape work. The picturesque dwarfs of the Japanese type are amongst the most curious of plant forms.

#### The Japanese practice of dwarfing. Figs. 1367, 1368.

The art of dwarfing trees has been long practised among the Japanese gardeners. Some trees are more adapted for this purpose than others. The following have been considered to be most suitable:

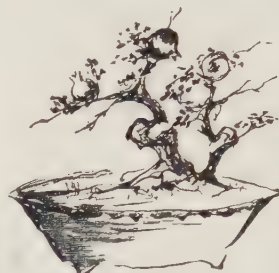
*Chamacyparis obtusa*.  
*Pinus pentaphylla*.  
*Pinus parviflora*.  
*Pinus Thunbergii*.  
*Pinus densiflora*.  
*Larix leptolepis*.  
*Juniperus rigida*.  
*Juniperus chinensis* var. *procumbens*.  
*Podocarpus chinensis*.  
*Podocarpus Nageia*.  
*Tsuga Sieboldii*.  
*Tsuga diversifolia*.  
*Cryptomeria japonica*.  
*Acer palmatum*.

*Acer trifidum*.  
*Styrax japonica*.  
*Lagerstromia indica*.  
*Punica Granatum*.  
*Trachycarpus excelsa*.  
*Rhapis flabelliformis*.  
*Rhapis humilis*.  
*Zelkova acuminata*.  
*Milletia japonica*.  
*Wistaria floribunda*.  
*Wistaria brachybotrys*.  
*Prunus Mume*.  
*Evonymus alata*.  
*Cycas revoluta*.

Various species of Japanese flowering cherries, ivies, bamboos, fruit trees, etc.

Before entering into a discussion of dwarfed trees, one should have a clear understanding between the "bonsai" or artistic plant and the "hachiuye" or ordinary potted plant.

There are two styles in which the "bonsai" is presented, one is the planting of one or more tiny trees of picturesque form in an artistic shallow pot; and the other is the representing of a part of a miniature garden or forest embracing trees, shrubs, grasses, mosses, rocks, and ponds. The former is simply an improved or



1367. Japanese dwarf tree.

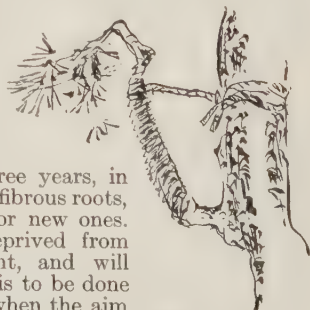
modified potted plant, whereas the latter exhibits an imaginary scene, so that one might feel by glancing upon the pot in a little Japanese chamber as if he were at that moment strolling in such a garden or wandering with-in forest. A little piece of stone gives an idea of Mt. Fuji, and a drop of water the surface of the Japan Sea. We often suspect the tree, covered with

mossed bark, of not more than  $\frac{1}{2}$  foot in height, would reach the cloud; or it might suggest a wintry landscape brought in amidst scorching summer days to release a man from heat.

The success in raising a valuable "bonsai" depends entirely on the skill of dwarfing the trees, and it requires a long experience. Remember always what the home of the plant was, and treat it according to its habitat. In other words, climate, soil, environment, nourishment, and all other circumstances of its original state should accompany the tree; and the degree of humidity, both in the air and ground, is of prime importance in the dwarfing process. Some have the erroneous notion that the dwarfing is accomplished merely by bending the tree unnaturally. The roots are confined to check growth, without making other alteration. The shape and size of the branches or leaves are affected by the firmness of the earth, the way of watering, the kinds of fertilizer, and the degree of sunshine. Between the leaves there should be ample air and frequent sunshine. Some plants need only slight moisture, and others much. Too wet is worse than too dry. Many are thoughtless in giving water, not considering the condition of the soil. Judicious watering is one of the first requisites to success. For example, after being placed on balconies or terraces in the daytime, the potted plants should be exposed outdoors during the night, if not stormy. Japanese gardeners use many different fertilizers in accordance with the time of growth, kind of plant, and purposes (i.e., whether for branches or leaves, for flowers or fruits), some of them being: oil-cake, bone-meal, tankage, clam-shells, barn-manures, night-soil, wine lees, tea dregs, cow's milk, rice-bran, fish refuse, iron-rust, and others.

Plants both of "bonsai" and "hachiuye" dwarfs should be repotted every two or three years, in order to destroy the old fibrous roots, and to give a chance for new ones. Otherwise, trees are deprived from taking any nourishment, and will soon die. This practice is to be done in February or March, when the aim of dwarfing is completed; whereas the pruning is to be between April and June, to secure more or even larger flowers.

**Pine.**—This is one of the most difficult plants to be treated as a dwarfed tree, although it will hardly result in failure, if taken direct from the mountain or seashore while new young needles are steadily growing. Pines that have suffered through various difficult



1368. Training a branch.



weather are preferred. About half a year previous to removal, a ditch should be made around the plant. In removing, the main root should be carefully cut off by scissors, leaving its end downward to avoid the resin from accumulating, which otherwise might destroy the tree. For different shapes, the branches are to be twisted to and fro, as shown in the cut (Fig. 1368); bind the part with hemp-palm rope, and pull it moderately toward the trunk with a cord. The special nature of this tree is to dislike the humid earth. Having no pleasing flower or fruit, the pine must exhibit merit in the arrangement of needles or the color of the bark. The best time to transplant is in autumn. For fertilizers, one may use oil-cake or a bone-meal.

*Mume (Prunus Mume).*—This is different from the Japanese flowering cherry; the beauty of the flower should accompany the picturesque form of the tree itself. The age of the tree is highly regarded. Slender branches as well as grotesque trunks with mossy bark are usually chosen. Hence, all dwarfed Mume plants are raised by grafting. The potting of Mume may take place as soon as the flowers have fallen. The pot is to be kept in shade at least one month, the earth having been thoroughly pressed. To have more flowers, the old roots are destroyed, and the branches cut, leaving a few branchlets. Potted Mume is fertilized with thin liquid manure, oil-cakes or occasionally cow's milk, between December and February.

*Pomegranate.*—In this plant, the portion of the roots which is close to the main trunk may be exposed to the air. As a dwarfed tree, pomegranate is enjoyed both for fruits and flowers. All new sprouts are to be pinched off, other than those that will produce flowers. Until the fruits have grown larger, one should wait for manuring. For flowers, oil-cake, tankage, or bone-meal are used; for fruits a light fertilizer is used.

*Bamboos.*—Choose one of the most proper kinds and keep it in a pot for two or three years. Then wait upon several shoots coming up. One year after this, these new bamboos are transferred into other pots. The practice needs much patience and great skill, and it would hardly pay, knowing that the prime age of bamboo is only for four or five years. ISSA TANIMURA.

#### Dwarf fruit trees.

Generally speaking, dwarf trees are those which by various means are made to remain smaller than normal trees of the same species or variety. Three means are in common use in dwarfing trees: by growing on dwarfing stocks, restricting the root run, and by pruning to check or suppress the growth of the top. Horticulturally speaking, and particularly as the term is applied to fruit trees, dwarf trees are those which are grown on dwarfing stocks. A discussion of dwarf fruit trees is, then, most largely concerned with dwarfing stocks.

Dwarfing stocks are not modern innovations. For at least three centuries, various stocks have been used to dwarf apples, pears, plums, cherries and quinces. In fact, dwarf fruit trees were quite as common, or even more so, in Europe a century ago than they are at present. They have been grown in America, at least dwarf apples and pears, for nearly a century, during which time in recurring periods they have received much attention from fruit-growers. There is in horticultural literature much data, which, while fragmentary, is still substantial, to guide us in the use of dwarfing stocks and to indicate the value of dwarf fruit trees.

The action of dwarfing stocks is readily explained after a statement of what stocks are. A dwarfing stock is always a smaller, a weaker, or a slower-growing variety or species than the tree to be propagated on it. The top conforms to the roots chiefly because of the inability of the latter to furnish sufficient nutrition. The tree is dwarfed through starvation. Other than

in size the trees are little or not at all affected, although minor changes in the fruit and in the bearing habit are supposed to be brought about by dwarfing.

Dwarf fruit trees are propagated by the same methods employed in growing standard trees with preference given to budding dwarfing stocks, whereas standard trees are still largely propagated by grafting. Propagators hold that a better union can be obtained by budding than by grafting, and since it is always difficult to secure a good union between plants as widely divergent as stock and cion in a dwarf tree must of necessity be, budding should have the preference of the two methods. In fact the chief problem in growing dwarf fruit trees is to find a stock with which the larger growing cion can easily be worked and with expectations of a close and permanent union. This brings us to the matter of stocks for the several fruits.

Dwarf apples are commonly grown on two stocks—the Paradise and the Doucin. Both of these, it must be understood, are class names, there being in the literature a dozen or more varieties of Paradise and about as many of the Doucin. Carefully compared, the many kinds in use can be reduced to the French Paradise (Pommier du Paradis), English Paradise, and the Dutch Paradise for the first class, while the Doucin stocks may be grouped under the Doucin, the English Broad-leaved and the English Nonsouch. There is much confusion in the names of dwarf apple stock in nurseries and the grower will be fortunate if he gets what he calls for. Of these two classes, the Paradise stocks make the dwarfier plants and should be used for trees to be kept as true dwarfs and for all that are to be trained in fancy forms. The Doucin stocks are the better for free-growing trees.

Pears are dwarfed by growing on quince roots. Any quince may be used, but the Angers, upon which quinces are commonly propagated, is the best dwarfing stock for the pear. Comparatively few pears can be successfully worked on quince roots because stock and cion do not make a good union. This antipathy is obviated by budding the quince with a pear which unites readily; the next year the untractable variety is budded on the more amenable variety, the resulting tree being thus pear on quince, followed by pear on pear—the "double-working" of nurserymen.

There is no question but that the Mahaleb is a dwarfing stock for the cherry, and in Europe, where it has long been used, it is always regarded as such. In America, where the Mahaleb in the last quarter century has all but superseded the Mazzard, a free-growing stock, it is not so commonly known that there is a difference in the size of trees on the two stocks. It must not be understood that the Mahaleb stock gives a true dwarf cherry, but it has a very decided dwarfing effect on either sweet or sour cherries.

Stocks for plums have not been well tested—a statement that holds for all stone fruits. It is very certain, however, that varieties of *Prunus insititia*, as the Damsons or the St. Julien, the latter one of the best of all plums for a stock, have a dwarfing effect on the varieties of the larger-growing trees of *P. domestica*, as do also several of our free-growing native species, among which *P. americana* may be recommended for cold climates. For true dwarf trees, however, the only stocks that give promise are the dwarf natives, of which *P. pumila* and *P. Besseyi* have been found to unite readily with several varieties each of either the *Domestica* or *Triflora* plums, and to make very good dwarfing stocks for them.

Peaches, apricots and nectarines are dwarfed by budding on *P. cerasifera*, *P. insititia* and *P. americana*. It is probable that all of these fruits, and the cherry as well, can be grown on *P. pumila* and *P. Besseyi* as true dwarfs, several experiments having demonstrated that good unions form between the peach, at least, and these dwarf sand cherries. As to whether the union

would be sufficiently permanent to make the trees so obtained worth while, remains to be seen.

The great advantage of a dwarf tree is its small size, which permits the planting of more varieties of a fruit in a small space. Dwarf fruits, then, deserve, in particular, the consideration of amateur fruit-growers and of those who want small-growing fillers for permanent orchards. Trees of small size are easier to prune, spray, and to care for in every way. Because of the low stature and compact head of the dwarfs, wind causes less injury to trees and crops.



1369. *Dyckia rariflora*.

Another very material advantage of the dwarfs is that they come into bearing earlier than the standards. The desirability of early bearing from several standpoints is obvious. Advocates of dwarf fruits very generally assert that the fruit from the dwarf trees is of higher quality, higher color and better flavor. As a generalization, this is not true, though it probably is true for a few varieties of each of the several fruits under consideration. Tests of many varieties of apples on dwarf and standard stocks on the grounds of the New York Agricultural Experiment Station show that more often the fruit from standard trees is the better. Pear-growers have found that comparatively few varieties of this fruit are improved in the qualities named by growing as dwarfs. Size, color and quality of fruit are as likely to be affected deleteriously as beneficially by dwarfing.

Dwarf stocks are much used to adapt varieties to soils. This is the chief value of most of the propagating plants named for the stone-fruits. The true purpose of such stocks must be clearly kept in mind—the dwarfing in this case is a disadvantage attendant upon the use of the stock for another purpose.

The disadvantages of dwarfing stocks, in America at least, are rather more pronounced than their advantages. They may be summed up as follows: Nearly all dwarf trees are shorter-lived than standards—the exceptions are very few. All dwarf trees, whether trained in fancy forms or free-growing, need more care than standard trees. The chief items needing extra care are pruning, tilling and fertilizing. It is more difficult to propagate dwarf trees and the cost of the plants is therefore greater, making the cost an acre, with the increased number of trees, much greater. Lastly, it is most difficult to secure trees, especially of apples, on dwarfing stocks that are known to be true to name.

In conclusion, it may be said that we have just passed through one of the recurring periods of interest in dwarf trees in America and that commercial fruit-growers are more than ever convinced that for the present, at least, dwarf trees are of little value to them. The place of these trees is in gardens of amateurs and on the estates of those who can afford to grow and

train them for their beauty as well as for their fruit. There is, however, a possible future for dwarf fruits in commercial plantations, when the refinements of horticulture have been carried far enough to show the special adaptations of varieties of the several fruits to different stocks and when the care of dwarf trees is better understood.

U. P. HEDRICK.

**DYCKIA** (after Prince Salm-Dyck, German botanist, and author of a great work on succulent plants). *Bromeliaceæ*. Succulents, grown under glass and in the open far South.

Dyckias somewhat resemble century plants, but with smaller spines, as a rule, and flowering regularly. They are usually stemless, and the lvs. form dense rosettes. —About 60 species in S. Amer. For cult., see *Agave*. They are rarely cult. in Fla. and Calif., and in a few northern collections. Following have showy yellow fls.

A. Infl. amply branched or paniced.

*altissima*, Lindl. (*D. princeps*, Lem.). Lvs. spiny at the margin; floral bracts small, all manifestly shorter than the fls. Brazil.

AA. Infl. not branched, a raceme or spike.

B. Filaments forming a tube: fls. with scarcely any pedicel.

*rariflora*, Schult. Fig. 1369. Lvs. with small spines on the margin, shorter than in *D. altissima*; sepals not emarginate at the apex; upper sheaths of the scape shorter than internodes. Brazil. B.M. 3449. B.R. 1782.

BB. Filaments not forming a tube all the way: fls. with a short but conspicuous pedicel.

*sulphurea*, C. Koch, not Baker. Lvs. with small spines at the margin; sheaths of the scape longer than the internodes, the higher ones entire; bracts lanceolate, the lowest conspicuously longer than the pedicelled fls.; blades of petals wide and longer than stamens. Brazil.

WILHELM MILLER.

**DYPSIS** (obscure name). *Palmaceæ*, tribe *Arécææ*. Madagascan palms that have been poorly described, are little known and of scarcely any horticultural significance. They are all small, unarmed palms, with reed-like sts.: lvs. terminal, entire, bifid at the apex or pinnatisect; segms. split at the apex or irregularly toothed, the apical one confluent; sheath short; spadices loosely fld.: fr. small, oblong or ovoid, straight or curved, oblique at base.—Perhaps half a dozen species.

No species of *Dypsis* are common in cultivation, as they possess but little beauty. They are among the easiest and quickest to germinate. All of them require a stove temperature. *D. madagascariensis*, Nichols. is also known as *Areca madagascariensis*, Mart., and is so treated here. *D. pinnatifrons*, Mart. (*A. gracilis*, Thouars), is one of several plants that have been known as *Areca gracilis*. It is a pretty palm, now grown in large quantities by some dealers. G.C. II. 24:394. The genus is closely related to *Chamædorea*.

N. TAYLOR.†

**DYSCHORISTE** (name refers to the scarcely divided or lobed stigma). Incl. *Calophanes*. *Acanthaceæ*. Fifty or more annuals or perennials of the tropics of Amer., Afr., and Asia, allied to *Ruellia* and *Strobilanthes*. None of them is apparently in regular cult. They are plants with opposite mostly entire small lvs. and blue or pale fls. in short-stalked cymes. *D. nobilior*, C. B. Clarke (*D. Hildebrandtii*, Lindl.), is a free-flowering shrub, with a penetrating odor, and hairy branches; lvs. elliptic, nearly 2 in. long, slightly crenulate; fls. purple-blue in many distant and dense axillary cymes; corolla less than ½ in. long. Brit. Cent. Afr.; recently cult. at Kew.



# E

**EARTH-NUT, EARTH-PEA.** Little-used names for the peanut, goober or pinder, *Arachis hypogæa*. The words earth-nut and ground-nut are used for many subterranean tubers, without much discrimination, and therefore they have small value as vernaculars. They may be applied to the underground tubers of *Apios tuberosa*, *Panax trifolium*, *Erigenia bulbosa*, *Cyperus esculentus*, and others. Earth-apple, earth-gall and similar variants are in use for various plants.

**EATÔNIA:** *Sphenopholis*.

**ËBENUS** (Greek name for the ebony). *Leguminosæ*. About 15 species of silky-hairy herbs or sub-shrubs, of the eastern Medit. region and eastward to Beluchistan, allied to *Onobrychis*, sometimes planted in borders but apparently not offered in this country. Fls. reddish or purplish, papilionaceous, in dense axillary long-peduncled spikes; standard obovate or obcordate, narrowed to base; wings short or minute; keel about equaling the standard, the apex obtuse and oblique; calyx-lobes subulate and plumose: pod obovate or oblong, compressed, included in the calyx-tube, indehiscent, 1- or 2-seeded: lvs. odd-pinnate or some of them somewhat digitately 3-foliolate or even simple. *E. crética*, Linn., is shrubby with lvs. usually of 5 (sometimes 3) lfts., and reddish purple fls. in ovate-cylindrical spikes. Crete. B.M. 1092 (as *Anthyllis crética*). *E. Sibthorpii*, DC., is herbaceous, with more lfts., and purplish fls. in spherical spikes.

This genus has no relation to the ebony, which is of the genus *Diospyros* (particularly *D. Ebenum*).

**EBONY:** *Diospyros Ebenum*.

**ECBÁLLIUM** (Greek, *to throw out*). *Cucurbitacæ*. SQUIRTING CUCUMBER. A perennial trailing vine, easily grown as an annual in any garden, cultivated for its explosive fruits.

When ripe, the oblong prickly fr. squirts its seeds at the slightest touch, or sometimes at the mere vibration of the ground made by a person walking by. Some of the old herbalists called this plant *Cucumis asininus*. Another curious fact about the plant is that a powerful cathartic is made from the juice of the fr., which has been known for many centuries. A preparation of it is still sold in the drugstores as *Trituratio Elaterini*. The drug "elaterium" is derived from the juice of the fr. *Ecballium* has only 1 species, and is closely related to the important genera *Cucumis* and *Citrullus*. With them it differs from *Momordica* in lacking the 2 or 3 scales which close the bottom of the calyx. Other generic characters are: prostrate herb, fleshy, rough hairy: lvs. heart-shaped, more or less 3-lobed: tendrils wanting: fls. yellow, the staminate in racemes, pistillate usually from the same axils with the staminate fls.; calyx 5-cut. It is a native of the middle and eastern Medit. regions, especially in rich moist forests.

**Elatèrium**, A. Rich (*Elatèrium cordifolium*, Moench. *Momordica Elatèrium*, Linn.). SQUIRTING CUCUMBER. Fig. 1370. Described above; grown in this country as a curiosity. B.M. 1914.

WILHELM MILLER.

**ECCREMOCÁRPUS** (Greek, *pendent fruit*). *Bigoniaceæ*. An attractive half-hardy tendril-climber.

Shrubs, but grown as annuals in the N., tall climbing:

lvs. opposite, 2-parted or -pinnate: fls. yellow, scarlet or orange, mostly racemose; calyx campanulate, 5-parted; corolla-tube elongated; limb more or less 2-lipped or in *E. scaber* small and nearly entire; stamens 4, didynamous, included; disk annular: fr. an ovate or elliptic loculicidal 1-celled caps.—Three or 4 species of tall somewhat woody plants from Peru and Chile, climbing by branched tendrils at the end of the twice-pinnate lvs., and having very distinct fls. of somewhat tubular shape, which are colored yellow, orange or scarlet.

*Eccremocarpus* has two sections, in one of which the corollas are cylindrical, but in the section *Calampelis*, to which *E. scaber* belongs, the corolla has a joint at a short distance beyond the calyx, then swells out on the under side, and suddenly constricts into a neck before it reaches the small circular mouth, surrounded by five very short rounded lobes.

**scàber**, Ruiz & Pav. (*Calampelis scàber*, D. Don). About 10 ft. high: lvs. bipinnate; lfts. obliquely cordate, entire or serrate: fls. 1 in. long, orange, in racemes. July, Aug. Chile. B.R. 939. B.M. 6408. Var. **coccineus**, Hort., has scarlet fls. Var. **aureus**, Hort., has fls. bright golden yellow. Var. **carmineus**, Hort., has fls. carmine-red.—*E. scaber* is hardy in the southern parts of the U. S., and makes a most attractive perennial woody subject. It is also satisfactory in the open in the N. if given a warm exposure, blooming readily from seed the first year.

L. H. B.†

**ECHEVÈRIA** (named for Atanasio Echeverria, an excellent Mexican botanical draughtsman). *Crassulacæ*. Stemless or somewhat caulescent succulents.

Leaves fleshy, but usually broad and flat, commonly making dense rosettes: fls. borne in loose spikes or racemes or sometimes paniculate, but never in a flat cyme; calyx deeply 5-parted; sepals usually elongated and narrow, unequal, commonly spreading but sometimes erect; corolla 5-angled, usually strongly so, very broad at base; stigma-lobes united below, very thick

and nerveless, erect but often spreading at tip; stamens 10, 5 attached near the middle of the petals, the other 5 either free or attached lower down on the corolla: carpels 5, erect; ovules and

1370. *Ecballium Elaterium*. (×½)

seeds many.—More than 60 species of this genus have been described. Most of them have been in cult. in Washington and at the New York Botanical Garden, although but few are in the trade. It is confined almost entirely to Mex., one species extending into the mountains of W. Texas, and one or two species extending into Cent. Amer. Many of the species are valuable for flat bedding on account of their compact rosettes and highly colored foliage. For cultural notes, see *Cotyledon* (with which it has been united by many authors).

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A. *Sepals orbicular, very small, obtuse.*

B. *Corolla twice as long as thick; sepals appressed.*

1. *amœna*, De Smet. Nearly stemless, with numerous offshoots: lvs. in small but dense rosettes: flowering branches slender, 4-8 in. long; fls. 1-8, in slender racemes; corolla red, 4-5 lines long. Native of Mex.—This species was intro. into cult. nearly 40 years ago.

BB. *Corolla little longer than thick; sepals not appressed.*

2. *microcalyx*, Brit. & Rose (*E. Purpusii*, Brit.). Shortly caulescent, sometimes 1 ft. high: corolla yellow-pink, 4 lines long. Native of Mex.

AA. *Sepals linear to ovate.*

B. *Fls. axillary, arranged in loose spikes or racemes.*

c. *The fls. in spikes.*

D. *Plant not caulescent, glabrous throughout.*

3. *mucronata*, Schlecht. Caulescent, glabrous throughout: basal lvs. in a dense rosette 4-8 in. long; fls. sessile; corolla 1 in. or more long, reddish tinged with yellow. E. Mex.

DD. *Plant caulescent, pubescent throughout.*

4. *coccinea*, DC. (*Cotyledon coccinea*, Cav.). St. 1-2 ft. high, finely grayish pubescent: lvs. oblanceolate, largest 8-9 in. long; infl. a spike of 15-25 fls. Common in Cent. Mex. Page 870.

5. *pubescens*, Schlecht. (*Cotyledon pubescens*, Baker). A similar species is sometimes cult., with obovate-spatulate lvs.

CC. *The fls. in racemes.*

D. *Species caulescent.*

E. *Infl. compound below; corolla pale.*

6. *linguæfolia*, Lem. Sts. 1 ft. or more high, very leafy: lvs. thick, fleshy, green, nearly terete at base: flowering branches long and drooping, each consisting of a simple raceme: fls. cream-colored. Mex.—This species has long been in cult., and has not been collected wild in recent years. It is so very different from the other echeverias of Mex. that we are led to suspect that it may be of hybrid origin.

EE. *Infl. simple throughout; corolla bright-colored.*

F. *Plant pubescent throughout.*

7. *pulvinata*, Rose (*Cotyledon pulvinata*, Hook.). Sts. 4-6 in. high, somewhat branching, becoming naked below: young branches, lvs. and sepals covered with a velvety pubescence: lvs. clustered in rosettes at the top branches, about 1 in. long, very thick; fls. in a leafy raceme; corolla scarlet, sharply 5-angled. Mex.—This is a very distinct echeveria, with a remarkable pubescence.

8. *Pringlei*, Rose (*Cotyledon Pringlei*, Wats.). This is perhaps nearest *E. pulvinata*, although not so pubescent nor so attractive a plant.

FF. *Plant glabrous throughout.*

9. *atropurpurea*, Baker (*Cotyledon atropurpurea*, Baker. *E. sanguinea*, Morr.). Sts. 4-8 in. high, glabrous throughout: lvs. aggregated at the top of the st. in a dense rosette, usually dark purple above, somewhat glaucous: flowering branches elongated; sepals somewhat unequal; corolla bright red, strongly angled. Probably native of Mex., but known only from cult. specimens. Page 870.

DD. *Species not caulescent.*

10. *lurida*, Haw. (*Cotyledon lurida*, Baker). Plants stemless, glabrous and glaucous throughout: lvs. forming a flat, rather open rosette, narrowly oblong, 2-4 in. long, acute, tinged with purple, especially when old: flowering branches 12-32-flid.; sepals thick, spreading or even reflexed; corolla bright red. Known only from garden material, but undoubtedly from Mex. B.R. 27:1.

11. *racemosa*, Schlecht. & Cham. This is similar to *E. lurida*, and was considered by Baker to be a synonym; but they are here kept distinct. The material of *E. racemosa* now in cult. was secured at the type locality of the species, Jalapa, Mex.

12. *carnicolor*, Morr. (*Cotyledon carnicolor*, Baker). Another somewhat similar species, but with only 6-8 fls. It is known only from garden specimens.

13. *maculata*, Rose. This belongs also to this alliance, but grows at higher localities in Mex., and has brighter green lvs. It ought to live throughout the year in our southern gardens.

BB *Fls. terminal, arranged in second spikes or racemes, either simple or compound.*

c. *Infl. a simple raceme.*

D. *Plant hairy throughout.*

14. *setosa*, Rose & Purpus. Plants stemless, giving out offsets from the base: lvs. often 100 or more, forming a dense, almost globular, rosette, thickish but flattened, about 2 in. long, covered on both sides with setiform hairs: infl. usually a simple second raceme with 8-10 fls.; petals red at base, yellow at tip, setose without. Contr. Nat. Herb. 13: pl. 10.—A very peculiar species, recently collected by C. A. Purpus in Puebla, Mex.

DD. *Plant glabrous throughout.*

E. *The fls. sessile.*

15. *Pæacockii*, Croucher (*Cotyledon Pæacockii*, Baker). Stemless: lvs. about 50 in a close rosette, obovate, spatulate, white-glaucous, slightly red toward the tip, faintly keeled on the back: flowering branches forming a scorpioid spike; corolla bright red, 6 lines long. It is doubtless of Mexican origin, although often reported as from New Mex. or Calif. Page 870.

EE. *The fls. pedicelled.*

F. *Lower pedicels short.*

16. *subsessilis*, Rose. This is very similar to *E. Peacockii*, but has shortly pedicelled fls. It is a very beautiful species, well suited for flat bedding. Native of Cent. Mex.

FF. *Lower pedicels elongated.*

G. *Lvs. very turgid.*

17. *élegans*, Rose. Stemless: lvs. numerous, sometimes 80-100 in cult. specimens, forming very compact rosettes, very glaucous, pale bluish green, very turgid, with translucent margins, these sometimes reddish: flowering branches pinkish, with 8-12 lvs.; fls. in a succulent raceme; corolla 5 lines long, its segms. distinct nearly to the base, pinkish with yellow spreading tips.—Known only from material collected near Pachuca, Mex., by J. N. Rose. This is one of the most beautiful species of the genus, and is well suited for rockeries or for use in flat bedding. This is not to be confused with *Cotyledon elegans*, N. E. Br., which is *Oliveranthus elegans*.

18. *simulans*, Rose. A similar species with somewhat different habit and lvs., and with slightly different corolla; sepals appressed rather than spreading.

GG. *Lvs. not turgid.*

H. *The lvs. glaucous green.*

19. *glauca*, Baker (*Cotyledon glauca*, Baker). Stemless: lvs. in small but dense rosettes, nearly orbicular,



broadened just above the apex, almost truncate, but with a decidedly purple mucro, very pale, slightly glaucous: fls. 15-20 in a small secund raceme. Cent. Mex.—Often confused with *E. secunda*, but apparently specifically distinct. Page 870.

HH. *The lvs. with reddish margins.*

20. *secunda*, Booth (*Cotyledon secunda*, Baker). Fig. 1083. Stemless, glabrous: lvs. numerous, inclined to be erect, forming a dense rosette, bluish green, ovate-cuneate, broad at margin and more or less reddish: fls. 12-15 in a secund raceme. Mex. Page 870.

CC. *Infl. a compound raceme.*

D. *Plants acaulescent.*

E. *Sepals widely spreading.*

21. *rubromarginata*, Rose. Stemless or sometimes with a short st.: lvs. comparatively few, stiff, ascending, glabrous, glaucous, with a somewhat crenulate, red margin: flowering sts. sometimes a foot high, more or less paniculate. Mex.

EE. *Sepals erect and closely appressed to the corolla.*

22. *subrigida*, Rose (*Cotyledon subrigida*, Rob. & Seaton). Stemless, glaucous throughout: lvs. in a dense rosette, flat, acute, very glaucous, bluish green, tinged with purple; the margins of young ones bright scarlet. Mex.—This is one of the most beautiful of all the echeverias. It is especially suitable for growing in clusters.

DD. *Plants caulescent.*

E. *Shape of lvs. acute.*

F. *Lvs. tapering into a long narrow stalk.*

23. *Scheerii*, Lindl. (*Cotyledon Scheerii*, Baker). Sts. sometimes 2 ft. tall, or more often branched, glabrous, and somewhat glaucous: infl. a few-branched panicle; petals red or tinged with yellow, thick, erect or spreading at tip. Undoubtedly Mex., but known only from cult. material. B.R. 31:27. Page 870.

FF. *Lvs. somewhat narrowed downward, but with a broad base.*

24. *fülgens*, Lem. (*Cotyledon fülgens*, Baker). Sts. usually 4-8 in. high, glabrous throughout: lvs. few in each rosette: infl. paniculate; corolla strongly 5-angled, coral-red without, yellowish within. Mex. Page 870.

EE. *Shape of lvs. obtuse.*

F. *Lvs. rounded on the face.*

25. *campanulata*, Kunze. Short, caulescent, the branches crowned by rosettes of large lvs.: lvs. spatulate, tapering into thick petioles, very glaucous, obtuse at apex: petals thick, reddish without, yellowish within, somewhat spreading at tip. Mex. B.R. 1247 (as *E. gibbiflora*).—It is said to be near *E. gibbiflora*, but it certainly has very different foliage.

FF. *Lvs. concave or flat on the face.*

26. *gibbiflora*, DC. Sts. often tall, 2 ft. or more high, glabrous throughout: lvs. 12-20 in a close rosette, obovate-spatulate, often highly colored: infl. a lax panicle. Mex. Var. *metallica*. A very common and popular greenhouse plant. It is very similar to the type, but has more highly colored lvs. Page 870.

*E. argentea*, Lem., I.H. 10: Misc. 78, 1863=Dudleya pulverulenta.—*E. Bernhardiana*, Foerst., is a garden species or form from an unknown source.—*E. bracteosa*, Lindl. & Paxt.=Pachyphytum sp.—*E. cinerea* is listed in Johnson's Gardener's Dict., p. 264, 1894, as a hybrid.—*E. clavifolia*, Deleuil, is a hybrid of Pachyphytum bracteolusum and Courantia rosea.—*E. Clavelandii* is a hybrid in cult. at the White House, Washington.—*E. cyanea*, Johnson Gard. Dict., is a garden hybrid.—*E. dealbata*, Johnson Gard. Dict. garden hybrid.—*E. Desmetriana*, L. De Smet=E. Peacockii.—*E. erecta*, Deleuil, is said to be a hybrid of *E. coccinea* and *E. atropurpurea*.—*E. ferrea*, Deleuil, said to be a hybrid of *E. Scheerii* and *E. Calophana*.—*E. globosa*, Hort. ex. E. Morr. in B.H. 24:161. (1874.) Caulescent or nearly so: lvs. numerous, forming a dense rosette, spatulate, pale and somewhat glaucous, about 3 in. long, broadest near the top and there  $\frac{1}{2}$ -1 in. broad,

mucronate at tip, rather flat: flowering branches weak and spreading, bearing a few linear bracts, branched at top into 2 secund racemes; sepals linear, very unequal, somewhat ascending; corolla both before and after flowering strongly 5-angled, reddish below, yellowish above and within; petals free nearly, if not quite, to the base; stamens opposite the petals borne on the lower third of the corresponding petals; the 5 alternate stamens free nearly to the base: carpels free, erect. This description is drawn from a plant in the Washington Botanical Garden of unknown origin. It resembles somewhat *E. secunda*.—*E. grandiflora*, E. Morr., is evidently a typographical error for *E. grandifolia*, Haw.—*E. grandidis*, E. Morr.=*E. gibbiflora*(?).—*E. grandidisepala*, Deleuil, is said to be a hybrid of *E. metallica* and a Courantia.—*E. herbacea*, Johnson Gard. Dict., is a garden hybrid.—*E. imbricata*, Deleuil, Cat. 1874; Deleuil in E. Morr. B.H. 24:329. (1874.) Deleuil in A. De Smet. R..B. 3:147. (1877.) This is cult. in the Washington Botanical Garden, and in the White House grounds. This species seems to be a favorite as a border plant in Washington City parks. It is said to be a cross between *E. glauca* and *E. metallica*. The infl., while secund as in *E. glauca*, is generally, although not always, 2-branched, while the lvs. are larger than in the true *E. glauca*.—*E. metallica decora*, Rodgers, I.H. 30:505, is a variegated form of *E. metallica*.—*E. mirabilis*, Deleuil, is a hybrid.—*E. mutabilis*, Deleuil, is said to be a hybrid of *E. Scheerii* and *E. lingulefolia*.—*E. ovata*, Deleuil, is said to be a hybrid of *E. Scheerii* and *E. metallica*.—*E. pachyphytioides*, L. De Smet, is a cross of Pachyphytum bracteolusum and *E. metallica*.—*E. pruinosa*, Deleuil, is said to be a hybrid between *E. lingulefolia* and *E. coccinea*.—*E. pulverulenta*, Nutt.=Dudleya.—*E. Pirpusii*, Schum.=Dudleya.—*E. rosea*, Lindl. & André. I.H. 20:124, said to be close to *E. secunda*; locality not given.—*E. rosea*, Lindl.=Courantia.—*E. scaphylla*, Deleuil, is a hybrid of Urbina agavoides and *E. lingulefolia*.—*E. securifera*, Deleuil, is a hybrid.—*E. spathulata*, Deleuil, is a hybrid.—*E. spiralis*, Deleuil, hybrid.—*E. stellata*, Deleuil, hybrid.

J. N. ROSE.

ECHIDNÓPSIS (viper-like, alluding to the serpent-like sts.). *Asclepiadaceæ*. A few species of leafless succulents of Trop. Afr. and Arabia, not sufficiently distinguished from Caralluma; allied to Stapelia, which see for cult. None of the species seems to be in the trade. The sts. are many-angled and tessellate, bearing small mostly fascicled fls. in the grooves: corolla rotate or approaching campanulate, 5-lobed, fleshy, yellow or purple-brown; staminal column very short and arising from the base of the corolla, and bearing the corona. The following species have recently been mentioned in garden literature: *E. cereiformis*, Hook. f. is 6 in. high, with elongated cylindrical serpentine or pendulous sts. and bright yellow fls. in fascicles. B.M. 5930. *E. Dammanniana*, Spreng. not Schweinf., is similar but has dark brown-purple fls. Nile Land. *E. Béntii*, N. E. Br., has 7-8-ribbed sts.  $\frac{3}{4}$  in. or less diam. and vinous-purple fls. in pairs toward the tips of the branches. S. Arabia. B.M. 7760. *E. somalensis*, N. E. Br., has columnar cereus-like shrubby cylindrical 6-8-furrowed branches, and nearly sessile dark purple yellow-spotted fls. solitary or in 2's or 3's. Somaliland. B.M. 7929.

ECHINACEA (Greek, *echinos*, hedgehog; alluding to the sharp-pointed bracts of the receptacle). *Compositæ*. PURPLE CONE-FLOWER. Perennial stout herbs, more or less grown in the border or wild garden.

Closely related to Rudbeckia, but rays ranging from flesh-color, through rose, to purple and crimson (one species, not in the trade, has fls. yellow to red), while those of Rudbeckia are yellow or partly (rarely wholly) brown-purple: the high disk and the downward angle at which the rays are pointed are features of echinaceas; the disk is only convex at first, but becomes egg-shaped, and the receptacle conical, while Rudbeckia has a greater range, the disk from globose to columnar, and the receptacle from conical to cylindrical; heads many-fld., mostly large; disk-fls. fertile, rays pistillate but sterile; pappus a small-toothed border or crown: sts. long and strong, nearly leafless above, terminated by a single head.—Five species in N. Amer., 2 of them from Mex., the others native to the U. S. By some treated as a section of Rudbeckia; by others now called Brauneria, which is an older name.

Echinaceas and rudbeckias are stout, and perhaps a little coarse in appearance, but their flower-heads, sometimes 6 inches across, are very attractive, and borne in succession for two months or more of late summer

With the growing appreciation of hardy borders and of native plants, it should be possible to procure four or five distinct colors in the flower, associated with low, medium and tall-growing habits. They do well in ordinary soils, and may be used to help cover unusually dry and exposed spots.

They respond well to rich soil, especially sandy loam, and prefer warm and sunny sites. They are perennials of easy culture. Propagated by division, though not too frequently; sometimes by seeds. The roots of *E. angustifolia* are black, pungent-tasted, and are included in the United States pharmacopœa as the source of an oleo-resin.

**purpurea**, Moench. (*Brauneria purpurea*, Brit.). Commonly not hairy, typically taller than *E. angustifolia*, 2 ft. or more high: lvs. ovate-lanceolate, or the lower ones broadly ovate, often 5-nerved, commonly denticulate or sharply serrate, most of them abruptly contracted into a margined petiole; upper lvs. lanceolate and 3-nerved: rays at first an inch long and broadish, later often 2 in. long or more, with the same color-range as *E. angustifolia*, but rarely almost white. Rich or deep soil. Va. and Ohio to Ill. and La. G.L. 19:28. G.M. 22: suppl. Nov. 11; 31:374. Gng. 5:41. Var. **serotina**, Bailey (*Rudbeckia purpurea* var. *serotina*, Nutt. *R. serotina*, Sweet). The varietal name means late-flowering, but the chief point is the hairy or bristly character of the plant. L.B.C. 16:1539. P.M. 15:79 (as *E. intermedia*).—Perhaps the best form for garden purposes, the rays said to be much brighter colored, broader and not rolling at the edges.

**angustifolia**, DC. (*B. angustifolia*, Brit.). Bristly, either sparsely or densely: lvs. narrower than in *E. purpurea*, from broadly lanceolate to nearly linear, entire, 3-nerved, all narrowed gradually to the base, the lower into slender petioles: fl.-heads nearly as large as in *E. purpurea*, but sometimes much smaller. Prairies and barrens, Sask. and Neb. to Texas, east to Ill., Tenn. and Ala. B.M. 5281. G.W. 4:164.—This species has several forms, which approach and run into *E. purpurea*.

A dealer advertises (1912) a "red sunflower" obtained by crossing a species of Echinacea with *Helianthus multiflorus*. It is described as 5-6 ft. high, with fls. 4-7 in. diam., red. See *Helianthus*.

N. TAYLOR.†

**ECHINOCACTUS** (Greek, *spine* and *cactus*). *Cactaceæ*. A very large group of globular, strongly ribbed, and strongly spiny cacti, growing from the United States to South America, particularly abundant in Mexico.

Sometimes these cacti become very short-cylindrical; occasionally the ribs are broken up into tubercles which resemble those of *Mammillaria*; and rarely spines are entirely wanting: the fls. usually appear just above the young spine-bearing areas, but sometimes they are farther removed, and occasionally they are in the axil of a tubercle; the ovary bears scales which are naked or woolly in the axils, and the fr. is either succulent or dry.—The genus is well developed within the U. S., about 40 species having been recognized, but its extreme northern limit is the southern borders of Colo., Utah, and Nev., apparently having spread from the great arid plateau regions of Mex. proper and Low. Calif. The genus extends throughout Mex. but is not found in Cent. Amer. It is well represented, however, in the drier regions of S. Amer. *Echinocactus* and *Mammillaria* are distinguished chiefly by the way in which the fls. are borne,—terminal on the tubercles in the former, and axillary to tubercles in the latter. In external appearance they are very similar. The genus *Astrophytum* is here included, although it seems to be very different from the typical forms of *Echinocactus* and should doubtless be kept distinct. It is impossible to identify with certainty all of the specific names found in trade catalogues, but the following synopsis con-

tains the greater part of them. In all cases the original descriptions have been consulted, and in some cases it is certain that a name originally applied to one form has been shifted to another. The following synopsis may be useful, therefore, in checking up the proper application of names, but it may thus leave some of the common species of the trade unaccounted for. No attempt is made to group the species according to relationships, but a more easily handled artificial arrangement, chiefly based upon spine characters, is used. It must be remembered that the species are exceedingly variable, especially under cult., and large allowance must be made for the characters given in the key and in the specific descriptions.

Unlike most globular forms of cacti, *echinocacti* do not readily produce offsets; consequently they must be propagated by seeds if one wishes to increase these plants in quantity. Seeds of *echinocactus*, and, in fact, most cacti, will germinate as freely as seeds of other plants, provided they have been allowed to ripen properly before gathering and carefully dried afterward. The months of May and June have been found to be by far the most favorable for germination. Seeds of *echinocactus* will then germinate in five or six days, while during the winter months it takes almost as many weeks. *Opuntias* will germinate in even less than six days; they germinate most readily of all the *Cactaceæ*, and grow the fastest afterward, while *mammillarias* are the slowest to germinate and grow the slowest afterward.—The seeds should be sown in well-drained 4-inch pots in a finely sifted mixture of one part leaf-mold, one part loam and one part charcoal dust and silver sand. The surface should be made very smooth, and the seeds pressed lightly into the soil with the bottom of a flower-pot and then covered with about  $\frac{3}{8}$  inch of fine silver sand. This allows the seedlings to push through readily and prevents the soil from crusting on the surface of the pots, as they usually have to stay in their seedling pots at least one year. The pots should be placed in a greenhouse where they will receive plenty of light but not the direct sunlight, for, although cacti are natives of desert regions, the seedlings will roast if exposed to full sunlight under glass. For the first winter, at least, the seedlings should be kept in a temperature of not less than 60° and carefully looked over every day to ascertain the condition of the soil, for, although they should be kept on the dry side, they must never be allowed to become quite dry during the seedling stage. When about a year old they may be transplanted to shallow pans not more than 6 inches in diameter, and prepared with the same mixture as for seedling pots. These pans will be found better than small pots, because the soil may be kept more evenly moist and the seedlings do better in consequence. When grown from 2 to 3 inches in diameter, seedling *echinocacti* may be transferred to pots, using only sizes just large enough to accommodate them, as they make but few roots. Pot them in a mixture of two parts fibrous loam, one part leaf-mold and one part pounded brick and silver sand. During the spring and summer months, established plants may be given a liberal supply of water, but must be studiously watered during the fall and winter months.—During the winter they should be given a light position in a dry greenhouse, with a night temperature of 45° to 50°, and a rise of 10° by day. For the summer, they may be either kept in an airy greenhouse or placed in some convenient position outside, plunging the pots in the soil or in some light non-conducting material. Some of the species will begin to blossom in May and others at intervals during the summer. The flowers vary considerably in size, and embrace a good range of color, from white to deep yellow, and from faintest purple to deep rose. They do not readily produce seed (in New England, at least) unless artificially pollinated.—Like most of the cactus family, the more cylindrical species



will readily unite when grafted upon other kinds, not only in the same genus, but in other genera of Cactaceæ, and for weak-growing species it may often be an advantage to graft upon some stronger-growing species. *Cleistocactus Baumannii* (or *C. colubrinus*) makes an excellent stock to graft upon, choosing stock plants of reasonable size and height. The system known as "wedge-grafting" is perhaps best for the purpose, and the early spring months, or just as the growing season is about to begin, is the best time for grafting.—If plants of echinocactus can be kept in a healthy condition, they are not much troubled with insect pests; mealy-bug is their worst enemy and should be removed at once with a clean mucilage brush.—The following varieties have been found to be among the most easily grown: *E. capricornis*, *E. coptonogonus*, *E. cornigerus*, *E. Grusonii*, *E. horizontalionius*, *E. longihamatus*, *E. myriostigma*, *E. setispinus*, *E. texensis*, and *E. Wislizenii*. (E. J. Canning.)

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## A. Spines, or some of them, hooked (Nos. I-10).

## B. Central spine solitary.

1. *Wrightii*, Coulter (*E. uncinatus* var. *Wrightii*, Engelm.). Oval, 3-6 in. high, 2-3½ in. diam.: radial spines 8, arranged as in *E. uncinatus*; central spine solitary, angled, flexuous and hooked, elongated (2-6 in.), erect, straw-color, with dark tip: fls. 1-1½ in. long, dark purple. Texas and N. Mex.

## BB. Central spines 4.

## c. Some or all of the spines annulate.

2. *cylindraceus*, Engelm. Globose to ovate or ovate-cylindrical, simple or branching at base, becoming as much as 3 ft. high and 1 ft. diam.: ribs 13 in younger specimens, 20-27 in older ones, obtuse and tuberculate: spines stout, compressed, more or less curved, reddish; radials about 12, with 3-5 additional slender ones at upper edge of areole, 1-2 in. long, the lowest stouter and shorter and much hooked; centrals 4, very stout and 4-angled, about 2 in. long and ½-⅓ in. broad, the uppermost broadest and almost straight and erect, the lowest decurved: fls. yellow. S. W. U. S. and Low. Calif.

3. *longihamatus*, Gal. Subglobose or at length ovate, becoming 1-2 ft. high: ribs 13-17, often oblique, broad, obtuse, tuberculate-interrupted: spines robust, purplish or variegated when young, at

length ashy; radials 8-11, spreading, straight or curved or flexuous, the upper and lower ones 1-3 in. long, the laterals 2-4 in.; centrals 4, angled, the upper ones turned upward, straight or curved or twisted, the lower one stouter, elongated (3-8 in.), flexuous and more or less hooked: fls. yellow, tinged with red, 2½-3½ in. long. Texas and Mex.

4. *Wislizenii*, Engelm. At first globose, then ovate to cylindrical, 1½-4 ft. high: ribs 21-25 (13 in small specimens), acute and oblique, more or less tuberculate: radial spines ¾-2 in. long, the 3 upper and 3-5 lower ones stiff, straight or curved, annulate, red (in old specimens the 3 stout upper radials move toward the center and become surrounded by the upper bristly ones), the 12-20 laterals (sometimes additional shorter ones above) bristly, elongated, flexuous, horizontally spreading, yellowish white; centrals 4, stout, angled, and red, 1½-3½ in. long, the 3 upper straight, the lower one longest (sometimes as much as 4-5 in.), very robust (flat and channeled above), hooked downward: fls. yellow or sometimes red, 2-2¾ in. long. From S. Utah to N. Mex. and Low. Calif.

## cc. None of the spines annulate.

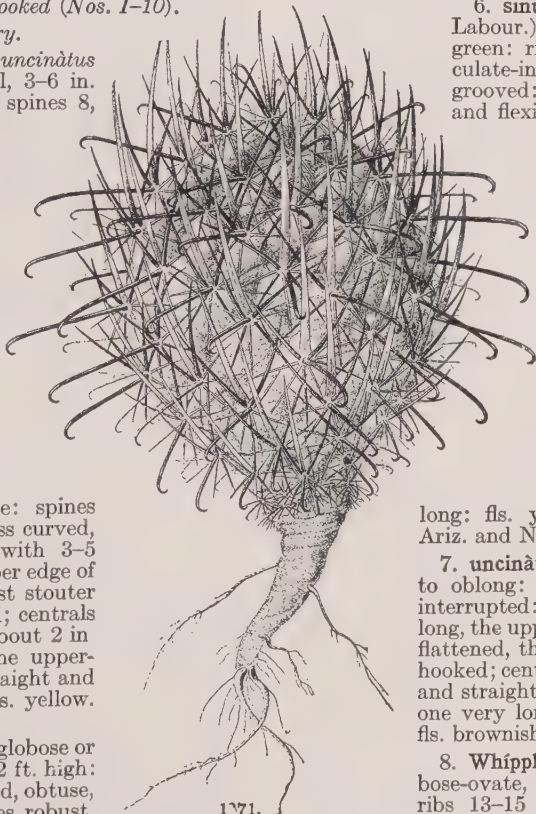
5. *brevihamatus*, Engelm. Globose-ovate, very dark green: ribs 13, deeply tuberculate-interrupted, the tubercles with a woolly groove extending to the base: radial spines mostly 12, terete, straight, white or yellowish, with dusky tips, ½-1 in. long, the upper longer; central spines 4 (rarely 1 or 2 additional ones), flattened, white with black tips, the 2 lateral ones divergent upward, straight or a little recurved, 1-2 in. long, the uppermost one weaker, the lower stoutest and darkest, porrect or deflexed, hooked downward, ¾-1 in. long: fls. funnelform, rose-color, 1-1½ in. long. S. W. Texas and New Mex.

6. *sinuatus*, Dietr. (*E. Treculianus*, Labour.). Globose, 4-8 in. diam., bright green: ribs 13, oblique, acute, tuberculate-interrupted, the tubercles short-grooved: radial spines 8-12, setiform and flexible, the 3 upper and 3 lower purplish brown and straightish (the lower ones sometimes more or less hooked), ½-1 in. long, the 2-6 laterals more slender, longer (1-1½ in.), often flattened, puberulent and whitish, sometimes flexuous or hooked; central spines 4, puberulent, yellowish (or purplish variegated), the 3 upper ones slender, flattened or subangled, erect and generally straight (rarely hooked). 1½-2 in. long, the lowest one much stouter, flattened or even channeled, straw-color, flexuous, more or less hooked (sometimes straight), 2-4 in.

long: fls. yellow, 2-3 in. long. Texas, Ariz. and N. Mex.

7. *uncinatus*, Gal. Glaucous, globose to oblong: ribs 13, obtuse, tuberculate-interrupted: radial spines 7 or 8, 1-2 in. long, the upper 4 or 5 straw-color, straight, flattened, the lower 3 purplish, terete and hooked; centrals 4, the upper 3 rather stout and straight, about 1 in. long, the lowest one very long, flattened, hooked at apex: fls. brownish purple. N. Mex.

8. *Whipplei*, Engelm. Fig. 1371. Globose-ovate, 3-5 in. high, 2-4 in. diam.: ribs 13-15 (often oblique), compressed and tuberculately interrupted: radia-



1371. *Echinocactus Whipplei*. (×½)

spines usually 7, compressed, straight or slightly recurved,  $\frac{1}{2}$ – $\frac{3}{4}$  in. long, lower ones shorter than the others, all white excepting the two darker lowest laterals; central spines 4, widely divergent, the uppermost one flattened, straight and white, 1–1½ in. long, turned upward in the plane of the radials (completing the circle of radials), the others a little shorter, quadrangular-compressed, dark brown or black, becoming reddish and finally ashy, the 2 laterals straight, the lowest one stouter and sharply hooked downward: fl. greenish red. N. Ariz. Fig. 1371 is adapted from the Pacific Railroad Report.

BBB. *Central spines 5 to 8.*

9. **cornigerus**, DC. Globose or depressed-globose, 10–16 in. diam.: ribs about 21, very acute and wavy (not tuberculately interrupted): radial spines 6–10, white and comparatively slender, or wanting; centrals red and very robust, angular-compressed, with long, sharp, horny tips, the upper 3 erect-spreading, 1–1½ in. long, the lower 2 weaker and declined, the central one longer, more rigid and keeled, very broad ( $\frac{1}{2}$ – $\frac{1}{3}$  in.) and hooked downward: fls. purple, 1–1½ in. long. Mex.

10. **polyancistrus**, Engelm. & Bigel. Ovate or at length subcylindric, becoming 4–10 in. high and 3–4 in. diam.: ribs 13–17, obtuse, tuberculately interrupted: radial spines 20 or more, compressed and white, the uppermost wanting, the 4 upper ones broader and longer (1–2 in.) and dusky-tipped, the laterals shorter ( $\frac{1}{2}$ –1 in.), the lowest very short ( $\frac{1}{2}$  in.) and subsetaceous; central spines of several forms, the uppermost one (rarely a second similar but smaller one above or beside it) compressed-quadrangular, elongated (3–5 in.), white with dusky tip, curved upward, the other 5–10 teretish or subangled, bright purple-brown; upper ones long (2–4 in.) and mostly straight, the others gradually shortening (to about 1 in.) downward and sharply hooked: fls. red or yellow, 2–2½ in. long and wide. Nev. and S. E. Calif.

AA. *Spines not hooked (Nos. 11–48).*

B. *Central spines none or indistinct.*

11. **Monvillii**, Lem. Stout, globose and bright green: ribs 15–17, tuberculate, broadest toward the base, undulate: tubercles somewhat hexagonal, strongly dilated below: radial spines 9–12, the lower ones somewhat longer, very stout, spreading, yellowish translucent, reddish at base; central wanting: fls. varying from white to yellow and red. Paraguay.

12. **Pfeifferi**, Zucc. Oblong-globose, becoming 1–2 ft. high and 1 ft. diam.: ribs 11–13, compressed and somewhat acute: spines 6, about equal, rigid, straight, divergent or erect, pale transparent yellow with a brownish base; very rarely a solitary central spine. Mex.

13. **coptonogonus**, Lem., var. **major**, Salm-Dyck. Depressed, from a large indurated naked napiform base, 2–4 in. across the top: ribs 10–15, acute from a broad base, more or less transversely interrupted and sinuous: spines 3, annulate, very stout and erect from deeply sunken areoles, reddish when young, becoming ashy gray; upper spine stoutest, erect and straight, or slightly curved upward, flattened and keeled, and occasionally twisted,  $1\frac{1}{2}$ – $2\frac{1}{4}$  in. long; the 2 laterals erect-divergent, straight or slightly curved, terete above and somewhat quadrangular below, 1–1½ in. long; all from an abruptly enlarged base: fls. said to be small and white, with purplish median lines. Mex.

14. **multicostatus**, Hildmann. Depressed-globose: ribs very numerous, 90–120, compressed into thin plates which run vertically or are twisted in every direction: spines exceedingly variable, in some cases wanting entirely, in others 3 or 4, short, rigid, and translucent yellow; in others more numerous, larger, and often flattish; in still other cases very long and flat, inter-

lacing all over the plant; no centrals: fls. white, with a broad purple stripe. Mex.

15. **capricornis**, A. Dietr. Globose: ribs about 11, broad, spotted all over with white dots: clusters of spines distant, usually seen only near the apex; spines 5–10, long and flexuous; centrals not distinct: fls. large, yellow. Mex.

16. **rinconensis**, Poselg. Cylindrical, covered with ivory-white spines which are tipped with crimson: spines 3, with no centrals: fls. large, purple-crimson, darker at base. N. Mex.

17. **phyllacanthus**, Mart. From globose to cylindrical, with depressed vertex, simple or proliferous,  $2\frac{1}{2}$ – $3\frac{1}{2}$  in. broad: ribs 40–55 (sometimes as few as 30), very much crowded and compressed, thin, acute, very wavy, continuous or somewhat interrupted: radial spines 5 (sometimes 6 or 7), straight and spreading, the 2 lowest ones white, rigid,  $\frac{1}{6}$ – $\frac{1}{4}$  in. long, half as long as the 2 darker, angled, larger laterals, the uppermost spine thin and broad, channeled above, faintly annulate, flexible, grayish pink,  $\frac{3}{5}$ –1 in. long; central spines none: fls. small, dirty white. Mex.

BB. *Central spine solitary (sometimes 2–4 in E. crispatus, E. helophorus, and E. setispinus, or wanting in E. lophothele).*

c. *Sts. with less than 13 ribs.*

18. **leucacanthus**, Zucc. Somewhat clavate-cylindrical, pale; ribs 8–10, thick, obtuse, strongly tuberculate, the areoles with strong wool: radial spines 7 or 8, similar, straight, finely pubescent, at first yellowish, at length white; central spine solitary, more or less erect, rarely wanting: fls. light yellow. Mex.

19. **ornatus**, DC. (*E. Mirbellii*, Lem.). Subglobose: ribs 8, broad, compressed, vertical, thickly covered with close-set white woolly spots, making the whole plant almost white: radial spines 7, straight, stout, yellowish or becoming gray; central spine solitary. Mex.

20. **ingens**, Zucc. (*E. Visnaga*, Hook.). Very large (sometimes as much as 10 ft. high and as much in circumference), globose or oblong, purplish toward the top: ribs 8, obtuse, tuberculate: areoles large, distant, with very copious yellowish wool: radial spines 8 or more; central spine solitary; all the spines shaded yellow and red or brownish, straight, rigid, and interwoven: fls. bright yellow, about 3 in. broad. Mex.

21. **horizontalis**, Lem. Glaucescous, depressed-globose or at length ovate or even cylindric with age, 2–8 in. high,  $2\frac{1}{2}$ –4 in. diam.: ribs 8–10 (fewer in very young specimens), often spirally arranged, the tubercles scarcely distinct by inconspicuous transverse grooves: spines 6–9, stout, compressed, reddish (at length ashy), recurved or sometimes almost straight, nearly equal,  $\frac{1}{2}$ – $1\frac{1}{2}$  in. long (sometimes long and slender and almost terete, sometimes short, stout and broad); radials 5–8, upper ones weaker, lowest wanting; a single stouter decurved central (sometimes wanting): fls. pale rose-purple,  $2\frac{1}{2}$  in. long or more. New Mex. and N. Mex.

cc. *Sts. with 13–27 ribs.*

22. **electracanthus**, Lem. Globose or thick cylindrical, becoming 2 ft. high and 1 ft. diam.: ribs about 15: radial spines about 8, equal, rigid, spreading, yellowish, about 1 in. long; the central one solitary, red at base: fls. clear yellow. Mex.

23. **Echidne**, DC. (*E. Vanderzypii*, Lem.). Depressed-globose, 5–7 in. diam., 3–4 in. high: ribs 13, acute: radial spines 7, broad, rigid, spreading, yellowish, 1 in. or more long; central spine solitary and scarcely longer than the others: fls. bright yellow, 1 in. or more long. Mex.

24. **texensis**, Hopf. Mostly depressed (sometimes globose), 8–12 in. diam., 4–6 in. high, simple: ribs



mostly 21 (sometimes 27, and in smaller specimens 13 or 14) and undulate: spines stout and fasciculate, reddish, compressed; the exterior 6 or 7 radiant, straightish or curved, unequal,  $\frac{1}{2}$ – $\frac{3}{4}$  in. long in some cases,  $1\frac{1}{2}$ –2 in. in others, much shorter than the solitary and stout recurved central, which is sometimes  $\frac{1}{2}$ – $\frac{1}{4}$  in. broad: fls. about  $\frac{1}{2}$  in. long, parti-colored (scarlet and orange below to white above). Texas and N. E. Mex.

25. *rectispinus*, Brit. & Rose. Fig. 1372. Globose, at length cylindrical: ribs 13–21, obtuse and strongly tuberculate: radial spines 7–9, very unequal, the 3 upper ones 4–5 in. long, the lower  $1\frac{1}{2}$ –3 in. long and paler; the central very long (12–13 in.), straight or slightly decurved: fls. about  $1\frac{1}{2}$  in. long, pinkish; ovary bearing a few ovate, scarious, naked scales. Low. Calif.

26. *Emoryi*, Engelm. Becoming large, globular to cylindrical plants, 1–4 ft. high: ribs 13–21, obtuse: radial spines 7–9, nearly equal, stout, 1–2 in. long; central spine single, porrect, hooked: fls. red, tipped with yellow: fr. 1–2 in. long, covered with thin bracts. S. Ariz. and N. Sonora.

27. *recurvus*, Link & Otto. Subglobose and very stout: ribs about 15, covered with broad, dark red spines, the radials spreading, the central one recurved and very stout. Mex.

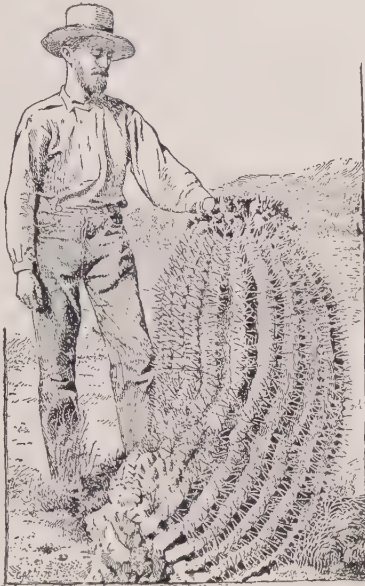
28. *setispinus*, Engelm. Subglobose, 2–3½ in. diam.: ribs 13, more or less oblique, often undulate or somewhat interrupted: radial spines 14–16, setiform and flexible,  $\frac{3}{8}$ – $\frac{1}{2}$  in. long, the uppermost (the longest) and lowest ones yellowish brown, the laterals white; central spines 1–3, setiform and flexuous, dark, 1–1½ in. long: fls. funnelform,  $1\frac{1}{2}$ –3 in. long, yellow, scarlet within. Texas and N. Mex.

29. *helóphorus*, Lem. Depressed globose, light green with purple-red veins: ribs about 20, compressed, obtuse: radial spines 9–12, very stout and porrect; central spines 1–4, stronger and annulate; all the spines pearl-gray. Mex.

ccc. *Sts. with 30 or more ribs.*

30. *obvallatus*, DC. Obovate-globose, depressed: ribs very numerous, vertical: spines most abundant towards the apex, unequal, spreading, stout, whitish; the 3 upper radials and solitary central strong, the others (especially the lowest) small: fls. purple, with whitish margin. Mex.—The name was suggested by the appearance of the terminal cluster of fls. surrounded by a fortification of strong spines.

31. *crispatus*, DC. (*E. drrigens*, Link) Globose, 5 in. or more high: ribs 30–60, compressed and sharp, more or less undulate-cripsed: spines 7–11, widely spreading, more or less flattened, the upper larger and brown at tip, the lower shorter and white, or all of them brown: fls. purple, or white with purple stripes. Mex.



1372. *Echinocactus rectispinus*. No. 25.

cccc. *Sts. tuberculate, as in Mammillaria.*

32. *hexædróphorus*, Lem. More or less globular, dark gray: ribs deeply tuberculate, giving the appearance of a mammillaria, with hexagonal tubercles: radial spines 6 or 7, radiating like a star; central spine solitary, erect, longer; all the spines annulate, reddish brown: fls. white, tinted with rose. Mex.

33. *lopothèle*, Salm-Dyck. Globose, strongly tuberculate, after the manner of *Mammillaria*: tubercles quadrangular, bearing clusters of 5–10, more or less porrect, long, rigid, and equal spines; central solitary or wanting: fls. white or yellowish. Mex.

BBB. *Central spines 4 (2 or 3 in E. Sileri and sometimes 3 in E. Scopa).*

c. *Ribs less than 13.*

34. *robustus*, Otto. Clavate and stout: ribs about 8, compressed, vertical: radial spines about 14, the upper ones slender, the lowest 3 stronger; central spines 4, 4-angled at base, transversely striate, the lowest one largest; all the spines purple-red,  $1\frac{1}{2}$ –3 in. long: fls. golden yellow. Mex.

35. *Ottónis*, Link & Otto. Depressed-globose or ovate, 3–4 in. high: ribs 10–12, obtuse: radial spines 10–18, slender, yellowish, more or less straight and spreading, about  $\frac{1}{2}$  in. long; central spines 4, dusky red, stronger, the uppermost very short, the 2 laterals horizontal, the lowest longest (1 in.) and deflexed: fls. lemon-yellow, becoming 2–3 in. diam. Mex.

36. *bicolor*, Gal. Globose-ovate, stout,  $1\frac{1}{2}$ –4 in. diam., sometimes becoming 8 in. high: ribs 8, oblique and obtuse, compressed, tuberculate-interrupted: lower radials and centrals variegated red and white; radials 9–17, spreading and recurved, slender and rather rigid, the lowest one  $\frac{1}{2}$ –1 in. long, the laterals 1–2 in. long and about equaling the 2–4 flat flexuous ashy upper ones; centrals 4, flat and flexuous,  $1\frac{1}{2}$ –3 in. long, the uppermost thin and not longer than the erect and rigid laterals, the lowest very stout, porrect and very long: fls. funnelform, bright purple, 2–3 in. long. N. Mex.

cc. *Ribs 13–27.*

37. *orthacánthus*, Link & Otto (*E. flavovirens*, Scheidw.). Globose, yellowish green: ribs 12 or 13, vertical, acute: radial spines 14, unequal, straight and spreading; central spines 4, stronger, the lowest the largest; all the spines rigid, annulate, and grayish white. Mex.

38. *intertéxtus*, Engelm. Ovate-globose, 1–4 in. high: ribs 13, acute, somewhat oblique, tuberculate-interrupted, the tubercles with a woolly groove: spines short and rigid, reddish from a whitish base and with dusky tips; radial 16–25, closely appressed and interwoven, the upper 5–9 setaceous and white, straight  $\frac{1}{2}$ – $\frac{1}{2}$  in. long, the laterals more rigid and a little longer, the lowest stout and short, a little recurved; centrals 4, the 3 upper ones turned upward and exceeding the radials and interwoven with them, the lower one very short, stout and porrect: fls. about 1 in. long and wide, purplish. Texas and N. Mex.

39. *Órcuttii*, Engelm. Cylindrical, 2–3½ ft. high, 1 ft. diam., single or in clusters up to 18 or more, not rarely decumbent: ribs 18–22, often oblique: spines extremely variable, angled to flat,  $\frac{1}{4}$ –3 in. wide; radials 11–13, unequal, lowest and several laterals thinnest; centrals 4: fls. about 2 in. long, deep crimson in center, bordered by light greenish yellow. Low. Calif.

40. *Jónhsonii*, Parry. Oval, 4–6 in. high: ribs 17–21, low, rounded, tuberculately interrupted, close set, often oblique, densely covered with stoutish reddish gray spines: radial spines 10–14,  $\frac{3}{8}$ – $1\frac{1}{2}$  in. long, the upper longest; centrals 4, stouter, recurved, about  $1\frac{1}{2}$  in. long: fls. 2–2½ in. long and wide, from deep red to pink. Utah, Nev., Calif.

41. *polycéphalus*, Engelm. & Bigel. Globose (6–10 in. diam.) to ovate (10–16 in. high, 5–10 in. diam.) and cylindrical (reaching 24–28 in. high and about 10 in. diam.), profusely branched at base: ribs 13–21 (occasionally 10): spines 8–15, very stout and compressed, more or less recurved and reddish; radials 4–11, comparatively slender (the uppermost the most slender), 1–2 in. long; the 4 centrals much stouter and longer ( $1\frac{1}{2}$ – $2\frac{1}{2}$  in.), very unequal, the uppermost one usually broadest and curved upward, the lowest one usually the longest and decurved: fls. yellow. Utah to Calif.

42. *viridescens*, Nutt. Globose or depressed, simple or branching at base, 4–12 in. high, 6–10 in. diam.: ribs 13–21 (fewer when young), compressed and scarcely tuberculate: spines more or less curved and sometimes twisted, reddish below, shading into greenish or yellowish above; radials 9–20,  $\frac{2}{5}$ – $\frac{1}{2}$  in. long, the lowest shortest, robust, and decurved; centrals 4, cruciate, much stouter, compressed and 4-angled,  $\frac{1}{2}$ – $1\frac{1}{2}$  in. long, the lowest broadest, longest and straightest: fls. yellowish green, about  $1\frac{1}{2}$  in. long. S. Calif.—*E. limitus*, Engelm., is closely related to this species and is thought by some to be identical with it.

43. *Lecónteii*, Engelm. Resembles *E. Wislizenii*, but often somewhat taller (sometimes becoming 8 ft. high and 2 ft. diam.), usually more slender, and at last clavate from a slender base: ribs somewhat more interrupted and more obtuse: lower central spine more flattened and broader, curved (rather than hooked) or twisted, usually not at all hooked, sometimes as much as 6 in. long: fls. rather smaller. From the Great Basin to Mex. and Low. Calif.

44. *Sileri*, Engelm. Globose: ribs 13, prominent, densely crowded, with short rhombic-angled tubercles: radial spines 11–13, white; centrals 3, black, with pale base,  $\frac{3}{8}$  in. long, the upper one slightly longer: fls. scarcely 1 in. long, straw-colored.

45. *Grüsonii*, Hildmann. Globose, completely covered by a mass of almost transparent golden spines, which give the plant the appearance of a ball of gold: centrals 4, curved: fls. red and yellow. Mountains of Mex.—From illustrations it is evident that the radial spines are somewhat numerous and widely spreading, and that the centrals are prominent and more or less deflexed.

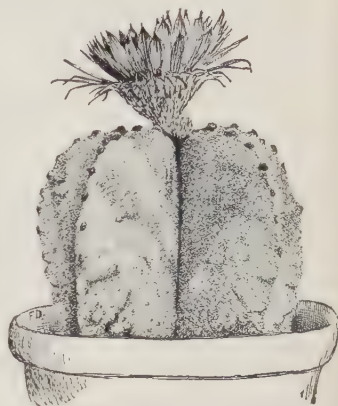


1373. *Echinocactus Palmeri*. No. 46.

46. *Pálmeri*, Rose (*E. saltillénsis*, Poselg.). Fig. 1373. Very stout, globose: ribs 15–19, compressed, dark green: spines very prominent, 5–7 in a cluster, stout and porrect, sometimes becoming 5 in. long; centrals 4. Mex.—Schumann makes this a variety of *E. ingens*.

ccc. Ribs 30 or more.

47. *Scôpa*, Link & Otto. More or less cylindrical, 1 ft. or more high, 2–4 in. diam., at length branching above: ribs 30–36, nearly vertical, tuberculate: radial spines 30–40, setaceous, white; central spines 3 or 4, purple, erect; sometimes all the spines are white: fls. yellow. Brazil.—The species is exceedingly plastic in form, branching variously or passing into the cristate condition.



1374. *Echinocactus myriostigma* No. 50.

BBBB. Central spines 5–10.

48. *pildsus*, Gal. Globose, 6–18 in. high: ribs 13–18, compressed, little if at all interrupted: radial spines represented by 3 slender ones at the lowest part of the pulvillus or wanting; centrals 6, very stout, at first purplish, becoming pale yellow, the 3 upper ones erect, the 3 lower recurved-spreading: fls. unknown. N. Mex.

AAA. Spines entirely wanting.

49. *turbinifórmis*, Pfeiff. Depressed-globose, grayish green, with 12–14 spirally ascending ribs, cut into regular rhomboidal tubercles; tubercles flat, with a depressed pulvillus, entirely naked excepting a few small setaceous spines upon the younger ones: fls. white, with a purplish base. Mex.—The depressed and spineless body, with its surface regularly cut in spiral series of low, flat tubercles, gives the plant a very characteristic appearance.

50. *myriostigma*, Salm-Dyck (*Astróphytum myriostigma*, Lem.). Fig. 1374. Depressed-globose, 5 in. diam.: ribs 5 or 6, very broad, covered with numerous somewhat pilose white spots, and with deep obtuse sinuses: spines none: fls. large, pale yellow. Mex.

*E. chrysanthus* (*E. chrysacanthus*)= (?).—*E. Drageanus*= (?).—*E. Lewinii*= Lophophora.—*E. micromeris*= Mammillaria.—*E. Poselgerianus*, A. Dietz.= Mammillaria Scheerii.—*E. Simpsonii*= *Pediocactus*.—*E. trifurcatus*= (?).—*E. Williamsii*= Lophophora.

JOHN M. COULTER.  
J. N. ROSE.†

**ECHINOCEREUS** (*spiny Cereus*). *Cactaceæ*. Condensed globular, cylindrical or prostrate cacti of the United States and Mexico.

Stems single or caespitose, sometimes forming large clusters of 200–300 sts., distinctly ribbed, usually low in stature, or, if elongated, sprawling or creeping, generally very spiny: fls. yellow, purplish or scarlet, with rather a short funnel-



shaped tube; fl.-tube and ovary covered with clusters of spines; stigma-lobes always green. This genus has commonly been merged into *Cereus*, although it seems to be quite distinct.

Most of the species of *Echinocereus* are unsuited for greenhouse purposes, for when brought under glass they survive only for a few years. The very large flowers of some species make them very attractive while in bloom.

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A. *Sts. covered with long weak bristles or hairs, and resembling a small plant of Cephalocereus senilis.*

1. *De Lætii*, Gürke. Low and caespitose, 6–10 in. high: ribs 17–20: radial spines numerous; central spines 4 or 5, intermixed with long, hair-like bristles entirely hiding the plant: fls. small, rose-colored. Mex.—This species has been secured in great quantities by European dealers. It closely simulates a small *Cephalocereus senilis*, but has very different fls. and fr.

AA. *Sts. variously covered with spines, but not like the above (Nos. 2–27).*

B. *The sts. weak and trailing, at least becoming prostrate.*

c. *Ribs nearly continuous.*

2. *Scheeri*, Lem. (*Cereus Scheeri*, Salm-Dyck). Branching freely from the base of the st. and forming dense clusters: branches upright or ascending, about 8 in. long by 1 in. diam., slightly tapering toward the apex, dark green: ribs 8–9, straight or sometimes inclined to spiral, separated above by sharp grooves which become flattened toward the base, low arched: areoles little more than  $\frac{1}{4}$  in. apart, round, yellowish white: radial spines 7–9, spreading, needle-like, the under pair the longest, about  $\frac{1}{4}$ – $\frac{3}{8}$  in. long, white with yellowish bases; centrals 3, the lower the longest, about  $\frac{3}{8}$  in., red with brown bases; later all the spines become gray: fls. red, from the upper part of the st., about 5 in. long; ovary and tube bracteate and furnished with abundance of wool and spines. Mex.

CC. *Ribs divided into tubercles.*

D. *Central spines, when present, short: flowering areoles bearing cobwebby wool.*

3. *procumbens*, Lem. (*Cereus procumbens*, Engelm.). Branching from the lower part of the st. and so forming clusters: branches procumbent or ascending, angled, at the base tapering into cylindrical,  $1\frac{1}{2}$ –5 in. long by  $\frac{1}{2}$ – $\frac{3}{4}$  in. diam.: ribs mostly 5, rarely 4, straight or spiral, on the upper portion of the branch almost divided into tubercles: areoles  $\frac{1}{4}$ – $\frac{1}{2}$  in. apart, round, sparingly white curly-woolly, soon naked: radial spines 4–6, subulate, stiff, straight, sharp, in young growth brownish, then white, at the base often yellowish and the tip brownish, horizontally spreading, the upper the longest, reaching  $\frac{1}{4}$  in. length; central solitary or absent on the lower areoles, somewhat stronger,  $\frac{3}{8}$ – $\frac{5}{8}$  in. long, darker: fls. lateral, from just below the crown, 3–4 in. long, carmine-red to violet, with white or yellowish throat: fr. ellipsoidal, green,  $\frac{5}{8}$  in. long. Mex.

DD. *Central spines slender: flowering areoles with short wool.*

E. *Length of central spine  $\frac{3}{4}$  in.*

4. *Berlandieri*, Lem. (*Cereus Berlandieri*, Engelm.). Sts. prostrate, richly branching, forming dense clus-

ters, the branches upright or ascending, 2–3 in. long or longer, by  $\frac{1}{2}$ – $\frac{3}{4}$  in. diam., light or dark green, and in young growth often purplish: ribs 5–6, broken up into as many straight or spiral rows of tubercles; tubercles conical, pointed: areoles  $\frac{3}{8}$ – $\frac{5}{8}$  in. apart, round, white-woolly, soon naked: radial spines 6–8, stiff bristle-form, thin, horizontally spreading, white, about  $\frac{3}{8}$  in. long, the upper one sometimes light brown and somewhat stronger; central solitary, yellowish brown, sometimes reaching  $\frac{3}{4}$  in. length: fls. from the upper lateral areoles, 2–3 in. long, red to light pink: fr. ovoid, green, bristly. S. Texas and N. Mex.

EE. *Length of central spine 1 in. or more.*

5. *Blankii*, Palmer (*Cereus Blankii*, Poselg.). Branching freely from the base and thus forming clusters: sts. columnar, tapering above, about 6 in. long by 1 in. diam., dark green: ribs 5–6 (rarely 7), straight, almost divided into tubercles: areoles about  $\frac{3}{8}$  in. apart, round, white curly-woolly, later naked: radial spines mostly 8, horizontally spreading, the under pair the longest, reaching about  $\frac{3}{8}$  in. length, all stiff, straight, thin, white or the upper ones carmine-red when young, later reddish brown; central solitary, porrect, later deflexed, 1–1 $\frac{1}{4}$  in. long, white or brownish, black when young: fls. from near the crown, 2 $\frac{1}{2}$ –3 in. long, purple-red to violet. Mex. R.H. 1865: 90.

BB. *The sts. usually short and stout, usually erect.*

c. *Fls. rather small, scarlet.*

D. *Ribs 5–7.*

E. *Spines terete.*

6. *paucispinus*, Rümpl. (*Cereus paucispinus*, Engelm.). Clustered in irregular bunches: sts. cylindrical to ovoid, 4–7 in. high by  $1\frac{1}{4}$ –3 in. diam.: ribs 5–7, undulate: areoles  $\frac{3}{8}$ – $\frac{5}{8}$  in. apart, round, white-woolly, later naked: radial spines 3–6, spreading, subulate, straight or curved, round, bulbous at the base, the lowest one longest, reaching  $\frac{3}{4}$  in., light-colored, the upper ones reaching to about  $\frac{1}{2}$  in., reddish or brownish; central solitary or none, reaching about 1 $\frac{1}{2}$  in. length, somewhat angled, brown-black, porrect or upright; later all the spines blackish: fls. 2 in. or more long, dark scarlet to yellowish. Texas and Colo.

Var. *gonacanthus*, K. Sch. (*E. gonacanthus*, Lem. *Cereus gonacanthus*, Engelm. & Bigel.). Radial spines 8, very large, angled and sometimes twisted, the upper strongest, reaching nearly 3 in. length, light or dark yellow with brown tips; central always present, deeply grooved, often flattened, 3 in. or more long. Colo.

EE. *Spines angled.*

7. *triglochidiatus*, K. Sch. (*E. triglochidiatus*, Engelm. *Cereus triglochidiatus*, Engelm.). Radial spines usually 3, sometimes as many as 6, strong, angled, base bulbous, straight or curved, about 1 in. long, soon ash-gray. Texas and New Mex.

DD. *Ribs 9–11.*

E. *Axils of fl.-bracts filled with long cobwebby hairs.*

8. *polyacanthus*, Engelm. (*Cereus polyacanthus*, Engelm.). Sts. clustered, forming thick masses, cylindrical to ellipsoidal: ribs 9–13: radial spines 8–12, robust, subulate, stiff and sharp, under one the longest, nearly 1 in., upper ones scarcely  $\frac{1}{2}$  in., white to reddish gray with dark tips; centrals 3–4, bulbous base, stronger, about the length of the radials or the lowest sometimes reaching 2 in., horn-colored; later all the spines become gray: fls. lateral, about 1 $\frac{3}{4}$ –2 $\frac{1}{4}$  in. long, dark scarlet to blood-red: fr. spherical, about 1 in. long. greenish red, spiny. Texas to N. Mex.

EE. *Axils of fl.-bracts bearing short wool.*

F. *Central spines always solitary: sts. 6–8 in. high. Mex.*

9. *ácifer*, Lem. (*Cereus ácifer*, Otto). Sts. thickly clustered, 6–8 in. high by  $1\frac{1}{2}$ –2 in. diam., becoming

gray and corky with age: ribs 9-11, usually 10: radial spines usually 9, spreading, under pair longest, about  $\frac{1}{2}$  in., in young growth white, later horn-colored to gray, the upper ones brownish; central solitary, straight, porrect, at first ruby-red, later brown, 1 in. long: fls. lateral, 2 in. and more long, clear scarlet-red, with a yellow throat and sometimes a carmine border. N. Mex.

FF. Central spines 1-4: sts. 2-4 in. high. New Mex. and Colo.

10. **coccineus**, Engelm. (*E. phæniceus*, Lem. *Cereus phæniceus*, Engelm.). Sts. irregularly clustered, ellipsoidal to short-cylindrical, 2-4 in. high by  $1\frac{1}{2}$ - $2\frac{1}{4}$  in. diam.: ribs 8-11, straight: spines bristle-form, straight, round; radials 8-12, white,  $\frac{1}{4}$ - $\frac{1}{2}$  in. long, upper ones shortest; centrals 1-4, stouter, white to yellow or brown, with bulbous base: fls. from upper lateral areoles scarlet-red, with the corolla-throat yellow. Colo. to Ariz.

Var. **conoideus**, Engelm. (*E. conoideus*, Rümpl. *Cereus conoideus*, Engelm.). Central spine long and robust: fls. large, red. S. Calif. and N. W. Mex.

cc. Fls. never scarlet, usually crimson or purplish, sometimes yellow.

d. Spines more or less pectinate: ribs 12 or more.

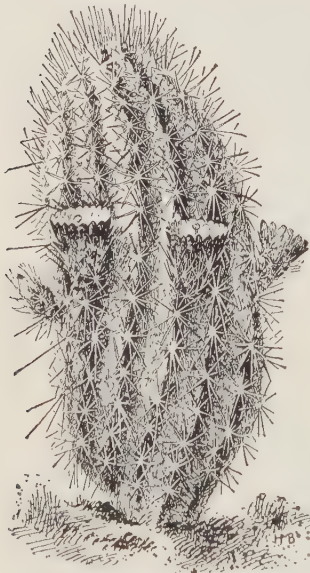
e. Areoles short, spines orbicular.

f. Color of spines white.

11. **longisetus**, Lem. (*Cereus longisetus*, Engelm.). Sts. clustered, cylindrical, covered with long, dirty white spines, about 8 in. high by 2 in. diam., light green: ribs 11-14, straight, undulate: radial spines 18-20, straight, compressed, base thickened, subulate, flexuose, usually horizontally spreading, interlocking with adjacent clusters, the lower laterals the longest, reaching  $\frac{3}{8}$  in. long, the upper more bristle-like and the shortest, all white; centrals 5-7, longer, reaching  $2\frac{1}{2}$  in., stronger, the upper ones scarcely longer than the longest radials; all are bulbous at the base; the 3 lower ones the longest and deflexed, spreading and sometimes curved: fls. red. Mex.

FF. Color of spines white and brown.

12. **chloranthus**, Rümpl. (*Cereus chloranthus*, Engelm.) Fig. 1375. Sts. in small clusters, cylindrical, slightly tapering above, 4-9 in. high by  $2\frac{1}{2}$  in. diam.: ribs 13-18, straight or rarely spiral: radial spines 12-20, horizontally spreading and appressed, sharp, the shortest one about  $\frac{3}{8}$  in. long and white, the lower laterals a little longer and have purple tips; centrals 3-5, or in young plants absent, bulbous at the base, the upper ones shortest, about the length of the radials, and darker colored, with purplish tips, the lower ones stouter, about 1 in. long, deflexed, white; frequently all the spines are white: fls. lateral, little more than 1 in. long; ovary and tube white bristly; petals green: fr. ellipsoidal, about  $\frac{1}{2}$  in. long, spiny. Texas and New Mex.



1375. *Echinocereus chloranthus*.

shortest one about  $\frac{3}{8}$  in. long and white, the lower laterals a little longer and have purple tips; centrals 3-5, or in young plants absent, bulbous at the base, the upper ones shortest, about the length of the radials, and darker colored, with purplish tips, the lower ones stouter, about 1 in. long, deflexed, white; frequently all the spines are white: fls. lateral, little more than 1 in. long; ovary and tube white bristly; petals green: fr. ellipsoidal, about  $\frac{1}{2}$  in. long, spiny. Texas and New Mex.

EE. Areoles more or less elongated.

F. Color of fls. greenish or yellow.

G. Fls. greenish.

13. **viridiflorus**, Engelm. (*Cereus viridiflorus*, Engelm.). Sts. solitary or only in age forming small, loose clusters, cylindrical or elongated, ellipsoidal, 3-7 in. high by 1-2 in. diam: ribs 13: radial spines 12-18, horizontally radiate, pectinate, straight or somewhat curved, subulate, the lower laterals the longest, about  $\frac{1}{2}$  in., translucent ruby-red, the others white; centrals usually absent, rarely 1, strong, about  $\frac{3}{4}$  in. long, curved upward, red with brown point: fls. lateral, from just below the crown, broad funnelform, little more than 1 in. long; ovary and tube spiny; corolla green, with a broad darker olive-green to pink stripe down the middle of each petal: fr. ellipsoidal, about  $\frac{1}{2}$  in. long, greenish. Wyo. and Kans. to Texas and New Mex.

GG. Fls. yellow.

H. Ribs 15-21: central spines unequal.

14. **dasyacanthus**, Engelm. (*Cereus dasyacanthus*, Engelm.). Sts. solitary or sometimes forming open clusters, ellipsoidal to short-cylindrical ribs 15-21, straight or sometimes slightly spiral, obtuse: radial spines 20-30, straight or sometimes slightly curved, subulate, stiff, sharp, pectinate, white with red or brown tips, later gray, the laterals longest,  $\frac{1}{2}$ -1 in., the upper ones shortest, about  $\frac{3}{8}$  in., those of one cluster interlocking with those of the adjacent clusters; centrals 3-8, the lower one longest, white with colored tips, mostly with bulbous bases: fls. from near the crown of the st. large,  $2\frac{1}{2}$ -3 in. long; ovary and short tube covered with white, reddish tipped stiff bristles; corolla yellow: fr. 1- $1\frac{1}{2}$  in. long, ellipsoidal, spiny, green to reddish. Texas.

HH. Ribs 15 or 16: central spines very short, equal.

15. **ctenoides**, Lem. (*Cereus ctenoides*, Engelm.). Sts. solitary or rarely branching, cylindrical to elongated ovoid, reaching a height of 6 in. and a diam. of  $2\frac{1}{2}$  in.: ribs 15-16, usually straight: radial spines 13-22, horizontally radiate, pectinate, subulate, bases bulbous and laterally compressed, stiff, straight or often slightly curved, the laterals longest and about  $\frac{3}{8}$  in., the upper ones very short, white or sometimes with brownish tips; centrals 2-3 or rarely 4, superposed, coarser, bulbous at the base, short and conical to  $\frac{1}{4}$  in. long, reddish; later all the spines are gray: fls. lateral, from near the crown,  $2\frac{1}{2}$ -3 in. long; ovary and short tube white bristly; corolla yellow, with greenish throat. Texas. and N. Mex.—This species is very rare in cult.

FF. Color of fls. purple.

G. The spines irregularly pectinate.

16. **Rötteri**, Rümpl. (*Cereus Rötteri*, Engelm.). Loosely open clustered: sts. upright, 4-6 in. high, 2-3 in. diam., cylindrical or ovoid: ribs 10-13, straight: radial spines 8-15, subulate, thickened at the base, stiff, sharp, straight or slightly curved, the laterals longest, about  $\frac{1}{2}$  in., the upper ones shortest, reddish with darker tips; centrals 2-5, stouter, bulbous at base,  $\frac{1}{4}$ - $\frac{3}{8}$  in. long, the lower ones the longest; later all the spines are gray: fls. lateral, from near the crown,  $2\frac{1}{2}$ -3 in. long, purple-red to violet: fr. short ellipsoidal, spiny, green,  $\frac{3}{4}$  in. long. Texas to Ariz. and N. Mex.

GG. The spines regularly pectinate.

H. Tube of fl. and spines of ovary slender and weak, the surrounding hairs long and cobwebby.

17. **cæspitosus**, K. Sch. (*Cereus cæspitosus*, Engelm.). Radials 20-30, curved, clear white or with rose-red tips; centrals absent, or 1-2 very short ones. Okla., Texas and Mex.



HH. Tube of fl. and spines of ovary short and stout, the surrounding hairs short.

I. Central spines several.

18. *pectinatus*, Engelm. (*Cereus pectinatus*, Engelm.). Clustered sts. cylindrical or ovoid, reaching a height of 10 in. by 3 in. diam.: ribs 13-23, straight: radial spines 16-30, pectinate, horizontally spreading and appressed, straight or curved, the laterals longest, round, hardly  $\frac{3}{8}$  in. long; central usually absent, or as many as 5, which are short, conical and superposed, white, with tips and bases variously colored with pink, yellow or brown; later all become gray: fls. lateral, from near the crown,  $2\frac{1}{2}$ -4 in. long; ovary tuberculate and spiny, light to dark rose-red or rarely white: fr. globose, spiny, green to reddish green. Mex.

Var. *adustus*, K. Sch. (*Cereus adustus*, Engelm.). Like the type, but with black-brown to chestnut-brown spines. Mex.

Var. *rufispinus*, K. Sch. Of more robust growth: radial spines curved, red. Mex.

II. Central spines none.

19. *rigidissimus*, Engelm. (*Cereus candicans*, Hort. *C. rigidissimus*, Hort.). RAINBOW CACTUS. Fig. 1376. Sts. comparatively shorter and thicker: radial spines 16-20, coarser and stiffer, straight or very little curved; base thickened, white, yellow or red to brown, these colors commonly arranged in alternating bands around the plant, the spines of adjacent clusters interlocking; centrals absent. Ariz. and N. Mex.

DD. Spines not pectinate.

E. Ribs 10 or fewer.

F. Fls. crimson.

20. *mojavensis*, Rümpl. (*Cereus mojavensis*, Engelm. & Bigel.). Sts. clustered, ovoid, reaching 3 in. height by 2 in. diam.: ribs 8-12, conspicuously undulate: radial spines 5-8, the lowest pair the longest, reaching about  $2\frac{1}{4}$  in. long; all are white with brown tips, subulate, straight or curved, strongly bulbous at the base; central solitary, or sometimes absent, stronger and somewhat longer and darker colored; later all the spines become gray: fls. 2-3 in. long, deep carmine: fr. ellipsoidal, about 1 in. long. Deserts of Ariz., Nev. and Calif.

FF. Fls. purple-violet.

G. The spines dark, often of several colors.

H. Central spine 1.

21. *Fendleri*, Rümpl. (*Cereus Fendleri*, Engelm.). Irregularly clustered: st. cylindrical or rarely ovoid or even globose, sparingly branching, 3-7 in. high by  $1\frac{3}{4}$ - $2\frac{1}{2}$  in. diam.: ribs 9-12, straight or slightly spiral, undulate: radial spines 7-10, subulate, straight or curved, the lowest or the 2 lower laterals the longest, about 1 in., stronger, quadrangular, white; the 2 next higher brownish; the upper ones round, white and much shorter; all are bulbous at the base; central solitary (or in old plants 3-4), very strongly thickened at the base, round, black, sometimes with a lighter colored tip, curved upward, reaching a length of  $1\frac{3}{4}$  in.: fls. lateral, from near the crown, 2- $3\frac{1}{2}$  in. long, dark carmine-red to purple and violet: fr. ellipsoidal, spiny, green to purple-red, about 1 in. long. Colo., Utah and south to N. Mex. B.M. 6533.

HH. Central spines several.

22. *Engelmannii*, Lem. (*Cereus Engelmannii*, Parry). Sts. clustered, cylindrical to ovoid, 4-10 in. high,  $1\frac{3}{4}$ - $2\frac{1}{2}$  in. diam., light green: ribs 11-13, undulate: radial spines 11-13, somewhat angled, stiff, sharp, straight or somewhat curved, horizontally spreading, the lowest or lower laterals the longest, about  $\frac{1}{2}$  in., the upper ones the shortest, whitish with brown tips; centrals 4, stiff, straight, angled, stout, the lowest one deflexed, white

to dark-colored, reaching a length of  $2\frac{1}{2}$  in., the upper ones about half as long, spreading, brown: fls. lateral, from just below the crown,  $1\frac{3}{4}$ - $2\frac{1}{2}$  in. long, purple-red: fr. ovoid, green to purple-red, spiny, later naked, about 1 in. diam.; pulp purple-red. Calif. to Utah and south into Mex.

Var. *chrysocentrus*, Engelm. & Bigel. The 3 upper centrals golden yellow, the lowest white. Mojave Desert, Calif.

Var. *variegatus*, Engelm. & Bigel. The 3 upper centrals curved, horn-colored and mottled with black. Utah, Nev. and Calif.

GG. The spines usually white or straw-colored.

H. Central spines somewhat curved.

23. *dubius*, Rümpl.

(*Cereus dubius*, Engelm.). Tolerably thickly clustered: sts. branching at the base, cylindrical or elongated ellipsoidal,  $4\frac{1}{2}$ -7 in. high by  $1\frac{1}{2}$ - $2\frac{1}{4}$  in. diam.: ribs 7-9, undulate: areoles  $\frac{3}{8}$ - $\frac{5}{8}$  in. apart, round, covered with short curly white wool, later naked: radials 5-8, subulate, horizon-



1376. *Echinocereus rigidissimus*.

tally spreading, stiff, round or faintly angled, the lower ones usually the longest, about 1 in. long, the upper ones about half as long, or sometimes absent, transparent white; centrals 1-4, stronger and longer, bulbous at the base, straight or curved, reaches  $2\frac{1}{2}$  in. length, the lowest one longest, straight, porrect or deflexed, the upper ones spreading: fls. lateral, 2 in. long, rose-red to violet: fr. spherical, greenish to purple-red, covered with bundles of deciduous spines. Texas and N. Mex.

HH. Central spines straight.

I. Sts. erect, with the spines pale at base.

24. *enneacanthus*, Engelm. (*Cereus enneacanthus*, Engelm.). Freely branching at the base of the st. and thus forming thick, irregular clusters: branches ascending, usually 3-5 in. long by  $1\frac{1}{2}$ -2 in. diam., green or sometimes reddish: ribs 8-10, straight, often divided by transverse grooves into more or less conspicuous tubercles: areoles  $\frac{3}{8}$ - $\frac{5}{8}$  in. apart, round, white curly-woolly, soon naked: radial spines 7-12 (mostly 8), horizontally spreading, needle-form, straight, stiff, translucent white, base bulbous, the under one longest, reaching about  $\frac{1}{2}$  in., the upper one very short; central solitary, or seldom with 2 additional upper ones, straight, porrect or deflexed, round or angled, whitish to straw-yellow or darker,  $\frac{3}{8}$ - $1\frac{1}{2}$  in. long; later all the spines are gray: fls. lateral, from near the crown or lower,  $1\frac{3}{4}$ - $2\frac{1}{2}$  in. long, red to purplish: fr. spherical, green to red, spiny,  $\frac{3}{4}$ -1 in. long. Texas and N. Mex.

II. Sts. spreading and flabby, with the spines red at base.

25. *Mérkeri*, Hildmann. Sts. at first upright, columnar, later reclining and by branching at the base forming clusters, in new growth bright green, later gray to gray-brown and corky: ribs 5-9, undulate to more or less tuberculate: areoles  $\frac{3}{4}$  in. and more apart, round, white velvety, later naked: radial spines 6-9, the upper ones the longest, reaching  $1\frac{1}{4}$  in. length, somewhat confluent with the centrals, subulate, spreading, straight; centrals 1-2, stronger, reaching a length of 2 in.; all the spines are white, nearly transparent, with red-tinted bulbous base. N. Mex.

EE. *Ribs 11 or 13.*F. *Plants in small clusters: central spines sometimes solitary.*

26. **conglomeratus**, Forst. Sts. clustered, columnar, somewhat tapering above, reaching a height of 1 ft. and 2 in. diam., light green: ribs 12–13, strongly undulate, tubercled above: radial spines 9–10, glossy, spreading, the lower pair the longest, base yellow; centrals 1–4, the lowest straight, porrect, reaching a length of  $1\frac{1}{2}$  in. and more, somewhat stronger than the rest. N. Mex.

FF. *Plants often 200 in a single mound: centrals never single.*

27. **stramineus**, Rümpl. (*Cereus stramineus*, Engelm.). Clustered in thick, irregular bunches: sts. ovoid to cylindrical, 4–8 in. long,  $1\frac{1}{2}$ – $2\frac{1}{2}$  in. diam.: ribs 11–13: radial spines 7–10 (usually 8), horizontally radiate, straight or slightly curved, subulate, sharp, round or the long lower ones angled, transparent white, tolerably equal in length, about  $\frac{1}{2}$ – $\frac{3}{4}$  in. or the lower ones sometimes longer and reaching a length of  $1\frac{1}{2}$  in.; centrals 3–4, much longer, stronger, twisted, angled, taw-yellow to brownish, when young reddish transparent, the upper ones shortest and spreading upward, the lower ones porrect or depressed: fls. lateral,  $2\frac{1}{2}$ – $3\frac{1}{2}$  in. long, bright purple-red or deep dark red, to scarlet: fr. ellipsoidal, about  $1\frac{1}{2}$  in. long, covered with numerous spines, purple-red. Texas to Ariz. and N. Mex.

Horticultural names are: *E. paucispina*, no doubt a mutilation of *paucispinus*.—*E. polycephalus*.—*E. sanguineus*.—*E. Schlenkeri*.—*E. Scheeri* (?).—*E. tuberosus*, Rümpl.=Wilcoxia.—*E. Uehri*.—*E. Uspendkii*.

C. H. THOMPSON.  
J. N. ROSE.†

**ECHINÓCHLOA** (Greek, *echinos*, a hedgehog, *chloa*, grass). *Gramineæ*. Annual grasses with narrow inflorescence of several thick spikes. Sometimes grown for grain and forage, but scarcely horticultural subjects.

Spikelets as in *Panicum*; glumes hispid-spiny, mucronate, the sterile lemma more or less awned.—Species about 12, in the warm regions of both hemispheres. Regarded by many botanists as a section of *Panicum*. *E. Crusgalli*, Beauv., barnyard grass, is a common weed in cult. soil. The spikelets are usually long-awned, the panicle 4–10 in. long, green or purple. Dept. Agric., Div. Agrost. 7:82.

**frumentacea**, Link (*Panicum frumentaceum*, Roxbg.). JAPANESE BARNYARD MILLET. Closely allied to *E. Crusgalli*, but differing in the compact, somewhat incurved, appressed spikes, of nearly awnless spikelets: culms 1–4 ft., erect.—Cult. in S. E. Asia for the seed which is used for food. Occasionally cult. in U. S. for forage. Sometimes known as “billion-dollar grass.”

A. S. HITCHCOCK.

**ECHINOCYSTIS** (Greek, *hedgehog* and *bladder*; from the prickly fruit). Syn. *Micrampelis*. *Curcubitaceæ*. WILD CUCUMBER. WILD BALSAM-APPLE. A profuse native annual vine which is a favorite for home arbors; the other species not generally cultivated, except perhaps the perennial-rooted *megarrhiza*.

Most of the species are annual herbs, with branched tendrils and palmately lobed or angled lvs.: fls. small, white or greenish, dioecious, the campanulate calyx 5–6-lobed and the corolla deeply 5–6-parted; stamens in staminate fls. 3; ovary 2-celled, with 2 ovules in each: fr. fleshy or dry, more or less inflated and papery, opening at the summit; seeds flattened, more or less rough.—The species are about 25, in the warmer parts of the western hemisphere, about 10 of them in the W. U. S., and 1 in the eastern states. The eastern species (*E. lobata*) is one of the quickest-growing of all vines, and is therefore useful in hiding unsightly objects while the slower-growing shrubbery is getting a start. Cogniaux, in DC. Mon. Phan. vol. 3, 1881, makes three sections of this genus, and this plant the sole

representative of the second section, or true *Echinocystis*, because its juicy fr. bursts irregularly at the top, and contains 2 cells, each with 2 flattish seeds. The *Megarrhiza* group (kept distinct by some) is distinguished by its thick perennial root, large turgid seeds and hypogeal germination.

**lobata**, Torr. & Gray. Lvs. wider than long, deeply 5-lobed, slightly emarginate at the base: tendrils 3–4-branched: staminate fls. small, in many-fl. panicles longer than the lvs.; calyx glabrous: fr. egg-shaped, sparsely covered with prickles. New Bruns. and Ont. to Mont. and Texas, growing in rich soil along rivers and in low places. A.G. 14:161. R.H. 1895, p. 9. G.C. III. 22:271. G.W. 10, p. 499.—Sometimes becomes a weed.

**fabacea**, Naudin (*Megarrhiza californica*, Torr.), is sometimes grown in fine collections and botanic gardens. It is a tendril-climber, reaching 20–30 ft. in its native haunts: lvs. deeply 5–7-lobed: fls. monœcious, greenish white, the corolla rotate: fr. densely spinose, globose or ovoid, 2 in. long; seed obovoid, nearly or about 1 in. long and half or more as broad, margined by a narrow groove or dark line. S. Calif.—Odd in germination (see Gray, Amer. Journ. Sci. 1877, and Structural Botany, p. 21).

L. H. B.†

**ECHINÓPANAX** (Greek, *hedgehog* and *panax*, referring to the prickly nature of the plant). *Arabiaceæ*. Ornamental shrub, but rarely grown; very handsome on account of the large foliage and scarlet fruits.

Deciduous, prickly throughout: lvs. alternate, long-petioled, palmately 5–7-lobed, with serrate lobes, without stipules: fls. greenish white, in umbels forming terminal panicles; calyx-teeth indistinct; petals 5, valvate; stamens 5, with filiform filaments; styles 2, connate at the base: fr. a compressed drupe.—One species, Pacific N. Amer., Alaska to Calif., and Japan.

This is a strikingly handsome shrub with its large bright green palmately lobed leaves and scarlet fruits late in summer. Little known in cultivation; it will succeed best in moist and cool places and in partial shade. Propagation is by seeds and by suckers and probably also by root-cuttings.

**hórridum**, Deene. & Planch. (*Fatsia hórridum*, Benth. & Hook. *Panax hórridum*, Smith). Shrub, to 12 ft.: sts. densely prickly: lvs. roundish-cordate, prickly on both sides, pubescent below, 5–7-lobed, lobes incisely lobulate and sharply serrate, 6–12 in. long; infl. tomentose: fr. scarlet,  $\frac{1}{3}$  in. long. July, Aug.; fr. Aug., Sept.

ALFRED REHDER.

**ECHINOPS** (Greek, *like a hedgehog*; alluding to the spiny involucre scales). *Compositæ*. GLOBE THISTLE. Coarse thistle-like plants, with blue or whitish flowers in globose masses, sometimes used in the wild garden.

More or less white-woolly herbs: lvs. alternate, sometimes entire, usually pinnate-dentate or twice or thrice pinnatisect, the lobes and teeth prickly: fls. in globes; the structure of one of the globes is very odd; each fl. in the globe has a little involucre of its own, and the whole globe has one all-embracing involucre; fls. perfect and fertile (or sterile by abortion), corolla regular and no ray-fls.; pappus of many short scales forming a crown: achene elongate, 4-angled or nearly terete, usually villous.—About 60 species, from Spain and Portugal to India and Abyssinia.

Globe thistles are coarse-growing plants of the easiest culture, and are suitable for naturalizing in wild gardens and shrubberies. An English gardener with an eye for the picturesque (W. Goldring) recommends massing them against a background of *Bocconia cordata*, or with such boldly contrasting yellow- or white-flowered plants as *Helianthus rigidum* or *Helianthus multiflorus*. The best species is *E. ruthenicus* (form of *E. Ritro*). A few scattered individuals of each species are not so effective as a condensed group of one kind.



*E. ruthenicus* flowers in midsummer and for several weeks thereafter. The silvery white stems and handsomely cut prickly foliage of globe thistles are interesting features. They make excellent companions for the blue-stemmed eryngiums. All these plants are attractive to bees, especially *E. exaltatus*, which has considerable fame as a bee-plant. Globe thistles are sometimes used abroad for perpetual or dry bouquets.

A. Lvs. not pubescent nor setulose above but sometimes roughish above.

**Ritro**, Linn. (*E. Vitro*, Hort.). Tall thistle-like plant, with pinnate-lobed lvs., which (like the sts.) are tomentose beneath, the lobes lanceolate or linear and cut, but not spiny: involucre scales setiform, the inner ones much shorter: fls. blue, very variable. G.M. 46:69. R.H. 1890, p. 524. G. 31:611. Var. *tenuifolius*, DC. (*E. ruthenicus*, Hort.), has the lower lvs. more narrowly cut, more or less spine-tipped. Gn. 45:174.—Perennials of S. Eu., growing 2-3 ft. high. They bloom all summer. Lvs. sometimes loosely webby above.

**Tournefortii**, Ledeb. (*E. Tournefortiana*, Hort.). Three to 4 ft., the sts. branched and velvety: lvs. rough above, white-hairy below, much divided into 5 linear segms., spiny: heads "silver-gray" (bluish), the involucre bracts free, bristly. E. Medit. region. Sept. B.M. 8217. R.H. 1906, p. 523.—Suitable for dry places.

AA. Lvs. pubescent or setulose above.

B. Plant perennial.

**sphaerocephalus**, Linn. Tall (5-7 ft.): lvs. pinnatifid, viscose-pubescent above, tomentose below, the teeth of the broad lobes yellow-spined: fls. white or bluish, the involucre bracts subulate-acuminate, free. S. Eu. B.R. 356 (as *E. paniculatus*).

**humilis**, Bieb. Three to 4 ft.: lvs. very hairy on both surfaces, webby above, those of the st. essentially entire, the radical lvs. sinuate-lyrate, almost unarmed; st.-lvs. with spiny tips: heads large, blue, the involucre bracts all distinct and free. Sept. Asia.

**bannaticus**, Rochel. Lvs. hairy-pubescent above, tomentose beneath (as also the sts.), the lower ones deeply pinnately parted, the upper pinnatifid, spiny: fls. blue. Hungary. R.H. 1858, p. 519.

BB. Plant biennial.

**exaltatus**, Schrad. Tall, the st. nearly simple and glandulose-pilose, the lvs. pinnatifid, scarcely spiny: fls. blue. Russia. B.M. 2457 (as *E. strictus*, Fisch.).—Distinguished by its simple, erect st. The garden *E. commutatus* may be the same as this.

*E. nivālis*, Hort., is a trade name that is unknown in botanical literature.

N. TAYLOR.†

**ECHINÓPSIS** (Greek, *hedgehog-like*). *Cactaceæ*. SEA-URCHIN CACTUS. South American small condensed cacti.

Stems spherical to ellipsoidal or rarely columnar: ribs prominent and usually sharp-angled: fls. usually long trumpet-shaped; ovary and tube covered with linear-lanceolate, cuspidate bracts which become longer toward the outer end of the tube, where they pass gradually into the outer petals, in their axils bearing long, silky, wavy hairs and usually a few rather rigid bristles.—This is a well-marked genus of about 18 species, although by some authors combined with *Cereus*. Cult. as for *Echinocactus*; see also *Succulents*.

Only a few species of *Echinopsis* are grown in this country, although they are more easily grown and

propagated than most of the United States species of cacti. The genus is well adapted for use as window plants.

A. Ribs of st. divided into more or less evident tubercles.

**Péntlandii**, Salm-Dyck (*Echinocactus Péntlandii*, Hook.). St. simple, later branching, spherical or ellipsoidal, reaching 6 in. diam.: ribs 12-15, divided between the areoles into oblique compressed tubercles: radial spines 9-12, spreading, straight or slightly curved, yellowish brown, the upper the longest and strongest, reaching  $\frac{1}{2}$ -1 $\frac{1}{4}$  in.; central solitary, or seldom in pairs, porrect, curved, 1-1 $\frac{1}{2}$  in., rarely 3 in. long: fls. lateral, 2-2 $\frac{1}{2}$  in. long, yellow, orange, pink to scarlet-red: fr. spherical, green,  $\frac{3}{4}$  in. diam. Peru, Bolivia. B.M. 4124.—Probably not of this genus.

AA. Ribs of sts. not divided.

B. Fls. red or pink.

**múltiplex**, Zucc. Sts. at first rather clavate, later globose to ellipsoidal, abundantly branching, 6-12 in. diam. and the same in height, or rarely taller, light green to yellowish: ribs 12-14, straight, scarcely undulate: radial

spines about 10, subulate, straight, yellow to yellowish brown, with darker tips, reaching  $\frac{3}{4}$  in. length, very unequal, horizontally spreading; centrals mostly 4, of these the lowest is the longest, reaching  $1\frac{1}{2}$  in., somewhat porrect at first, later curved and deflexed, darker colored than the others: fls. rare, lateral, 11-15 in., rose-red. S. Brazil. B.M. 3789. Var. **cristata**, Hort. Sts. flat and spreading in growth, like an open fan or the fl.-stalk of the common garden cockscomb: spines reduced to fine, stiff bristles. This is merely a monstrosity of the species.

**oxygona**, Zucc. Sts. at first simple, nearly spherical or rarely clavate, becoming short columnar, reaching  $1\frac{1}{2}$  ft. height and 1 ft. diam., gray-green, darker above: ribs 13-15, straight or wavy at the base: radial spines 5-15, horizontally spreading, very unequal, reaching  $\frac{5}{8}$  in., subulate, obliquely upright; centrals 2-5, somewhat longer, straight, porrect or deflexed, dark horn-colored, with black tips: fls. commonly many together, lateral, reaching 13 in. length, pink to carmine-red, the inner petals lighter than the outer ones. S. Brazil.

**triumphans**, Jacobi. This is a hybrid between *E. Eyriesii* and *E. oxygona*, with pink double fls.

BB. Fls. white.

**Eyriesii**, Zucc. St. simple, commonly branching later, at first somewhat depressed, later short to rather tall columnar, reaching a height of 2 ft. and a diam. of 4-6 in., dark green: ribs 11-18, straight, undulate, with sharp-angled margins: radial spines about 10, scarcely more than  $\frac{1}{2}$  in. long, rigid, straight, slender conical, pointed, dark brown to black; centrals 4-8, but very little different from the radials: fls. lateral, 10-15 in. long, white: fr. small, ellipsoidal, about 1 in. long. S. Brazil, Uruguay and Argentina. B.M. 3411. B.R. 1707 (as *Echinocactus*).

**gemmata**, K. Sch. (*E. turbinata*, Zucc.). Fig. 1377. St. simple or sometimes branching, at first low spherical or short columnar, later more top-shaped, reaching 1 ft. height by 4-6 in. diam., dark green: ribs 13-14, rarely more, straight or sometimes slightly spiral with sharp or obtuse margins, which are but little or not at all undulate; central spines appear first, about 3-6 in number, very short, stiff, black; later the radials appear.



1377. *Echinopsis gemmata*.

about 10-14, longer, horizontally spreading, at first yellowish brown, later horn-colored: fls. lateral or from the upper areoles, 9-10 in. long, clear white, with a pale greenish midline in the petals. S. Brazil.

**tubiflora**, Zucc. (*E. Duvallii*, Hort. *E. Zuccarinii*, Pfeiff.). Sts. spherical to ellipsoidal, at first simple but later more or less branching, reaching 10 in. height by 8 in. diam., dark green: ribs 11-12, straight, with margins inconspicuously undulate: radial spines numerous, sometimes as many as 20, unequal, horizontally or obliquely spreading, yellowish white with brown tips, sometimes darker; centrals 3-4, the lowest the longest, reaching  $\frac{5}{8}$  in., later deflexed: fls. lateral, about 14 in. long, white with pale green midline in the petals. S. Brazil and Uruguay. B.M. 3627.

C. H. THOMPSON.

J. N. ROSE.†

**ECHINOSPÉRMUM**: *Lappula*.

**ECHINÓSTACHYS** (Greek, *spiny head*). *Bromeliaceae*. About a half-dozen species allied to *Æchmea* (with which some writers unite it), from S. Amer. Outer fl. parts bristly; petals broadly clawed, with 2 fringed scales or glands; ovary thick and fleshy, 3-seeded; spike cylindrical, thin, club-shaped: lvs. small, becoming darker after flowering. The species require hothouse conditions, as for *Æchmea* and related things. Three names have appeared in the American trade: *E. Hystrix*, Wittm., for which see *Æchmea Hystrix*. **E. Pineliána**, Wittm. (*Æ. Pineliána*, Baker). Two to 3 ft.: peduncle and bracts brilliant red: lvs. 12-18 in. long in a rosette, strap-shaped, deltoid at summit, spine-edged: spike dense, 2-3 in. long, spiny; petals golden yellow and becoming black-brown, the tips fringed and incurved. Brazil. B.M. 5321. **E. Van Houtteána**, Van Houtte (*Æ. Van Houtteána*, Mez. *Quesnelia Van Houtteána*, Morr.). Lvs. many, strong-spined, sometimes white-banded beneath: fls. white, blue-tipped, in a crowded spike, the bracts reddish at the summit and white-downy at the base: 1-2 ft. Brazil.

L. H. B.

**ECHITES** (Greek, *viper*; possibly from its poisonous milky juice or from its twining habit). *Apocynaceae*. Tropical American twining shrubs related to *Dipladenia*, and of similar culture.

The genus differs technically from *Dipladenia* in the 5-lobed disk and the glandular or 5-scaled calyx. Lvs. simple, opposite, penninerved: fls. usually showy, purple, red, yellow or white, in sub-cymose clusters; calyx small, 5-lobed, with many glands at the base inside or else 5 scales opposite the lobes; corolla salver-shaped, the throat usually contracted, the limb 5-lobed; stamens included, the filaments very short; stigma with an appendage in the form of a reversed cup or of 5 lobes.—Some 40 species, S. Fla. to Chile.

**Andrewsii**, Chapm. (*E. suberecta* Andr.). Lvs.  $1\frac{1}{2}$ -2 in. long, close together, oval or oblong, mucronate, acute or rounded at the base, margins revolute; peduncles axillary, 3-5-fl., shorter than the lvs.; fls. yellow, 2 in. long; corolla-tube much dilated above the insertion of the stamens, bell-shaped, scarcely longer than the lobes; anthers tapering into a long bristle-like awn. Sandy shores, S. Fla., W. Indies. B.M. 1064. P.M. 7:101.

**paludosa**, Vahl. Lvs. oblong, oval-oblong, or lanceolate-oblong, rounded toward the mucronate top: calyx-segms. glandular, devoid of an interior scale, oblong, mucronate-blunt, spreading; corolla-tube funnel-shaped above a cylindrical base; anthers oblong-lanceolate, acuminate, rounded-cordate at the base, hirsute on the back above. Mangrove swamps, S. Fla.

**umbellata**, Jacq. Lvs. ovate or ovate-roundish, mucronate: fls. greenish white; calyx-segms. glandular, devoid of an interior scale; corolla-tube cylindrical, enlarged below the middle, tapering again above; anthers rigid, tapering from a hastate base, glabrous. S. Fla., W. Indies.

WILHELM MILLER.

**ÉCHIUM** (from the Greek for a *viper*). *Boraginaceae*. **VIPER'S BUGLOSS**. Coarse, mostly rough herbs and shrubs, with spikes of blue, violet, red or white flowers, some of them grown in the open and others under glass.

Plant usually scabrous, hispid or canescent: lvs. alternate: fls. in unilateral, scirpoid, forked or simple spikes, with either small or foliaceous bracts; calyx with 5 narrow lobes; corolla tubular-trumpet-shaped, the throat oblique and dilated and without appendages; corolla-lobes 5, roundish and unequal, somewhat spreading or erect; stamens 5, inserted below middle of tube, unequal and exserted; ovary deeply 4-lobed; style filiform, 2-parted at top: fr. 4 nutlets.—Some 30-40 species, from the Canaries and Madeira (where they are specially important) to W. Asia. One species, *E. vulgare*, Linn., is a showy intro. biennial weed in fields and along roadsides, with blue or rose-tinted fls.; it is known as blue-weed and blue-devil. The shrubby species of Madeira and the Canaries are much confused, some of the names having been established on cult. material. This is particularly true of the forms passing as *E. candicans* and *E. fastuosum*, which are very unsatisfactorily determined (See Hooker, B.M. 6868). In those islands, the plants produce much forage and they persist from the goats in inaccessible places. (The portraits quoted below are cited under the names they bear.)

In rich soil echiums grow coarse and scarcely flower, and the flowers are never as richly colored as when the plants are more or less starved. Biennials seed freely, and the seed is sown as soon as gathered. *E. fastuosum* is said to be the handsomest of the shrubby kinds, grows 2 to 4 feet high, has long, pale green leaves covered with soft white hairs, and flowers of a peculiarly brilliant deep blue. Echiums are eminently suited for dry places, and need good drainage.

**candicans**, Linn. f. (*E. fastuosum*, Jacq. f., not Ait. *E. truncatum*, Hort.). Forms a bush several feet high, but flowers at 3 ft., the lvs. and sts. white-hairy; branches thick, leafy toward the tips: lvs. lanceolate, the upper ones smaller, crowded and narrower; panicles much looser than the spikes of *E. fastuosum*; fls. sessile, pale blue, the buds reddish purple, the pink stamens protruding. Madeira, Canaries, on mountains. B.M. 6868. B.R. 44. G.C. III. 51:368. G.M. 55:376.—The fls. are said sometimes to be streaked with white or all white.

**fastuosum**, Ait., not Jacq. This has darker blue fls. in a dense spike and perhaps less hoary foliage than *E. candicans*, the protruding filaments nearly white (said by some to be white in *E. candicans*). Coast, Canaries. R.H. 1876:10. Gn. 10:546. G.C. III. 33:328. G.W. 15, p. 356.—*E. fastuosum* has dark blue, 5-lobed fls. about  $\frac{1}{2}$  in. across, in spikes 6 in. long and 2 in. wide, perhaps as many as 200 fls. in a spike. Great masses of stamens are thrust out and add to the interest, and the young fl.-buds look like pink 5-pointed stars.

**simplex**, DC. Woody but biennial and not branched, 8-10 ft.: lvs. ample, oval-lanceolate; panicle very long, cylindrical, spike-like, the spikelets 2-fl., pedicelled; stigmas simple. R.H. 1912, p. 351. Gt. 51, p. 375. G.C. III. 53:20.

*E. Auberianum*, Hort., not Webb & Berth.—=*E. Bourgeanum*.—*E. Bourgeanum*, Webb. Stout and strict, 8-11 ft., the st. covered with long-linear drooping lvs.: fls. rose-colored, in a dense pyramidal spike. Mountains, Canaries. R.H. 1912, p. 440. G.C. III. 53:25. A striking plant.—*E. callithyrsum*, Webb. Woody or tree-like, robust, hispid-hairy: lvs. strongly nerved: calyx-segms. very unequal: fls. pale red: floral lvs. exceeding the different cymes of the thyrses. Canaries.—*E. formosum*, Pers.—=*Lobostemon*.—*E. Pininana*, Webb & Berth. Very large species, reaching 16 ft., with an abundance of stout spreading long-oblong lvs. G.C. III. 53:20.—*E. Wildpretii*, Pears. A tall soft-hairy biennial, with simple erect st. 2-3 ft.: lvs. sessile, narrowly linear-lanceolate, hairy: fls. pale red with long-exserted filaments, in a large terminal thyrsis: floral lvs. much exceeding the different cymes. Canaries. B.M. 7847. G.C. III. 38:5; 52:317. G.M. 53:111. Gn. 76, p. 363. G. 27:261.

WILHELM MILLER.  
L. H. B.†



EDELWEISS: *Leontopodium*.

**EDGEWORTHIA** (after M. P. Edgeworth, English botanist in East Indies, and his sister Maria). *Thymelæaceæ*. Ornamental woody subjects grown chiefly for their early yellow and fragrant flowers and for the handsome foliage.

Deciduous sparingly branched shrubs, with stout branches: lvs. alternate, entire, short-petioled, crowded at the end of the branches: fls. in dense, peduncled heads, axillary, on branches of the previous year, with or before the lvs., apetalous; calyx-tube cylindric, with 4 spreading lobes, densely villous outside; stamens 8, in 2 rows; style elongated, stigma cylindric: fr. a dry drupe.—Two species in Japan, China and Himalayas.

These plants are hardy only in warmer temperate regions, but do not stand hot and dry summers; they thrive in any good well-drained garden soil; if grown in pots, a sandy compost of peat and loam, with sufficient drainage given, will suit them. Propagation is by green-wood cuttings in spring under glass; also by seeds.

**papyrifera**, Zucc. (*E. chrysantha*, Lindl. *Daphne papyrifera*, Sieb.). Small shrub with thick branchlets: lvs. deciduous, membranous, elliptic-oblong to oblong-lanceolate, acute at the ends, at first clothed with silky hairs on both sides, later glabrous above, 3–5 in. long: heads of fls. dense, up to 2 in. across, on short axillary stalks; fls.  $\frac{3}{4}$  in. long, densely silky-hairy outside, fragrant, yellow, drying whitish; ovary pubescent only at the apex. April. Japan, China. B.R. 33:48. F.S. 3:289.—Cannot withstand the long dry summers.

**Gárdneri**, Meisn. Large shrub, with slender branchlets: lvs. persistent, of firmer texture: fls. with a more shaggy pubescence, drying black; ovary hairy throughout: otherwise very similar to the preceding species which is, by some botanists, considered not specifically distinct. April. Himalayas. B.M. 7180.

ALFRED REHDER.

**EDRAIÁNTHUS**: *Wahlenbergia*. By some kept distinct, to include about a dozen species. Spelled also *Hedreanthus*.

**EDUCATION, HORTICULTURAL.** In the United States and Canada, instruction in horticulture is part of the publicly maintained colleges of agriculture. In Canada, these colleges are provincial rather than national or established by the Dominion. The Canadian colleges of agriculture are: Nova Scotia and New Brunswick, Truro, N. S.; Quebec, Sainte Anne de Bellevue (only in part provincial); Ontario, Guelph; Manitoba, Winnipeg; Saskatchewan, Saskatoon; British Columbia, in plan at the university being established at Victoria.

In the United States, general horticultural education is mostly a part of a national system of professional and applied education of collegiate grade or name. There is a college of agriculture in every state in the Union, being part of a national system with coöperation and aid from the State. (For list, see *Experiment Stations*, p. 1195.)

There is little development, as yet, in North America of the training-school idea on either a private or a public basis, and relatively few institutions or establishments in which persons are trained for "gardening," as they are trained in the Old World. There is no recognized apprentice system for gardeners. The whole subject, therefore, needs to be considered quite by itself and not in comparison with systems or methods of education in horticulture in other and older countries; and it is necessary to understand something of the system of publicly endowed industrial education, of which instruction in horticulture is a part. The general nature of these institutions in both Canada and the United States may be understood from a brief discussion of the land-grant institutions in the latter country.

The public industrial education of the United States,

of college grade, is founded on the Land-Grant Act of 1862. By the terms of this great instrument, every state received from the federal government 30,000 acres of land for every representative that it had in Congress, the proceeds of which are to be used for "the endowment, support, and maintenance of at least one college where the leading object shall be, without excluding other scientific and classical studies, and including military tactics, to teach such branches of learning as are related to agriculture and the mechanic arts, in such manner as the legislature of the states may respectively prescribe, in order to promote the liberal and practical education of the industrial classes in the several pursuits and professions in life." This endowment has been supplemented by subsequent direct federal appropriations, to further the objects for which the original grant was made. On this foundation, all the forty-eight states comprising the Union have established colleges of agriculture and the mechanic arts, about half of them separate institutions and about half of them connected with or part of state universities or other general institutions. The states themselves have supplemented and extended the proceeds of the land-grant. These and the Canadian colleges represent many types of organization and method. Their purpose is increasingly to train young men and women broadly by means of agricultural and country-life subjects. They are now exerting great influence in re-directing rural civilization. They are rapidly putting agricultural and rural subjects into educational form, and are demonstrating that such subjects may have training and even cultural value equal to that of historical subjects.

The agricultural colleges contain many departments, and horticulture is usually one of these departments, coördinate with the others. Some of these departments, aside from the work in the fundamental arts and sciences, are as follows: agricultural chemistry, agronomy, entomology, plant physiology, plant pathology, bacteriology, plant-breeding, soils, farm crops, farm management (the principles of business as applied to farming), horticulture, pomology, floriculture, forestry, animal husbandry, poultry husbandry, veterinary, dairy industry or dairy husbandry, home economics, farm mechanics and engineering, rural economy or agricultural economics, landscape gardening or landscape art, drawing, rural education, meteorology, and extension teaching. It will be seen, therefore, that horticulture is only one contributing part in an educational establishment for the teaching of agriculture in a broad way.

Aside from these publicly endowed or maintained institutions, there are a few other regular colleges that teach horticulture with other work, but they have not made great headway, although the subject may assert itself strongly in some of them in the future. There are two or three training-schools, one for women. More training-schools will be needed.

The students in agriculture in the colleges of agriculture number many thousands, in some cases 1,000 and more in one institution. They come from all walks and conditions of life, and from city and country alike. Some of them, of course, have strong inclinations for horticulture, and soon specialize in that subject. The full course of instruction is four years, following college entrance requirements, and the student at graduation receives a diploma carrying Bachelor of Science or a similar degree. In many of these institutions, post-graduate work in a variety of subjects is provided, leading to a master's degree or even to a doctor's degree.

The first institutions to develop horticulture as a separate subject appear to have been those in Michigan, under W. W. Tracy, Chas. W. Garfield and successors, Mr. Tracy having been instructor in horticulture as early as 1867; New York (1874) and in Ohio under

W. R. Lazenby; and in Iowa (1876) under J. L. Budd. The instruction by means of horticulture has now grown to great importance in many of the colleges, the staffs comprising, in some cases, as many as fifteen to thirty persons.

*The horticultural work in the colleges.*

We may now consider the horticultural teaching work of these colleges in more detail.

In the early days of such instruction, the horticulture was set over against the agriculture, and these two comprised the main applied groups. The breaking-out of the group of horticulture was really the beginning of the broadening of these institutions and of their more perfect articulation with the conditions before them.

Horticulture, as understood in these colleges, comprises fruit-growing, flower-growing, vegetable-gardening, together with the nursery and glasshouse subjects naturally associated with them. With the further differentiation of the curriculum, horticulture tends to be split or separated into its three main parts, with separate units or teacherships for each, but this division has not yet proceeded far in most of the institutions. If this division is ever carried to its conclusion, the name "horticulture" as an educational unit may pass out.

In the colleges, horticulture is regarded as a phase of the general agricultural field. For the most part, the student approaches the subject from the point of view of farming by means of fruits or vegetables or even of flowers. The strictly amateur phase is incidentally emphasized as a rule, and this undoubtedly is one of the weaknesses of the American horticultural instruction. The amateur attitude, however, will appear more markedly as the country develops and matures. The present attitude very well represents the development that America is now making, as expressed particularly in the great orchard interests. The gardeners, as a group, have had relatively little touch with these institutions in the way of dictating or even influencing their development. So far as institutions are concerned, the gardening phase of horticulture is well expressed where the great collections are, as at the Shaw or Missouri Botanical Gardens, Arnold Arboretum, New York Botanic Gardens, and others; and these institutions will also produce highly trained specialists in small numbers in related scientific lines.

The content of the work in the land-grant colleges varies greatly, depending, of course, on the constituency of the particular college as well as on the staff. Naturally, in the states in which horticultural interests are large, the work will express itself strongly in the college. Some of the courses in horticulture now offered in different colleges of agriculture may be displayed, showing how the subject is divided and what is considered to be the content of the instruction. These examples are chosen only to show the kind and the range of representative courses, and the writer makes no comment on them. Other courses might be chosen from the catalogues, but these are sufficient for illustration. In some cases, practically the same subject is entered twice: this represents the way in which the subject is phrased in different institutions. Some of the courses in landscape work that are given by departments of horticulture are also included.

*Elements of horticulture.*—Fruit-growing, vegetable-gardening and ornamental planting, with special reference to the farm home.

*Gardening.*—A personal and informal course for lovers of plants and gardens. The course consists of actual work with identification and growing plants, supplemented by conferences and informal discussions. Attention is given to garden literature and history, planning of grounds.

*Cultivated plants.*—The relationship and classification of certain economic and ornamental plants of the temperate zone; identification of species; examination of living plants and herbarium specimens.

*Evolution of horticultural plants.*—History, botanical classification, and geographical distribution of cultivated plants; modification under culture; theoretical causes and observed factors that influence variation, particularly food-supply, climate and cross-fertilization.

*Amateur floriculture.*—Window-gardening; growing of flowers on the home grounds; containers; potting soils; fertilizers; preparation and planting of flower-beds; propagation and culture of plants suitable for window and garden.

*Commercial floriculture.*—Studies in the propagation and culture of the leading florist crops. As facilities permit, students are assigned space in the greenhouses for practical experience in the growing of roses, carnations, chrysanthemums, violets, sweet peas, and other plants. Discussions on diseases, insects, botany, and the packing, handling, and marketing of cut-flowers and plants for retail and wholesale markets. Classes participate in a required excursion.

*Garden flowers.*—Designed to acquaint the student with garden plants and to give practical knowledge of the propagation and culture of the annuals, herbaceous perennials, bulbs, and shrubs used for cut-flowers or in ornamental planting.

*Greenhouse construction.*—The development of the modern greenhouse; types of houses, materials, and methods of construction, installation of heating systems, etc. Laboratory practice in erecting section of cypress and iron frame houses, and in planning and estimating the cost of commercial ranges for flower- and vegetable-production. The class participates in a required excursion.

*Greenhouse management.*—Studies of the principles and practice of propagation, soils, potting, shifting, watering, ventilation, and fumigation of plants cultivated by florists.

*Conservatory plants.*—A study of the culture and uses of tropical and subtropical plants grown in conservatories, including palms, ferns, begonias, orchids, etc.

*Floral design.*—A study of the principles of floral art. Practice in the arrangement of flowers in designs and bouquets, baskets, table decorations, interior decoration, etc.

*Greenhouse and garden practice.*—Designed to give the student practical knowledge of greenhouse work. Lectures and exercises in greenhouse management, propagation, composting soils, potting, watering, etc.

*Investigation in floriculture.*—The investigation of problems in the growing of cut-flowers, exotics, and garden flowers; hybridizing; study of varieties. Designed primarily for upper classmen and graduate students.

*Elements of landscape gardening.*—Reconnaissance surveys and mapping, with special reference to the methods used in landscape gardening; detailed study of selected designs of leading landscape gardeners; grade design, road design and field work.

*General design.*—Field notes; examination of completed works and those under construction; design of architectural details, planting plans, gardens, parks and private grounds; written reports of individual problems.

*Civic art.*—The principles and applications of modern civic art, including city design, city improvement, village improvement, and rural improvement.

*Trees and shrubs.*—Plant material important to landscape gardening; landscape value of each plant with respect to adaptability to the soil and situation and the use of the plant in design.

*Advanced landscape design.*—Real estate subdivisions and a complete set of plans, including a sketch plan, general plan, report, detailed study of architectural features, grading plans, planting plans, set of specifications, and estimate of cost.

*Landscape practice.*—Interpretation of topographic maps and their relation to landscape design; calculation of cut and fill; quantities of material; preparation of grading plans and working drawings.

*Exotics.*—Temporary decorative plants used in landscape gardening.

*Plant materials.*—This course aims to make the student familiar with the character of the trees, shrubs and herbaceous perennials used in ornamental work, and with the methods of propagating them.

*Decorative and bedding plants.*—Tropical and subtropical plants used in decorative work in the conservatory; tender plants used in outdoor bedding.

*Home vegetable-gardening.*—A study of vegetables and their production for home use. The planning and management of the garden, special crop requirements, factors influencing quality, and control of pests, will be considered. The laboratory work consists of actual practice in the garden. The starting of early plants in hotbeds and frames, intercropping and succession-cropping to secure largest yields from small areas, are studied. Each student assumes charge of his own plants and carries them through to the end of the term.

*Commercial vegetable-gardening.*—The principles of vegetable-growing as applied in commercial production; the scope of the industry and its opportunities; choice of location; equipment; management. The vegetable crops are considered singly, as to their adaptation, culture, special requirements, varieties, enemies, marketing, and profits. The laboratory work includes exercises in growing plants under glass and in the planting and care of early outdoor vegetables. Each student assumes full charge of his own plantings.

For students specializing or desiring a fuller knowledge of vegetable-gardening, another course is given, throughout the year. Advantage is taken of the opportunity for practice in harvesting, packing, and marketing fall crops. A two-days' excursion to two or three important vegetable-growing centers some time during May constitutes a part of the course. Each student gives a part of his time to a special problem, to be agreed on. Report on this problem is presented in typewritten form.

*Vegetable-forcing.*—Vegetable-growing under glass. Important



forcing crops. Laboratory consists of practical work in crop-production. Each student is assigned a plot in the greenhouse on which he grows vegetables to maturity, assuming full charge except in heating and ventilation. This is supplemented by descriptive studies.

**Systematic vegetable crops.**—Lectures and descriptive studies dealing with vegetable crops, their origin and botany. Special attention is given to varieties, and their adaptation to different cultural and market conditions. The important commercial types of the different vegetables are grown in the garden each year, and there is an abundance of first-hand material for the course.

**Advanced vegetable-gardening.**—The student's time is divided between advanced studies of vegetable crops and their culture and the study of a special problem to be agreed upon. An excursion to two or three important vegetable-growing centers constitutes a part of this course.

**Elementary pomology.**—A study of the methods of propagation and early care of commercial fruits, including the growing of seedlings, cuttings, and layers; the principles of budding, grafting, pruning, and planting; the soils, varieties, and planting plans for the orchard.

**Practical pomology.**—A study of the soils and varieties for the orchard; cultivation, cover-crops, fertilization, spraying, pruning, and thinning as practised in orchard management; the picking, grading, packing, storing, and marketing of fruit. This course considers the apple, pear, quince, cherry, plum, apricot, and peach.

**Systematic pomology.**—A study of the varieties of the different fruits and of nomenclature, with critical descriptions; special reference being given to relationships and classification.

**Bush-fruits.**—A lecture course which considers the grape, raspberry, blackberry, dewberry, currant, gooseberry, and strawberry. The topics discussed are: varieties, planting, culture, picking, grading, packing, and marketing.

**Small-fruits and grapes.**—The strawberry, raspberry, blackberry, dewberry, currant, gooseberry, grape. History; extent of cultivation; soil; location; fertilizers; propagation; planting; tillage; pruning; insect enemies; diseases; varieties; harvesting; marketing.

**Spraying of fruit trees.**—A study of the preparation and application of the spray mixtures used in orchard practice.

**Nuciculture.**—Lectures on the practical and systematic phases of nut-culture, with special reference to the cultivation and improvement of the forms native to the United States.

**Subtropical pomology.**—A study of citrus and other tropical fruits, with special reference to American conditions. Laboratory work in describing and judging the various fruits.

**Plant-propagation.**—Grafts; buds; layers; cuttings; seeds.

**Systematic pomology.**—A course designed primarily for graduates and students who are preparing to do experimental work. A study of the characters and botanical relationships of the fruits of the United States. Each student is required to collect and mount a number of varieties and species.

**Research in pomology.**—Original investigation of problems in pomology. A typewritten thesis is required.

The equipment for the horticultural work usually consists of classrooms, laboratories with tables and sometimes equipped for microscopic work, and herbaria; workrooms in which practice may be had in the mixing of soils, the compounding of spraying materials, the testing of machines, the study of vegetables and fruits, and the like; range of glasshouses; and a number of acres of land for gardens and orchards. Sometimes the orchard area amounts to fifty and more acres. In some colleges the plant-breeding is included with the horticulture; and in some of those that are least differentiated the plant pathology and economic entomology are also included, as also forestry. In the courses detailed above, all these subjects are excluded as horticulture, since they are likely to be handled in regular departments by themselves in numbers of different courses.

The subject of landscape architecture, or landscape gardening, has developed in the institutions in the United States from two sides. When it is an offshoot of colleges or departments of architecture, or when strongly dominated by architectural ideas, it is likely to be known as landscape architecture. In the agricultural colleges, however, the subject has developed mostly from the horticultural or gardening side, and has usually been called landscape gardening. As a part of the curriculum, landscape gardening is given more or less attention in nearly all the land-grant institutions. In three or four of them, however, the subject is now being given special and professional attention, as also at Harvard. Two institutions in this country give a post-graduate degree, Master of Landscape Architecture or Master of Landscape Design.

### Other forms of horticultural teaching.

The colleges of agriculture are engaged rather largely in extension work, the extension meaning all educational efforts prosecuted at the homes and on the farms of the people. The extension work is welfare work, and it is properly a necessary part of an institution that is maintained by the people for the service of the people. Some of this extension work is horticultural. It comprises tests and experiments in orchards, gardens, and greenhouses; coöperation with growers' associations; surveys of conditions and industries; the issuing of popular bulletins and other literature; lecture-courses, reading-courses, and much correspondence. See *Extension Teaching in Horticulture*, page 1199.

The experiment and research work of the institutions is also of course educational, but this effort is reserved for separate discussion. See *Experiment Stations*, page 1195.

In the public schools, there is now a strong sentiment for the introduction of agriculture. This pertains in all parts of the United States and Canada. This agricultural instruction will be organized eventually on the same basis as other instruction in the common schools. Agriculture will include a great variety of subjects, the horticultural affairs being given their due consideration. This will result in a gradual re-direction of the youthful mind toward horticultural and other rural pursuits.

The nature-study movement is widespread and established, and the material of the teaching is largely of plants. School-gardening is growing in popularity and importance. All these subjects are finding their way into normal schools and colleges, in some of which there is definite horticultural work for the training of teachers. Correspondence courses, the rural press, state departments of agriculture, and other agencies and enterprises are also forwarding horticultural education as a part of the general rural betterment.

In the United States and Canada, horticulture is largely a training for citizenship, on the basis of general collegiate education. The Americans have had a continental area to discover and to conquer; they are endeavoring to conquer it by many means, and the most fundamental means is by organizing all industry educationally. The horticultural subjects are important not only in themselves but in their personal appeal, and the organizing of horticultural knowledge into large plans and methods of human training is one of the best privileges of any people.

L. H. B.

EEL-GRASS: *Vallisneria spiralis*.

**EGGPLANT** (*Solanum Melongena*, Linn.). *Solanaceæ*. GUINEA SQUASH. AUBERGINE of the French. Strong perennial herb or sub-shrub, grown as a vegetable-garden annual for its large fruits, which are eaten cooked; requires a long warm season.



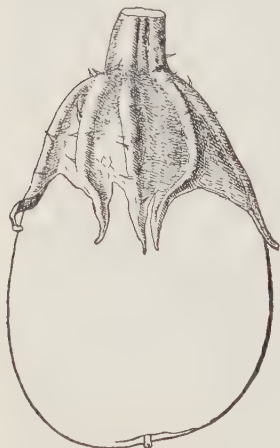
1378. Rotate corolla of eggplant; stamens connivent.

The eggplant is native of the tropics, probably from the East Indies, but its native land is not known. It is cultivated to a greater or less extent throughout the entire tropical regions. The first reports of its use as a vegetable come from India, hence the above assumption. In the United States it is cultivated as a vegetable as far north as

New York, but it usually grows to greater perfection in the southern states. It is much grown in Florida. The demands for it in the early months of the year have not been fully supplied. Its cultivation demands a specialist as much as either celery or tobacco, while the specialization must be in a different direction from that of either one of these. Nearly all of the fruit

that grows to proper size is edible, and there is no special demand for particular flavors. Eggplants are forced under glass to a limited extent for home use. They require the temperature of a tomato house, and great care must be taken to keep off red-spider and mites.

In order to insure large fruits, practise artificial pollination. Non-pollinated fruits will grow for a time, but always remain small (Fig. 1379).



1379. Non-pollinated fruit.

*Soil.*—Eggplant will grow on almost any land in the South, but it develops to greater perfection on a rich, deep, loamy soil free from debris. In the clay districts this is not easily secured, but there are often small fields that are sufficiently dry and yet contain enough sand to make eggplant-growing profitable. No matter whether clay land, loam or sandy land be employed for raising this crop, it will be necessary to plow deeply and thoroughly. The land should be drier than that required by cabbage or beets. In fact it will stand a greater drought than the ordinary vegetables. On the other hand, one should not attempt to grow a crop on land that is composed of large particles, such lands as are ordinarily called "thirsty" in the vegetable-growing sections of Florida.

*Fertilizer.*—On the coastal plains of the South Atlantic and Gulf States, barn manure is of doubtful value for fertilizing eggplant. When it is advisable to use this material, it is preferable to compost it and use it in the form of well-rotted stable manure. A cheaper and at the same time preferable way of securing the humus necessary in the loamy sands is to grow leguminous plants that are not subject to root-knot. Such plants will give much more humus and at a cheaper price than can be obtained by the use of stable manure. On the loamy sands, the fertilizer should not be applied until after the plants have been set out and have started. A small quantity is then applied by hand or by drill. On very poor land, as much as 200 to 500 pounds of a good home-mixed fertilizer should be used. In the course of two to four weeks, the eggplants will have shown the effect of the fertilizer and by this time will be making a considerable growth. A second application may then be made of as much more, or twice as much as was used the first time. Later in the season, when the plants are beginning to make bloom buds or setting the fruit well, an after-dressing of nitrate of soda could be applied if the plants show need of further fertilizing, using it at the rate of 100 to 300 pounds to the acre. This can be applied very readily by hand or by the use of a fertilizer drill. The hand method is more economical of fertilizer but more costly in applying. On the heavy clay lands less potash will be needed and in those places in which a stiff clay is employed for gardening purposes, the potash may be reduced to 4 or 5 per cent, or even eliminated. Ammonia and phosphoric acid are needed on nearly all the soils.

*Propagating the seedlings.*—The time required to bring plants into bearing from seeds varies with the condition of the soil and the temperature. During cool weather the plants grow very slowly, but during hot weather they grow rapidly and mature fruit in much less time. Those who wish to have early fruit and are able to use hotbeds or propagating-houses should sow the seed 120 to 150 days before the fruit is wanted. Pre-

pare the hotbeds as for other seedlings, and sow in rows a few inches apart. When these are beginning to show their leaves or when the seedlings are beginning to look spindly, they should be pricked out and transferred to another bed. In this each plant should be given about a 2-inch square; then they may be forced until the plants crowd one another in the bed, when they should be transferred again. When the plants have attained the size of 6 inches, and the atmosphere will permit, they may be set out in the field. A somewhat more laborious, but at the same time more successful plan, is to plant the seedlings in 2-inch flower-pots and then shift to larger ones as often as the plants become pot-bound or crowd one another in the bed. Fig. 1380 represents a plant three-tenths natural size, just taken from a flower-pot and ready to be shifted to a larger one. By shifting until 6-inch pots are reached, the eggplant may be forced along without injury to blooming size or even to a size when fruit is beginning to set, and then set out in the field without injury to the plants or crop. Eggplant-growers should bear in mind constantly that from the time of sprouting the seeds to the harvesting of the crop, the plants cannot stand a severe shock in their growth without detriment to the crop. When the plant is once started, it should then be forced right along and never allowed to become stunted during its growth. The amount of damage done by neglecting plants before they are set in the field varies with the severity of the shock and the length of time during which the plant undergoes the disadvantageous conditions. If it becomes necessary to harden the plants off before setting them in the field, this should be done gradually.

*Culture in the field.*—After the field has been thoroughly prepared in the way of plowing and fertilizing, which should have been done at least two weeks before the plants were set out, the rows should be laid off 3 to 4 feet apart. The plants may be set 2 to 4 feet apart in the row, varying with the varieties to be used and the soil. Tillage should be continued and varied according to the conditions of the weather. In a wet season it is well to cultivate the land as deeply as possible, while in dry weather cultivation should be shallow, simply sufficient to keep the weeds from growing, to keep the soil well aired, and to keep mulching of dry soil on the land. Under ordinary circumstances it does not pay to prune or pinch out the buds, but when the season is short this may be resorted to with some advantage. If it is desirable to have the fruit attain a certain size before frost, one may begin to pinch out the blossoms and new growth about three weeks before its usual occurrence. This same process will be of advantage when the fruit is to be brought into market at a certain time. A great many attempts have been made to hold eggplants



1380. Pot-grown plant ready for setting in the field.

over the summer, that is to have a spring cropping and then allow the plants to remain in the field, cultivate them up and make a fall crop from the old stalks. Sometimes this process is successful but generally speaking it is a wasteful and expensive method. The old plants that have borne a crop should be discarded and a fresh seed-bed started to bring the plants in at the



time desired. If about 150 days are allowed from the time of sowing the seed, the grower will have a good field of fresh plants to start in with, which will produce a higher quality and larger quantity of fruit.

**Marketing.**—It is better to cut the fruit from the plant than to attempt to break it, especially if the work is being done by careless laborers. After cutting the fruit, it may be placed in large baskets and hauled to the packing-house for crating. Each fruit should be wrapped separately in heavy paper, either manila or brown, and care must be exercised not to wrap it while moist. Formerly the large crate was generally employed, but in the last ten years there has been a decided tendency toward reducing the size of the crate. The eggplant crate is now about double the size of the bean crate, and usually ships at the 80-pound rate. The eggplant is regarded as a staple vegetable, consequently fancy wrapping-paper or fancy methods of packing do not pay for the trouble. It stands shipment well to distant markets, so that freight shipments are usually employed. At times in the winter and spring, the price of eggplant becomes very high and then the shipments go forward by express.

**Varieties.**—There are only a few varieties offered in the market. The New York Improved Spineless matures a little earlier than the Black Pekin. The New York Purple (Fig. 1381), Black Pekin and the New York Spineless are excellent for shipping purposes. The above varieties are the black-fruited, and the most popular in the United States, while the white-fruited sorts are said to be the most popular in Europe. For home use, the white-fruited varieties are preferable, but as these make poor sellers in the United States, one must raise the purple sorts for market. For home gardens, the early and small Early Dwarf Purple (Fig. 1382) is useful. It is particularly recommended for northern climates. There are three main types of eggplants, as follows: The commoner garden varieties, *Solanum Melongena* var. *esculentum*, Bailey (Figs. 1381, 1383); the long-fruited or "serpent" varieties, *S. Melongena* var. *serpentinum*, Bailey; the Early Dwarf Purple type var. *depressum*, Bailey (Fig. 1382). See *Solanum*. The so-called Chinese eggplant is a different species, for which consult *Solanum*.

**Seed-growing.**—This is by no means a difficult operation and may be done profitably in certain sections of the South. For this purpose all defective or dwarfed plants in the field should be cut out. By a little attention one will be able to know when the seeds have matured sufficiently for gathering. At this time the eggs usually turn a lighter color or even somewhat yellow. The fruit should be gathered and carried to the

packing-house, where it may be left in a pile for two or three days, as there is very little danger from rotting. When a sufficient number have been collected, the laborers may be set to paring off the extra amount of meat on the outside of the seed. The remaining core may then be cut longitudinally into quarters or eighths,



1382. Sprays of Early Dwarf Purple eggplant.

using a dull knife to avoid cutting the seed. After a quantity of these have been pared, they may be placed in a barrel and covered with water. The barrel should not be made more than two-thirds full. In a day or two fermentation will set in and the meaty portion will macerate from the seed. The seed may then be separated from the meat by means of sieves, using first wide-meshed ones to remove the meat and then finer-meshed ones to screen out the seed from the finer pulp. The seed should not be allowed to stand more than two or three days in the macerating barrel, as the heat evolved by fermentation and the heat of the summer is liable to cause them to germinate. After separating the seed from the pulp, it should be dried in the shade and wrapped in secure packages. By covering with tin-foil or oil-paper, the atmospheric moisture will be kept out and molding prevented.

**Diseases.**—The most destructive of diseases in the lower South is a blight fungus which attacks the plant just beneath the surface of the ground, causing the softer tissues at this point to rot off and the plant to die. The fungus is not able to penetrate the harder portion of the stem, consequently the plant lingers along for weeks after being attacked. A number of attempts have been made to cause this blight fungus to produce fruiting organs so it could be classified, but up to the present this has proved futile. In such cases as this there is no remedy. After the plant is attacked, it is usually doomed. Much, however, can be done in the way of preventing the spread of this fungus. If all plants are destroyed as soon as found to be affected, the fungus cannot perfect its sclerotia, or rusting state, and thus its propagating is prevented. The normal home of this fungus is in decaying vegetable matter. If, therefore, a field is kept free from this sort of material one will do much to prevent this fungus from being present. Some soluble form of fungicide, as Eau Celeste or potassium sulfide, may be sprayed about the roots of the plants to good advantage. Practise rotation of crops. A second form of blight is caused by *Bacillus solanacearum*. This disease has its origin of infection in the leaves, and is introduced by means of insects



1381. Field-grown plant of New York Improved eggplant.



which have fed upon diseased plants and carried the infection to the well ones. The disease works rapidly down the tissues and causes the death of the leaf and finally of the whole plant. The only remedy for this is to destroy all plants that are affected with the disease as soon as detected, and kill off all insects. When this disease is known to be present in a section, it is best to set the plants as far apart as practicable. In this way the danger of infection from insects is somewhat reduced. When the disease is known to be present in a field it should not be planted to this crop. Anthracnose (*Glaesporium melongenæ*) does not cause great damage to this crop, but is one of the agents that reduce the profits. "It may be recognized by its producing decided pits in the fruit, upon which soon appear minute



1383. Long White eggplant.

blotches bordered with pink." Bordeaux mixture may be used to good advantage for preventing this disease. *Phoma solani* frequently causes damping-off in the hotbed. It often renders a whole bed worthless. Plants affected with this fungus usually fall over as if eaten off by some insect. Some plants, however, continue a miserable existence and finally die. Careful examination will reveal the point of injury, which is at the ground-level. The best preventive is to use well-drained beds and then avoid excessive watering. When damping-off is detected in a seedling bed, the atmosphere and surface soil should be dried as rapidly as possible, followed by one application of fungicide.

**Insect enemies.**—Among the most annoying of the insect enemies is the cutworm (larvæ of Noctuidæ). These insects are almost omnipresent, and when nearly full grown are liable to cut off plants that are 4 or 5 inches high. It is not common for one insect to cut off more than a single plant, but in ordinarily fertile soil there are enough cutworms present to destroy the entire field. So that, on the whole, it becomes very annoying. When these insects are quite destructive, it is possible to kill them with poisoned bran or poisoned

cottonseed meal, sweetened with syrup or sugar. Another insect that does more or less damage is the cotton bollworm (*Heliothis armiger*). This insect does its damage by boring a hole into the stems or the fruit. In the latter case it causes it to rot before it is picked, or possibly in transit. As the fruit becomes larger there is less danger of attack from this insect, so that the main trouble occurs in the earlier stages of its growth. The eggplant aphid (*Siphonophora cucurbitæ*) is one of the most annoying pests to this crop. It usually makes its appearance about the time the crop is fit to ship, and appears in such numbers that the plants are ruined in the course of a week or two. The insect attacks the lower surface of the leaves, making it difficult to reach the pests with insecticides, but persistent efforts and a good tobacco decoction, applied with a fine nozzle, will give considerable relief. Sulfur spray or other mild contact insecticide will be found more uniformly effective than tobacco decoction. Whale-oil soap is an excellent insecticide to use. Kerosene emulsion and insecticides made from the miscible oils, largely employed in proprietary insecticides, should be avoided. While they may be used effectively, there is considerable danger from scalding in handling by indifferent laborers.

P. H. ROLFS.

**EGLANTINE:** *Rosa rubiginosa*; also applied to *Rubus Eglantaria*, *Rosa Eglantaria*, and perhaps *Lonicera Periclymenum*.

**EGYPTIAN LOTUS:** *Nymphaea Lotus*; also *Nelumbium*.

**EHRËTIA** (G. D. Ehret, botanical painter, born in Germany, 1708 or 1710, died in England 1770). *Boraginaceæ*. Tender trees and shrubs, found in the warmer regions of the world.

Plants with or without rough, short hairs: lvs. alternate, entire or dentate: fls. small, often white, in cymes, corymbs, terminal panicles, or rarely all borne in the upper axils; calyx 5-parted or -cleft; corolla short-tubed, rotate, with 5 obtuse spreading lobes; stamens 5, affixed in the tube, exerted or rarely included, the filaments very slender; style 2-lobed or -parted: fr. a small drupe, usually containing two 2-celled 2-seeded nutlets.—Species 40–50, the larger number in the Old World tropics, but widely dispersed about the globe. A few species are planted in S. Calif. and perhaps elsewhere along the southern parts.

A. Lvs. toothed.

B. Foliage hairy.

**macrophylla**, Wall. Tree: lvs. 6–8 in. long, broadly elliptic, acuminate, bristly above and soft-hairy beneath, serrate: panicle terminal, pubescent; calyx ciliate: fr. globose, obscurely 4-grooved. Himalayas, China.

BB. Foliage not hairy.

**acuminata**, R. Br. (*E. serrata*, Roxbg.). **HELIO-TROPE TREE**. Tree, to 40 ft.: lvs. 3–4 in. long, elliptic to oblong, acuminate, serrate: panicles terminal and axillary; fls. clustered, sessile; corolla-tube very short. Trop. Asia, Japan and Austral. B.R. 13:1097. Hardy at Arnold Arboretum.

AA. Lvs. usually not toothed.

**elliptica**, DC. Tree, 15–50 ft. high: lvs. oval or oblong, sometimes serrate, nearly smooth, or with minute hairs and very rough above: fls. small, white, fragrant, in cymes or panicles; calyx-lobes broad-lanceolate and acute, as long as the corolla-tube: fr. a yellow globose drupe, the size of a small pea, with edible thin pulp. Texas, Mex.

WILHELM MILLER.  
L. H. B.†

**EICHHORNIA** (after J. A. F. Eichhorn, a Prussian Minister, born 1779). *Pontederiacæ*. Tropical aquatic herbs, grown for showy flowers and interesting habit.

Perennial, floating, rooting at the nodes: immersed lvs. on young sts. linear; emerged lvs. obovate or



rounded (or rarely lanceolate), the petioles in some species much inflated and acting as buoys: fls. in a spike or panicle, the scape 1-lvd.; perianth funnel-shape with a long or short tube; stamens 6, attached unequally in the tube, part of them exserted; ovary sessile, 3-celled; style filiform: fr. a caps. contained in the withering perianth, ovoid to linear.—About a half-dozen species in S. Amer., one reaching Afr.

This genus includes the water hyacinth (see Fig. 1384), the famous "million-dollar weed" that obstructs navigation in the St. John's River, Florida, and is a source of wonder and delight in every collection of tender aquatics in the North. The curious bladders made by the inflation of the petioles help the plant to float freely. About flowering time the plant sends down anchoring roots which, if the water be only 3 or 4 inches deep, penetrate the soil. The true hyacinths belong in an allied family (Liliaceæ); the pickerel weed, in the allied genus *Pontederia*, the ovary of which by abortion is one-celled, and each cell one-ovuled, while *Eichhornia* is three-celled and many-ovuled. The plants of this family have been greatly confused botanically, partly because the fugacious, membranous flowers are not well preserved in dried specimens, and partly because of variation in form of leaves, depending upon whether the plants grow in deep or shallow water, or in mud. The common water hyacinth sends out two kinds of roots, the horizontal ones often thick and fleshy, and apparently for reproductive purposes, the vertical ones long, slender, and clothed with innumerable small, horizontal fibers.

The flowers are most beautiful, and the plant is worthy of special cultivation. It is often called a water-orchid, being of such delicate coloring and texture. The plants must be more or less stationary although it is a floating plant, for they will not flower when drifted about by any light breeze or where the water is 2 or more feet deep as is often the case where nymphæas are grown. A depth of 9 to 12 inches of water is sufficient with a guard to keep the plants in bounds. Good soil underneath is necessary so that the plants will derive some nourishment. They will grow rapidly and flower profusely all through the season, and it may be necessary to thin out the plants, for when too crowded the petioles will become elongated and the plants unsightly. They can also be grown in a tub or tank observing the same method of culture. Propagated by division. (Wm. Tricker.)

A. *Lf.-stalks inflated: inner perianth-segms. not serrated.*

**crassipes**, Solms (*E. speciosa*, Kunth. *Pontederia crassipes*, Mart.). Fig. 1384. Lvs. in tufts, all constricted at the middle, bladder-like below, sheathed, many-nerved: scape 1 ft. long, with wavy-margined sheaths at and above the middle; fls. about 8 in a loose spike, pale violet, 6-lobed, the upper lobe larger and having a large patch of blue, with an oblong or pear-shaped spot of bright yellow in the middle; stamens 3 long and 3 short, all curved upward toward the tip. Brazil. B.M. 2932 (as *Pontederia azurea*). I.H. 34:14. A.F. 5:511. Var. *majör*, Hort., has rosy lilac fls. Var. *azùrea*, Hort., has yellowish fls.

AA. *Lf.-stalks not inflated: inner perianth-segms. beautifully serrate.*

**azùrea**, Kunth. Lvs. on long or short not-inflated petioles, very variable in size and shape: scape often as stout as the lf.-stalk, gradually dilated into a hooded spathe; fls. scattered or crowded in pairs along a stout, hairy, sessile rachis; perianth bright pale blue, hairy outside, inner segms. beautifully toothed, the upper a trifle larger, with a heart-shaped spot of yellow, which is margined with white. Brazil. B.M. 6487. G.C. II. 25:17. I.H. 34:20. R.H. 1890:540.—One plant will become 5 or 6 ft. across in a season.

*E. paniculata*, Spreng. Fls. in a compound spike or panicle, 2-lipped, purple and blue and with large white spots: lvs. long-petioled, cordate-acuminate, without petiole bladders: st. 12–18 in., often several. B.M. 5020 (as *E. tricolor*).

WILHELM MILLER.

**ELÆAGNUS** (ancient Greek name, meaning a kind of willow; from *elaïos*, olive). *Elæagnacæ*. Shrubs and small trees, grown chiefly for their handsome foliage and for their ornamental fruits, edible in a few species.

Deciduous or evergreen, sometimes spiny: lvs. alternate, short-petioled, entire, clothed more or less with silvery or brownish scales: fls. axillary, solitary or in clusters, apetalous, perfect; perianth campanulate or tubular, 4-lobed; stamens 4, included, on very short filaments: fr. a 1-seeded drupe.—About 40 species in S. Eu., Asia and N. Amer. Monograph by Servettaz in Bot. Centralblatt, Beihefte 25, pt. 2:1–128 (1908).



1384. *Eichhornia crassipes*.

These are highly ornamental shrubs with handsome foliage and mostly decorative fruits; the flowers are inconspicuous, but mostly fragrant. Some of the deciduous species, as *E. argentea*, *E. multiflora* and *E. umbellata*, are hardy North, while the evergreen ones are hardy only South. A distinct feature of some species, as *E. argentea*, *E. angustifolia* and *E. parvifolia*, is the conspicuous silvery hue of their foliage, while *E. multiflora* and *E. umbellata* are the most ornamental in fruit.

They grow in almost any well-drained soil, including limestone, and prefer sunny position. Propagation is by seeds which do not germinate until the second year and ought to be stratified and sown the second spring, and by cuttings of mature and half-ripened wood; also sometimes increased by layers and by root-cuttings; varieties and rarer kinds can be grafted on seedlings of vigorous-growing species.

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A. *Lvs. deciduous.*

B. *Winter-buds and lvs. beneath and usually the branchlets silvery white, without any brown scales.*

1. *angustifolia*, Linn. (*E. hortensis*, Bieb.). OLEASTER. Shrub or small tree, to 20 ft., sometimes spiny:

lvs. lanceolate or oblong-lanceolate, quite entire, light green above, 2-3 in. long; fls. short-pedicelled, 1-3, axillary, on the lower parts of the branches; perianth campanulate, tube about as long as limb, yellow within, fragrant; style at the base included by a tubular disk: fr. oval, yellow, coated with silvery scales. June. S. Eu. W. Asia to W. Himalayas. Var. *orientalis*, Dipp. (*E. orientalis*, Linn. f. *E. hortensis* var. *orientalis*, Schlecht.). Often spineless: lvs. often oblong or oval, usually rounded at the base, clothed more with stellate hairs beneath than with scales, usually glabrous above at length: fr. rather large to 1 in. long. A.G. 21:405, 519, 613, 645. Var. *spinosa*, Schneid. (*E. spinosa*, Linn.). Spiny: lvs. linear-lanceolate or lanceolate, narrowed at the base, scaly above and densely scaly beneath: fr. smaller. L.B.C. 14:1339. B.R. 1156.

2. *parvifolia*, Royle (*E. japonica*, Hort. *E. umbellata* var. *parvifolia*, Servettaz.). Shrub or small tree to 20 ft., with erect sts. and spiny, spreading branches: lvs. elliptic-ovate or oblong-lanceolate, crisped at the margin, usually with stellate hairs above, glabrous at length, silvery beneath,  $1\frac{1}{2}$ -3 in. long; fls. axillary, usually crowded on short lateral branchlets, short-pedicelled; perianth narrow, tube longer than limb, whitish within, fragrant: fr. globose or nearly so, densely silvery when young, pink when ripe,  $\frac{1}{8}$  in.



1385. *Elaeagnus multiflora*. ( $\times \frac{1}{4}$ )

long. June; fr. in Aug. Himalayas, China, Japan. B.R. 29:51. Mn. 5:145.—Not quite hardy N. Sometimes cult. under the name of *E. reflexa*, which species, however, is evergreen. Var. *japonica macrophylla* is advertised but probably does not belong to this species.

BB. *Winter-buds and branchlets with reddish or yellowish brown scales and sometimes silvery besides; lvs. silvery white beneath, often with few brown scales.*

c. *Fr. juicy, scarlet-red or brownish red.*

3. *umbellata*, Thunbg. Spreading shrub, to 12 ft., often spiny, with yellowish brown branchlets, often partially silvery: lvs. elliptic or oval to ovate-oblong, above usually with silvery scales while young, sometimes glabrous, often crisped at the margin,  $1\frac{1}{2}$ -3 in. long; fls. yellowish white, fragrant, 1-7 in the axils, usually crowded on short lateral branchlets, tube much longer than the limb, slender: fr. globose or oval, scarlet,  $\frac{1}{4}$ - $\frac{1}{3}$  in. long, erect, on stalks  $\frac{1}{3}$ - $\frac{1}{2}$  in. long, clothed with silvery scales, mixed with brown scales while young. May, June; fr. in Sept., Oct. M.D.G. 1899:569. A.G. 12:206. R.H. 1901, p. 85. S.I.F. 2:54.

4. *multiflora*, Thunbg. (*E. longipes*, Gray. *E. edulis*, Sieb.). GUM. Fig. 1385. Shrub, to 6 ft., with reddish brown branchlets: lvs. elliptic, ovate or obovate-oblong, with stellate hairs above, usually glabrous at length, mostly with scattered brown scales beneath, 1-2 $\frac{1}{2}$  in. long; fls. usually solitary in the axils, sometimes 2 on the lower part of the branches or on short branchlets, yellowish white, fragrant; tube as long as the limb: fr. pendulous, oblong,  $\frac{3}{4}$  in. long, scarlet, on

slender pedicels, much longer than the fr.; fr. with brown scales when young, ripening in June or July, of agreeable, slightly acid flavor. April, May. Japan, China. B.M. 7341. L.I. 4. G.F. 1:499. G.C. 1873: 1014. G.M. 31:715. B.H. 33:217. F.E. 13:830. A.G. 1890:565. M.D.G. 1901:573. Gng. 1:275, 277. Var. *rotundifolia*, Servettaz. (*E. rotundifolia*, Gagnaire). Lvs. broadly oval, half-evergreen, glabrous above. Var. *ovata*, Servettaz. Lvs. usually with stellate hairs above while young, soon glabrous: fls. 1-3: fr. oval,  $\frac{1}{3}$ - $\frac{1}{2}$  in. long, nodding, with brown scales when young, ripening July or Aug.; pedicels  $\frac{1}{2}$  in. long or longer. Japan. M.D.G. 1899:569 (as *E. multiflora*). Var. *crispa*, Servettaz. Similar to the preceding var., usually spiny: lvs. oblong-lanceolate: pedicels as long as fr.

cc. *Fr. rather dry, silvery white.*

5. *argentea*, Pursh. SILVERBERRY. Erect shrub, to 12 ft., spineless, stoloniferous, with reddish brown branchlets: lvs. ovate or oblong-lanceolate, silvery on both sides, often with scattered brown scales beneath, 1-3 in. long; fls. 1-3, axillary, yellow within, fragrant: fr. oval or roundish oval, densely clothed with silvery scales, short-pedicelled,  $\frac{1}{3}$ - $\frac{1}{2}$  in. long. May, June. Canada, south to Que., Minn., Utah. B.B. (ed. 2) 2:576. B.M. 8369.

AA. *Lvs. evergreen: usually flowering in fall.*

6. *macrophylla*, Thunbg. Spineless shrub, to 6 ft., with silvery white branchlets: lvs. broad-ovate or broad-elliptic, on stout and rather long petioles, scaly above, usually glabrous at length, silvery white beneath: fls. axillary, with silvery and brownish scales outside; tube campanulate, abruptly narrowed at the base, as long as limb. Japan. B.M. 7638. G.C. III. 25:90.

7. *pungens*, Thunbg. Spreading shrub, to 6 ft., mostly spiny, with brown branchlets: lvs. oval or oblong, undulate and often crenulate at the margin, at length glabrous above, silvery beneath, more or less interspersed with brown scales, 2-4 in. long; fls. in axillary clusters; tube cylindrical, slightly narrowed at the base, longer than the limb: fr. short-stalked, about  $\frac{3}{4}$  in. long, with silvery and brown scales. Japan. Var. *Frederici variegata*, Servettaz. Lvs. with yellow center and green margin. Var. *maculata*, Hort. (var. *aureo-maculata*, Hort.). With a large yellow blotch in the middle. A. G. 13:122. A.F. 23:1015. Var. *Simoni*, Rehd. (*E. Simoni*, Carr.). Lvs. rather large, oblong-elliptic, with few brown scales beneath or nearly without. Var. *Simoni tricolor*, Hort. Lvs. like the former, but variegated with yellowish and pinkish white. Var. *reflexa*, Rehd. (*E. reflexa*, Morr. & Deene.). Branches elongated and flexile: lvs. ovate-lanceolate, acute or acuminate, lustrous above, only scaly while young, ferruginous below. H.U. 4:328. Var. *variegata*, Rehd. (var. *aurea*, Servettaz., var. *aureo-variegata*, Hort.). Lvs. margined yellowish white. G.M. 54:327.

*E. ferruginea*, A. Rich. Spineless evergreen shrub, with spreading brown branches: lvs. with yellowish and brown scales beneath: perianth with quadrangular, abruptly contracted tube: fr. long-stalked. Japan.—*E. glabra*, Thunbg. Spineless evergreen shrub, with brown branches: lvs. shining above, with yellow and brown scales beneath: perianth with slender, tubular tube, gradually narrowed toward the base, twice as long as the limb: fr. short-stalked. Japan. S.I.F. 2:54.

ALFRED REHDER.

ELÆIS (Greek, *olive*). *Palmaceæ*, tribe *Cocoinææ*. Tropical spineless palms with pinnate foliage, of which the best known is the oil palm of western Africa, whose red fruits, borne in large clusters, yield the palm oil of commerce, which is used in making candles and soap.

Leaves terminal, numerous, large and pinnately divided, the segms. sword-shaped, the margins in some species spiny: spadix short and thick. Young plants are grown for ornament in S. Calif., and in the N., but it is not hardy outdoors in U. S., according to Franceschi. The other 6 species are from Trop. S. Amer. The genus is separated from *Cocos* by the 1-3-seeded frs., with 3 pores above the middle.



**guineënsis**, Jacq. **OIL PALM**. Sts. stout, 20–30 ft., coarsely and deeply ringed: lvs. 10–15 ft.; petiole spiny-serrate; lfts. 50–60, linear-lanceolate, acute, the same color above and below. F.S. 14:1492.—From an early stage in growth, this is one of the most ornamental palms. Until it reaches several feet in height, it is a slow grower, consequently one does not see much of it, except in collections. It does best in a warm temperature, although it will thrive in an intermediate house. Seeds are always obtainable from several of the large European houses. It is but little grown as a commercial palm, as young plants do not show their full character. Given same treatment as *Areca lutescens*, will grow well. This treatment includes night temperature of 65° and plenty of water.

JARED G. SMITH.  
N. TAYLOR.†

**ELÆOCÁRPUS** (Greek, *olive-fruit*). *Elæocarpææ*; formerly included in *Tiliææ*. Tropical trees, with showy flowers, in their juvenile stages also sometimes cultivated under glass.

Leaves simple, usually alternate; to 50 and 60 ft. high or some of them practically shrubs in cult.: fls. perfect or polygamous, in axillary racemes; sepals distinct, 4 or 5; petals 4 or 5, cut or fringed (rarely entire), attached about a thickened torus; stamens many (rarely 8–12), with long-awned anthers opening by a slit at the apex; ovary 2–5-celled: fr. a drupe, with a large and bony stone, sometimes 1-celled by abortion. —Perhaps 100 species, in the Old World tropics. They are little known in cult. but are sometimes mentioned in greenhouse lists. The pulp of the fr. in some species is said to be edible; and the interesting sculptured stones of some kinds (as of the bead-tree of India, *E. Ganitrus*, Roxbg.) are used for beads, heads of ornamented pins, and other decorations. They propagate by ripened shoots with the lvs. left on, and also by seeds when obtainable.

**grandiflorus**, J. Smith. A much-branched shrub, about 7 ft. high under glass: lvs. considerably clustered at the ends of branches, 3–6 in. long, broadly lanceolate; petiole  $\frac{1}{4}$ –1 in. long, with a few distant saw-teeth, or more or less round-toothed or wavy-margined: sepals 5, red outside, white inside; petals 5, white or pale yellow, silky outside, fringed. Java. B.M. 4680 (as *Monocera grandiflora*). F.S. 8:817. J.F. 4:339.—Lvs. rather leathery, dark green above, paler beneath. Warmhouse. Prop. by cuttings of nearly ripened wood.

**cyaneus**, Sims (*E. reticulatus*, Smith). Under glass a shrub, but in the wild a small tree and sometimes reaching 60 ft., glabrous: lvs. elliptic-oblong, or lance-oblong, acuminate, prominently reticulate: fls. cream-white, fringed, in loose racemes that are shorter than the lvs.; stamens many: drupe globular or nearly so, blue (whence the specific name). Austral. B.M. 1737. B.R. 657. G.C. III. 36:272; 51:393. G.M. 55:423. G. 34:389. Gn. 77, p. 301. L. H. B.†

**ELÆOCÓCCA**: *Aleurites cordata*.

**ELÆODÉNDRON** (Greek for *olive tree*, from the resemblance of the fruit). *Celastrææ*. Tropical shrubs or small trees, some kinds of which are grown in the juvenile state under glass for the interesting foliage.

Leaves simple, entire or crenate, opposite or alternate, thickish, frequently evergreen: fls. inconspicuous, greenish or white, in axillary or lateral clusters; calyx usually 4–5-parted; petals 4–5, and exceeding the calyx; stamens 4–5, inserted under the edge of the thick disk; ovary single, mostly 3-celled; style very short: fr. a small fleshy or nearly dry drupe.—Species probably upward of 40, in Afr., India to Austral., and somewhat in S. Amer. Very closely allied to Cassine, a South African genus.

**orientale**, Jacq. A graceful and handsome plant: the mature lvs. are very different from the juvenile lvs., being obovate, obtuse, crenate, cuneate at base, and 2–3 in. long, and the slender graceful young lvs. pass into them by gradual transition: fls. less than  $\frac{1}{4}$  in. across in close axillary cymes which are shorter than the lvs.; pedicels equaling or surpassing the corolla; calyx deeply lobed; petals yellow-green: drupe size of olive, oblong. Madagascar, Mauritius.—The plant holds its lower foliage well, or throws out new foliage to take the place of that which drops. It thrives in either an intermediate or a warmhouse. Prop. by single eye cuttings in small pots, kept rather warm. It has been said that *Aralia Chabrieri* of gardens belongs to this species (although of a different family), but this is apparently an error. See *Polyscias* for a discussion of this plant.

**australe**, Vent. Intro. into S. Calif. from Austral., and prized for its holly-like foliage. In its native habitat it is a tree 30–40 ft. high, producing useful close-grained wood: lvs. mostly opposite, ovate to oblong-lanceolate, nearly or quite obtuse, entire or open-crenate, coriaceous, very reticulate beneath: fls. with parts in 4's: drupe about  $\frac{1}{2}$  in. long, red, ovoid or globular. L. H. B.

**ELAPHOGLÓSSUM** (Greek, *serpent tongue*). *Poly-podiææ*. A large group of tropical ferns, with creeping rootstocks and simple leaves.

The sporangia cover the entire under surface of the fertile leaves which are usually much smaller than the sterile ones. Nearly all the species are free-veined but a few have netted venation.—There are 80–100 species in the tropics of both hemispheres. They were formerly included under *Acrostichum*. All require warmhouse treatment, an abundance of water at the roots, and an open porous compost.

#### INDEX.

conforme, 7.	hirtum, 2.	reticulatum, 10.
crinitum, 9.	muscosum, 3.	simplex, 6.
flaccidum, 8.	petiolatum, 4.	villosum, 1.
gorgoneum, 11.	pilosum, 5.	

#### A. Veins all free.

#### B. Surface of lvs. densely scaly throughout.

#### c. Texture thin, flaccid.

1. **villosum**, J. Smith. Fig. 1386. Sterile blades 6–9 in. long; fertile lvs. scarcely more than half as large, both with abundant slender, dark brown scales. Mex. and W. Indies. —Dwarf, variable.

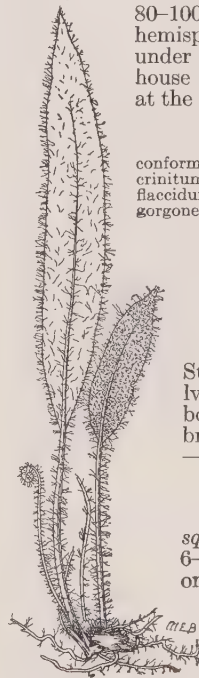
#### cc. Texture thick, leathery.

2. **hirtum**, C. Chr. (*Acrostichum squamodum*, Swartz). Sterile blades 6–12 in. long, the fertile narrower, on longer sts., both surfaces matted with bright reddish brown linear or lanceolate scales. Tropics of both hemispheres.

3. **muscosum**, Moore. Sterile blades 6–12 in. long, fertile much shorter; upper surface slightly scaly, the lower densely matted with ovate, rusty scales. Tropics of both hemispheres. S. 1:211 (as *Acrostichum*).—Very distinct in habit, and an interesting greenhouse species.

#### BB. Surface of lvs. slightly scaly.

4. **petiolatum**, Urban (*Acrostichum viscosum*, Swartz). Sterile blades 6–12 in. long, narrowed gradually at the base: the fertile shorter, on longer stalks; texture



1386. *Elaphoglossum villosum*. ( $\times \frac{1}{2}$ )

leathery, the surfaces somewhat viscid. Tropics of both hemispheres.

5. *pilōsum*, Moore. Blades flexuous, 6-8 in. long,  $\frac{3}{4}$  in. wide, with tufts of star-like scales beneath; texture herbaceous. Mex. to Colombia.—Chiefly of botanical interest.

BBB. Surface of lvs. not scaly; texture leathery.

c. Margins of lvs. thick, cartilaginous.

6. *simplex*, Schott. Sterile blades 4-12 in. long, with a very acute point, the lower portion gradually narrowed into a short, somewhat margined stalk. W. Indies to Brazil.

7. *confōrme*, Schott. Sterile blades 2-9 in. long, with a bluntish point and wedge-shaped or spatulate base; fertile lvs. narrower. Tropics of both hemispheres.

cc. Margins of lvs. not thickened.

8. *flāccidum*, Moore. Sterile blades 6-12 in. long, with very acute point, the lower portion gradually narrowed to the short stalk; fertile lvs. on stalks 3-4 in. long. S. Amer.—Of botanical interest only.

AA. Veins uniting to form a network.

B. Surface of lvs. densely clothed with narrow scales. (*Hymenodium*.)

9. *crinitum*, Christ. ELEPHANT-EAR FERN. Fig. 1387. Blades 10-18 in. long, 4-8 in. wide, on densely scaly stalks; fertile lvs. smaller, on shorter stalks. W. Indies. F.S. 9:936 (as *H. crinitum*).—Omit sand in potting, and avoid over-watering.



1387. *Elaphoglossum crinitum*.

BB. Surface of lvs. mostly smooth, 6-15 in. long.

10. *reticulātum*, Gaud. Blades on distinct stalks, with wedge-shaped bases,  $1\frac{1}{2}$  in. wide; veins forming copious meshes. (*Chrysodium*.) Hawaiian Isls.—Of botanical interest only.

11. *gorgōneum*, Brack. Blades tapering gradually downward to the short stalks, 2-3 in. wide; veins forming meshes only near the margin. (*Aconiopteris*.) Hawaiian Isls.—Of little decorative value.

L. M. UNDERWOOD.

R. C. BENEDICT.†

**ELATINE** (Greek name of doubtful application). *Elatinaceæ*. Small mostly glabrous creeping herbs, probably annuals, of temperate and warm regions (perhaps 10 species), sometimes used in bog- and water-gardening. They root at the nodes, spreading along the margins of streams and ponds. Lvs. opposite or verticillate, mostly broad, entire; fls. minute and inconspicuous, mostly solitary in the axils; sepals and petals

2-4, and stamens as many or sometimes twice as many; styles or stigmas 2-4; pod 2-4-valved. The plants are grown for their foliage cover. Four species are native in the U. S. and Canada, but they appear not to be in the trade. Abroad, *E. macrópoda*, Guss., of the Medit. region, is offered. Lvs. oblong, short-petioled; fls. axillary and terminal, 4-merous, stalked; caps. half shorter than the sepals.

The family *Elatinaceæ* is allied to the *Hypericaceæ*. It comprises perhaps 25 species in many parts of the world. The only other genus is *Bergia*, which differs from *Elatine* in being terrestrial and in having 5-merous fls. *B. texana*, Seub., occurs in swamps and on wet banks from S. Ill. to Texas and Calif. The *Bergias* are apparently not in cult.

L. H. B.

**ELDER AND ELDERBERRY:** *Sambucus*.

**ELECAMPANE:** *Inula Helenium*.

**ELECTRO-HORTICULTURE** is a term used by Siemens to designate the application of the electric light to the growing of plants. The term is an unfortunate one, since the use of electric light is not an application of electricity to plant-growing, but is a way of securing illumination. Any strong artificial light hastens assimilation and thereby causes plants to grow more rapidly. The practical questions to be considered are, therefore, the expense of using the light, and whether there are injurious elements in the spectrum of the given light.

The spectrum of the electric arc light is the spectrum of carbon plus that of certain gases incident upon combustion. The spectrum of the arc light is rich in rays which light beyond the luminous part, and these rays are very injurious to most plants. These rays of the ultra-violet part of the spectrum are eliminated by a plain glass, so that when the electric light is surrounded by a globe, or when the light is hung above the roof of the greenhouse, the injuries are reduced to a minimum. Experiments at Cornell University showed that each kind of plant behaves in its own way in the presence of electric light. It is not possible to prophesy what the results may be in a given species, without experiment. A few plants, as tomatoes, cucumbers, melons and carrots, seem to be very little affected either injuriously or beneficially. Nearly all flowers are hastened into bloom by the influence of the light, and their colors are often brighter than under normal conditions; but in very many cases they do not last so long. The best results are secured if the light is applied to the plants when they have reached nearly or quite their full stature. If applied very early in its growth, the plant tends to make flowers before it has attained sufficient size. In floriculture, therefore, the practical value of the electric arc light seems to be its influence in hastening the flowering of certain plants in dark climates, or when plants must be had for a definite season. For example, if the light is applied to Easter lilies for a month before their normal blooming time, the period of bloom may be hastened four to ten days.

Lettuce has shown greater beneficial results from the application of the electric light than any other plant with which careful experiments have been made. Lettuce which receives light from the arc lamp for half of each night may be expected to reach marketable size from one to two weeks before that which is grown in normal conditions.

As a rule, better results are secured when the light runs only half the night. A common two-thousand candle-power light has a marked effect on the growth of many plants at a distance of sixty to even one hundred feet. The incandescent light has a similar influence, but not so marked. It has no injurious effect, however.

As now understood, the application of the electric light to the growing of plants is a special acceleration to be used when the climate is abnormally cloudy or



when it is desired to hasten the maturity of crops for a particular date. Only in the case of lettuce is it yet thought to be of any general commercial importance; and even with lettuce, it is doubtful whether it will pay for its cost in climates that are abundantly sunny. For the literature of the subject, consult the publications of the experiment stations of Cornell University and of West Virginia. See the article *Light*, Vol. IV.

*Electroculture* is a term employed to designate any culture of plants under the influence or stimulus of electric currents. The electric stimulation may arise from the electrification of the atmosphere in the immediate vicinity of the plants, or from the application of electric currents to the plants themselves. In either case, electricity exerts an appreciable and often a very marked influence, resulting in accelerated germination and growth (see the discussion, pp. 30-35, Vol. II, *Cyclo. Amer. Agric.*).

In recent years much more attention has been given to the stimulation of plants by electricity directly through the atmosphere than through the soil. According to experiments made at the Massachusetts Experiment Station, this method appears to be successful and offers a most promising field for future research. Of the various methods used to stimulate plants by electricity, direct currents applied through the soil prove less valuable than alternating currents or static charges. In a series of experiments made with radish plants in closed glass cases, an average increase of 50 per cent was secured, and in another case 45 per cent increase when the case was charged from a static machine with an average potential of 150 volts for a few minutes each day. There are some obstacles in the way of electrically treating plants by the use of high tension wires or static machines owing to the possibility of grounding through steam-pipes and iron posts, and nothing very definite has been obtained as yet from this method. High tension wires (100,000 volts, more or less) have been used in the field with fairly good results, but winds affect a charged atmosphere to a certain extent. The use of high poles provided with points to collect atmospheric electricity has proved successful in laboratory experiments for the stimulation of plants and the fixation of nitrogen, and in the future probably some such method will become of practical use. At present the various methods cannot be considered as of great economic importance. (G. E. Stone.)

**ELEOCHARIS** (Greek-made word, meaning *delighting in marshes*). Sometimes written *Heleocharis*. *Cyperaceæ*. Rush-like native plants, mostly of low, wiry growth, and commonest in marshes and on muddy shores, mostly perennial. The culms are simple, terete or angular, bearing a spherical or oblong head of inconspicuous fls.: lvs. usually reduced to mere sheaths. They are interesting for the borders of ponds, and are very easy to naturalize. Numbers of species are likely to be offered by dealers in native plants; three have been listed: *E. interstincta* R. & S. (*E. equisetoides*, Torr.). A shore plant, with terete knotted culms 2-3 ft. high, and cylindrical heads about the thickness of the culm; resembles horse-tail (*Equisetum*). *E. acicularis*, R. & S. Hair-like, 3-6 in. high, making grass-like mats. *E. ovata*, R. & S. Culms nearly terete, 12-15 in. high; head globose or ovate. *Eleocharis* has about 100 species, widely distributed, of which nearly half occur in Canada and the U. S. L. H. B.

**ELEPHANT'S EAR** is a name for begonias. The elephant-ear *Caladium* is a *Colocasia*.

**ELEPHANT'S FOOT:** *Testudinaria*.

**ELETTARIA** (East Indian name). *Zingiberaceæ*. **CARDAMON.** Hothouse perennial herbs, sometimes seen in collections of economic plants.

Differs from *Amomum* in technical characters, as in the slender tube of the perianth, the presence of internal lobes in the perianth, and the filaments not prolonged beyond the anther. Probably only 1 species, although more have been described. *E. Cardamomum*, Maton (*Cardamomum officinale*, Salisb. *Amomum Cardamomum*, Linn.), affords the small or true cardamoms of commerce, which are the dried capsules and which are used in medicine. Species of *Amomum* yield other kinds of cardamon. The *elettaria* is native to India, but is cult. in Jamaica, and it will no doubt thrive in parts of S. Fla., where plants have been offered. The cardamon plant grows 5-10 ft. high, bearing a curving jointed, closely sheathed st. and oblong-lanceolate acuminate entire nearly sessile lvs. often 2 ft. long rootstock horizontal: fls. purple-striped: caps oblong or nearly globular, with many thin vertical ribs, indehiscent; seeds small, angled. *Gt. 62, p. 93*. It is said to prefer shade and a moist soil. In three or four years plants give full crops, but they become more or less exhausted after bearing three or four crops. Prop. by dividing the roots and by seeds. Under glass, handled the same as *Alpinia*. L. H. B.

**ELEUSINE** (Greek, *Eleusin*, the town where Ceres, the goddess of harvests, was worshipped). *Gramineæ*. **CRAB-GRASS. YARD-GRASS.** Coarse tufted annual grasses, more or less grown as ornamentals; also for the grain in Africa.

The stout unilateral spikes digitate at the apex of the culm; spikelets several-fl'd., awnless, arranged in 2 rows along one side of a continuous rachis; rachilla articulate above the empty glumes; fls. perfect or the upper one staminate: grain loosely inclosed by the lemma and palea.—Species about 6 in tropical regions of the Old World. Some are valued as cereals in Afr., India, and some other eastern countries. For *E. ægyptiaca*, see *Dactyloctenium*.



1388. *Eleusine indica*.  
( $\times \frac{1}{2}$ )



1389. *Eleusine coracana*.  
( $\times \frac{1}{2}$ )

*indica*, Gaertn. **WIRE-GRASS. GOOSE-GRASS.** Fig. 1388. Erect, or in open ground prostrate, 2-4 ft. high: culms flattened: spikes 5-7, about 2-4 in. long, digitate, often with one or two lower down; spikelets 3-6 fl'd. Blooms from June to Oct.—A very common grass in cult. fields and dooryards in the S., often troublesome as a weed on lawns throughout the S. and in Calif.

**coracana**, Gaertn. **AFRICAN MILLET**. Fig. 1389. Erect, 2-4 ft. high, closely related to and much resembling *E. indica*. Can be distinguished from it by its stouter habit, shorter, broader and larger spikes.—Cult. in S. E. Asia for the grain. Beer is brewed from the grain in Abyssinia. In cult. in Amer. as an ornamental grass. *Coracana* means "pertaining to crows."



1390. *Elliottia racemosa*.  
( $\times \frac{1}{2}$ )

**tristachya**, Kunth (*E. barcinonensis*, Costa). Culms tufted, 6 in. to 1 ft. high: lf.-blades short, about  $\frac{1}{8}$  in. wide, obtuse at the apex: spikes broad, mostly 3, digitate, 1-1 $\frac{1}{2}$  in. long,  $\frac{1}{4}$  in. thick; spikelets closely imbricate, 5-flid. India.—Intro. into Amer. on ballast, and in cult. as an ornamental plant.

P. B. KENNEDY.  
A. S. HITCHCOCK.†

**ELEUTHERÏNE** (Greek *free*, referring to the stamens). *Iridaceæ*. Two or three species in the W. Indies and S. Amer., perhaps forms of one; bulbous plants of warmhouse cult., allied to *Cipura* and *Ixia*: fls. white, several on a naked scape, the perianth-tube none and the segms. obovate and spreading; stamens attached to base of perianth-segms., the filaments short and free; ovary oblong, 3-celled; style very short, 3-branched: lvs. long, radical. *E. plicata*, Herb. (*Galathea plicata*, Salisb.), has a large ovoid bulb: root-lvs. 1-2, linear to linear-lanceolate, plicate, 18 in. or less long; scape 6-12 in. high; perianth white, 1 in. or less diam., not lasting: something the general habit of *Babiana*. B.M. 655 (as *Marica plicata*).

**ELEUTHEROCÓCCUS**: *Acanthopanax*.

**ELÍSMÀ** (suggested from *Alisma*). *Alismaceæ*. One species in W. Eu., sometimes grown in water-gardens. It is known also as *Alisma* (p. 246, Vol. I) but has been separated from that genus because of its floating rather than erect habit, sub-solitary fls., and character of the ovules. *E. natans*, Buch., is a slender perennial, with the sts. and developed ovate or oblong lvs. floating: radical lvs. of the original tuft represented by a lf.-stalk which is only slightly or not at all widened at

the top, every succeeding node producing the floating lvs. and roots: fls. 1-3 or 5, large, white, with 3 broad obtuse petals: carpels forming a globular head, each with many slender ribs: summer. Of easy cult.

L. H. B.

**ELLIÓTTIA** (after Stephen Elliott, South Carolina's early and excellent botanist. For a fine portrait and sketch of him, see G.F. 7:204-6). *Ericaceæ*. Deciduous shrub cultivated for its handsome racemes of delicate white flowers.

Leaves alternate, entire, without stipules: fls. in terminal racemes; calyx small, 4-parted; petals 4, oblong; stamens 8, with short filaments; ovary 4-celled; cells 1-ovuled; style slender, exserted: fr. unknown.—One species in S. C. and Ga., very rare and local. The Japanese species formerly referred to this genus are well distinguished by the 3-merous fls. and by the many-ovuled cells of the ovary; they form the genus *Tripetaleia*. Like *Cladothamnus*, *Ledum* and *Leio-phyllum*, the genus differs from most other *Ericaceæ* in having distinct petals, but is easily distinguished from the genera mentioned by its racemose infl. and other characters.

*Elliottia* is very rare in cultivation owing to its difficult propagation; it is not hardy North and seems to grow best in a humid sandy or peaty soil. Propagation by suckers, which appear only occasionally.

**racemosa**, Muhl. Fig. 1390. Shrub, 4-10 ft. high: branches slender: lvs. alternate, oblong, acute at both ends, glandular-mucronate, entire, thin, membranous, 3-4 in. long, 1-1 $\frac{1}{2}$  in. wide; petioles slender, grooved, hairy, about 1 in. long; racemes 6-10 in. long, often branched at the base; calyx-lobes short, rounded; petals spatulate-oblong,  $\frac{1}{2}$  in. long. Wet, sandy woods of S. C. and Ga. G.F. 7:205 (adapted in Fig. 1390). B.M. 8413. G.C. III. 51:11. Gn. 75, p. 471.

ALFRED REHDER.

ELM: *Ulmus*.

**ELODËA** (Greek, *marshy*). *Hydrocharitaceæ*. Aquatic herbs, one of which is grown in aquaria.

The genus is known in horticulture as including the ditch-moss, an interesting hardy perennial plant found in slow streams and ponds nearly throughout N. Amer., except the extreme north and particularly desirable for home and school aquaria. It is a slender, wholly submerged plant, with branching sts. 4 in. to 3 ft. long, according to the depth of the water. The pistillate fls. are raised to the surface by their long calyx-tubes, and float there. The minute staminate fls., which are rarely seen, commonly break off below, rise to the surface, float about, open, and shed their pollen. The fr. ripens below the surface, and the seeds rise. It reached England in 1841 and choked up many canals and waterways, notably the Cam. It was very abundant in 1852 and 1853, but declined in the next few years. Ducks, geese and swans are fond of it, and render great service in getting rid of it. It can be used for manure where it grows in sufficient quantities. Like many other water plants, it makes heavy buds in the fall (Fig. 1391), which drop to the bottom and grow in the spring. This genus contains perhaps 10 species.

**canadensis**, Mich. (*Anácharis canadensis*, Planch. *A. alsinástrum*, Bab. *Philótria canadensis*, Brit.). **WATER-WEED. DITCH-MOSS. WATER-THYME.** Lvs. in whorls of 3 or 4, or the lower ones opposite, linear, minutely toothed or not, 2-7 lines long,  $\frac{1}{2}$ -2 lines wide: fls. white; calyx-tube of the pistillate fls. 2-12 in. long; spathes 5-7 lines long.



1391. Winter bud of *Elodea*. (Nat. size)



Var. *gigantæa*, Hort. GIANT WATER-WEED. A much stronger grower than the species and a desirable plant for the aquarium, and a good oxygenator. Now generally used in preference to the type.

WM. TRICKER and WILHELM MILLER.



1392. *Elsholtzia cristata*.

ELÔDES: *Hypericum*.

**ELSHOLTZIA** (John Sigismund Elsholtz, author of unpublished *Flora Marchica*, the MS. of which is in the Royal Library, Berlin). *Labiata*. Herbs or undershrubs grown chiefly for their blue or lilac flowers appearing in dense spikes late in summer.

Usually aromatic: lvs. opposite, short-petioled, serrate; fls. in usually 1-sided, terminal spikes; calyx tubular or campanulate, 5-toothed; corolla 2-lipped or slightly so; lower lip 3-lobed, the upper undivided, emarginate, concave; stamens 4, exserted; anther-cells diverging; fr. consisting of 4 ovoid or ovoid-oblong nutlets.—Twenty species in E. and Cent. Asia, south to Java, 1 in Eu. and 1 in Abyssinia. Of the cult. species *E. cristata* and *E. Stauntonii* are hardy N., while *E. polystachya* is tender. They are chiefly valued for their late-appearing fls., profusely produced in dense upright spikes; they do not seem particular as to the soil, but demand a sunny position to bloom well. Prop. is by seeds, sown in spring; also with the suffruticose species by greenwood cuttings in summer.

*cristata*, Willd. Fig. 1392. Twelve to 18 in. high, with opposite, petioled, ovate-oblong toothed lvs. and small, light blue fls. in crowded, more or less 1-sided spikes: calyx enlarging in fr. Asia. B.M. 2560.—Hardy annual, with very aromatic foliage and attractive, upright habit. Said to be a good bee plant.

*Stauntonii*, Benth. Undershrub, to 5 ft.: branchlets terete, pubescent: lvs. ovate-oblong to oblong-lanceolate, acuminate, serrate, bright green and glabrous above, lighter green and densely glandular below, 3-5 in. long: fls. lilac-purple, in dense 1-sided spikes 4-8 in. long, usually paniced at the end of the branches; stamens and style long exserted. Sept., Oct. N. China. B.M. 8460. G.C. III. 51:21. Gn. 75, p. 533. M.D.G. 1910:541-2; 1913:52.

*E. polystachya*, Benth. Undershrub, to 6 ft.: lvs. elliptic-oblong to lanceolate, serrate, pubescent on the veins beneath and glandular, 3-5 in. long: fls. white, in very slender spikes 2-6 in. long. Himalayas, W. China.

ALFRED REHDER.

**ÉLYMUS** (Greek name for a kind of millet). *Gramineæ*. LYME-GRASS. WILD-RYE. Erect perennial grasses with terminal usually bristly spikes somewhat resembling rye, sometimes grown as ornamentals and having other uses.

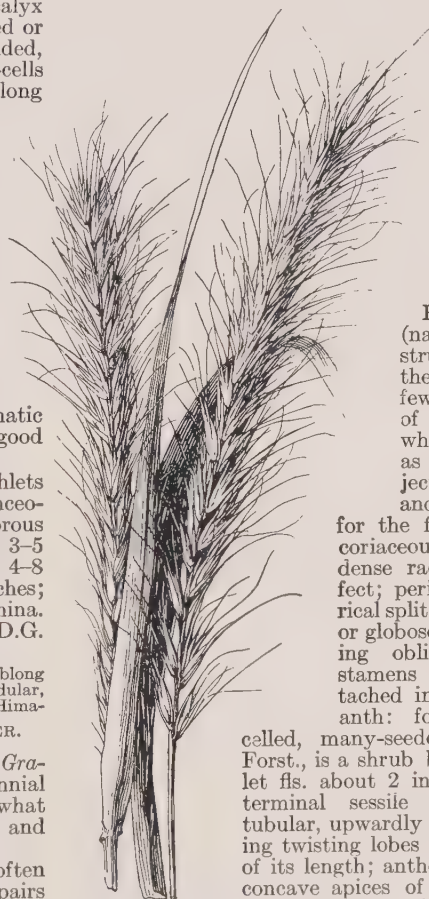
Leaves flat or convolute: spikelets 2-6 fld., often long-awned, the uppermost imperfect, sessile, in pairs (rarely in 3's or 4's), at each joint of the continuous or articulate rachis, forming terminal spikes; glumes acute

or awned, often placed at the front of the spikelet.—Species about 25, in the temperate regions of both hemispheres. For *E. Hystrix*, see *Hystrix*. See p. 3568.

*arenarius*, Linn. SEA LYME-GRASS. Stout, coarse perennial, 2-8 ft. high, with strong, creeping rootstocks: lvs. long, rigid, smooth: spikes dense, terminal, 6-12 in. long; spikelets about 1 in. long and 3-4 fld., awnless. G. 15:701. Dept. Agric., Div. Agrost., 7: 319.—Sometimes used for binding the drifting sands of our Atlantic and Pacific coasts, especially when combined with beach grass, *Ammophila arenaria*. The seed is also used by the Digger Indians for food.

*canadensis*, Linn. CANADA LYME-GRASS. TERREL GRASS. Fig. 1393. Rather stout, smooth perennial, 2-5 ft. high, with broad, flat lvs. 6-12 in. long: spikes 4-9 in. long, exserted, nodding; spikelets very rigid, 3-5 fld.; lemmas long-awned. Common in low thickets and along streams in rich, open woods throughout the country.—Cult. as an ornamental plant. Var. *glaucofolius*, Gray (*E. glaucifolius*, Hort.), is pale and glaucous throughout, with usually more slender awns. Cult. as an ornamental grass.

*condensatus*, Presl. GIANT RYE-GRASS. The largest of the native rye-grasses, growing to the height of 5-10 ft.: culms in dense tufts, stout: spikes 6-12 in. long, very variable, compact or interrupted, bearing branching clusters of spikelets at each joint; glumes subulate; lemmas awnless or mucronate. Rocky Mt. regions and the Pacific slope.—Cult. as an ornamental. A Pacific Coast form has large branched heads.



1393. *Elymus canadensis*. ( $\times \frac{1}{2}$ )

*E. glaucus*, Regel. A glaucous-leaved, dense, caespitose, hardy perennial grass 3-4 ft. high, with very short, smooth lvs. and erect, elongated spikes: spikelets in 2's, erect, usually 5-fld., densely villous-pubescent, short-awned. Turkestan.—Rarely in cult. as an ornamental grass.

P. B. KENNEDY.

A. S. HITCHCOCK.†

## EMBOTHRIUM

(name refers to the structure of the anthers). *Proteaceæ*. A few trees and shrubs of S. Amer., one of which is offered abroad as a greenhouse subject, grown from seeds, and apparently prized

for the fls. Foliage sparse, coriaceous, entire: fls. in dense racemes, showy, perfect; perianth with a cylindrical split tube, the limb ovoid or globose in bud but becoming oblique or recurved; stamens 4, the anthers attached in lobes of the perianth: follicles oblong, 1-

called, many-seeded. *E. coccineum*, Forst., is a shrub bearing bright scarlet fls. about 2 in. long in many-fld. terminal sessile racemes: perianth tubular, upwardly curved, the 4 reflexing twisting lobes representing a third of its length; anthers imbedded in the concave apices of the perianth-lobes; pistil with an elongated cylindrical ovary and long-exserted red style: lvs.

oblong to elliptic, short-stalked, alternate, obtuse and mucronate, pale beneath. Chile. B.M. 4856.—Should be hardy in warm-temperate parts.

**EMÍLIA** (perhaps a personal name). *Compositæ*. Flower-garden herbs, perennial or annual, with orange or scarlet bloom.

Related to *Senecio* (to which some authors refer it), but always without rays: heads rather small, the involucre very simple and cup-shaped, with no small outer scales; style-branches long or short: achenes with 5 acute ciliate angles: florets all perfect.—A dozen or more species have been described from warm parts of Afr., Asia to China, Polynesia and Amer. One species in common cult.

**flammea**, Cass. (*E. sagittata*, DC. *E. sonchifolia*, Hort., not DC. *E. sonchifolia*, Linn., var. *sagittata*, Clarke. *Cacalia coccinea*, Sims, B.M. 564. *C. sonchifolia*, Hort., not Linn. *C. sagittata*, Vahl. *Senecio sagittatus*, Hoffm.). **TASSEL-FLOWER**. **FLORA'S PAINT-BRUSH**. A neat annual, erect, 1–2 ft., glabrous or sparsely hairy, the long sts. terminated by clusters of small scarlet (golden yellow in the form called *Cacalia lutea*, Hort.) heads: lvs. lance-oblong or ovate-lanceolate, clasping the st., remotely crenate-dentate: involucre-scales much shorter than the florets. Probably tropics of New World. H.F. 7:50.—This much-named annual is one of the commonest garden fls. It is of the easiest cult. in any good soil. Blooms from July until frost, if sown as soon as weather is settled. Two species are sometimes recognized in this variable group,—*E. sagittata*, DC., with involucre shorter than the fls., and *E. sonchifolia*, DC., involucre as long as the fls.

*E. purpurea*, Cass. (*E. sonchifolia*, DC., not Hort. *Cacalia sonchifolia*, Linn. *Senecio sonchifolius*, Moench). Radical lvs. often more or less lyrate, st.-lvs. broader and clasping, the heads fewer in the cluster and the involucre-scales nearly as long as the florets. Apparently not in cult. in this country.

L. H. B.

**EMMENÁNTHE** (Greek, *enduring flower*; the persistent corollas retain their shape when dry). *Hydrophyllaceæ*. A half-dozen low annual herbs from western North America, of which the most interesting species was introduced to cultivation in 1892, under the name of California yellow- or golden-bells.

Diffuse, depressed or erect: lvs. mostly alternate: fls. yellow or cream-color, the corolla campanulate and persistent; corolla-lobes 5; stamens 5; style 2-cut. The species named below belongs to a section of the genus, with calyx-lobes broader downward, and coarsely pitted seeds. All the others have the calyx-lobes broader upward and the seeds more or less wrinkled transversely.

**penduliflora**, Benth. **CALIFORNIA YELLOW- or GOLDEN-BELLS**. Somewhat sticky, with long or short soft hairs: lvs. pinnatifid, lobes numerous, short, somewhat toothed or sharply cut; ovules about 16; seeds 1 line long. Calif. G.C. III. 11:339.—It grows 9–12 in. high, forming bushy plants, each branch loaded with broadly bell-shaped, pendulous, unwithering fls., about  $\frac{1}{2}$  in. long, of creamy yellow. The general effect of a branch suggests the lily-of-the-valley, but the foliage is pinnatifid.

WILHELM MILLER.

**EMMENÓPTERYS** (Greek, *persistent*, and *wing*; referring to the wing-like calyx-lobe, persistent on the fruit). *Rubiaceæ*. Ornamental tree grown for its large leaves and the handsome flowers.

Deciduous: lvs. opposite, petioled, with caducous stipules, entire: fls. in many-fld. terminal panicles; calyx small, 5-parted, deciduous, in some fls. 1 lobe leafy and changed into a petioled, oblong, obtuse whitish lf. persistent on the fr.; corolla campanulate-funnelform, tomentulose outside, with a narrow tube and 5 ovate lobes pubescent inside; stamens 5, included; ovary inferior, 2-celled; style filiform, not exceeding

the stamens: fr. a spindle-shaped 2-celled caps., with numerous irregularly winged seeds.—One species in Cent. China. A tall tree, with large elliptic lvs. and showy yellow fls. in many-fld. dense terminal panicles. It will succeed in warmer temperate regions only and is yet little known in cult., as it has been only recently intro. Prop. is by seeds and possibly by softwood cuttings under glass.

**Hénryi**, Oliver. Tree, to 40 ft., quite glabrous: lvs. chartaceous, elliptic, acute, cuneate at the base, entire, 4–6 in. long; petiole 1–2 in. long: fls. in many-fld. panicles, yellow, about 1 in. long: caps. spindle-shaped, about  $1\frac{3}{4}$  in. long, often at the apex with a persistent enlarged wing-like calyx-lobe  $1\frac{1}{2}$ –2 in. long on a petiole of equal length. Cent. China. H.I. 19:1823.

ALFRED REHDER.

**ÉMPETRUM** (Greek, *en*, in, *petros*, rock; growing often on rocks). *Empetraceæ*. **CROWBERRY**. Ornamental low shrubs sometimes grown for the evergreen foliage and attractive fruits.

Leaves linear-oblong, obtuse, thick: fls. dioecious or monœcious, axillary, 1–3, nearly sessile; sepals and petals 3; stamens 3, exserted; ovary superior, 6–9-celled with as many stigmas on a short and thick style: fr. a 6–9-seeded drupe.—Five species through the northern hemisphere in mountainous and arctic regions, also in Chile, antarctic Amer. and Tristan da Cunha.

The crowberries are hardy, evergreen, densely branched, prostrate or creeping, heath-like shrubs, with small, crowded leaves, inconspicuous purplish flowers, and globose, red or black, edible berries. They grow best in moist, sandy or peaty soil, and are especially handsome for rockeries. Propagated usually by cuttings of nearly ripened wood in late summer under glass.

**A. Branchlets and margin of expanding lvs. glandular, the latter not tomentose.**

**nigrum**, Linn. Lvs. linear to linear-oblong, divergent, soon reflexed, glabrous or nearly so, entire,  $\frac{1}{6}$ – $\frac{1}{4}$  in. long: fls. purplish: fr. black, about  $\frac{1}{2}$  in. diam. April, May; fr. in Aug., Sept. N. Eu., N. Asia., in N. Amer. south to N. H., N. Y., Mich. and N. Calif. B.B. (ed. 2) 2:479. S.E.F. 8:1251.

**AA. Branchlets and margins of expanding lvs. white-tomentose.**

**atropurpureum**, Fern. & Wiegand (*E. nigrum* var. *andinum*, Fern., not *E. andinum*, Philippi. *E. nigrum* var. *purpureum*, Auth., not DC.). Trailing: lvs. linear-oblong, soon loosely divergent, rarely becoming reflexed, those of the leading shoots  $\frac{1}{6}$ – $\frac{1}{4}$  in. long: fr. red to purplish black, opaque,  $\frac{1}{6}$ – $\frac{1}{2}$  in. across. Gulf St. Lawrence to Maine and N. H.

**Eamesii**, Fern. & Wiegand (*E. nigrum* var. *purpureum*, Auth., not DC. *E. rubrum*, La Pylaie, not Vahl). Lvs. linear-oblong, crowded, ascending, becoming slightly divergent, those of the leading shoots  $\frac{1}{2}$  in. or less long: fr. pink or light red, becoming translucent,  $\frac{1}{2}$  in. or less across. S. Labrador, Newfoundland, E. Que.—Very handsome in fruit.

*E. rubrum*, Vahl (*E. nigrum* var. *rubrum*, DC.). Closely related to *E. Eamesii*. Lvs. less crowded, spreading, somewhat larger. Antarctic Amer., Tristan da Cunha. B.R. 1783.

ALFRED REHDER.

**ENCÈLIA** (Christopher Encel in 1577 wrote a book on oak galls). *Compositæ*. Herbs or sub-shrubs, one or two of which have been sparingly introduced for planting in the southern parts of the United States.

Rather showy plants with mostly yellow-rayed naked-stalked heads (rays now and then absent), and yellow or brownish disk: lvs. alternate or opposite, entire, toothed or lobed, often white-tomentose: rays neutral, disk-fls. perfect; pappus none or an awn or scale for each margin or angle of the achene.—About 30 species, Utah and Calif. to Chile.



*californica*, Nutt. Woody at base, 2-4 ft. high, strong-scented, rather hoary, or becoming green: lvs. 1-2 in. long, ovate to broadly lanceolate, usually entire, indistinctly 3-ribbed from the base, abruptly stalked: heads  $2\frac{1}{2}$  in. across, the golden yellow rays numerous, 2-4-toothed: seeds obovate, with long, silky hairs on the callous margins and a shallow notch at the tip. Calif., Ariz.

*adenóphora*, Greenm. Stout almost woody herb, 3-6 ft., sometimes 10 ft., glandular-hairy throughout: lower lvs. opposite, stalked, ovate or deltoid,  $2\frac{1}{2}$ -4 in. long, 3-nerved; upper lvs. gradually smaller: fls. cymose, the rays pale yellow, sometimes tinged with orange. Autumn. N. Mex.—Not hardy north of Washington, D.C.

N. TAYLOR.†

**ENCEPHALÁRTOS** (Greek combination, alluding to the bread-like interior of the trunk). *Cycadaceæ*. Excellent cycads from tropical and southern Africa, grown chiefly for their evergreen foliage.

The species are probably 20 or more, allied to *Dioon* and *Macrozamia*; with *Stangeria*, they constitute the peculiarly African representatives of the family. They are trees with stout cylindrical often fleshy trunks, and a terminal crown of stiff mostly spiny pinnate long lvs. or fronds: fls. diceious, in cones; staminate cone oblong, ovoid or cylindrical, the scales in many series, imbricate, thick and often rough, broadly or elongate-cuneate, with anthers on the under surface; pistillate cone ellipsoid or oblong, thick, the scales numerous in many series and imbricated, peltate, with the ovule beneath. For differences between this and related genera, see Vol. I, p. 120. From *Dioon* it is distinguished by its pinnate rather than pinatifid lvs., and from *Cycas* by straight rather than circinnate segms. in veneration, as well as by technical features of cones. These plants are specially suited for large conservatories, the fronds being not easily injured. They should succeed outdoors S. The trunks of some kinds grow only a few inches in many years. Most kinds prefer a sunny, tropical house, but *E. brachyphyllus* and perhaps others may be grown in a cool greenhouse if kept a little dry in winter. The cones are always interesting and often very decorative. Those of *E. villosus* are twice as large as a pineapple, orange-yellow, half revealing the scarlet frs. They are prop. by seeds; also by offsets or suckers. Some other cycads frequently produce seed in conservatories, but *Encephalartos* seldom does, and plants are, therefore, usually imported. Dry trunks, weighing frequently 50-75 lbs. have been received from S. Afr. They often remain dormant for a year or more, and do not make ornamental specimens for two or more years. They are slow-growing, except in very warm houses. They like a strong, loamy soil. While making new growth they need plenty of water. See *Cycas*.

The woolliness of the stem and leaf-segments varies with the age of the plants and of the leaves. The pith and central portion of the cones of some species form an article of food among the Kafirs, hence the common name of Kafir bread. The most widely known species in cultivation are *E. villosus*, *E. Altensteinii* and *E. pungens*. Though very handsome cyads, they are by no means popular. They require much room for best results.

In the following descriptions "rachis" refers to the midrib of the leaf on which the leaflets or segments are borne, and "petiole" means the part of the leaf below where the leaflets begin.

A. Lfts. toothed (sometimes entire in the first).

B. Petiole 4-angled: foliage glaucous.

*hórridus*, Lehm. Trunk short and stout, woolly or not: lvs. to 6 ft., reflexed at top; lfts. opposite or alternate,

lanceolate, mostly entire, sometimes toothed, with a sharp spine at the apex. Var. *glaúca*, is presumably more glaucous than the type. B.M. 5371. There is a var. *trispinosus*.

BB. Petiole sub-cylindrical: foliage not glaucous.

*Áltensteinii*, Lehm. Trunk stout, not woolly: lvs. 2-6 ft.; lfts. about 6 in. long and 1 in. broad, oblong-acuminate, paler beneath, edges and apex spiny; petioles swollen at base; lfts. mostly opposite, lanceolate. B.M. 7162-3. G.C. II. 6:392, 393, 397; III. 2:281; 12:489-493; 40:206 (showing a specimen in Cape Colony over 100 years old, with a high trunk and an offshoot over half way up). G. 7:516.

*villósus*, Lehm. Trunk short and thick, woolly and scaly, 6 ft.: lvs. to 6 ft.; lfts. very numerous, opposite or alternate, linear-lanceolate, spiny-toothed and pointed. B.M. 6654. R.H. 1897:36. G.C. II. 1:513; 3:400; 7:21; 13:181.



1394. *Encephalartos cycadifolius*.

AA. Lfts. not toothed (except in young lvs. of the last one).

B. Foliage glaucous.

*Léhmännii*, Lehm. (*Cycas Léhmännii*, Hort.). Trunk not woolly: rachis and petiole obtusely 4-angled; lfts. nearly opposite, narrowly or broadly lanceolate, to 7 in. long, rarely 1-toothed, with brown spine at apex. Gt. 1865:477.

BB. Foliage not glaucous.

c. Apex of lfts. mostly obtuse, pointless.

*longifólius*, Lehm. Trunk not woolly, at length tall: rachis and petiole 4-cornered but flattish above; lowest lfts. often 1-3-toothed, margin somewhat revolute: wool soon vanishing from the rachis and lfts. S. Afr. G.W. 5, p. 404. Var. *revolutus*, Miq., has the margins more distinctly revolute. Var. *angustifólius* has narrower, flat lfts. Var. *Hoòkeri*, DC., has narrowly lanceolate lfts., not glaucous but intense green, and rachis not woolly. B.M. 4903, erroneously named *E. caffer*, is referred to this place, though the lfts. are distinctly pointed in the picture.

cc. Apex of lfts. always strong-pointed.

D. Form of lfts. linear.

*cycadifólius*, Lehm. (*E. Friderici-Guilielmi*, Lehm. *E. cycadifólius* var. *Friderici-Guilielmi*, Rod.). Fig. 1394. Trunk nearly globular, several inches in diam., woolly at first: rachis and petiole ashy-pubescent;



lfts. opposite and alternate, linear, margin revolute. I.H. 29:459. G.F. 4:209 (adapted in Fig. 1394). G.W. 10, p. 377 (as *E. cycadifolius* var. *Friderici-Guilielmi*).

**püngens**, Lehm. (*Zamia püngens*, Ait.). Rachis and petiole glabrous; lfts. long-linear, dark green, rigid, flat, striated beneath, margin not revolute. Var. **glauca** is also sold.

DD. *Form of lfts. lanceolate.*

**cáffer**, Miq. (*E. cáfra*, Hort.). Trunk to 18 ft. and 1 ft. or more diam.: lvs. to 4 ft., very stiff, recurved; petiole 3-angled; rachis glabrous; lfts. alternate, narrower at the base, twisted, the younger ones with 1 or 2 teeth, to 6 in. long. R.H. 1869, p. 233. Not B.M. 4903, which is *E. longifolius* var. *Hookeri*.

Var. **brachyphýllus**, DC. (*E. brachyphýllus*, Lehm.). Rachis and blades of the lower lfts. spidery pubescent: male cones sessile instead of peduncled. The pinnæ are erect, and longer and narrower than in *E. cáffer*.

*E. Bárteri*, Carr. St. short, about 1 ft. high and to 9 in. diam.: lvs. to 5 or 6 ft. long, and 10 in. broad, erect or suberect; petiole and rachis with a gray tomentum that falls off; lfts. about 80 pairs, linear-lanceolate, sharp at the apex, few-toothed: male cone to 9 in. long, pale; female cone about 8 in. long, oblong-ellipsoid, dark olive. W. Trop. Afr. B.M. 8232.—*E. Ghellinckii*, Lem. Spineless: trunk stout, woolly-sealy: lvs. 3-4 ft., erect-spreading; pinnæ very narrow-linear, densely tomentose. S. Afr. I.H. 15:567.—*E. Hildebrandtii*, A. Br. & Bouché. Trunk cylindrical: lvs. pinnate, with numerous lanceolate toothed pinnæ which become 3-parted scales toward the end of the lf., woolly at least at first. Trop. Afr. G.C. III. 27:120. R.B. 29:196. G.W. 10, p. 210. An attractive species.—*E. Laurentianus*, Wildem. Large, the st. reaching 30 ft. or more and 2½ ft. diam.: lvs. often over 20 ft. long; lower lfs. small, 3-toothed; middle lfts. lanceolate, 12-16 in. long and 2 in. broad, spiny on both edges and at the apex. Congo. G.C. III. 35:370. Named for Professor Laurent.—*E. Lemarinellianus*, Wildem. & Dur. St. 3-7 ft.; lvs. to 3 ft. or more; petiole shaggy; lfts. 18-60 on each side, rigid, coriaceous, glaucous, lanceolate, the edge slightly recurved, more or less spiny: male cone greenish, subcylindrical; female cone thick, green turning to salmon-color, short-peduncled, the scales triangular. Congo. Named for Capt. Lemarinell. G.C. III. 35:371. R.H. 1904, p. 59.—*E. Woodii*, Hort. Allied to *E. Altensteinii*: st. 18 in. high and 8 in. thick, bearing about 25 lvs. which are gracefully curved and reach 5 ft.: lfts. 8 in. long and 2 in. broad, spiny-toothed, the broadest ones pinnatifid. Zululand. G.C. III. 43:282. R.B. 34, p. 193. L. H. B.†

ENCHOLIRION: *Vriessia*.

**ENCHYLÈNA** (name alludes to the soft or juicy character of the berry-like fructification). *Chenopodiaceæ*. One procumbent or wide-branched very small-leaved shrub from Austral. recently intro. by U. S. Dept. Agric., and thriving well at the University of California. *E. tomentosa*, R. Br., grows 3 ft. or more high and makes a mass many feet across; branches mostly woolly or silvery: lvs. alternate, linear, usually under ½ in. long; fls. solitary in the axils, bracted, very small, perfect; perianth urn-shaped to globular, with

5 short teeth that close over the fr.; stamens 5, somewhat exserted: fr. inclosed in the perianth, which becomes red or yellow, fleshy and berry-like and the size of a small pea. The Australian aborigines are said to eat the berries in great quantities. The plant endures drought, and it is eaten by sheep when other herbage becomes scarce. The procumbent habit and the enduring color suggest its use in landscape work in dry mild climates.

ENCKËA: *Piper*.

**ENDIVE** (*Cichorium Endivia*). *Compósitæ*. A leaf-salad plant. See *Cichorium*.

Until recently endive has been almost unknown in American home gardens, but it is gradually receiving favor with salad-lovers. Although more frequently a product of the amateur, during August and September, and possibly later, it is now freely offered in the larger markets. It is especially the people of foreign descent who grow, buy and use endive. In the hot weather of summer and fall, when lettuce plants are more likely to produce seed-stalks than good solid heads, endive, although of somewhat bitter flavor when unbleached, makes a good and acceptable substitute for lettuce as a salad plant. In the unbleached state it may even be used for "greens."

The requirements as to culture are simple, as the plant succeeds well on any ordinary well-enriched garden soil. Seed may be sown in the open ground as early as June, and as late as August, the rows to be a foot apart and the plants to be thinned early to a foot apart in the row; or seed may be started in flats and the young seedlings transplanted to open ground. The latter is the better way when the ground is very dry. In extreme cases, it may be advisable for the home gardener to grow his seedlings in flats and pot them off in thumb-pots to become well rooted. This gives a chance to grow good plants, while waiting for a rain to moisten the open ground. To be tender, the plants should be forced into strong and succulent growth by high feeding and the free use of the hoe. It is a waste of effort to plant endive on poor land that is deficient in humus, or naturally dry and exposed.

The originally bitter flavor becomes pleasant and acceptable when the leaves or hearts are well blanched. The blanching is accomplished by tying the outer leaves over the heart with bast (Fig. 1395), or by placing a big flower-pot over each plant, or by setting boards, say 10 inches wide, on edge along each side of the row, in inverted V shape, and in somewhat the same fashion as for blanching celery, except that no opening is left on top. The light should be excluded from the hearts as much as possible. In any of these ways endive may be well blanched in about three weeks, and will come out with inner leaves showing a delicate whitish or creamy color, and being crisp, tender and of pleasant flavor.

If to be kept for winter use, sow the seed of Green Curled endive in August, or set the plants early in September; then take up the full-grown but as yet unblanched plants with a ball of earth adhering to the roots, and store them in a root-cellar as is done with celery. If kept in the dark, they will soon bleach and be ready for use.

Green Curled has long been the favorite variety in our markets and gardens. Its narrow curled leaves make the well-blanched plant far more attractive to the eye than the wider and plain leaves of Broad-Leaf. The latter, however, is gaining on the other in both growers' and consumers' favor. This is the only practical difference between the two varieties. The catalogues of European seedsmen list and describe several additional varieties, such as the Moss Curled and Rouen, none of which is often met with in American gardens. A few fungi and the spinach insects sometimes attack the plant.

T. GREYNER.



1395. Green curled endive tied up for blanching.



**ENGELMANNIA** (Dr. Geo. Engelmann, eminent botanist of St. Louis, died 1884). *Compositæ*. One yellow-fl. herb, *E. pinnatifida*, Torr. & Gray, allied to Parthenium and Silphium, Kans. to La., Ariz. and Mex., that is likely to be planted in wild gardens. It grows a foot or two high, in dry places, from a stout perennial root, branching above, hirsute, with alternate and radical deeply pinnatifid lvs., and corymbose heads of golden yellow fls. on slender and naked peduncles: involucre hemispherical, somewhat double; receptacle flat and chaffy; ray-fls. 8-10, pistillate and fertile, the rays  $\frac{1}{2}$  in. or more long; disk-fls. perfect and sterile: achene obovate, wingless, ribbed, with a persistent pappus-crown.

**ENKIANTHUS** (Greek *pregnant and flower*, referring to the colored involucre which subtends the flowers of *E. quinqueflorus*, giving the appearance of small flowers springing from a larger flower). Also written *Enkianthus*. *Ericaceæ*. Ornamental woody plants, chiefly grown for their handsome flowers and the brilliant autumnal tints of the foliage.

Deciduous, rarely evergreen shrubs with whorled branches: lvs. alternate, usually serrulate, crowded toward the end of the branchlets: fls. in terminal umbels or racemes; sepals 5, small; corolla campanulate or urceolate, usually 5-lobed; stamens 10; anthers 2-awned at the apex, opening with short slits: fr. a dehiscent caps.; cells 1- to few-seeded; seeds 3-5-winged or -angled.—About 10 species in China and Japan, Cochinchina and Himalayas. Closely related to Pieris and Zenobia; chiefly distinguished by the few- or 1-seeded cells of the caps. and the winged or angled seeds.

These are charming ornamental shrubs, with bright green, medium-sized leaves turning brilliant colors in autumn and with handsome white, red or yellow-and-red, drooping flowers appearing in spring; the flowers are not of the showy kind, but very graceful and of distinct appearance. Most of the cultivated species, as *E. campanulatus*, *E. cernuus*, *E. perulatus* and *E. subsessilis*, have proved hardy in Massachusetts; they seem to grow well in any well-drained humid soil, but probably are impatient of lime, as are most *Ericaceæ* and in limestone regions should be grown in specially prepared beds of peaty soil. Propagation is by seeds sown in spring, by cuttings of ripe wood under glass in spring, or by greenwood cuttings in summer; also by layers.

A. Fls. urceolate, gibbous at the base, white.

*perulatus*, Schneid. (*E. japonicus*, Hook. f. *Andrómæda perulata*, Miq.). Shrub, to 6 ft.: lvs. petioled, obovate to elliptic-ovate, acute, sharply appressed-serrulate, glabrous and bright green above, pubescent on the veins below, 1-2 in. long: fls. in drooping umbels, slender-pedicelled; corolla urceolate, with 5 revolute lobes and with 5 sacs at the base,  $\frac{1}{3}$  in. long: caps. oblong-ovoid, about  $\frac{1}{3}$  in. long, on straight pedicels. May. Japan. B.M. 5822. G.C. III. 21:357. R.H. 1877, p. 467. S.I.F. 2:62.—The foliage turns yellow and partly scarlet in autumn.

AA. Fls. campanulate, not gibbous at the base, usually red or yellow-and-red.

*campanulatus*, Nichols. (*Andrómæda campanulata*, Miq.). Fig. 1396. Shrub, to 15 or occasionally to 30 ft.: lvs. petioled, elliptic or rhombic-elliptic, acute or acuminate, sharply appressed serrulate, glabrous except few scattered bristly hairs, particularly on the veins below,  $1\frac{1}{2}$ -3 in. long: fls. slender-pedicelled, in drooping, 8-15-fl. puberulous racemes; corolla with short obtuse upright lobes, yellowish or pale orange, veined darker red, nearly  $\frac{1}{2}$  in. long: caps. oblong-ovate on pendulous stalks turned upward at the apex. May. Japan. B.M. 7059. Gn. 75, p. 287. G. 29:361. Gt. 22:747. M.D.G. 1900:550. S.I.F. 2:62.—This is one

of the handsomest species and the strongest grower; the peculiar coloring of the gracefully drooping fls. is very attractive; the foliage turns brilliant red in autumn.

*cernuus*, Makino (*E. Meistèria*, Maxim. *Andrómæda cernua*, Miq.). Shrub, to 15 ft.: lvs. short-petioled, obovate or rhombic-obovate, acute or obtusish, crenately serrate, bright green above, lighter below and pubescent on the veins, 1-2 in. long: fls. in pendulous racemes, slender-pedicelled; corolla with irregularly lacinate limb, about  $\frac{1}{2}$  in. long, white in the type: caps. on pendulous stalks turned upward at the apex. May. Japan. Var. *rubens*, Makino. Fls. red.—Only the red-fl. variety seems to be in cult. and is a very distinct-looking handsome shrub.

*E. chinensis*, Franch. (*E. himalaicus* var. *chinensis*, Diels). Allied to *E. campanulatus*. Lvs. quite glabrous, more crenately serrate: racemes glabrous; corolla yellow and red, with darker red lobes. Cent. and W. China. J.H.F. 1900: 212.—*E. deflexus*, Schneid. (*E. himalaicus*, Hook. f. & Thoms.). Closely related to *E. campanulatus*. Lvs. elliptic-ovate to elliptic-lanceolate, acute, slightly serrate, margin and petioles red while young: racemes many-fl.; corolla yellow, striped dark red, with darker lobes. Himalayas. W. China. B.M. 6460.—*E. himalaicus*, Hook. f. & Thoms.—*E. deflexus* and *E. chinensis*.—*E. nikoensis*, Makino = *E. subsessilis*.—*E. quinqueflorus*, Lour. (*E. reticulatus*, Lindl.). Lvs. elliptic, long-petioled, entire, persistent: fls. about 5, in umbels, subtended by colored bracts, drooping; corolla campanulate, scarlet. S. China, Cochinchina. B.M. 1649. B.R. 884, 885. L.B.C. 12:1101. P.M. 5:127. R.H. 1849:221. H.F. 1859:101. Tender. Var. *serrulatus*, Wilson (*E. serrulatus*, Schneid.). Lvs. deciduous, membranous, finely serrulate: fls. smaller. Cent. and S. W. China.—*E. reticulatus*, Lindl.—*E. quinqueflorus*.—*E. serrulatus*, Schneid.—*E. quinqueflorus* var. *serrulatus*.—*E. subsessilis*, Makino (*E. nikoensis*, Makino). Allied to *E. perulatus*. Lvs. short-petioled, elliptic or obovate: fls. in pendulous racemes, small, white,  $\frac{1}{3}$  in. long. June. Japan. S.T.S. 1:25. S.I.F. 2:62.—This is the least attractive in bloom, but the autumnal tints of the foliage are as beautiful as in the other species.

ALFRED REHDER.

**ENNEALOPHUS** (name refers to the 9 crests on the style). *Iridaceæ*. A very recently described genus of one species, *E. amazonicus*, N. E. Br., differing from *Tigridia* in the 3 style-branches being 3-crested rather than bifid or subulate. The perianth-segms. are free, unequal and clawed, the exterior ones much the larger, the blades of all of them more or less reflexed; stamens 3, the filaments connate into a tube. The bulb of the single known species is about 1 in. long, ovoid: lvs. linear-lanceolate, about 4, the upper one about 2 in. long and the others 6-12 in.: fls. about  $1\frac{1}{2}$  in. across, blue-violet with pale brown claws and a white spot at the base of the blade of the inner segms. Brazil; apparently not in the trade.

**ENTADA** (a Malabar name). Syn. *Pusætha*. *Leguminosæ*. Tropical woody spineless climbers.

Leaves bipinnate, often cirriferous: fls. not papilionaceous, white or yellow, in slender spike-like racemes which are solitary or paniced; calyx campanulate, shortly 5-toothed; petals 5, free or somewhat coherent; stamens 10, free, short-exserted: pod straight or arcuate, flat-compressed, jointed, the joints separating and leaving a continuous border.—Perhaps 20 species of high climbers in Afr. and Amer. The genus is remark-



1396.  
*Enkianthus*  
*campanulatus*.  
( $\times \frac{1}{2}$ )

able for the jointed pods, which sometimes reach several feet in length. Two of the American species are mentioned as planted in S. Fla. Some of the species yield "sea beans" (G. F. 7:503).

**polystachya**, DC. At length tendrill-bearing: pinnæ in 4-6 pairs; lfts. in 6-8 pairs, oblong, rounded at apex, beneath glabrous or puberulent; racemes in terminal panicles: pod oblong, straightish, reaching 1 ft. in length. W. Indies to Venezuela and Guiana.—Makes a rapid growth.

**scândens**, Benth. Climbing to a great height, tendrill-bearing, the sts. terete: pinnæ 1 or 2 pairs; lfts. 2-5 pairs, coriaceous, oblong or elliptic, usually unequal-sided, glabrous or nearly so beneath; racemes solitary or twin: pod twisted, sometimes 8 ft. long. W. Indies, Afr., Asia, Pacific Isls. G.C. II. 15:430.—Seeds 2 in. across, dark brown or purple, handsome, used in the making of trinkets and small receptacles. Lvs. long-stalked, the rachis commonly ending in a tendrill. L. H. B.

**ENTELEËA** (Greek, *complete*; the stamens all fertile, a distinguishing feature). *Tiliaceæ*. A shrub or small tree from New Zeal., intro. in S. Calif. Lvs. large, alternate, 5-7-nerved, cordate at base, toothed or crenate, stellate-pubescent: fls. white, 1 in. across, in terminal cymes; sepals 4-5; petals 4-5; stamens numerous, free; ovary 4-6-celled; cells many-ovuled; style simple: fr. a globose bristly loculicidal caps.

**arborëscens**, R. Br. Attaining 20 ft.: the heart-shaped outline of the lf. broken on each side, about two-thirds of the way toward the tip, by a projection or lobe  $\frac{1}{2}$  in. long or nearly as long as the tip of the lf.; blade 6-9 in. long, 4 in. wide, doubly serrate. New Zeal. B.M. 2480.—Eaten by horses and cattle in New Zeal. Allied to *Sparmannia*, *Aristotelia* and *Elæocarpus*. L. H. B.

**ENTEROLÔBIUM** (name refers to the *intestine-form* pods). *Leguminosæ*. Tropical trees.

Unarmed: lvs. bipinnate, the pinnæ and lfts. many: fls. not papilionaceous, greenish, in large heads or clusters; calyx campanulate, shortly 5-toothed; corolla 5-toothed, somewhat trumpet-shaped, the petals connate part way; stamens many, connate at base into a tube, exerted, purple or white: legume broad, circinate, attached at or near the middle, restricted between the large seeds, leathery, pulpy.—About a half-dozen species in the American tropics, 2 of which have been intro. in S. Calif.

A. *Pod bent back in a complete circle.*

**cyclocârpum**, Griseb. Tall tree, glabrous: pinnæ in 4-9 pairs; lfts. in 20-30 pairs, unequal-sided, oblong, pointed; the petiole with glands between bottom and top pinnæ: stamens white. Cuba, Jamaica, Venezuela.

AA. *Pod forming half or two-thirds of a circle.*

**Timbouva**, Mart. Said to be a fine tree: pubescent or glabrous, glaucous: pinnæ 2-5-pairs; lfts. 10-20 pairs, falcate-oblong, mostly acute: pod coriaceous and indehiscent, reniform, fleshy within; seed elliptic. L. H. B.

**EOMËCON** (Greek, *eastern poppy*). *Papaveracææ*. Herbaceous perennial, with white flowers on a slender-branched scape.

Rhizomatous, with radical lvs., glabrous: "monotypic, intermediate between *Stylophorum* and *Sanguinaria*, differing from both in the scapose habit, racemose fls. and sepals confluent in a membranous, boat-shaped spathe, and further from *Stylophorum* in the form of the lvs. and color of the fls., and from *Sanguinaria* in the 4 petals and elongate style" (Hooker).

**chionántha**, Hance. Rootstock creeping, ascending, full of yellow sap: lvs. all from the root; stalks twice as long as the blades; blades 3-6 in. long, heart-shaped, concave, broadly sinuate, rounded at the apex, bright

pale green above, almost glaucous beneath: scape 1 ft. or more high, reddish; fls. 2 in. across, white; petals 4. Spring; hardy near New York City. E. China. B.M. 6871. WILHELM MULLER.

EOPËPON: *Trihcosanthes*.

**ÉPACRIS** (Greek-made name, *upon the summit*; referring to their habitat). *Epacridacææ*. Heath-like shrubs of Australia and New Zealand, of which half a dozen or less are grown as cool greenhouse pot-plants.

Leaves small and entire, usually sharp-pointed, sessile or short-stalked, scattered or sub-opposite: fls. small and axillary, short-stalked, the flowering sts. being elongated leafy spikes, regular and perfect; calyx bracteate; corolla tubular, 2-toothed, white or shades of purple and red; stamens 5; ovary 5-loculed, ripening into either a fleshy or capsular fr. Distinguished from *Erica* by the bracteate or scaly calyx, and the anthers opening by slits rather than pores.—About 40 species. In the Old World, epacris are prized by those who grow heaths, and many good varieties are known. They bloom in early spring or late winter. The varieties of *E. impressa* may be flowered for Christmas; perhaps others may be so treated. A carnation house, 50-55°, suits them well. There are double-fl. forms.

A. *Corolla-tube decidedly longer than the calyx.*

**impressa**, Labill. Three ft., erect, twiggy, downy: lvs. horizontal or deflexed, narrow-lanceolate and sharp: fls. rather large (often  $\frac{1}{2}$  in. long), tubular, pendent, on very short stalks, red or white. B.M. 3407. There are many forms: var. **parviflora**, Lindl., B.R. 25:19; *E. campanulata*, Lodd., with broader fls., L.B.C. 20:1925; *E. ceræflora*, Graham. B.M. 3243; *E. nivâlis*, Lodd., snow-white, L.B.C. 19:1821. B.R. 1531; *E. variabilis*, Lodd., blush, L.B.C. 19:1816; var. **longiflora**, Cav., (*E. miniata*, Lindl. *E. grandiflora*, Willd.). Sts. woolly, straggling: lvs. ovate-pointed or cordate-pointed, sessile or nearly so, many-nerved: fls. long (nearly 1 in.), red at base and white at the limb, cylindrical. B.M. 982. B.R. 31:5.—Handsome. Var. **splendens**, Hort., has brighter colors.

AA. *Corolla-tube shorter than the calyx or only as long as it.*

B. *Lvs. acute or acuminate.*

**acuminata**, Benth. Lvs. ovate, acuminate, clasping, ascending: fls. small, red nearly sessile in the upper axils; corolla-tube not exceeding the calyx; sepals broad, ciliate.—Little known in U. S. outside of botanic gardens, but of considerable worth.

**breviflora**, Stapf. (*E. hetronema*, Hook.). A graceful shrub, 1 ft., with many wary branches, naked below, with many lvs. above: lvs. divaricate on upper part of st., reflexed below, elliptic-ovate, 3-6 lines long, sharp-pointed: fls. spicate at the ends of the branches, white; bracts and sepals whitish. New Zeal. Flowers in May in England. B.M. 3257.

**purpurascens**, R. Br. Lvs. ovate-acuminate, trough-shaped, tipped with a long curved point or spine: fls. short, the calyx nearly equaling the corolla, white or pinkish. There is a double-fl. form. L.B.C. 3:237. G.C. II. 5:340.—Probably identical with *E. pulchella*, Cav.

BB. *Lvs. very obtuse.*

**obtusifolia**, Smith. An erect, much-branched shrub 1-3 ft. tall, the branches usually hairy: lvs. small, elliptic or linear, thick and obtuse: fls. small, white, in axillary racemes which are more or less one-sided. L.B.C. 3:292.

Other trade names are: *E. ardentissima*. Fls. crimson.—*E. hyacinthiflora* var. *candidissima*, white, early, and var. *fulgens*, pink.—*E. hybrida superba* is merely a catalogue name for mixed kinds of Epacris.—*E. rubella*. Fls. bright red.—*E. salmonea* (?)

N. TAYLOR.†



**EPHÉDRA** (ancient Greek name, used by Pliny for the horse-tail). *Gnétaceæ*. Woody subjects, rarely cultivated; usually found only in botanical collections, although the scarlet fruits of some species are very attractive.

Usually low much-branched shrubs, often procumbent and sometimes climbing, the green branches resembling much those of *Equisetum*, bearing minute, scale-like, sheathing lvs. in distant pairs or whorls; fls. dioecious, in small aments, forming usually peduncled axillary clusters; staminate fl. with a 2-4-lobed perianth and with the 2-8 stamens united into a column; pistillate fl. with an urceolate perianth, including a naked ovule, developing into a nutlet; in some species the bracts of the ament become fleshy, and form a berry-like syncarp.—About 30 species from S. Eu., N. Afr., Asia and in Trop. Amer. Latest monograph by O. Stapf, in Denkschr. Akad. Wissensch. Wien., vol. 56 (1889), (in German and Latin). Curious-looking, usually low shrubs, with pale green apparently leafless branchlets, much resembling those of the horse-tail and with inconspicuous fls., but fr. in some species decorative, berry-like and scarlet. They are but rarely grown, and most of them are tender; half-hardy N. are *E. distachya*, *E. foliata*, *E. nevadensis*, *E. trifurca*. They can be used for covering dry, sandy banks or rocky slopes. Prop. is by seeds or by suckers and layers.

*E. altissima*, Desf. Climbing shrub, to 20 ft., green: lvs. to 1 in. long: aments paniculate or solitary: fls. with 2-3 stamens; pistillate fls. 1-2: fr. berry-like, ovoid,  $\frac{1}{2}$  in. long, scarlet. N. Afr. B.M. 7670. G.C. III. 7: 792.—*E. distachya*, Linn. (*E. vulgaris*, Linn.). Low, often procumbent, 1-3 ft., pale or bluish green: lvs. one-twelfth in. long: aments usually clustered, staminate oblong; fls. with about 8 stamens, pistillate 2-fld.: fr. berry-like. S. Eu., W. Asia. R.F.G. II. 1: 809. Var. *monostachya*, Stapf. Aments usually solitary.—*E. foliata*, Boiss. (*E. kokanica*, Regel). Procumbent or erect, to 15 ft., bright or bluish green: lvs. to 1 in. long: aments usually clustered, ovate; staminate fls. with 3-4 sessile stamens; pistillate 2-fld.: fr. berry-like. W. Asia.—*E. kokanica*, Regel=*E. foliata*.—*E. nebrodensis*, Tineo. Erect, with rigid, pale green branches: lvs.  $\frac{1}{2}$  in. long: aments solitary or few; staminate globular; pistillate 2-fld.: fr. berry-like. Medit. region to Himalayas.—*E. nevadensis*, Wats. Erect, 2-3 ft., with pale or bluish green branches: lvs.  $\frac{1}{2}$  in.: aments usually solitary; staminate ovate, 6-8-fld.; pistillate 2-fld.: fr. dry, with ovate bracts. Calif., New Mex.—*E. trifurca*, Torr. Erect, with rigid, yellowish or pale green branches: lvs. in 3's, connate, about  $\frac{1}{4}$  in. long: aments solitary; pistillate 1-fld.: fr. dry, the roundish bracts with transparent margins. Ariz. to Colo.—*E. vulgaris*, Linn.=*E. distachya*.

ALFRED REHDER.

**EPICÁTTLEYA** (compounded of *Epidendrum* and *Cattleya*). *Orchidaceæ*. A genus established to contain hybrids between *Epidendrum* and *Cattleya*.

The following are some of these: *E. balarucensis* (*C. labiata* × *E. eburneum*).—*E. cándida* (*C. Skinneri* × *E. nocturnum*).—*E. decipiens* (*C. gigas* × *E. ciliare*).—*E. Lillianæ* (*C. Gaskelliana* × *E. costaricensis*).—*E. madeburgensis*.—*E. Nébo* (*C. Clæsiana* × *E. O'Brienianum*).—*E. nemorale-gigas* (*C. Warszewiczii* × *E. nemorale*).—*E. O'Brieniæ* (*C. Bowringiana* × *E. O'Brienianum*).—*E. Orpetii* (*C. amethystoglossa* × *E. O'Brienianum*).—*E. salmonicolor* (*C. Mendelii* × *E. aurantiacum*).—*E. Sédenii* (*C. Bowringiana* × *E. radiatum*).—*E. Wolteriana* (*C. Schröderæ* × *E. aurantiacum*).

GEORGE V. NASH.

**EPIDÉNDRUM** (upon trees, alluding to their epiphytal habit). *Orchidaceæ*. Epiphytic orchids, some requiring hothouse and some coolhouse conditions; although a large genus, of minor importance horticulturally.

Inflorescence simple or branched, nearly always terminal; claw of the labellum more or less adnate to footless column, the blade spreading and usually deeply lobed; pollinia 4, 2 in each anther-cell, separated.—Nearly 500 species discovered and described from the New World tropics, chiefly from Cent. Amer.

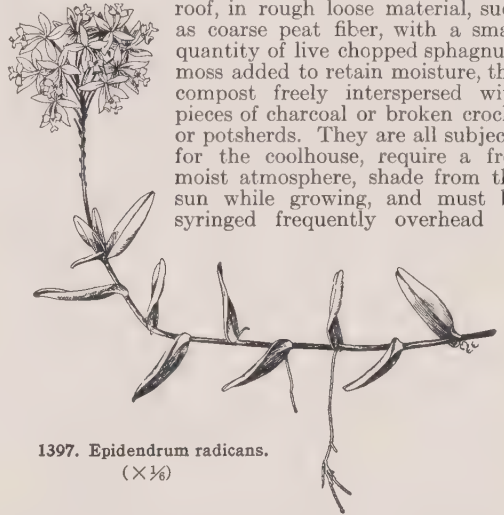
*Cultivation of epidendrums.*

Epidendrums are noted as the rankest weeds amongst the orchid tribes. The remarkable success in the rais-

ing of hybrids, be it in the genus itself or with the related *Cattleya* and *Lælia*, has opened a wide field for the breeder. *Epidendrum* seedlings grow freely; the time required to bring them to the flowering stage is little compared with other orchids, and it is but a question of a short time till the blood of the epidendrums will be infused into the weaker but more gorgeous flowers of genera more difficult to grow. It is also the long stem and the grace of the racemes of the epidendra, as well as the odor of some of their species, which the hybridist will try to blend with the largeness of short-stemmed flowers, of cattleyas for example. Therefore a list of the species but rarely found under cultivation is given below, the value of which, however, will call for and justify large importations of their kind before long.

It is scarcely possible to apply any one rule for the cultivation of this widely divergent and large genus, which includes many hundreds of variable individuals geographically distributed all over tropical America. For convenience they are treated under their several separate sections.

*Section I. BARKERIA* embraces several deciduous small-growing species which generally deteriorate sooner or later under cultivation. They succeed best in small baskets, suspended from the roof, in rough loose material, such as coarse peat fiber, with a small quantity of live chopped sphagnum moss added to retain moisture, this compost freely interspersed with pieces of charcoal or broken crocks or potsherds. They are all subjects for the coolhouse, require a free moist atmosphere, shade from the sun while growing, and must be syringed frequently overhead in



1397. *Epidendrum radicans*.  
( $\times \frac{1}{6}$ )

bright weather. After the plants have matured growth, they should be removed to a rather sunny location and be syringed overhead often enough to keep them in sound condition until they start new action. While resting during winter the temperature may range from 50° to 55° F. at night, and a few degrees higher during the day. They are increased by division. This should take place as the plants start growth action in early spring, allowing at least three pseudobulbs to each piece.

*Section II. ENCYCLIUM*, of which *E. atropurpureum*, *E. nemorale* and *E. prismatocarpum* are good examples, may be grown either in pots or baskets in equal parts clean peat fiber and live chopped sphagnum, with a liberal amount of drainage, and excepting *E. vitellinum*, which must be grown cool, they require a moist sunny location with a winter temperature of 58° to 65° F. by night and several degrees advance during the day. In February and March, many species will start root or growth action; such as need it should then be repotted or top-dressed, as occasion requires. The temperature should be increased several degrees, and a greater amount of water be allowed with frequent overhead syringing on bright days. Ventilation should be given whenever the weather will permit, to keep the young growths from damping-off and the atmosphere active; at this time the plants will need light shading to pre-

vent sun-burning. The stock is increased by cutting nearly through the rhizome three or four bulbs behind the lead, when starting action; this will generally cause the latent eyes to grow, but the pieces should not be removed until the new growth is well advanced.

**Section III. AULIZEUM** includes such species as *E. ciliare*, *E. cochleatum*, and the like, the several requirements being identical with the preceding.

**Section IV. EUEPIDENDRUM.** These are mostly tall-growing species, some reed-like as in *E. evectum*, and others rambling in an irregular way, producing aerial roots along the stems as they grow; a good example of this is seen in *E. radicans*. All are best grown in pots and placed near a partition or end of a greenhouse where support may be given as the growth advances. There is, in fact, no better example of an epiphyte than *E. radicans*, the roots often attaining several feet in length, and appearing from nearly every node. A structure in which 50° F. is maintained in winter will be ample, and full exposure to sun should be permitted at all times. This prevents immature growth, and flowers are produced very freely. After flowering time, young shoots appear, often from the old stems, and when a few roots are formed and before they become too long to go into a small pot without injury, remove them and pot with care, place the young plants in a shady place for a few weeks; in this way propagation is easily accomplished. This section of epidendrums produce seeds the largest known among orchids. They are green in color, and under favorable conditions germinate very readily. It is, in fact, much easier to get the seeds to grow than to get the species to produce good seeds, for when flowering plants are produced from seed, there is an infinite variation that has not yet been understood.

**Section V. PSILANTHEMUM** contains but one species, *E. Stamfordianum*, which requires the same general treatment as those in Section II.

ROBERT M. GREY.  
E. O. ORPET.

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#### A. Infl. radical. (*Psilanthemum*.)

1. *Stamfordianum*, Batem. Sts. fusiform, 12 in. long; lvs. 7-9 in.: large panicles of yellow and green fls., crimson-spotted, fragrant. Mex. to Colombia. B.M. 4759. G.C. III. 17:655. J.F. 3:251.

#### AA. Infl. terminal.

B. Sts. without bulbs: lvs. distichous, alternate; only top of column free from lip. (*Euepidendrum*.)

#### c. Fls. red, orange or vermilion.

2. *Catillus*, Reichb. f. (*E. imperator*, Hort.). Fls. cinnabar-red. Colombia. I.H. 21:162.

3. *cinnabarinum*, Salzm. Sts. 3-4 ft.: fls. orange-red, 2 in. diam., lobes of lip deeply fringed. Brazil. B.R. 28:25.—A beautiful species.

4. *radicans*, Pav. (*E. rhizophorum*, Batem.). Fig. 1397. Sts. semi-scandent, up to 5 ft. long, long white roots from opposite the lvs.: fls. up to 2 in. diam., numerous; most brilliant of the red-flowering species. Guatemala, amongst heavy grass. Gn. 24:390. O.R. 5:273.

#### cc. Fls. white.

5. *Endresii*, Reichb. f. Sts. 6-9 in.: racemes 9-12-fld.; fls. 1 in. diam., pure white; lip and column spotted purple. Costa Rica. G.C. II. 23:504. B.M. 7855. O.R. 12:145.

#### ccc. Fls., at least sepals and petals, rose or purple.

6. *ellipticum*, Graham (*E. crassifolium*, Hook.). Fls. on long scapes, clustered, rose or purple, ½ in. diam. Brazil. B.M. 3543.

7. *paniculatum*, Ruiz & Pav. Sts. 3-4 ft.: fls. ¾ in. across, lilac-purple, lip whitish yellow. Venezuela to Peru, high altitudes. B.M. 5731. I.H. 22:211.—Most free-flowering and best of paniculate species.

8. *evectum*, Hook. Sts. 3-5 ft.: peduncles nodding, 2 ft.; fls. rich purple, lip deeply fringed. Colombia. B.M. 5902.—Easily cult. and on account of its free-flowering habit deserves a place in the warm greenhouse.

#### cccc. Fls., at least sepals and petals, yellowish green.

9. *leucochilum*, Klotzsch (*E. imperator*, Hort.). Sts. 2 ft.: fls. 5-9, on long pedicels, greenish yellow; lip pure white. Colombia, 6,000-9,000 ft.

10. *eburneum*, Reichb. f. Sts. terete, 2-3 ft.: fls. 3-4 in. diam., yellowish green; lip ivory-white, with yellow calli; raceme terminal, 4-6-fld. Panama, in swamps. B.M. 5643.



139E. *Epidendrum*  
*ciliare* (×½)

BB. Sts. thickened into  
pseudobulbs.

C. Pseudobulbs 2-4-lvd.:  
labellum adnate less  
than half; column broad-  
winged. (*Barkeria*).

D. Lip obovate, obtuse.

11. *élegans*, Reichb. f. (*Barkèria elegans*, Knowl. & West.). Sts. terete, 12 in.: pedicels 24 in.; fls. 5-7, nodding, 1½ in. diam., lilac-purple; lip whitish, with purple blotch. Pacific coast of Mex. B.M. 4784.

#### DD. Lip acute.

#### E. Fls. about 1 in. across.

12. *Skinneri*, Batem. (*Barkèria Skinneri*, Paxt.). Lvs. ovate-oblong, sheathing the slender st.: peduncle terminal, bearing rose-lilac fls. about 1 in. across; petals and sepals nearly equal, petals so twisted at the base as to present dorsal surface to the observer; labellum ovate, with 3 raised lines. Guatemala. B.R. 1881. P.M. 15:1 (var. *major*).

#### EE. Fls. 2-4 in. across.

13. *Lindleyanum*, Reichb. f. (*Barkèria Lindleyana*, Batem.). Sts. slender; fls. numerous, about 2 in. across, rose-purple; labellum with a white disk; petals broader than the sepals. Cent. Amer. 1839. J.H. III. 44:53.

14. *spectabile*, Reichb. f. (*Barkèria spectabilis*, Batem.). FLOR DE ISABAL. Sts. tufted, cylindrical, 4-5 in. high; lvs. 2: raceme about 6-fld.; fls. 3-4 in. across, bright lilac; sepals linear-lanceolate; petals ovate-lanceolate; labellum white at base, red-spotted. Guatemala.



cc. *Pseudobulbs* 1-2-, rarely 3-lvd.: *labellum* adnate at base, or not up to the middle; *column* not winged. (*Encyclium*.)

D. *Fls. cinnabar.*

15. *vitellinum*, Lindl. *Pseudobulbs* ovoid, 2 in. long: lvs. 6-9 in.: peduncles 15-18 in., 10-15-fld.; fls. cinnabar-red; lip and column orange. Mex., 6,000-9,000 ft. B.M. 4107. G.C. III. 10:141.

Var. *majus*, Veitch. *Pseudobulbs* shorter: racemes denser; fls. larger and more brilliant. G.C. III. 12:159. —Very superior to the species; type no longer imported.

DD. *Fls. rose.*

16. *nemorale*, Lindl. *Pseudobulbs* subglobose, 3-4 in. high: lvs. 9-12 in.: peduncles 2 ft. long, covered with warts; fls. 3-4 in. diam., rose-colored; lip rosy mauve, streaked with purple. Mex. B.M. 4606 (as *E. verrucosum*). G.C. II. 24:332. A.F. 6:633.

DDD. *Fls. other than above.*

E. *Sepals and petals white.*

17. *dichromum*, Lindl. *Fls.* white, lip rose-colored, yellow and downy at base. Brazil.

EE. *Sepals and petals green.*

18. *osmáanthum*, Rodr. (*E. Godseffianum*, Rolfe. *E. Capartianum*, Lindl.). *Fls.* 1½ in. across, in large panicles, light green, suffused with brown; lip white, lined with rose-purple, fragrant. Brazil. B.M. 7792. —One of the handsomest species.

19. *prismatocarpum*, Reichb. f. (*E. maculatum*, Hort.). *Pseudobulbs* ovoid, tapering, 4-5 in.: lvs. 12-15 in.: fls. 1½ in. across, pale yellow-green, with purplish black spots; lip pale purple, with yellow tip and white border. Cent. Amer., 5,000 ft. B.M. 5336. G.W. 5, p. 126. O.R. 12:57.

EEE. *Sepals and petals purple or brown.*

20. *atropurpureum*, Willd. (*E. macrochilum*, Hook.). *Pseudobulbs* ovoid, 3-4 in. high: lvs. lanceolate, 12-15 in. long, dull purple-colored; peduncle 6-10-fld.; fls. 2½ in. diam., purplish brown upon greenish ground; lip yellowish white, with crimson stripes. Mex. to Venezuela. B.M. 3534. A. F. 6:609. J.H. III. 51:243, 401.

Var. *Randiánum*, Lind. & Rod. *Sepals and petals* margined with light yellowish green, the white middle lobe of lip with a red-purple-rayed blotch.

Var. *roseum*, Reichb. f. *Sepals and petals* purplish, lip bright rosy. Guatemala. P.M. 11:243.

21. *Brassávolæ*, Reichb. f. *Pseudobulbs* pear-shaped: lvs. 6-9 in.: racemes 18-24 in., 6-9-fld.; fls. 4 in. across; sepals and petals narrow, yellowish brown; lip trowel-shaped, purple, white and green. Mex. to Guatemala, 8,000 ft. B.M. 5664.

ccc. *Pseudobulbs* 1-2-, rarely 3-lvd.: *lip* adnate up to apex of *column*. (*Aulizeum*.)

D. *Lip fringed.*

22. *ciliare*, Linn. Fig. 1398. *Pseudobulbs* clavate, 4-6 in.: lvs. 4-6 in., springing from sheathing bract: peduncles 5-7-fld.; fls. yellowish green; lip white. Trop. Amer., between 5th and 20th parallel of north latitude. B.R. 784. —Plant resembles a cattleya. Intro. to cult. in 1790.

DD. *Lip not fringed.*

E. *Fls. vermilion.*

23. *aurantiacum*, Batem. Once classed in the separate group of *Epicladium*, now often accepted as a species of *Cattleya*, where it was first referred by Don. The plant grows with, and much resembles *Cattleya Skinneri*. *Fls.* 1½ in. across, orange-red, appearing in Feb. and March and lasting several weeks. Guatemala. Gt. 5:130.

EE. *Fls. not vermilion.*

F. *The lip deeply 3-lobed, the middle lobe long and lanceolate.*

24. *falcatum*, Lindl. (*E. Parkinsonianum*, Hook.). *Pseudobulbs* thin, rising from running rhizomes, monophyllous: lvs. 6-12 in., fleshy, channeled on one side: peduncles 2-5, sheathed, 1-fld.; fls. 5 in. across, greenish yellow; lip white, greenish at apex. Mex. to Guatemala. B.M. 3778. G.C. III. 44:378. —Plants grow inverted.

FF. *The lip not as in F.*

25. *venosum*, Lindl. BUTTERFLY ORCHID. Scape 1 ft., with white sheaths: lvs. 3, 4-6 in. long, linear-lanceolate: scape tumid at base, 5-7-fld.; fls. pink, chocolate and green, about 1 in. long, lasting a long time. On oaks, etc., Mex. —Of easy cult. The Fla. representative of this species is *E. tampense*, Lindl. See 9th Rept. Mo. Bot. Gard. 137, pls. 38, 39.

26. *fragrans*, Swartz. *Pseudobulbs* fusiform, monophyllous, 3-4 in.: lvs. 8-12 in.: fls. inverted, 2 in. diam., very fragrant, pale greenish or whitish; lip crimson-streaked. Guatemala, through the W. Indies to N. Brazil. B.M. 1669.

27. *cochleatum*, Linn. *Pseudobulbs* 3-4 in.: lvs. 6 in.: racemes 4-7-fld.; fls. 3-4 in. across, greenish white; lip deep purple beneath, light green above, with maroon blotch on each side, column white. Trop. Amer. from Fla. to Colombia. B.M. 572. —Intro. 1787; first epiphytical orchid to flower in England.

Garden hybrids: *E. Berkeleyi* (*E. Stamfordianum* × *E. O'Brienianum*). —*E. Burtonii* (*E. O'Brienianum* × *E. ibaguense*). —*E. Clarissia superbum* (*E. elegantulum* × *E. Wallisii*). —*E. dellense* (*E. xanthinum* × *E. radicans*). —*E. elegantulum* (*E. Wallisii* × *E. Endresio-Wallisii*). G.C. III. 19:361. —*E. Endresio-Wallisii*. —*E. keuense* (*E. evectum* × *E. xanthinum*). —*E. O'Brienianum* (*E. evectum* × *E. radicans*). G.C. III. 3:771. —*E. Phæbus* (*E. O'Brienianum* × *E. vitellinum*). —*E. radicans* (*E. Stamfordianum* × *E. radico-vitellinum*). —*E. Wallisio-ciliare*. —*E. xantho-radicans*.

*Eupidendrum*: *E. arachnoglossum*, André. Sts. 4-5 ft.: fls. rich purple-lilac; lip fringed, with orange calli. Colombia. R.H. 1882:554. —*E. Clavianum*, Cogn. Sts. up to 2 ft. tall: racemes numerous, pendulous; fls. pure white. Colombia. G.C. III. 29:70. —*E. cnemidophorum*, Lindl. Sts. 4-6 ft.: racemes ample, drooping; fls. purple, brown and yellow, fragrant. Guatemala, 7,000 ft. B.M. 5656. —*E. conopseum*, R. Br. Scape few to many-fld.: lvs. 1-3, thick; fls. green, tinged with purple, the sepals spatulate and revolute, the petals narrower and obtuse. S. Fla. and S. Once offered by Reasoner. —*E. Cooperianum*, Batem. Sts. 2-3 ft.: fls. yellow-green; lip bright purple. Brazil. B.M. 5654. —*E. costatum*, Rich. & Gal. Raceme nodding; fls. about 1 in. across, the sepals and petals reddish brown, the lip whitish, purple-marked. Mex. G.C. III. 44:425. —*E. decipiens*, Lindl. *Fls.* orange or vermilion. Colombia. —*E. Ellisii*, Rolfe. *Fls.* carmine-rose, very handsome. Colombia. —*E. fulgens*, Brongn. *Fls.* orange-scarlet, in crowded racemes. Guiana to Brazil. —*E. gracilis*, Lindl., was once offered by John Saul. —*E. ibaguense*, HBK. Sts. 2-3 ft.: fls. orange-scarlet; lip yellow. Colombia to Peru, 4,500 ft. —*E. Lambeauianum*, De Wild. Sepals and petals whitish, the lip claret. G.C. III. 44:228. —*E. myrianthum*, Lindl. Sts. 3-5 ft.: enormous panicles of rich purple fls.; lip with 2 yellow calli. Guatemala. B.M. 5556. —*E. nocturnum*, Linn. Sts. 2-3 ft.: peduncles 8-10-fld.; fls. white and yellowish, 5 in. across, very fragrant. S. Fla. and Mex. to Peru and W. Indies. B.M. 3298. Once offered by Reasoner. —*E. palpitgerum*, Reichb. f. *Fls.* beautiful lilac. Mex. —*E. Pfavii*, Rolfe. Sts. 4-6 ft. high: fls. light purple; lip with white disk, in numerous racemes. Costa Rica. —*E. Pseudopidendrum*, Reichb. f. Sts. 2-3 ft.: fls. 3 in. diam., green; lip orange-red and yellow. Cent. Amer., 4,000 ft. B.M. 5929. —*E. raniferum*, Lindl. Sts. 2-3 ft.: fls. yellow-green, thickly spotted with purple. Mex. to Guiana. B.R. 28:42. —*E. rigidum*, Jacq., was once catalogued by Reasoner. —*E. Schomburgkii*, Lindl. Sts. 2-3 ft.: fls. vermilion. Guiana, Brazil, Quito. B.R. 24:53. —*E. stenopetalum*, Hook. Sts. up to 2 ft.: fls. 1½ in. across, rosy mauve, the lip with a white blotch. Jamaica. B.M. 3410. —*E. syringothyrsis*, Reichb. f. Sts. 4-5 ft.: fls. deep purple; lip and column with orange and yellow, crowded in long racemes. Bolivia, 8,000-9,000 ft. B.M. 6145. —*E. Wallisii*, Reichb. f. Sts. 4-6 ft.: fls. yellow, some purple spots; lip orange and purple, upon white ground. Colombia. 4,000-7,000 ft. Has lateral as well as terminal racemes.

*Encyclium*: *E. advena*, Reichb. f. *Fls.* yellow, veined brown; lip yellowish white, purple-streaked. Brazil. —*E. alatum*, Batem. *Fls.* 2 in. across, purple and green; lip yellowish, streaked with purple, fragrant. Cent. Amer. B.M. 3898. —*E. bifidum*, Aubl. *Fls.* pale green, dotted with purple; lip rose, orange and white. W. Indies, Guiana. B.R. 1879. —*E. Friderici-Guilielmi*, Warsc. & Reichb. f. *Bulbs* 4-5 ft.: fls. dark purple; base of lip white and yellow. Peru, 6,000-8,000 ft. I.H. 18:48. —*E. gallopavinum*, Reichb. f. *Fls.* brown in large racemes; lip yellow. Brazil. —*E. oncidoides*, Lindl. Panicles up to 6 ft. long; fls. yellow and brown, sweet-

scented. Stately species. Guiana. B.R. 1623.—*E. phaniceum*, Lindl. Panicles 2-3 ft.; fls. deep purple, mottled green; lip rich violet, stained crimson. Handsome. Cuba.—*F. virgatum*, Lindl. Scape up to 7 ft. high; fls. small, up to 20, greenish, stained brown. Mex.

Aulizeum: *E. variegatum*, Hook. Racemes many-fl'd.; fls. fragrant; sepals and petals pale yellow, the lip rose or white-and-rose-spotted. S. Amer. B.M. 3151.

Other species mentioned in horticultural literature are: *E. campylostylus*, Reichb. f. A curious species with glaucous green pseudobulbs and lvs.; fls. yellowish tinged with chocolate color. Cent. Amer.—*E. Lambda*, Lind. Closely allied to *E. fragrans*. Sepals and petals light salmon-color; lip cream-yellow with violet lines; crest velvety. Colombia.—*E. laterale*, Hort. Infl. produced on a rudimentary pseudobulb as in *E. Stamfordianum*. Cent. Amer.—*E. pterocarpum*, Lindl. Of diminutive growth, chiefly of botanical interest. Mex.—*E. punctiferum*, Reichb. f. Fls. in erect spikes, green, the lip spotted with purple. Brazil.—*E. purpurachylum*, Rodr. "Sepals and petals dull olive-green, tinged with brown; corrugated front lobe of lip deep purple, with whitish yellow margin; fls. fragrant, not unlike violets."—*E. saccharatum*, Kränzl. Raceme 15-20-fl'd.; fls. green, marked with dark brown; lip white, rose-purple at apex. Guiana.—*E. Stallforthianum*, Kränzl. Sepals and petals dull brown; column ivory-white; fls. have a peculiar and disagreeable odor. Mex. G.C. III. 51:114.—*E. tripunctatum*, Lindl. Intro. in 1881 and now reappearing in cult.

GEORGE HANSEN.

GEORGE V. NASH.†

**EPIDIACRIUM** (compounded of Epidendrum and Diacrium). *Orchidaceæ*. A genus established to contain hybrids between Epidendrum and Diacrium.

The following is sometimes found in collections: *E. Cölmarii* (*E. ciliare* × *D. bicornutum*).

**EPIGÆA** (Greek, *epi*, upon, *gaia*, earth; in reference to the trailing growth). *Ericaceæ*. Evergreen spring-blooming plants, herbaceous in appearance but with woody creeping stems, sometimes planted.

Leaves alternate, petiolate, entire, leathery: fls. usually dioecious, sometimes perfect, in short terminal or pseudo-axillary spikes, each in the axil of a green bract and with 2 green bractlets; sepals 5, green; corolla pink or white, salver-shaped, with 5 lobes; stamens 10, attached to the base of the corolla-tube, the 2-celled anthers dehiscing by slits not, as is usual in the *Ericaceæ*, by pores; style columnar; stigma 5-lobed; ovary densely hairy, 5-celled, with many ovules; fr. depressed-globose, fleshy, dehiscent along the partitions, the many minute seeds set on the surface of the white succulent placentæ.—Two species, N. E. Amer. and Japan.

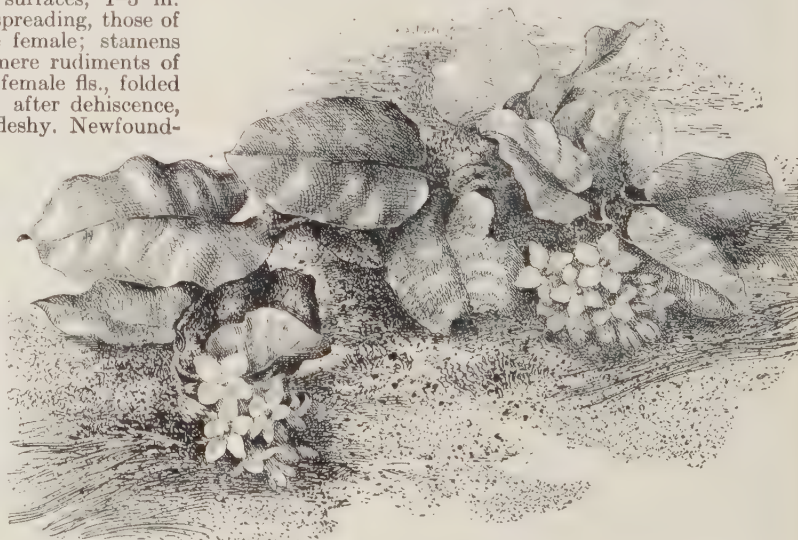
*repens*, Linn. **TRAILING ARBUTUS. MAYFLOWER.** Fig. 1399. Spreading on the ground in patches sometimes 2 ft. diam., the hirsute sts. rooting; lf.-blades ovate-oblong to orbicular, cordate or rounded at the base, obtuse or broadly acute at the apex, sparingly hirsute on the margins and both surfaces, 1-3 in. long; fls. fragrant, the corolla-lobes spreading, those of the male fls. much larger than the female; stamens in the female fls. often reduced to mere rudiments of filaments; stigmas spreading in the female fls., folded together in the male; fr. berry-like after dehiscence, the axis, dissepiments, and placentæ fleshy. Newfoundland to Sask., south to Fla., Ky., and Wis.—It grows only in acid soils.

Trailing arbutus, probably the best beloved of all the early wild flowers of the eastern United States, is rarely seen in cultivation. Yet it thrives in the same acid peaty sandy well aerated soils as the blueberry, and like the blueberry it has in and on its roots a mycorrhizal fungus upon which it probably depends for nutrition. One of the most satisfactory potting mixtures is nine parts finely sifted kalmia peat, one part clean sand, and three parts clean broken crocks. In watering the plants one should use rain-water, bog-water, or some other water free from lime.

Wild plants may be transplanted, preferably in autumn or very early spring, care being taken to lift a large portion of the root-mat without disturbing the roots. Such plants should be kept in a coldframe or coolhouse and until abundant new roots are formed should receive little or no direct sunlight. They may be propagated by division or by layers, but the resulting plants are seldom symmetrical.

The best method of propagating trailing arbutus is by the seed. The fruit, which is often borne in abundance on vigorous female plants, ripens at the same season as the wild strawberry. At maturity and while still herbaceous the wall of the fruit splits from the center into five valves which turn backward in a green rosette exposing the white fleshy edible berry-like interior,  $\frac{1}{4}$  to  $\frac{1}{3}$  of an inch in diameter and dotted with seeds. The fruits disappear quickly after dehiscence, commonly within a few hours, being eagerly sought by ants, snails, and birds. A fruit bears usually 300 to 500 seeds. The seeds, which are easily separated from the pulp by rubbing between the fingers, should be sown at once in a well-drained shallow box, in a mixture of two parts finely sifted kalmia peat and one part of clean sand, covered about  $\frac{1}{8}$  of an inch with the same material, and watered slowly but thoroughly with a very fine rose. If covered with a glass and kept away from direct sunlight a second watering may not be required before germination. The seeds come up in three to four weeks, and in their earliest stages after germination often require protection from ants. This is best accomplished by setting the seed-boxes on pots inverted in saucers of water. In the heat of summer young seedlings, and older plants as well, can not stand full sunlight. A lath shade with spaces of the same width as the lath usually furnishes sufficient protection. In the third or fourth month from germination, when the plants are about  $\frac{3}{8}$  of an inch in diameter, they should be potted in 2-inch pots in the mixture of peat, sand, and crocks already described, and the pots plunged in sand in shallow boxes.

If carried through the first winter in a greenhouse, with a night temperature of 55° to 60° and a day temperature of about 65° to 70°, the plants continue their growth all winter, and in the following summer some of them even without transfer to larger pots will lay down a few clusters of flower-buds, in preparation for the next spring's blooming, when they are a year and a half old. Many of the plants, however, do not flower until they are two and a half years old, their



1399. Trailing arbutus or Mayflower —*Epigaea repens*.





XXXVIII. The California poppy.—*Eschscholtzia californica*.





rosettes having reached a diameter of about 7 to 10 inches.

The flower-buds are formed from midsummer to autumn. If the plants are kept in a warm greenhouse during the winter the flower-buds seldom open. To make them open normally the plants must be subjected to a prolonged period of chilling. Actual freezing is not necessary. The best chilling temperature for the greenhouse is a little above freezing, about 35°. Alternate freezing and thawing, with strong sunlight, is likely to injure the foliage. Strong sunlight without freezing heightens the color of the flowers. After two to three months of chilling the plants may be forced, if early flowers are desired, by alternating the same low night temperature with a day temperature of 45° to 60°. Plants kept in a cool humid atmosphere often remain in flower three to four weeks, redolent with their well-known delightful fragrance. The male flowers, with their yellow centers, are much larger and prevailing much pinker than the green-centered female flowers. In cultivated plants the corollas sometimes have a spread of  $\frac{1}{8}$  of an inch. The most robust plants have been secured by plunging the pot in moist sphagnum in a pot of 2 inches greater diameter. The roots then grow through the hole in the bottom of the inner pot and develop profusely in the moist, well aerated sphagnum of the outer pot. Old plants which have become ragged at the center may be revived by cutting the stems back almost to the main root immediately after flowering. They then throw out a new circle of branches with new and bright foliage and flower profusely the following spring.

FREDERICK V. COVILLE.

**EPILÆLIA** (compounded of *Epidendrum* and *Lælia*). *Orchidaceæ*. A genus established to include hybrids of these genera.

*E. belairensis* (*E. ciliare* × *L. autumnalis*).—*E. Charlesworthii* (*E. radicans* × *L. cinnabarina*).—*E. Fletcheriana* (*E. atropurpureum* × *L. harpophylla*).—*E. Hardyana* (*E. ciliare* × *L. anceps*). C. O. 1.—*E. heateriensis* (*E. O'Brienianum* × *L. cinnabarina*).—*E. Lawrencei* (*E. vitellinum* × *L. tenebrosa*).—*E. Lionetii* (*E. atropurpureum* × *L. purpurata*).—*E. Margaritæ* (*E. Parkinsonianum* × *L. grandis*).—*E. Sylvia* (*L. cinnabarina* × *E. Cooperianum*).—*E. Veitchii* (*E. radicans* × *L. purpurata*).—*E. vitellbrosa* (*E. vitellinum* × *L. tenebrosa*).

GEORGE V. NASH.

**EPILØBIUM** (Greek, *upon the pod*, referring to the structure of the flower). Including *Chamænerion*. *Onagraceæ*. Border plants, with willow-like foliage, and large showy spikes of deep pink, rosy crimson or white or even yellow flowers borne from June to August.

Herbs or sub-shrubs, sometimes annual, erect, sprawling or creeping: lvs. alternate or opposite, toothed or entire: fls. axillary or terminal, solitary or in spikes or racemes, rosy purple or flesh-colored, very rarely yellow; calyx-tube little, if at all, produced beyond the ovary; petals 4, obovate or obcordate, erect or spreading; stamens 8; ovary 4-celled; seeds comose; stigma often 4-lobed: caps. long and narrow, 4-sided and 4-valved.—Species about 200 or more, in many parts of the world, mostly in temperate regions.

The taller species, like *E. angustifolium* and *E. hirsutum*, make very rank growth in moist places, and are therefore especially adapted for the wild garden or for naturalizing along the water's edge and in low meadows. The underground runners reach far, and the plants spread fast when not kept in bounds. Propagation is by division or seeds.

*angustifolium*, Linn. (*E. spicatum*, Lam. *Chamænerion angustifolium*, Scop.). GREAT WILLOW-HERB. FIRE-WEED. In cult. mostly branched and 3-5 ft. high; in the wild simple or branched, 2-8 ft. high: lvs. alternate, very short-petioled, lanceolate, entire or

minutely toothed, 2-6 in. long, 4-12 lines wide, pale beneath, acute, narrowed at bases: fls. spreading, in long, terminal spike-like racemes, petals rounded at tip; stigma 4-lobed: caps. 2-3 in. long. Eu., Asia, N. Amer. B.B. 2:481. Var. *álba*, Hort., has pure white fls. suitable for cutting; also occurs wild. This variety was perfected in England. It forms a compact bush.

*hirsutum*, Linn. Stout, 2-4 ft. high, with short but conspicuous soft straight hairs: lvs. oblong-lanceolate, usually opposite, sessile and often clasping, with many small, sharp teeth, 1-3 in. long, pubescent on both sides: fls. erect, axillary, about 1 in. across; petals notched: weed from Eu., showy, and sometimes found in old gardens.

*Dodonæi*, Vill. (*E. rosmarinifolium*, Haenke). Perennial, 1-3 ft., blooming in midsummer, mostly erect: lvs. linear, tapering somewhat toward either end, entire, smooth or somewhat soft-hairy: fls. red, the infl. terminal on the branches. Eu.

*obcordatum*, Gray. Glabrous perennial: decumbent, sts. 3-5 in. long, 1-5-flid.: lvs. numerous, opposite, ovate, sessile,  $\frac{3}{4}$  in. or less long: fls. bright rose-color, the petals  $\frac{1}{2}$  in. long and obcordate; stamens yellow, shorter than declining style: caps. short and thick. Calif. in the high Sierras, and in Nev.—Offered as an alpine. A handsome species.

*luteum*, Pursh. Nearly simple, 1-2 ft., nearly glabrous: lvs. ovate or elliptical to broad-lanceolate, toothed, slightly fleshy, 1-3 in. long, sessile or with a short-winged petiole: fls. bright yellow, the petals  $\frac{3}{4}$  in. long; style often exserted: caps. long-stalked, somewhat puberulent. Ore. to Alaska.

*E. abyssinicum album* is offered abroad, as "pure white, pretty" the name does not appear to have botanical standing.—*E. latifolium*, Linn. (*Chamænerion latifolium*, Sweet). Erect, caespitose, about 1  $\frac{1}{2}$  ft.: lvs. lanceolate or ovate-lanceolate, tapering at both ends, thick: fls. purple, showy, sometimes 2 in. across. Newfoundland to Ore. and north.

L. H. B.

**EPIMEDIUM** (Greek, *like Medion*, a plant said to grow in Media; a name from Dioscorides, retained by Linnaeus). *Berberidaceæ*. Herbs suitable for rock-gardens and shady places.

This genus contains some of the daintiest and most interesting plants that can be grown in the hardy border, and *E. macranthum*, particularly, is as distinct, complicated and fascinating as many of the rare, tender and costly orchids. The whole family to which it belongs is exceptionally interesting, and is one of the most striking of those rare cases in which the cultural, botanical and artistic points of view have much in common. Of the 8 or 9 genera of this family only *Berberis* and *Nandina* are shrubs, all the others being herbs, with creeping, underground sts., and all small, choice, curious, and cult. to a slight extent, except *Bongardia* and *Leontice*. *Podophyllum* contains our mandrake; *Caulophyllum* the quaint blue cohosh; and the others are *Aceranthus*, *Achlys*, *Diphylleia*, *Jeffersonia* and *Vancouveria*. A collection of all these plants should make a charming study. What appear to be petals in *E. macranthum* are really the inner row of sepals, colored like petals, and performing their functions, while the long spurs or nectaries are supposed to be highly specialized petals. *Epimedium* has 8 sepals and 4 petals, which are mostly small and in the form of nectaries: stamens 4: caps. opening by a valve on the back: lvs. pinnately twice or thrice dissected. They grow a foot or two high. For *E. diphyllum*, see *Aceranthus*, which is distinguished by its flat, not nectary-like petals, and its lvs. with a pair of lfts. on each of the 2 forks of the petiole.—There are 11 species, all natives of the northern hemisphere, but some are found as far south as N. Afr. There is none native in Amer. The Garden, 48, p. 486, shows what a charming picture can be made of the foliage alone when cut and placed in a bowl. The plants retain their foliage all winter, especially in sheltered spots under trees.

Epimediums thrive best in partial shade, and are particularly well suited for rockeries and the margins of shrubberies. Almost any soil will answer for them. The peculiar bronzy tints of the young foliage con-

tion, its spurs having an individuality difficult to describe. Var. *rùbrum*, Hort., is presumably an error, as a red-fl. form would be very unexpected.

AAA. *Spurs much shorter than the inner sepals, being, in fact, merely small nectar-glands.*

B. *Lvs. once or twice ternate.*

*pinnatum*, Fisch. Fig. 1400. Lvs. usually biternate, with 5 lfs., 3 above and 1 on each side; lfts. with a deeper and narrower basal cut than in *E. macranthum*, the whole plant densely hairy; scape about as long as the fully developed lvs.; fls. typically bright yellow; nectaries red, a third or a fourth as long as the inner sepals. Shady mountain woods of Persia and Caucasus. B.M. 4456. Gn. 46:356, (erroneously as *E. macranthum*); 48, p. 486. G. 18:706.—Best suited to the alpine garden.

Var. *élegans*, Hort., presumably has larger, brighter and more numerous fls. *E. sulphureum* of European catalogues is regarded by J. W. Manning and J. B. Keller as a pale yellow-fl. form of *E. pinnatum*, but by Voss as a variety of *E. macranthum*. A yellow form of the violet-fl. *E. macranthum* would be very surprising.

Var. *colchicum*, Hort. (*E. colchicum*, Hort.), has brilliant golden yellow fls. and nectaries 1-1½ lines long.

BB. *Lvs. always once ternate.*

*Perralderianum*, Coss. This is the African representative of *E. pinnatum*, from which it differs in the key characters and also in the much more strongly ciliate-toothed lfts.; when young the lfts. have rich bronze markings, making a handsome showing. Its fls. are a "paler yellow than the typical *E. pinnatum*. It is far from improbable that specimens connecting them will be found in S. Eu., if not in Afr." Algeria. B.M. 6509.—Lvs. remain all winter. Less desirable than *E. pinnatum*.

*E. diphyllum*, Lodd. See *Aceranthus diphyllus*.—*E. niveum* is catalogued by Van Tubergen as a synonym of *E. Musschianum*, but the chances are that all the plants advertised as *E. niveum* are *E. macranthum* var. *niveum*. The spurs are so obviously longer in *E. macranthum* that there is no reason for confusion.

WILHELM MILLER.

N. TAYLOR.†

**EPIPÁCTIS** (Greek, *epipegno*; it coagulates milk). *Orchidaceæ*. Hardy terrestrial orchids of minor value.

Leafy orchids with creeping rootstocks and unbranched sts.: lvs. ovate or lanceolate, with plaited veins; fls. purplish brown, nearly white or tinged red; lower bracts often longer than the fls.; sepals free, spreading, nearly as large as the petals; lip free, deeply concave at base, without callosities, narrowly constricted and somewhat jointed in the middle, the upper portion dilated, petaloid.—Ten or a dozen species in the north temperate zone. The first mentioned may be secured through dealers in native western and Japanese plants; the second is listed in the American edition of a Dutch catalogue. For other definitions of the name *Epipactis*, see *Goodyera*.

*Royleana*, Lindl. (*E. gigantea*, Douglas). Stout, 1-4 ft. high; lvs. from ovate below to narrowly lanceolate above, 3-8 in. long; fls. 3-10, greenish, strongly veined with purple. June, July. Wash. to Santa Barbara, east to S. Utah and W. Texas, on banks of streams. Also Himalayas. Intro. 1883. Mn. 8:145.

*atrórubens*, Schult. (*E. rubiginosa*, Crantz). Lvs. often reddish; fls. and ovary dark purple; lip oval, acute, or slightly notched; bracts equaling the fls. or rarely longer. July-Sept. Eu., W. Asia. L. H. B.

**EPIPHRONITIS** is a bigeneric orchid hybrid of *Epidendrum* and *Sophranitis*, for a picture of which see R.H. 1896:476. It has about 10 fls., chiefly a brilliant scarlet, set off with bright yellow. Gt. 46, p. 555.



1400. *Epimedium macranthum*. a, *E. alpinum* var. *rubrum*; b, *E. pinnatum*; showing three types of spur or nectary.

trast well with the variously colored flowers. Propagation by division. (J. B. Keller.)

A. *Spurs conspicuous, often 1 in. long, sometimes twice as long as the showy inner sepals.*

*macranthum*, Morr. & Decne. Fig. 1400. Lvs. thrice ternate; lfts. cordate-ovate, unequal at the base, sharply toothed; petioles with short, spreading, conspicuous hairs; outer sepals sometimes colored bright red, remaining after the larger and showier parts of the fl. have fallen; inner sepals ovate-lanceolate, violet; spurs white. Japan. B.R. 1906. P.M. 5:151. Not Gn. 46:356, which is *E. pinnatum*. Var. *niveum*, Voss (*E. niveum*, Hort.), has pure white fls. G.W. 3, p. 591. Var. *roseum*, Voss (*E. roseum*, Hort. *E. niveum* var. *roseum*, Hort.), has fls. white, tinged with pink or pale rosy red. Var. *violaceum*, Voss (*E. violaceum*, Morr. & Decne.), has violet spurs, shorter than in *E. macranthum*, but much larger than in the other species. B.M. 3751. B.R. 26:43. H.F. 4:168.—A very interesting species. The *E. lilacea* advertised in some American catalogues seems to belong here. *E. lilacea* is a name unknown in botanical literature.

AA. *Spurs medium-sized, nearly as long as the inner sepals.*

B. *Inner sepals bright red.*

*alpinum*, Linn., var. *rùbrum*, Hook. (*E. rùbrum*, Morr.). Fig. 1400. Lvs. biternate (but Hooker's picture shows tendency to thrice ternate condition), minutely toothed; spurs white, marked with red, as in Fig. 1400, which shows the very distinct appearance of the fls. Japan. B.M. 5671. R.B. 3, p. 33.—Hooker says this differs in no way from *E. alpinum*, except in the larger and red fls., while the type which grows wild in England (though probably not native) has dull reddish yellow fls., and, though advertised, is probably not in cult.

BB. *Inner sepals whitish or pale yellow.*

*Musschianum*, Morr. & Decne. Lvs. only once ternate, sharply toothed, as in *E. macranthum*: all floral parts whitish or pale yellow. Japan. B.M. 3745.—The least showy kind, but worth growing in a collec-



**Veitchii**, Hort. (*Epidendrum radicans* × *Sophranitis grandiflora*). Fls. like those of *Epidendrum radicans*, which it much resembles in habit, but the parts all broader. C.O. 1.

GEORGE V. NASH.

**EPIPHYLL**. A plant that grows on a leaf. It is a kind of epiphyte. The epiphylls are algæ, lichens, liverworts, and mosses. The name is applied to those species or kinds that find their physical support on foliage leaves rather than to those that are parasitic on them as are the fungi. Epiphyllous plants are likely to be most abundant in the tropics.

**EPIPHYLLÁNTHUS** (*flower upon the leaf*). *Cactaceæ*. Epiphytic: sts. much branched, jointed, ribbed: areoles bearing setæ instead of spines: fls. resembling those of *Zygocactus*; ovary angled.—One species known. Native of Brazil. For cult., see *Succulents*.

**obtusángulus**, Berger (*Cereus obtusángulus*, Schumann). Joints somewhat flattened, about 10-ribbed: stamens of two kinds.—Although usually considered a *Cereus*, it is more closely related to *Zygocactus*, but from both it seems generically distinct. Indeed Berger says it resembles certain *Opuntias* and seems to have a relationship with *Rhipsalis*. It is not grown in this country, and is still rare in Eu.

J. N. ROSE.

**EPIPHÝLLUM** (*on a leaf*; refers to the leaf-like branches on which the flower grows). *Cactaceæ*. Spineless upright branched flat-stemmed cacti with very large and showy flowers, some of them popular as houseplants.

Branches flat, 2-edged, crenate or serrate on the margins, spineless: fls. usually large, mostly nocturnal; petals white, red, or yellow; stamens elongated, numerous: fr. oblong in outline, bearing a few bracts, red, juicy; seeds numerous, black. In the Cyclopedia of American Horticulture, the name *Phyllocactus* was used for this genus, but this is a much later name and hence it is given up. The epiphyllums of the first Cyclopedia will be found under *Zygocactus*. For cult., see *Succulents*.

Several hundred hybrids are in the trade, the most common ones being with *E. crenatum*, *E. Ackermannii* and *E. phyllanthoides*. Fig. 1401. Crosses are often made with the various *Cereus* allies, such as *Heliocereus speciosus*, and with some species of *Echinopsis*.

A. Tube of fl. always elongated, usually much longer than the limb; petals white or yellowish: mostly night-bloomers.

B. Style white.

C. Branches thin, usually spreading in some plane: petals pure white.

**oxypétalum**, Haw. (*Phyllocactus grándis*, Lem.). Very large, sometimes 20 ft. long, with numerous short side branches, and these in the same plane with the main st., thin and lf.-like: fl. large (nearly a foot long), white, night-blooming (sometimes described as day-blooming). Originally from Mex., but said to be found in Honduras and Guatemala; also reported from Cuba, but surely not native there. G.W. 10:560 (as *Phyllocactus latifrons*).—One of the commonest and best species in cult.

CC. Branches thick, not spreading in the same plane: petals cream-colored or yellow.

D. Fls. large: sts. with shallow crenations.

**crenátum**, Don (*Phyllocactus crenátus*, Lem.). Sts. about 3 ft. long, erect, thick, strongly crenate, somewhat glaucous: midrib very thick: fl. large, 6–10 in. long, said to be a day-bloomer; petals white or cream-colored in life, drying yellow; tube 4–5 in. long; style said to be white; very fragrant. Guatemala and S. Mex., and said to come from Honduras.

DD. Fls. small for the genus: sts. with deeply cut margins.

**angùliger**, Don (*Phyllocactus angùliger*, Lem.). About 3 ft. high, much branched below: branches narrow, thick, with deeply cut margins: fls. 5–8 in. long, with a slender tube; petals yellow.

BB. Style red.

C. Sts. stiff, erect.

**strictum**, Brit. & Rose (*Phyllocactus strictus*, Lem.). Erect, branching, reaching a height of 10 ft., with long cylindrical branches and shorter, lf.-like secondary branches: crenatures or teeth rather deep, unequal on the opposite sides: bristles wanting: tube of the fl. very long and slender, outer sepals brownish, inner pure white; the fl. opens late in the evening and closes before dawn; in full bloom the sepals are very strongly recurved. Said to come from Cuba.—Often found in collections under the name of *P. latifrons*.

CC. Sts. rather weak, spreading.

D. Petals very narrow: areoles bearing black bristles.

**látifrons**, Zucc. (*Phyllocactus látifrons*, Link. *P. stenopétalus*, Salm-Dyck?). Branches very long and large, crenate or somewhat serrate, acute or acuminate: midrib and usually side ribs evident: areoles with rather large scales and dark bristles: fl. 8–10 in. long, spreading and in full bloom bent backward; petals narrow. Supposed to be from Mex., but not known from wild material.—Much advertised as the queen cactus.

DD. Petals broader: areoles without bristles.

**Hodkeri**, Haw. (*Phyllocactus Hodkeri*, Salm-Dyck). Sts. 6–10 ft. high: branches rather thin, light green, strongly crenate: fls. night-blooming, 8–9 in. long; fl. tube narrow, tinged with yellow; sepals narrow, lemon-yellow; petals pure white, narrow, 2 in. long; stamens in a single series; style red. Brazil and Guiana. B.M.



1401. One of the many hybrid Epiphyllums.

2692 (as *Cactus phyllanthus*).—Although long in cult., the species is not now well known, there being 2 or more closely related species in cult. under this name.

AA. Tube of fls. short, always shorter than the limb: day-bloomers.

B. Style reddish: fls. 4½ in. broad.

**Áckermannii**, Haw. (*Phyllocactus Áckermannii*, Salm-Dyck). Fig. 1402. Sts. numerous, sometimes reaching 3 ft., somewhat recurved: branches usually less than a foot long, with evident middle and side ribs: areoles on the lower and younger shoots bearing short bristles: fls. scarlet-red outside, carmine-red within,

the throat greenish yellow, tube very short, the limb wide-spreading, 4-6 in. diam. B.R. 1331.—Not known in the wild state.

BB. *Style white; fls. smaller than the last.*

**phyllanthoides**, Sweet (*Phyllocactus phyllanthoides*, Link). Branches at length hanging, cylindrical at base, lanceolate above; serratures obtuse; middle and side ribs evident; bristles few; fl.-tube 2 in. long or less, with spreading scales, the limb somewhat longer, often striate. S. Mex.

J. N. ROSE.

**EPIPHYTES.** Literally "air plants:" those plants that do not grow in earth or water, but are supported in air on trees or other objects and usually drawing no organic nourishment from such object or support.

True epiphytes are widely distributed in all climates, but it is in the moist tropics that they become so numerous and conspicuous as to arouse the special interest and enthusiasm of the serious student as well as of the traveler or casual observer. One thinks of epiphytes as growing upon trees, and trees are usually the supporting plants. The term merely signifies that ecological type that has the habit of growing upon other plants, although in this account it is not the purpose to discuss such seaweeds or other algae as grow upon larger plants in the water. The word epiphyte also involves a contrast with parasite, the latter denoting that nourishment and water are derived from the living tissues of the supporting plant or host. The epiphytic habit implies no particular method of nutrition, and the epiphytes are entirely independent of the nutrition of the

supporting plant. This habit is not restricted to a single class, or to a few families of plants, although in some families many representatives of the type have been developed, while in related families there may be none. The seed plants are represented by many species of tropical orchids, arums, bromeliads, and numerous others; lycopods, ferns, mosses and liverworts all contribute many examples; and in the lower groups of plants the lichens are in some regions dominantly epiphytic.

The luxuriant tropical rain-forest is regarded as the climax in development of vegetation. In describing this type, Humboldt declared that "forest is piled upon forest." Under such conditions the trunks and branches are clothed with larger epiphytes, and the leaves of some species accommodate algae and lichens. It is in the South American tropical forests that the better known of our greenhouse epiphytes are native. Orchids, bromeliads, and arums are among the most abundant. In the Javanese forests, the wealth of species is great, but mosses, ferns and lycopods are particularly numerous, and these are accompanied by some interesting species of *Ficus*, epiphytic for a time, and by the striking *Rhododendron javanicum*, among others. In the mountain forests of tropical regions there are, as epiphytes, representatives of several families of ferns, likewise many mosses and lichens. The dicotylous and certain coniferous forests of Europe and America harbor a few mosses and liverworts and numerous species of lichens. A conspicuous epiphyte of the southern states, as well as of tropical America is the long or Florida moss, *Tillandsia usneoides*, the extremest epiphyte among the Bromeliaceæ. Accompanying this, the common polypody fern is also found on trees. Going northward, the total number of epiphytic lichens may decrease, but several of the larger forms seem to become more abundant and some of the moss-like usneas extend to the northernmost latitude of tree growth.

The habit of growing upon trees renders epiphytes subject to an inconstant water-supply. On this account the larger and more delicate epiphytes are restricted to regions constantly moist. Even in the moist forest, the species less resistant to drying out are found on the lower branches, and those more resistant maintain themselves higher up, so that there is a distribution in strata, analogous to the lateral distribution of species about the edge of a pond. In general, however, there is exposure to drying out, and, as might be anticipated, these plants exhibit the structural characteristics of xerophytes (dry-land plants). Many of them are modified so that transpiration is reduced, and they are able to withstand considerable desiccation. Among greenhouse forms this is notably true of many orchids and lichens. Moreover, many species of orchids possess special tissues to which water is transported and there accumulated as a "reserve" supply. Leaf-tissues may function in this way, but usually more important are the bulb-like enlargements of the stems.

Of special interest are the organs of absorption of certain epiphytes. Aërial roots are characteristic of tropical arums and orchids. The typical air-root is provided with an outer cylinder of tissue, the velamen, derived from the epidermis, consisting at maturity of dead cells capable of taking up liquid water and substances in solution like a sponge. From these roots as capillary reservoirs, the supply is gradu-



1402. *Epiphyllum Ackermannii*. ( $\times \frac{1}{2}$ )



ally absorbed by the living tissues. Rain, dew, or moist substrata may furnish the water, but the view that these roots absorb water vapor is erroneous. The Bromeliaceæ are peculiar in the possession of certain absorbing leaf-scales or hairs. The Florida moss possesses such hairs over the entire surfaces of the thread-like stems and leaves, and the plant is rootless. There are all gradations between this and the soil-rooted pineapple-like forms. The arrangement of the leaves in many of the bromeliads possessing larger leaves is such as to establish after a rain a temporary reservoir about the leaf-bases. The absorbing scales of the bromeliads exhibit features worthy of note in three particulars: (1) When dry certain dead cells absorb water greedily; (2) with absorption they assume a position making possible the entry of water to a considerable surface of living cells, and (3) with collapse, due to loss of water, the spaces admitting water are closed and loss is minimized.

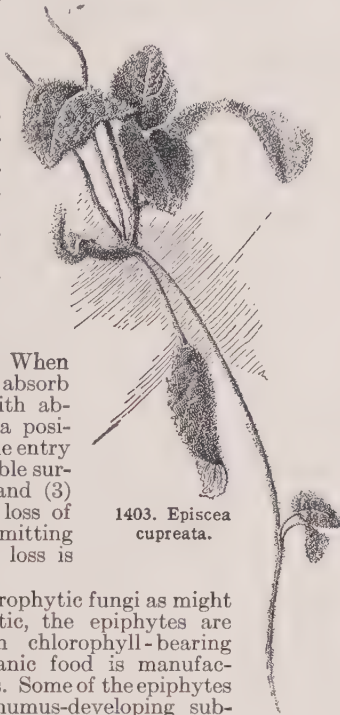
Aside from such saprophytic fungi as might be considered epiphytic, the epiphytes are amply provided with chlorophyll-bearing tissue; therefore, organic food is manufactured as in other plants. Some of the epiphytes growing upon such humus-developing substrata as the decaying bark of trees, or such as passively accumulate humus and other materials in the vicinity of their absorbing surfaces, might absorb some organic compounds as well as salts in this way; but this supply of organic matter is certainly inconsequential in most cases. Water and salts are secured either through the air-roots, as described, or partially through normal roots, when such occur. Many species, epiphytic at first, ultimately send roots into the soil, and then secure water and salts largely through the terrestrial habit.

In the forest, certain of the seed-bearing epiphytes are specialized with respect to supporting plants, often due to the special nature of the protection offered, or to the physical advantages of the substratum in regard to fixation of the plant. Most species are markedly unspecialized and may be grown in the greenhouse most successfully.

B. M. DUGGAR.

**EPIPRÉMNUM** (*upon the trunk of trees*). *Araceæ*. Resembling the genus *Rhaphidophora* but has fewer ovules, 2 or more 1-seeded berries not confluent, and albuminous kidney-shaped instead of almost terete seeds. About 8 species from Malay and Polynesia. *E. giganteum*, Schott. A robust climber over 100 ft. high, the sts. emitting long rope-like roots from every growth: lvs. cordate-oblong, 6-8 ft. long, including the petiole which is as long as the blade and winged throughout its length: spathe about 1 ft. long, ending in a curved beak-spadix as long as spathe. Malay Penins. B.M. 7952.

**EPÍSCIA** (Greek, *shady*; they grow wild in shady places). *Gesneriáceæ*. Choice and interesting warm-house plants, *E. cupreata* being much prized for baskets



1403. *Episcia cupreata*.

Herbs, with long, short or no hairs: st. from a creeping root, branched or not: lvs. opposite, equal or not in size: fls. pedicelled, axillary, solitary or clustered; corollas mostly scarlet, rarely whitish or purplish; tube straight or curved, more or less spurred at the base; limb oblique or nearly equal; lobes 5, spreading, rounded —Perhaps 30 species, all Trop. American.

*Episcia cupreata* is one of the standard basket plants, especially for the warmest greenhouses. It can also be used in pyramids and mounds, as told under *Fittonia*. As it does not require so close an atmosphere as the *fittonias*, it can be grown in some living-rooms and perhaps outdoors in summer in a shady place. Its chief charms are the slender, trailing habit, the soft hairiness of the leaves, the coppery hue, which is often laid on like paint in two broad bands skirting the midrib, and the rarer and perhaps finer metallic bluish luster of which one occasionally gets a glimpse in a finely grown specimen. Give very rich, fibrous loam, mixed with peat, leaf-mold and sand; in summer partial shade. (Robert Shore.)

A. Fls. pale lavender to white.

**chontalénsis**, Hook. (*Cyrtodeira chontalénsis*, Seem.). St. stout, more or less ascending, dark reddish purple, 6-10 in. long; lvs. opposite and irregularly whorled, 3-4 in. long, oblong-ovate to elliptic-ovate, crenate, obtuse, rounded at the base, decidedly convex on both sides of the midrib and between the much-sunk veins; margins recurved, green, marked with regular purple patches, which advance from the margins between the veins toward the midrib and are more or less oblong: fls. solitary or in small clusters; corolla-tube with a sac at the base, the limb oblique, 1½-2 in. across, with small and regular but conspicuous and beautiful teeth. Chontales region of Nicaragua. B.M. 5925. R.B. 22:241. F.S. 18:1924.

AA. Fls. scarlet.

B. Lvs. usually not green, or only partially so.

**cupreata**, Hanst. (*Achimenes cupreata*, Hook.). Fig. 1403. Sts. slender, creeping, branched, rooting at the joints, with a main branch rising erect a few inches, which bears the fls. and the largest lvs.: lvs. copper-colored above: fls. solitary, 9 lines wide, scarlet, with a small sac and denticulate limb. Nicaragua. B.M. 4312. Var. *viridifolia*, Hook., has green foliage and larger fls., 1 in. across. B.M. 5195.

**coccinea**, Benth. & Hook. (*Cyrtodeira coccinea*, Hort., B. S. Williams). Lvs. dark metallic green, 3-4 in. long, 2½-3 in. wide.—Free-flowering. Some of the plants sold as *E. metallica*, a name otherwise unknown in botanical literature, probably belong here.

BB. Lvs. a rich dark green.

**fúlgida**, Hook. A beautiful, creeping, much-branched hothouse plant, covered throughout with soft villous pubescence: lvs. ovate to elliptic, wavy and serrate margined, ciliate: fls. axillary, solitary, the calyx prominently 1-sided, the sepals with recurved tips; corolla bright red, the limb deeper colored than the tube which is about 1½ in. long; corolla-lobes rounded and hairy toward the throat. N. S. Amer. B.M. 6136. G.W. 3, p. 161.

WILHELM MILLER.  
N. TAYLOR.†



1404. *Equisetum hiemale*.—Common scouring-rush.

**EQUISETUM** (from the Latin *equus*, horse, and *sela*, bristle). *Equisetáceæ*. Contains the weeds known as horse-tails, or scouring-rushes which are suitable for naturalizing in waste

and wet places and help to hold sandy banks. The following have been advertised by dealers in native plants: *E. arvense*, *E. hiemale* (Fig. 1404), *E. lævigatum*, *E. limosum*, *E. pratense*, *E. robustum*, *E. scirpoides*, *E. sylvaticum*, *E. variegatum*. For descriptions, consult the manuals of native plants. They grow usually in moist or swale-like places. They are flowerless plants, allied to ferns and club-mosses.

Of the species named above, *E. arvense* has been found to have a poisonous effect on grazing stock when it occurs in any quantity in hay or pasturage.

R. C. BENEDICT.†

**ERAGRÓSTIS** (Greek, *er*, spring, and *agrostis*, a grass). *Gramíneæ*. LOVE-GRASS. Annual or perennial grasses with more or less diffuse panicles of small several-flowered compressed spikelets. Some species grown in the open for ornament.



1405. *Eragrostis suaveolens*. ( $\times \frac{1}{4}$ )

From 6 in. to several feet tall: culms simple or often branched; lemmas keeled, 3-nerved, the palea ciliate on the keels.—Species about 100 in warm and temperate regions of both hemispheres.

Some annual species are common weeds, such as *E. megastachya*, Link (*E. major*, Host), STINK- or SNAKE-GRASS, with rather large, ill-smelling spikelets in a compact panicle. Dept. Agric., Div. Agrost. 17:215. *E. pectinacea*, Nees, a native of U. S., is a handsome perennial, with large open panicles of purple spikelets. Well adapted to cult. in sandy soils. Ibid 17:261. *E. obtusa*, Munro (*Briza geniculata*, Thurb.), an annual with showy spikelets, is cult. in Eu., but little known in U. S. V. 3:247.

**abyssinica**, Link (*Poa abyssinica*, Jacq.). TEFF. A branching and spreading leafy annual, 1–3 ft.: panicle large and open, 1 ft. long, the branches capillary; spikelets numerous, loosely 5–9-fl., 3–4 lines long; lemmas acuminate, scaberulous on the tip and nerves. Afr.—This and the following are cult. for ornament, the spreading panicles being used for bouquets. The abundant seed used for making bread in N. E. Afr.

**suavèolens**, Becker (*E. collina*, Trin.). Fig. 1405. A spreading leafy annual, 1–2 ft., differing from the

preceding in the less diffuse panicles, the more compact spikelets and the less acuminate lemmas. W. Asia.

**interrúpta**, Doell (*E. elegans*, Nees). An erect annual, 1–2 ft.: panicle feathery, 1 ft. long, rather narrow, the branches ascending, closely fld. with numerous small spikelets. Brazil.

**amábilis**, Wight & Arn. (*Poa amabilis*, Linn.). Erect or spreading annual, 1–2 ft.: panicles small, 4–6 in., rather compact; spikelets purple, many-fl., 3 lines long, 1 line wide. India.

**máxima**, Baker. An erect, robust annual, 2–3 ft.: blades lanceolate, cordate at base: panicle erect, lax, 6–9 in. long and broad, the pedicels capillary; spikelets oblong,  $\frac{1}{8}$ – $\frac{1}{2}$  in. long. Madagascar.

A. S. HITCHCOCK.

**ERÁNTHEMUM** (Greek, *lovely flower*). *Acanthaceæ*. Tropical shrubs and sub-shrubs, some of which are cultivated chiefly for their foliage and others for their flowers.

Leaves entire or rarely coarsely toothed: fls. white, lilac, rosy or red, borne in various ways; bracts and bractlets narrow, small; corolla-tube long, slender, cylindrical throughout or rarely with a short throat; limb 5-parted; stamens 2; ovules 2 in each cell; seeds 4 or fewer.—Perhaps 30 species. The genus *Dædalacanthus*, although in a different tribe, is separated only by a combination of technical characters, but the garden forms of both genera described in this work are all distinguishable at a glance. For cult., see *Jus-ticia*. Consult *Dædalacanthus* for related species.

A. Fls. purple.

**laxiflórum**, Gray. Height 2–4 ft.: lvs. on the same plant varying greatly in size and shape, those near the fls. 2–3½ in. long, 8–15 lines wide; petioles 2–6 lines long, widest below, at or above the middle, more or less ovate-oblong, obtuse, narrowed at the base: fls. in cymes; stamens 2, perfect, sharp-pointed. Fiji. B.M. 6336.

AA. Fls. pure white.

**tuberculátum**, Hook. Easily told while growing by the many small roundish and rough elevations on the branches: lvs. small,  $\frac{3}{8}$ – $\frac{5}{8}$  in. wide, rarely if ever 1 in. long, broadly elliptical, obtuse or notched, almost sessile: fls. numerous, borne singly in the axils, in summer; corolla-tube very long and slender, 1½ in. long; limb 1 in. across; stamens scarcely exerted. Habitat unknown. B.M. 5405.

AAA. Fls. white, speckled with red-purple.

B. Foliage netted with yellow.

**reticulátum**, Hort. (*E. Schömburgkii*, Lind.). Height 4 ft.: upper lvs. 2–7 in. long, ovate-lanceolate, characteristically netted with yellow; lower lvs. 6–10 in. long, not netted, but the veins prominent and yellow: fls. racemose; corolla speckled with blood-red at the mouth; anthers reddish brown, exerted. Possibly Austral. B.M. 7480. I.H. 26:349.

BB. Foliage not netted with yellow.

**Ándersonii**, Mast. Lvs. lanceolate or elliptic, narrowed into a short stalk: fls. in a spike 6 in. long; lower middle lobe of the corolla larger and speckled with purple. Trinidad. Gn. 45:11. G.Z. 25:49.

The following trade names belong to plants grown chiefly for their foliage. Probably many of them belong in other genera.—*E. albo-marginátum*. Lvs. broadly margined with white and irregularly suffused gray.—*E. atrosanguineum*, Hort. Intro. by W. Bull, 1875. Lvs. large, dark, wine-purple, or blackish crimson, ovate entire, opposite, stalked. Said to endure the hottest sunshine.—*E. cultrátum*. "Lvs. shining, thick, deep-veined."—*E. Dutrebrayianum*, Hort., is supposed to be a garden hybrid. Intro. from France in 1907.—*E. Eldorado*. Lvs. greenish yellow, veins deeper yellow.—*E. igneum*. G.W. 3, p. 159. See *Chamæranthemum*.—*E. Magneanum*, Hort., is recorded as a garden hybrid. Intro. from France 1907. Scarcely known in U. S.—*E. nervum rubrum* presumably a misprint for *nervum rubrum*, has lvs. "irregularly shaped, shaded with light and dark green, and blotched



with yellow, which darkens to reddish purple." Possibly=*Fittonia Verschaffeltii*.—*E. nervosum*=*Dædalacanthus nervosus*, T. Anders.—*E. nigrescens*. Presumably with blackish lvs.—*E. pulchellum*, Hort. and And.—*Dædalacanthus nervosus*, T. Anders.—*E. purpureum*. "Lvs. and sts. dark, lurid purple." Siebrecht & Wadley.—*E. Wattii*, Stapf, is probably the correct name for the plant treated as *Dædalacanthus Wattii*, Bedd. See B.M. 8239. G.C. III. 45:89.

WILHELM MILLER.

N. TAYLOR.†

**ERÁNTHIS** (Greek, *er*, spring, and *anthos*, a flower; from the early opening of the flowers). *Ranunculaceæ*. WINTER ACONITE. Low perennial herbs, grown in open flower-beds because of the very early show of bright flowers; very desirable.

Rootstock tuberous: basal lvs. palmately dissected, 1 st.-lf. sessile or amplexicaul just beneath the large yellow fl.: sepals 5-8, petal-like; petals small, 2-lipped nectaries; stamens numerous: carpels few, stalked, many-ovuled, becoming follicles.—About 7 species, natives of Eu. and Asia. The earliest generic name is *Cammarum* which was given in Hill's British Herbal, p. 47, pl. 7 (1756), but it is not accepted by the "nomina conservanda" of the Vienna code.

Winter aconites are very hardy, and at home in half-shady places, among shrubs or in the border.

Propagated by division of roots. The place in which the tubers are planted should be marked during the summer, when the foliage is dead.

*hyemalis*, Salisb. (*Helleborus hyemalis*, Linn.). Fig. 1406. Erect, 5-8 in.: basal lvs. long-petioled: involucre 12-15-parted, the bright yellow fls. always sessile; anthers oblong. Jan.-March, or as soon as frost is out of the ground. Naturalized from Eu. B.M. 3. Mn. 8, p. 43. G.C. II. 11:245. G. 1: 628; 34:277.

Var. *cilicica*, Huth. (*E. cilicica*, Schott & Kotschy). Much like the above: involucre of deeper

and more numerous lobes; anthers ovate instead of oblong; sepals broader, being about  $\frac{1}{2}$  in. across: follicles always straight. Season a few weeks later. G.C. III. 13:266. G.M. 49:180.—The sts., when grown in gardens, said to be red-brown. Roots of this were first sent to England from its native home near Smyrna in 1892. Rare in Amer.

*sibirica*, DC. Much dwarfer, seldom over 3-4 in. high: fls. bright yellow, a little smaller than those of *E. hyemalis*, 5-sepaled. Siberia.

K. C. DAVIS.

**ERCÍLLA** (Peruvian name). *Phytolaccææ*. One twining shrub from Peru and Chile, apparently not in the trade but sometimes cult. in this country for its dense spikes of pale purple fls. and dark purple berries. By some it is united with *Phytolacca*, from which it differs in habit, the coriaceous evergreen lvs., larger bracteoles and technical characters of the fl. *E. volubilis*, Juss. (*E. spicata*, Moq. *Bridgesia spicata*, Hook. & Arn. *Phytolacca volubilis*, Heiml.), has alternate, petioled, ovate-cordate or oblong or orbicular lvs. 1-2 in. long: fls. perfect, in spikes 1-1 $\frac{3}{4}$  in. long, the perianth 5-parted, segms. oblong and obtuse; stamens 8-10, with filiform fleshy filaments, the alternate ones being shorter: carpels 4-8, somewhat impressed in the torus, becoming as many ovoid berries. G.C. II. 9:653. Said to be excellent for covering walls, and climbs by aerial rootlets. It is easily prop. by seeds and cuttings.

L. H. B.

**EREMOCÍTRUS** (Greek, *desert* and *Citrus*). *Rutaceæ*, tribe *Citrææ*. AUSTRALIAN DESERT KUMQUAT. Spiny shrub or small tree: lvs. small, simple or emarginate, thick and leathery, alike on both sides; spines single, long, slender, axillary: fls. small, 4- (rarely 3- or 5-) merous, white, fragrant, borne singly; or 2 or 3 together in the axils of the lvs.; stamens free, 4 times as numerous as the petals: frs. small, subglobose, oblate or pyriform, yellow, with a thin fleshy peel like that of a lime, 4- (rarely 3-5-) celled with 1 or 2 seeds in each cell; cells containing stalked subglobose pulp-vesicles filled with a pleasant acid juice.—Only 1 species of this subtropical Australian genus is known.

*glauca*, Swingle (*Triphasia glauca*, Lindl. *Atalántia glauca*, Benth.). A shrub or small tree bearing edible frs. and occurring in Queensland and New S. Wales, Austral., in subtropical regions subject to severe cold and extreme drought. The lvs. of this plant are small (1-1 $\frac{1}{2}$  ×  $\frac{1}{8}$ - $\frac{1}{4}$  in.), emarginate, and show marked drought-resistant adaptations; both faces of the lvs. show palisade cells, and stomates at the bottom of deep pits; the long and slender spines are borne singly in the axils of the lvs. (see Fig. 1407): frs. subglobose, flattened or slightly pyriform (see Fig. 1408), usually 4-celled and containing globose stalked pulp-vesicles (see Fig. 1408); seeds small, with a longitudinally furrowed and rugose testa. Yearbook Dept. Agric., 1911, pl. 45, fig. 1. Jour. Agric. Research, U. S. Dept. Agric. vol. 2, pp. 85-100, figs. 1-7, pl. 8.—The frs. of this species are used by the settlers in Austral. for jam and pickles and ade is made from the juice. The Australian desert kumquat is the hardiest evergreen citrus fr. known besides being the only one showing pronounced drought-resistant adaptations; it bears in the wild state edible frs. with a pleasant acid juice and a mild-flavored peel. These characteristics make this plant very promising for use in breeding new types of hardy drought-resistant citrus frs. It has been intro. into the U. S. by the Dept. of Agric., and is now growing in the greenhouse of the Dept. of Agric. and in the southern and western states. It can be grafted on the common citrus fruit trees, and can in turn be used as stocks for them.

WALTER T. SWINGLE.

**EREMÓSPATHA** (*solitary spathe*). *Palmaceæ*. Above a half-dozen Trop. African climbing palms, with long slender ringed sts. and pinnate lvs. Apparently none is in the trade. The fls. are perfect; calyx 3-toothed, campanulate; corolla urn-shaped, with 3 short lobes; stamens 6, with broad connate filaments; ovary 3-celled, and stigmas 3: fr. berry-like: lfts. alternate and opposite; rachis spiny, with a long tendril at end.



1408. Fruit of *Eremocitrus glauca*, entire and in cross-section, showing stalked globose pulp-vesicles and furrowed seeds. (Natural size)



1407. Spiny twig of young seedling of *Eremocitrus glauca*. (×  $\frac{1}{2}$ )

**EREMÓSTACHYS** (*deserted* or *solitary spikes*). *Labiataæ*. Outdoor perennial, apparently only 1 species of the 50 or so in the genus being in commercial cult. The genus is allied to *Leonotis* and *Phlomis*, and the species are from Cent. and W.



1406. *Eranthis hyemalis*.

Asia. Erect herbs, with the lvs. mostly radical, large, toothed or cut-pinnatifid; st.-lvs. small, passing into floral bracts: fls. often ochroleucous, in many-ld. whorls in terminal and axillary spikes; corolla-tube included within the calyx; upper lip of corolla erect and hooded, bearded inside; lower lip 3-lobed and the middle lobe largest; stamens 4, with connivent anthers. *E. laciniata*, Bunge, is catalogued abroad. Nearly simple, 12-20 in.: lvs. pinnatisect, the lobes again pinnatifid: fls. yellow or ochroleucous, in midsummer. Asia Minor.—Said to be an attractive perennial. *E. superba*, Royle, reported from Eu., has a strict st., unbranched, 2 ft., root-lvs. pinnatisect, with segms. lobed, forming a rosette: fls. deep primrose-yellow in woolly heads to 6 in. long and 4 in. broad, showy. W. Himalaya.

L. H. B.

**EREMURUS** (Greek name, probably referring to their tall and striking aspect in solitary and desert places). *Liliacæ*. These hardy desert plants, when in flower with their great flower-stalks taller than a man and crowned with a spike of flowers from 1 to 4 feet long, are amongst the most striking objects in the choicer gardens of the North and East.

Root clusters of fleshy fibers: lvs. all from the root, in dense rosettes, long and linear: fls. white, yellow or rosy; perianth bell-shaped or more widely spreading, withering and persisting or finally dropping away; segms. 6, distinct or very slightly united at the base; stamens 6; ovary 3-celled; seeds 1-4 in each cell, 3-angled.—About 20 species, from the mountains of W. and Cent. Asia.

Probably *E. robustus* and *E. himalaicus* are the hardest of all the tall desert-inhabiting plants of the lily family—a family including the poker plant, the aloes, the yuccas, and many others that are not so tall and striking in appearance or else too tender to grow outdoors in the North. Large specimens of *E. robustus* will annually produce a flower-stalk 8 feet or more high, with racemes 4 feet long, remaining in bloom for a month. After flowering the leaves disappear entirely, but early in spring they reappear, and should then be covered with a box or barrel, to protect the forming flower-stalk from late frosts. A mound of ashes over the crown in winter is advisable, or a box with watertight top filled with dry leaves. Both species like a rich soil, moist but well drained, and plenty of water in the flowering period, but none afterwards. Propagation is by division, or slowly by seeds. Large plants are expensive, but they can sometimes be secured large enough to flower within a year or so of purchase. It tries one's patience to wait for seedlings to reach flowering size. The flowers look like small stars. (W. C. Egan.)

A. Fls. rosy.

B. Lvs. linear-ligulate.

**robustus**, Regel. Root-fibers thick and fleshy: lvs. glaucous, glabrous, linear-ligulate, 2 ft. long,  $1\frac{1}{2}$ -2 in. wide, roughish on the margin, with minute recurved teeth: raceme 4-4½ in. wide; stamens about as long as the perianth. Turkestan. B.M. 6726. Gng. 6:52, 324. Gn. 46, p. 335. Mn. 8, p. 123. J.H. III. 29:267. Gt. 61, p. 366. G.C. III. 28:228; 30:426. Var. *álbus*, Hort. Stronger and pure white.—May be grouped in the hardy perennial border with bold effect.

BB. Lvs. ovate-lanceolate.

**Élwesii**, Mich. (*E. Elwesianus*, Hort.). Lvs. light green, ovate-lanceolate, obtuse, flat, not at all rough at the margin, shorter than in *E. robustus*, nearly triangular, even more glaucous, and beginning to decay at the time of flowering: perianth-segms. with a band of deeper color down the middle. Habitat(?). R.H. 1897:280. Gn. 54, p. 99. G.C. III. 24:137; 33:381. G.M. 44:321.—Intro. by Leichtlin as *D. robustus* var. *Elwesii*.

AA. Fls. white.

**himalaicus**, Baker. Fig. 1409. Root-fibers thick and fleshy: lvs. 9-12, ligulate, firm, persistent, 1-1½ ft. long, 6-15 lines wide above the middle: raceme 3-3½ in. wide; stamens about as long as the perianth. Himalayas. B.M. 7076. Gn. 49, p. 131. G.C. II. 16:49. G.M. 44:321; 52:631 (as *E. Elwesii*.)

**Ólgæ**, Regel. Lvs. narrow, glabrous, but with rough margins, about 8-12 in. long and 7-8 lines broad: fls. in a dense raceme, spreading; the white petals with a single brownish nerve down the center. Turkestan. Var. *álbus*, Hort., a white-fl. form is known.

AAA. Fls. some shade of yellow.

B. Color light yellow.

**spectabilis**, Bieb. Root-fibers thick and fleshy: lvs. 6-15, lorate, slightly glaucous, 12-18 in. long, 6-12 lines wide above the middle, noticeably narrowed at the base: raceme 1-1½ ft. long, 2 in. wide; stamens orange, finally twice as long as the perianth. Asia Minor, Persia. B.M. 4870.

BB. Color pure yellow or orange.

**Búngei**, Baker. Lvs. contemporary with the fls., linear, 1 ft. long, less than 3 lines wide: raceme 4-5 in. long, 2 in. wide; stamens finally twice as long as the perianth. Persia. G. 19:31. G.L. 20:155. Gn. 60, p. 53; 66, p. 150. Var. **magnificus**, Hort. A larger form than the type and with brighter yellow fls. Var. **præcox**, Hort. An early flowering more slender form than the type, the fls. smaller and loosely scattered on the spike. Var. **citrinus**, Hort. "More robust than the type and with larger citron-yellow fls."

BBB. Color orange.

**aurantiacus**, Baker. Closely allied to *E. Bungei*, but live plants have less acutely keeled lvs.: root-fibers tapering upward, and orange fls. and stamens. Bokhara, Turkestan. B.M. 113.

During recent years many beautiful hybrid plants have been intro. into cult., often under some specific name which gives no indication of the parentage. Of these the following are known and the parents are indicated when possible.—*E. isabellinus*, Vilm. A hybrid between *E. Bungei* and *E. Ólgæ*. Fls. large, apricot-rose.—*E. Micheliæus*, Hort., is supposed to be a hybrid between *E. Warei* and *E. Bungei*. G.C. III. 40:83, desc.—*E. Tubergemii*, Hort. A hybrid, crossed in Holland between *E. himalaicus* and *E. Bungei*.—*E. vedrariensis*, Hort.—*E. robustus* × *E. spectabilis*? R.H. 1907, p. 229.—*E. Warei*, Hort., is supposed to be a natural Eastern Asiatic hybrid between *E. Bungei* and *E. Ólgæ*. It is described as growing in ordinary seasons about 8 ft. high. The fls. are less bright than in *E. Bungei*, and in rootstock it resembles the later-flowering *E. Ólgæ*. Gn. W. 22: suppl. May 27.

WILHELM MILLER.

N. TAYLOR.†

**ÉRIA** (from Greek for *wool*, as the leaves of some species are downy or woolly). *Orchidacæ*. About 100 species of tropical Asian orchids allied to *Dendrobium* but with eight rather than two or four pollinia, of most diverse habit, and very little in cultivation outside the



1409. Eremurus himalaicus.



collections of botanic gardens and fanciers, being mostly curious and botanical rather than beautiful. They require greenhouse treatment, after the manner of stanhopeas.

**ERIÁNTHUS** (Greek, *erion*, wool, and *anthos*, a flower). *Gramíneæ*. PLUME-GRASS. Tall reed-like ornamental perennials with large woolly plume-like inflorescence.

Spikelets in pairs, one sessile, the other pedicellate, as in *Andropogon*, arranged in spikes, and these in a large terminal panicle, clothed with long hairs, especially around the base, the fertile lemma awned.—Species about 18, warmer regions of both hemispheres.

**Ravennæ**, Beauv. PLUME-GRASS. RAVENNA-GRASS. HARDY PAMPAS-GRASS. Fig. 1410. Three to 12 ft.: blades  $\frac{1}{2}$  in. wide, narrowed into a firm rough point; panicle or plume as much as 2 ft. long. S. Eu. Gn. 54, p. 496. R.H. 1890, p. 546. V. 3:247.—This is one of the best of the stout and tall perennial grasses. It thrives in light and open places in well-drained soils, and makes great clumps, when well established sometimes producing as many as 40 or 50 heads. Hardy in latitude of New York City.

A. S. HITCHCOCK.

**ERICA** (practically meaningless; probably not from *ereiko*, to break, as commonly stated). *Ericáceæ*. HEATH. This is the genus that the gardener usually means by "heath." The heath or heather of English literature and history belongs to the closely allied genus *Calluna*. The next most important group of cultivated "heaths" is *Epacris*, which, however, belongs to a different family.

Ericas are perennial woody plants from 6 in. to 12 ft. or more, usually much branched; lvs. in whorls of 3-6, very rarely flat, usually 3-sided and with revolute margins that are sometimes connate with the under side; infl. usually terminal or sometimes axillary, very seldom actually, though often apparently, racemose; calyx free, 4-parted; corolla hypogynous, white, rosy or sometimes yellow, usually early deciduous, variously shaped, the commonest forms (in cult.) being bell-shaped, tubular and ventricose, usually 4-lobed; stamens 8; ovary sessile or rarely stalked, 4-celled, rarely 8-celled, with 2- $\infty$  ovules in each cell; fr. a 4-valved caps., with minute seeds.—About 500 species, mostly from S. Afr. and the Medit. region, nine-tenths from the former. There are many hybrids and horticultural forms. So far as the S. African species are concerned, the latest monograph is that of Guthrie and Bolus, which has served as the basis for the treatment below.

Only a few of the European heaths are hardy in America, and there are no native heaths at all in this hemisphere. Of about fourteen kinds of *Erica* grown outdoors in Europe to produce large showy masses, only three are hardy here, and it is safest to cover these with evergreen boughs in winter. Two others (*E. mediterranea* and *E. lusitanica*) are grown under glass somewhat but they are probably hardy, with protection, from New York southward. The tree heath of southern Europe (*E. arborea*) will probably never be a feature of our southern landscapes. The heath that is naturalized in places from Rhode Island to Newfoundland

is *Calluna vulgaris* (which see); and this is sometimes advertised as *Erica vulgaris*.

The halcyon days of the heaths were from about 1806 (when the English took the Cape of Good Hope) until the middle of the century. Andrews' colored engravings of heaths (1809)\* marks the first flush of their popularity. Practically, if not absolutely, all the heaths that are grown on a large scale have been developed from the South African species. The old English gardeners still lament the glorious days when the hard-wooded plants of Australia and the Cape formed the chief feature of European indoor horticulture. They complain that the present generation is not willing to give them the care they deserve. This is especially true of America. In America, heaths are of minor importance, even at Easter, and the kind grown most extensively for Christmas seems to be *E. melanthera*.

The great trouble with heaths is the immense amount of care they need. Few, if any, classes of plants require more attention. Hence the growing of heaths for the market is extremely specialized, and there the American retail catalogues only rarely offer more than one species. Nevertheless, all the kinds described below are grown commercially, and are of the first importance in the genus. The stock is largely imported from England. Germany has a very different set of varieties, and France still another, and there are few cases among cultivated plants showing so great a difference in the three countries. The risks of importation are considerable, and the tendencies toward American independence in this line seem to be gaining. Another difficulty in heath-culture is the poor quality of peat obtainable in America. In England the peat is more fibrous, and has been formed in past ages largely by the decay of the native heather.

The soft-wooded kinds are the ones most grown. The hard-wooded sorts require a longer period of growth and more thorough ripening of the wood. Apparently only one yellow-flowered heath is cultivated in America, *E. Cavendishiana* which is a hybrid species about which little is known. See supplementary list (p. 1132).

In general, the ericas do not grow well in this climate on account of the extreme heat of the summer months, but some varieties grow and flower even better here than in Europe. The

choice of the soil is very important. A light peat, mixed with sharp coarse sand is about the best we can get here. After flowering, the plants should always be cut down to keep them bushy at the base and well shaped. They will then receive a good repotting, always using very clean pots and plenty of drainage. Cuttings are made from December to April, preferably from young plants, the tender shoots about 1 inch in length being best. These are planted firmly in a pan filled with clean fine sand, and covered with a bell-glass, or in a box covered tightly with a pane of glass. Bottom heat is not necessary. When rooted, the cuttings should be potted in small pots, and when well started should be given as much air as possible. It is well to bring the ericas out of the greenhouse as early in the spring as possible. The pots should be plunged in a good location, where plenty of air and



1410. *Erianthus Ravennæ*.

sunlight can be had. They should be wintered in a greenhouse extremely well ventilated, and a temperature not higher than 40° to 45° F. When in bud the plants should not be allowed to dry out too much. One drying might be enough to cause the loss of all the buds. Very often the heaths are attacked by a disease similar to mildew, brought on by an excess of humidity in the air. As this disease is very contagious, it is well, as soon as noticed, to use sulfur in powder or sulfate of copper in solution until the plants are rid of it (Louis Dupuy).

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## KEY TO THE SPECIES.

- A. Heaths hardy, European, or hardy with protection from New York southward.  
B. Lvs. and calyx-segms. ciliate: stamens included.  
C. Fls. in spike-like clusters. . . . . 1. ciliaris  
CC. Fls. in umbel-like clusters. . . . . 2. Tetralix  
BB. Lvs. and calyx-segms. glabrous.  
C. Anthers usually exerted well beyond the corolla-tube.  
D. Fls. usually solitary and lateral, rose-colored. . . . . 3. mediterranea  
DD. Fls. clustered, pink, usually all lateral. . . . . 4. carnea  
DDD. Fls. all clustered at the ends of the branches. . . . . 5. vagans  
CC. Anthers included in the corolla-tube.  
D. Fls. rose-violet or purplish.  
E. The lvs. verticillate in 3's. . . . . 6. cinerea  
EE. The lvs. verticillate in 4's. . . . . 7. stricta  
DD. Fls. pale rose, in broad panicles. . . . . 8. lusitanica  
AA. Heaths tender, S. African, always grown under glass in Amer.  
B. Fls. mostly showy, petal-like, scarcely greenish or sepal-like.  
C. Corolla tubular, the limb not spreading.  
D. Length of fls. usually more than 6 lines, in cult. specimens umbellate. . . . . 9. verticillata  
DD. Length of fls. usually 10-12 lines, in 2's or 3's. . . . . 10. hyemalis  
CC. Corolla various, not tubular, the limb often spreading.  
D. The corolla-segms. spreading, the tube mostly elongate.  
E. Length of corolla 6-8 lines; segms. ovate, acute. . . . . 11. ventricosa  
EE. Length of corolla 3-4 lines; segms. ovate or sub-orbicular. . . . . 12. præstans  
DD. The corolla-segms. usually not spreading, the tube rarely over 4 lines long.  
E. Lvs. channeled.  
F. The lvs. in 3's. . . . . 13. sicæfolia  
FF. The lvs. in 4's. . . . . 14. propendens  
EE. Lvs. not channeled, more or less open-backed and spreading.  
F. Infl. variable, often terminal and axillary on the same plant. . . . . 15. fiacca  
FF. Infl. always terminal.

- G. Sepals about as long as the corolla-tube.  
H. Lvs. rough or tuberculate. . . . . 16. turrigera  
HH. Lvs. not rough.  
I. The lvs. glabrous. . . . . 17. gracilis  
II. The lvs. usually pubescent. . . . . 18. persoluta  
GG. Sepals about half as long as the corolla-tube. . . . . 19. formosa  
BB. Fls. not so showy, calyx-like, the calyx often colored also.  
C. Lvs. in 3's: sepals colored. . . . . 20. melanthera  
CC. Lvs. opposite: sepals green. . . . . 21. fragrans

1. *ciliaris*, Linn. A much-branched nearly hardy shrub, 10-20 in. tall, the branches usually glandular: lvs. small, but not as in typical heaths, ovate, mucronate: fls. about 4 lines long, or more, purplish, in spike-like, lateral clusters. Eu. June-Sept. B.M. 8443.

2. *Tetralix*, Linn. BELL HEATHER. CROSS-LEAVED HEATH. Lvs. in 4's, margin folded back: fls. rosy; sepals ovate-lanceolate, ciliate; anthers awl-shaped or awned, included; ovary with short, soft hairs. W. Eu.—Foliage grayish. Height in England 6-12 in. With Manning, at Reading, Mass., about 8 in.

3. *mediterranea*, Linn. (*E. carnea* var. *occidentalis*, Benth.). Fig. 1411. This is considered by Bentham a western form of *E. carnea* (No. 4), with a little smaller fls., corolla a trifle wider at the apex, and anthers shortly exerted instead of included. *E. mediterranea* of the trade is hardy in England, and perhaps second only to *E. carnea* in popularity there. In Amer. it seems to be cult. only under glass but should be hardy from N. Y. southward with protection. B.M. 471. Gn. 54:263; 55, p. 403; 61, p. 431. G.M. 45:261; 55:315. Var. *alba*, a white-fl. form is known. Gn. 59, p. 94.

4. *carnea*, Linn. (*E. herbacea*, Linn.). Height 6 in.: lvs. in 4's: infl. lateral; corolla broadly bell-shaped; anthers exerted; ovary glabrous. March-May. Alps. L.B.C. 15:1452. B.M. 11. Gn. 54:6 (a charming picture).—The bright rosy-fl. form is the best and most striking. There are pale red and pure white varieties. The most popular of all hardy ericas. Very easily prop. by division. *E. mediterranea* var. *hybrida*, Hort., is said to be a cross with *E. carnea*, and in England thriving almost as well in loam as in peat. See Gn. 54:262; 55, p. 127; 61, p. 399; 72, p. 176. G.M. 50:39. J.H. III. 51:293.

5. *vagans*, Linn. CORNISH HEATH. Fig. 1412. Lvs. in 4's or 5's: sepals small, ovate, obtuse; corolla ovate-bell-shaped; anthers ovate-oblong, 2-parted, exerted; ovary not hairy. W. Eu. and Medit.—Fls. pale purplish red. Grows 3-4 ft. in England; 1 ft. with J. W. Manning, Reading, Mass. Var. *alba* has white fls. Var. *capitata*, grows 1-2 ft. high with Meehan at Germantown, Pa., and has "small whitish fls. with a purplish tip." F.E. 22:685.

6. *cinerea*, Linn. A twisted and much-branched shrub, 8-15 in. high: lvs. verticillate, in 3's, narrow, glabrous, and usually not over 3 lines long: fls. showy, rose-violet, in usually verticillate clusters; corolla much contracted at apex, the lobes reflexed. June-Sept. Eu. Var. *alba*, Hort., a white-fl. form, and var. *coccinea*, Hort., a scarlet form, are both in the trade. Gn. 61, p.

1411. *Erica mediterranea*.



433.—Hardy in U. S., with a little protection, from N. Y. southward.

7. *stricta*, Don. CORSICAN HEATH. Lvs. in 4's, a little more erect than in No. 2: sepals lanceolate, obtuse; corolla ovoid-oblong, narrowed at the throat; anthers awl-shaped or awned, included; fls. rosy purple; ovary densely covered with long, rough hairs. Corsica.—Summer. Attains 4 ft. in Eng., but grows 1–2 ft. high with Meehan, at Germantown, Pa. Branches strict, rigid.

8. *lusitânica*, Rudolph (*E. condonodes*, Lindl.). SPANISH HEATH. Branches tomentose-pubescent; lvs. glabrous and ovary glabrous: fls. pale rose, in broad panicles. W. Eu. B.R. 1698. G.C. II. 7:463; III. 19:487; 35:91. I.H. 43, p. 321. Gn. 54:263; 55, p. 125; 67, p. 328. B.M. 8018. G. 21:384; 30:130.—Hardy in England, but in U. S. only south of N. Y., and then must be protected.

9. *verticillata*, Berg. An erect shrub, 4–6 ft., with lvs. 4–6 in a whorl: lvs. densely imbricate, erect or spreading: fls. mostly in 4's in wild specimens, but, according to Andrews, umbellately 3–10-fld. in cult.; corolla tubular, hairy, usually straight, bright rosy-scarlet, and very showy: caps. unique in splitting into 8 valves. Andr. Heathy, 58.

10. *hyemalis*, Hort. Fig. 1413. Written also *hiemalis*. Watson thinks it may be a winter-flowering form of *E. perspicua*, figured in L.B.C. 2:102 and 18:1778 as *E. Linnaëana*. Fls. rosy pink, tipped white. Var. *alba* has white fls. With L. Dupuy, Whitestone, L. I., it flowers in Sept. G.F. 5:137. Gn. 41:420. G. 25:567. H. D. Darlington says it is very distinct from *E. perspicua*.

11. *ventricosa*, Thunb. Lvs. in 4's, incurved to spreading, with pilose margins: infl. terminal; sepals keeled; anthers with 2 very short ears, or awned, included; ovary glabrous. B.M. 350. L.B.C. 5:431. G. 9:565; 26:239. Var. *grandiflora*, with tubes over  $\frac{1}{2}$  in. long. L.B.C. 10:945 (as *E. prægnaans*). The following varieties are reported: *Bothwelliana*, *breviflora*, *cárnea rosea*, *cintra*, *hirsuta*, *alba*, *magnífica*, *superba*, *tricolor*. See R.H. 1858, p. 450; 1880:50. Gn. 45, p. 87. A.F. 10:1111. F.E. 9:333.

12. *præstans*, Andr. (*E. Parmetiærii*, Lodd.). Lvs. in 4's, somewhat incurved; bracts crowded: fls. nearly sessile, white, faintly flushed pink at base, in terminal groups of 4 or more; sepals ovate, rough-margined; anthers scarcely acute. Sept. Varieties are pictured under various names in L.B.C., plates 154, 197, 1695, and 1804.

13. *sicáfolia*, Salisb. (*E. pygmæa*, Andr. and Hort.). Dwarf cushiony heath, perhaps best treated in the alpine garden, 4–8 in. high: branches ascending, nearly glabrous: lvs. in whorls of 3, linear-acuminate,  $2\frac{1}{2}$ –5

lines long: fls. in 3's, the corolla dark purple, its segms. ciliate. L.B.C. 5:468. B.M. 2263.

14. *propendens*, Andr. An erect sub-shrub, 10–18 in. high, the branches nearly straight, the younger pubescent: lvs. in 4's, linear and usually 3-sided, ciliate, or sometimes glabrous: fls. 1–4 in a cluster, the corolla red, broadly bell-shaped and hairy, about  $\frac{1}{3}$ – $\frac{1}{2}$  in. long; ovary 4–8-celled, rough but not hairy. L.B.C. 1:63. B.M. 2140. Andr. Heathy, 141. G. 25:137. G.C. III. 32:278, 279. Gn.W. 21:759. J.H. III. 47:543.

15. *flacca*, E. Mey. (*E. ciliàris*, Thunb., not of Hort.). An erect shrub, usually branched, but not diffuse, the branches pubescent or glandular hairy: lvs. in 3's, rarely in 4's on the same plant, spreading, usually "linear, as if subterete," the margins revolute,  $1\frac{1}{2}$ – $2\frac{1}{2}$  lines long: fls. in 3's, the corolla bell-shaped to tubular, the segms. about a third as long as the tube; ovary sometimes hairy on the top.

16. *turrigera*, Salisb. (*E. cupressina*, Forbes). Lvs. glabrous, sub-ciliate or naked: infl. terminal; fls. pedicelled, in 1's to 4's; bracts remote; sepals finally reflexed; sinuses of the corolla acute, narrow. Probably a hybrid, cult. since 1802. F.E. 9:333. A.F. 15:

1175. Gng. 9:35 (the last two as *E. cupressina*).

17. *gracilis*, Salisb. Lvs. in 4's, somewhat erect; bracts remote: sepals smaller, lanceolate; anthers with a short, sharp point. L.B.C. 3:244 (pale violet). G. 25:602. Gn. 76, p. 11. "Fls. purplish red." Var. *autumnalis*, Hort. Fls. Sept. Var. *vernalis*, Hort. Fls. in Oct. and Nov.

18. *persoluta*, Linn. Fig. 1414. Essentially a white-fld. and very variable species, particularly as regards hairiness: lvs. erect or spreading, hirsute or glabrous: corolla small, originally  $1\frac{1}{2}$  lines long; lobes ovate, 2–3 times shorter than the tube, the sinuses acute, narrow. S. Afr. The numerous varieties Bentham found impossible to separate either in the wild or in cult. Var. *hispidula*, Benth. Slightly hirsute: lvs.  $2\frac{1}{2}$ –3 lines long, rough; anthers sub-ovate. Var. *lævis*, Benth. Lvs. shorter, blunter, often appressed, glabrous: anthers subglobose. Var. *subcárnea*, Benth., has the corolla lobes more evident. To this last variety Bentham seems to refer most of the horticultural varieties cult. under the name of *E. persoluta*. *E. assurgens*, Link, he refers to the first variety; *E. cáffra* of Linnaeus to the first, but of L.B.C. 2:196 (and the trade?) to the second. *E. regérminans* of Linnaeus is a distinct species (figured in L.B.C. 17:1614 as *E. Smithiana*); of the trade=*E. persoluta* var. *hispidula*; of L.B.C. 18:1728=*E. persoluta* var. *subcárnea*. Flowers in Feb and March, while other related species mostly flower in March and April.



1412. *Erica vagans*. ( $\times \frac{1}{4}$ )



1413. *Erica hyemalis*. Great numbers of this heath are sold in London every Christmas.

19. *formosa*, Thunb. (*E. grandinosa*, Hort.). Erect shrub, 1-2 ft., the branches hairy, covered with lvs. in whorls of 3: lvs. glossy, channeled, the younger ciliate, about  $1\frac{1}{2}$  lines long: fls. in 3's, the corolla white, with 8 longitudinal channels, sticky. Andr. Heathy 265.



1414. A form of *Erica persoluta*.

rous or slightly bristly at the tip. B.M. 2181. L.B.C. 3:288.

The following are mostly kinds that have been grown successfully in small quantities in this country but appear not to be advertised in American trade catalogues. H=hard-wooded; the rest are soft-wooded. S. Afr., unless stated. Aside from these, *E. scoparia*, Linn., of S. Eu., is sometimes listed: 2-3 ft., glabrous: lvs. in 3's: fls. greenish, in 1-sided racemes; calyx-lobes about half the length of the subglobose corolla. *E. capensis* also appears, but it is apparently only a catalogue name.

*E. ampullacea*, Curt. Lvs. ciliate, mucronate: bracts colored; fls. mostly in 4's: corolla ventricose, very sticky, typically white, lined with red; limb spreading, white. Var. *ribra* is the only form cult. B.M. 303. L.B.C. 6:508. H.—*E. arborea* var. *alpina*, W. I. Beau. An alpine variety, grown only at Kew. It is a stiff erect bush with tiny white fls. in plume-like clusters. Gn. 75, p. 384.—*E. aristata*, Andr. Readily distinguished by the long bristle which ends the lvs.: lvs. recurved: fls. in 4's; sepals keeled with red; corolla sticky, 1 in. long, ventricose, but with not so long and narrow a neck as in *E. ampullacea*. B.M. 1249. L.B.C. 1:73. H.—*E. barbata*, Andr. Bristly and glandular-pubescent: lvs. in 4's: corolla urn-shaped, villous; ovary villous. L.B.C. 2:124.—*E. Boniédina*, Lodd. Lvs. in 4's to 6's: infl. axillary; corolla tubular, slightly inflated; limb erect or scarcely open. L.B.C. 9:842.—*E. Burnettii*, Hort. Hybrid. F.S. 8:845.—*E. Cavendishiana*, Hort. (*E. Cavendishii*, Hort.). Hybrid of *E. depressa* × *E. Patersonii*. Lvs. in 4's, margins revolute: fls. in 2's to 4's; corolla tubular; stamens included; anthers awned. P.M. 13:3. G.C. 1845, p. 435; II. 18:213; 20:597. F.S. 2:142. A.F. 12:1143. Gng. 5:331. C.L.A. 7:180. G. 6:489; 10:243.—*E. conspicua*, Soland., is a species with club-shaped, villous fls. and villous lvs. in 4's. Var. *splendens*, Klotzsch, with the lvs. and sepals shining green and pubescent corollas, includes *E. elata*, Andr. L.B.C. 18:1788.—*E. cylindrica*, Andr. and Hort. Important hybrid of unknown parentage, cult. since 1800. Lvs. in 4's: fls. nearly sessile; corolla 1 in. long, brilliant rosy red, with a faint circle of dull blue about two-thirds of the way from the base; anthers awned, included; ovary glabrous. L.B.C. 18:1734. R.H. 1859, p. 42.—Fls. very showy and unusually long. The oldest *E. cylindrica*. That of Wendland is a yellow-fl. species unknown to cult.—*E. Devoniana*, Hort. Hybrid. Fls. rich purple. H.—*E. elata*, Andr.—*E. conspicua* var. *splendens*.—*E. Irbiana*, Andr. Allied to *E. ampullacea*, but with corolla narrower at the base and tapering with perfect regularity to just below the limb, where it has a prominent red bulge. It is also distinctly lined with red, and the sepals are green, although the bracts are colored, as in *E. ampullacea*. L.B.C. 9:816. H.—*E. nigrescens* is presumably *E. melanthera* (H. D. Darlington).—*E. pallida*. A confused name. The oldest plant of this name is Salisbury's, which has an urn-shaped corolla, fls. often in 3's, pubescent and hirsute branches and lvs. in 3's. L.B.C. 1:72 (as *E. pura*). *E. pallida* of the trade is probably the tubular-fl. hybrid of Loddiges in L.B.C. 14:1355, which has axillary and terminal fls., and lvs. in 4's to 6's.—*E. perspicua*, Wendl., has a tubular or slightly club-shaped corolla, lvs. in 4's, pubescent or rough-hairy, and fls. in 1's to 3's, but the plant in the trade is probably *E. perspicuoides*, Forbes, a hybrid, with longer and woollier hairs, fls. somewhat in umbels, nearly 1 in. long. Only var. *erecta* is grown here.—*E. Syndriana* is grown by Louis Dupuy.—*E. transiens*, Andr. Perhaps the first of all the garden hybrids between *E. tubiflora* and *E. ventricosa*. Lvs. rigid, with or without long, soft, red hairs: fls. in umbel-like heads; bracts remote: corolla rosy, 8-9 lines long; tube narrowly ventricose, pubescent limb short, spreading; ovary sessile. Andr. Heaths, 295. Bentham considers this a synonym of *E. spuria*, Andr. Heaths, 60. Schultheis

says "it is the finest erica grown; a poor propagator but good grower. Takes 3 months to root."—*E. tricolor* is perhaps the most confused name in the genus, and apparently one of the important kinds abroad, where it has many varieties and synonyms. In the trade it seems to stand for a handsome heath, with lvs. in 4's, distinctly ciliate and terminated by a bristle: fls. in umbels of 8-10, 1 in. long, a little too inflated at the base for the typical tubular form, rosy at the base, then white, then green, and then suddenly constricted into a short neck; pedicels red and exceptionally long. This description is from L.B.C. 12:1105 (as *E. eximia*), one of the earliest pictures of these charming hybrids which Bentham refers to the hybrid *E. aristella*, Forbes.—*E. Wilmorea*, Knowles & Weste. (*E. Wilmorea* and *Wilmorea*, Hort.). Hybrid: corolla tubular, bulged below the lobes, slightly velvety-hairy: fls. in 1's to 3's, rosy, tipped white. R.H. 1892, p. 202. A.F. 4:251. G.C. III. 19:201. A.G. 21:869. Var. *glauca*, Carr., has nearly glaucous foliage. Var. *calyculata*, Carr., has a large additional calyx. R.H. 1892, p. 203.

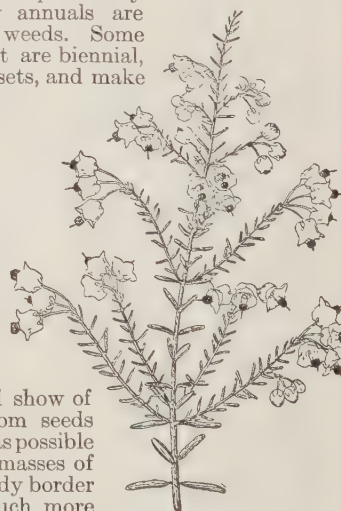
WILHELM MILLER.  
N. TAYLOR.†

**ERIGENIA** (Greek, *spring-born*). *Umbelliferae*. HARBINGER-OF-SPRING. A monotypic genus of E. N. Amer. *E. bulbosa*, Nutt., is low (4-10 in.), nearly stemless, hardy, from a deep-lying tuber, with ternately decomposed lvs. and small umbels of minute white fls. A few plants may have been sold by collectors and dealers in native plants, but it is not a cult. plant. It grows in rich deciduous woods and clearings.

**ERIGERON** (Greek, *old man in spring*; some of the early kinds are somewhat hoary). *Compositae*. FLEABANE. Hardy border plants, suggesting native asters, but blooming much earlier, growing in tufts like the English daisy, though usually from 9 inches to 2 feet high.

Stem-lvs. entire or toothed: fls. solitary, or in corymbs or panicles; rays in 2 or more series, mostly rose, violet or purple, rarely cream-colored or white, and one kind has splendid orange fls.; involucre bell-shaped or hemispheric, the bracts narrow, nearly equal, in 1 or 2 series, differing from Aster in which the bracts are in many series.—About 150 species scattered over the world, particularly in temperate and mountainous regions.

The garden fleabanes are practically all perennials. A few annuals are harmless and pretty weeds. Some species have roots that are biennial, but they increase by offsets, and make larger clumps from year to year. They are of easy culture. They do best when somewhat shaded from the mid-day sun. They are easily propagated by seeds or division, and doubtless by cuttings, if there were sufficient demand. Small, divided plants set out in early spring produce good-sized flowering plants the first year. A good show of bloom may be had from seeds sown outdoors as early as possible in spring. Some fine masses of these plants in the hardy border or wild garden are much more desirable than an isolated specimen or two of each kind. The most popular species is *E. speciosus*. At present it is the best kind that has the rich soft colors, from rose to violet and purple. *E. aurantiacus* has dazzling orange flowers, and is unique in the genus.



1415. *Erica melanthera*.

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A. *Fls. orange.*

1. *aurantiacus*, Pegel. More or less velvety: height 9 in.: lvs. oval-oblong, clasping at the base, more or less twisted: heads 1 on a st.; involucre scales loose, reflexed. July, Aug. Turkestan. R.H. 1882:78. Gn. 52, p. 485. G. 5:239. J.H. III. 52:303.—Perhaps the showiest of the genus. Sold as "double-orange daisy."

AA. *Fls. creamy or white.*B. *Lvs. linear.*

2. *ochroleucus*, Nutt. Height 9–18 in.: sts. mostly not branched: lvs. rather rigid: rays 40–60, white or purplish, never yellow. Gravelly hills and plains N. Wyo. and Mont. to Utah.—This and the next are rare kinds in cult., sometimes sold by collectors and dealers in native plants.

BB. *Lvs. broader, lanceolate to ovate, or obovate.*

3. *Höwellii*, Gray. Height about 1 ft.: root-lvs. obovate; st.-lvs. ovate, half-clasping, all thin: rays 30–35, 1–2 lines wide, white. Mountain meadows, Cascade Mts., Ore. and Mont.

4. *mucronatus*, DC. (*Vittadinia triloba*, Hort., not DC.) Lvs. lanceolate, narrowed at base, ciliate, mostly entire, often with a long, callous mucro. Mex. This plant, grown in Calif., is a much-branched perennial with variable sometimes lobed lvs., and the white rays purple on the back. G.C. III. 48:203.

5. *Coulteri*, Porter. A slender equally leafy perennial about 15 in. high: lvs. thin, obovate or oblong, almost mucronate, and usually soft-hairy: fls. solitary on each stalk, sometimes 2 or 3 together, the white rays about 1 in. long. July. Rocky Mts. G.C. III. 30:99. Gn.W. 3, p. 587; 16:440.

AAA. *Fls. rosy violet or purple.*B. *Rays 100 or more, mostly narrow: lvs. entire.*c. *Fl.-heads large.*D. *Involucre hairy.*E. *Height about 2 ft.: sts. several-fl.*

6. *speciosus*, DC. (*Stenactis speciosa*, Lindl.). Height 1½–2 ft., the st. more or less woody: hairs few, loose: st. very leafy at top: root-lvs. more or less spatulate; st.-lvs. lanceolate, acute, half-clasping. Brit. Col. to Ore. near the coast. B.M. 3606. B.R. 1577. Gn. 52:484. G. 21:15. Var. *superbus*, Hort., sold abroad, has lighter colored and more numerous fls. Gn. 75, p. 118. G. 31:81. Var. *major*, Hort., has broader rays and brighter colors. Var. *roseus*, Hort. Ray-florets lilac; disk-florets yellow. Var. *grandiflorus*, Hort. Fls. larger and deeper in color than in var. *superbus*.

EE. *Height 9–15 in. or less: sts. usually 1-fl.*

7. *glabrus*, Ker-Gawl. BEACH ASTER. Lvs. slightly glaucous or often green in cult.; root-lvs. rarely 2–3-toothed: rays not narrow, light lavender-blue. Pacific coast, where it flowers most of the year. B.R. 10. Gn. 52, p. 484. Var. *semperflorens*, Hort. A dwarf floriferous form.

8. *alpinus*, Lam. (*E. Røylei*, Hort.?). A dwarf species suitable for rockwork: sts. hairy, bearing a single head of purplish fls.: lvs. acute, lanceolate, sometimes ciliate but otherwise entire. Northern regions. L.B.C. 6:590. —Suitable chiefly for alpine gardens.

DD. *Involucre not hairy.*

9. *macranthus*, Nutt. Height 10–20 in.: hairs numerous and long or short, sometimes nearly absent: lvs. lanceolate to ovate: rays very numerous, at least ¾ in. long. Rocky Mts., Wyo. to New Mex. and S. W. Utah. Gn. 52, p. 484. G.C. III. 46:53.—A good species. Blooms later than the eastern species. Violet. Hardy. Can be used with good effect in mass plantings of autumn-flowering asters and goldenrods.

cc. *Fl.-heads (or disk) small.*

10. *glabellus*, Nutt. (*E. asper*, Nutt.). Height 6–20 in., the st. simple or a little branched above: root-lvs. spatulate; st.-lvs. lanceolate, gradually narrowing into bracts: involucre bristly, or at least pubescent; rays violet-purple or white, very narrow. Minn. to Rockies. Gn. 52, p. 485. B.M. 2923. B.B. 3:385. L.B.C. 17:1631.—Much cult. abroad. Var. *arizonicus*, Hort. A variety from Ariz.

BB. *Rays 70 or less, wider: lvs. entire or toothed.*c. *Lvs. almost or quite entire.*D. *Sts. with several fls. in a corymb.*

11. *Villarsii*, Bell. Root biennial: height 1 ft.: lvs. with 3 or 5 nerves, roughish: fls. corymbose. Eu. B.R. 583. L.B.C. 14:1390.—Not cult., but in I.H. 43, p. 301, said to be a parent with *E. aurantiacus* of *E. hybridus roseus*, Hort., Haage & Schmidt. This is said to resemble *E. Villarsii* in habit, and *E. aurantiacus* in form of fls. but not in color. Said to bloom freely from May to autumn.

12. *philadelphicus*, Linn. Perennial by offsets: a roughish, much-branched herb with spatulate or obovate lvs. often st.-clasping along the upper part of the st.: heads several, corymbose, the numerous purplish white rays being attractive in June. N. Amer.—Almost a weed and easily grown in any ordinary garden.

DD. *Sts. mostly 1-fl.*

13. *salsuginosus*, Gray. Height 12–20 in.: upper st.-lvs. with a characteristic mucro: rays broad, giving an aster-like effect, purple or violet; the slightly viscid character of the involucre is particularly designative. Wet ground, on higher mountains, Alaska to Calif. and New Mex. C.L.A. 21. No. 11:40.

cc. *Lvs. coarsely toothed above the middle.*

14. *bellidifolius*, Muhl. (*E. pulchellus*, Michx.). POOR ROBIN'S PLANTAIN. Makes new rosettes by offsets from underground sts.: height 2 ft.: root-lvs. wider above the middle than in most species; st.-lvs. fewer: fls. spring, clear blue, on long sts. Damp borders of woods. Canada to Ill. and La. B.M. 2402. B.B. 3:388.—Weedy.

*E. caeruleus*, Hort.=(?).—*E. divergens*, Torr. & Gray. Diffusely branched with pubescent lvs. and white or purple fl.-heads. W. U. S.—*E. flagellaris*, Gray. A spreading plant bearing a profusion of white or pale lilac fl.-heads. W. U. S.—*E. grandifolius elatior*, Hort. "Large solitary fls. with purple disk. June and July."=(?).—*E. leiomerus*, Gray. Lvs. small, linear: solitary fl.-heads with violet rays and a yellow disk. Colo. B.M. 7743.—*E. multiradiatus*, Benth. & Hook f. Fl.-heads terminal, solitary: ray-florets purplish; disk yellow; height 6 in. to 2 ft. Himalayas. B.M. 6530.—*E. neomexicanus*, Gray. Fl.-heads loosely paniced; ray-florets linear, white; disk-florets tubular, yellow. New Mex.—*E. purpureum*, Hort., according to H. A. Dreer, "rarely exceeds 10 in. height, and has medium-sized fls. of soft, rosy purple, borne in graceful, spreading panicles." Form of *E. macranthus* (?).—*E. trifidus*, Schlecht. Fl.-heads white or pale lilac, daisy-like. Rocky Mts. *E. uniflorus*, Linn. Involucre hirsute, lanate, occasionally becoming naked; rays purple or sometimes white. Arctic regions.

WILHELM MILLER.

N. TAYLOR.†

ERINACEA (Latin, *erinaceus*, hedgehog, alluding to the spiny nature of the plant). *Leguminosae*. A low almost leafless shrub forming dense spiny tufts covered in spring with numerous blue flowers.

Deciduous, very spiny: lvs. simple or ternate, pubescent, only present at the end of young branchlets: fls. 1–3, axillary toward the end of the branchlets; calyx tubular, with 5 short teeth, inflated after flowering; petals narrow, long-clawed, claws of the wings and keel adnate to the staminal tube; standard ovate, slightly auriculate at the base; stamens connate: pod oblong, glandular-hairy, 2-valved, 4–6-seeded.—One species in S. W. Eu. Not hardy N.; likes limestone soil and a sunny position, best adapted to be planted in rockeries. Prop. by seeds.

*pungens*, Boiss. (*Anthyllis Erinacea*, Linn.). Shrub, to 1 ft.: lfts. 1–3, oblong-obovate or spatulate, ⅓–½ in.

long, pubescent: fls. 1-3, nearly 1 in. long, violet-blue, the petals exceeding the large inflated calyx only about one-third; the short pedicels, bractlets and calyx pubescent: pod about  $\frac{3}{4}$  in. long. May, June. Mountains of S. France, Spain and Corsica. L.B.C. 4:318. B.M. 676. G.C. III. 41:310. Gn. 62, p. 127; 64, p. 399.

ALFRED REHDER.

**ERINUS** (a name used by Dioscorides). *Scrophulariaceæ*. A hardy tufted plant 3 or 4 inches high, suited for steep sides of alpine gardens, where it produces in spring its racemes of small purple, rosy or white flowers.

One species, in the mountains of W. and Cent. Eu.: root-lvs. crowded, opposite; st.-lvs. alternate, oblong-spatulate, with a few coarse, rounded teeth: corollalobes 5, obovate, the 2 upper ones slightly smaller; stamens 4, in 2 groups, included; style very short, 2-lobed at apex: caps. ovate, obtuse, dehiscent.—Several species described in this genus belong in *Zaluzianskya*. Not to be confounded with *Lobelia Erinus*.



1416. Loquat. ( $\times \frac{3}{4}$ )

*Erinus* should be planted in steep parts of the rockery where water cannot lodge on rainy days or in the winter and spring months. It needs slight shade from mid-day sun. Divided plants are chiefly sold in America, but the amateur can soon produce a good carpet by the use of seeds. When well established, the seeds are self-sown and the offspring gain in hardness. It may be safest to keep a pot or two in a coldframe over winter, until the plant can take care of itself. In England, seeds may be sown in earthy holes of brick walls, and grown as informal masses on old stone steps. (J. B. Keller.)

**alpinus**, Linn. Racemes  $2\frac{1}{2}$  in. long; fls.  $\frac{1}{2}$  in. across, purple. April-June. B.M. 310. Vars. *albus* and *carminæus*, Hort., have white and crimson fls. respectively. Var. *hirsutus*, Gren. (*E. hirsutus*, Hort.). More vigorous: lvs. villous or hairy; violet-red.

WILHELM MILLER.

**ERIOBÔTRYA** (Greek, *woolly cluster*). *Rosaceæ*, subfamily *Pomeæ*. Small tree, grown for its handsome large foliage and also for its edible acid fruits.

Evergreen trees or shrubs: lvs. alternate, short-petioled or nearly sessile, dentate, with strong veins running straight to the teeth: fls. in terminal, broad panicles; calyx-lobes 5, acute; petals 5, oval or sub-orbicular, clawed; stamens 20; styles 2-5, connate below; ovary inferior, 2-5-celled; cells 2-ovuled: fr. a pome with persistent incurved calyx-teeth, thin endocarp and 1 or few large, ovoid or angular seeds.—About 10 species in the warmer regions of China, Japan, Himalaya and S. Asia. Closely related to *Photinia*, from which it differs chiefly in the larger fr. with thin endo-

carp and few large seeds and in the lvs. having straight veins ending in the teeth. The only species known in cult. is *E. japonica*, an evergreen tree with large ornamental foliage, comparatively inconspicuous white fragrant fls. in terminal rusty-wooly clusters, followed by large pear-shaped yellow frs. It can be cult. only in warmer temperate regions, and if protected during the winter, may be grown as far north as Philadelphia; does not seem to be exacting as to the soil. Prop. by seeds.

**japonica**, Lindl. (*Photinia japonica*, Gray). **LOQUAT**. Fig. 1416. Small tree, to 20 ft.: lvs. thick, evergreen, nearly sessile, oval-oblong or obovate, remotely toothed, bright green and lustrous above, rusty-tomentose below, 6-10 in. long; panicles 4-7 in. long; fls. white,  $\frac{1}{2}$  in. across, nearly hidden in the rusty-wooly pubescence: fr. pear-shaped, yellow, about  $1\frac{1}{2}$  in. long, with few large seeds, of agreeable acid flavor. Sept., Oct.; fr. April-June. Japan, China. B.R. 365. G.C. III. 26:660 (suppl.); 52:318. H.U. 3, p. 97. A.G. 1891, pp. 19, 370. G.W. 3, p. 439; 8, p. 314.—The loquat is native to China and Japan, but is much planted in the Gulf states and westward. It blooms from Aug. until the approach of winter, and ripens its clustered fr. in very early spring. The fr. is often seen in northern markets. It is a profuse bearer in congenial climates. See *Loquat*. Loquat is an excellent decorative plant, either as an evergreen lawn tree south of Charleston, or as a pot-plant in the N. It is a most satisfactory conservatory subject, resisting uncongenial conditions. Var. *variegata*, Hort. Lvs. variegated with irregular markings of pale green, dark green and white.

ALFRED REHDER.

**ERIOCÉPHALUS** (from *erion* wool, and *kephale*, head, in allusion to the wooliness of mature heads). *Compositæ*. A scarce little-known group of greenhouse shrubs, grown for their violet-white flowers and pleasantly scented leaves.

Leaves usually entire, sometimes 3-lobed, often in bunches: fls. in umbellate clusters in the only cult. species, in some others racemose; heads with white ray-fls. and purplish disk-fls.; involucre in 2 series, the outer series of 4-5 bracts.—Twenty species, all S. African, but only one seems to be grown and this is confined to fanciers' collections in Amer.

It is best grown in the temperate house in a mixture of sand and peat. Propagated by cuttings, in sand, under a bell-jar.

**africânus**, Linn. Lvs. opposite or tufted, silky-pubescent, about  $\frac{1}{2}$  in. long, thickish, channeled; heads umbellate at the ends of the branches, the white-rayed, purple-centered heads making attractive clusters. S. Afr. B.M. 833.

*E. pectinifolius*, Linn. An attractive yellow-fl. sort with smooth green lvs. is perhaps referable to *Hippia frutescens*. B.M. 1855. It is known only in botanic gardens in Amer.

N. TAYLOR.

**ERIOCÈREUS** (*woolly* and *Cereus*; referring to the wool in the axils of the bracts on the ovary). *Cactaceæ*. Usually slender plants, at first erect, but usually afterward clambering and creeping, often forming great clumps and thickets: fls. usually large; ovary covered with more or less enlarged bracts bearing hairs and spines in their axils: fr. red, spiny; flesh white; seeds numerous, black. For cult., see *Succulents*.

**Jusbértii**, Riccob. Ribs 6, usually low, with broad intervals; spines very short: fls. funneliform; petals white; stigma-lobes linear, green; bracts on ovary and fl.-tube filled with long hairs. It is now believed that this species is a hybrid between an *Echinopsis* and some *Cereus*.

See *Cereus* for descriptions of the following species: *Bonplândii*, Riccob; *Cavendishii*, Riccob. This is described under *Cereus*, but probably does not belong to either genus; *Martini*, Riccob; *platygônus*, Riccob; *tephracanthus*, Riccob; *tortuosus*, Riccob.

J. N. ROSE.



**ERIOCHILUS** (*woolly lip*). *Orchidaceæ*. A half-dozen species of terrestrial orchids from Austral., with small subterranean tubers and a solitary lf. at the base of the st. or higher up: fls. pink or white, 1 or more and sessile on a scape or peduncle; labellum much shorter than lateral sepals, the margins often with small and erect lateral lobes. Some of the species have been mentioned as greenhouse subjects, but they are horticulturally little known.

**ERIOCNEA**: *Bertolonia*.

**ERIODENDRON**: *Ceiba*.

**ERIODICTYON** (*woolly net*, referring to the under surface of the lvs.). *Hydrophyllaceæ*. Four species and many varieties (see Brand in Engler's *Pflanzenreich*, hft. 59, 1913) of shrubs of Calif. and the Great Basin, with alternate coriaceous entire lvs., and white, purple or blue fls. in scirpioid cymes. Apparently not cult. *E. Parryi*, Greene = *Nama*.

**ERIOGONUM** (Greek, *woolly joints*). *Polygonaceæ*. About 140 species, W. N. American (with extension into Mex.), herbs tufted sub-shrubs or slender annuals, mostly densely woolly: lvs. crowded at the base of the st., alternate or whorled, entire: fls. small, perfect, in an involucre head, fascicle or umbel, mostly recurved or reflexed with age, mostly white, rose or yellow; perianth 6-parted; stamens 9; styles 3: fr. an achene, mostly 3-angled. Now and then some of the species are listed by dealers in native plants, but they can hardly be regarded as cult. subjects. *E. compósitum*, Douglas, perhaps the best known, has very many minute neutral-colored fls., dull white to rosy, borne in compound umbels 5-6 in. deep and broad. B.R. 1774. The following have been advertised, but are practically unknown in our gardens: *E. campanulatum*, *E. compósitum*, *E. flavum*, *E. heracleoides*, *E. incanum*, *E. microthécum* var. *effusum*, *E. niveum*, *E. nudum*, *E. ovalifolium*, *E. racemósum*, *E. sphærocéphalum*, *E. thymoides*, *E. umbellatum*. *E. giganteum* makes a mound or mat many feet across. G.C. III. 28:337. Descriptions of eriogonums may be readily found in the floras of the western part of the U. S.

**ERIOGYNIA**: *Luetkea*.

**ERIOLOBUS**: *Pyrus*.

**ERIOPHORUM** (*wool-bearing*, from the Greek; alluding to the heads of fr.). *Cyperaceæ*. Perennial rush-like plants, growing in swales: fls. in dense heads, the perianth-bristles very numerous and often becoming greatly elongated in fr. and giving the head a wool-like appearance. None of them is known in cult., but the following names have been offered by collectors for bog gardens: *E. alpinus*, Linn.; *E. cyperinum*, Linn.; *E. lineatum*, Benth. & Hook.; *E. polystachion*, Linn.; *E. vaginatum*, Linn.; *E. virginicum*, Linn. All these are wild in the northern states, and descriptions may be found in the regular manuals. *Eriophorum* comprises upward of a dozen species in the northern hemisphere.

**ERIOPHYLLUM** (Greek, *woolly-leaved*). *Compositæ*. Herbs, mostly woody, and commonly with yellow-rayed heads; one kind cult. in a few hardy borders is a low, tufted, herbaceous perennial, with much-divided lvs., covered with wool beneath (each st. bearing about 5), and 8-rayed yellow heads 2 in. across, borne in a loosely forking fashion on peduncles 3-7 in. long. The genus was included in *Bahia* by Benth. & Hooker, but is now kept distinct largely because of the permanently erect involucre bracts: seeds mostly 4-angled, and pappus of nerveless and mostly pointless, colorless portions. *Actinolepis* is included in this genus by some authors. There are about a dozen species, in N. W. Amer. *E. cæspitòsum*, Douglas (*Actinella lanata*, Pursh, not Nutt. *Bahia lanata*, DC.), described

above, has been advertised. Either moist or dry ground, Mont. to Brit. Col. and S. Calif.; very variable.

**ERIOPSIS** (Greek, *like Eria*, an orchid of the *Epidendrum* tribe, which it resembles when not in flower). *Orchidaceæ*. Five or six South American orchids of the *Vanda* tribe allied to *Acacallis* and *Warrea*, requiring coolhouse treatment as given to *Cattleya*; epiphytes. Leaves 2 or 3, long, plicate: racemes 2 or 3, basal; fls. open, small, but showy, maxillaria-like; lip 3-lobed, the lateral lobes broad and erect and inclosing the column, the middle lobe small and spreading and sometimes 2-lobed.—About half a dozen species in S. Amer.

**biloba**, Lindl. Pseudobulbs 3 in. long: lvs. lanceolate: fls. 1 in. across; sepals and petals yellow, with orange-red margins; labellum yellow spotted with brown. Colombia. B.R. 33:18.

**rutidobúlbon**, Hook. Stoutier in habit than the above: pseudobulbs wrinkled, dark-colored: racemes drooping; sepals and petals orange-yellow, with deeper colored margins; labellum white, with purple spots. Antioquia, in exposed positions on the sts. of palms. Peru. B.M. 4437.

**Hélenæ**, Kränz. Said to be the finest in the genus. It differs greatly in habit from the other members; the pseudobulbs (standing 16 in. high) somewhat resemble those of *Epidendrum Brassavolæ*, but are much stronger, and bear 3 long, coriaceous dark glossy green linear-lanceolate lvs. The fls. are twice as large as those of *E. biloba*, and are borne on tall, arching scapes. The sepals and petals are orange-colored, margined with purple, the lip similar, but with a yellow blotch, spotted with purple at the base. Peru.

*E. Fuerstenbergii*, Kränz. Racemes up to 12 in. long; fls. about 1½ in. across; sepals and petals brown outside, orange with brown border inside; lip whitish, densely dotted with purple.

OAKES AMES.

**ERIOSTEMON** (Greek, *woolly stamens*). *Rutaceæ*. Coolhouse evergreen shrubs from Australia, with starry, five-petaled flowers an inch wide, of white or blush-pink. Very little known in America, but abroad considered amongst the finest of hard-wooded winter or spring-blooming Australian plants.

Leaves alternate, entire, glandular-dotted: infl. axillary or terminal, solitary or in clusters; calyx and corolla 5-parted, rarely 4-parted; stamens 8-10, free, shorter than the petals; anthers pointed: fr. 2-valved, 1-seeded. Much care is needed to produce well-trained specimens.

Eriostemons are among the most beautiful of Australian hard-wooded plants. They are propagated from cuttings made of the points of half-ripened wood. Choose pieces about 3 inches long, and insert in a pot filled with one part finely sifted peat, and two parts sharp sand. Water them and set in a case in a temperature of 55° to 60°, shading them from the sun. After they have rooted, pinch out the heart of the shoots, and when they show signs of breaking, transfer them singly into small pots in equal parts of peat and sand. When well rooted in these pots, give them a shift about two sizes larger, using good fibrous peat, in rather a lumpy state, and about a fifth part of good sharp sand, adding a little of finely broken charcoal. This compost may be used for all future pottings. If large plants are wanted quickly, it is better to grow them indoors all the year round, but they will not set flowers so well. Eriostemons flower in the smallest sized pot in spring, if they are grown outdoors all summer. The outdoor treatment ripens the wood thoroughly and the result will be seen when flowering time arrives. These plants are liable to run into strong shoots to the detriment of the weaker ones. When this is observed, cut them well back, and this will preserve the symmetry of the plant. During their growing period they should be syringed freely. This helps to soften the wood and secure

plenty of breaks, and also keep red-spider in check. A favorite method of propagation in the British Isles is by grafting on small plants of *Correa alba*. This insures a quicker means of raising the plants and is practised largely by nurserymen. A winter temperature of 40° by night should be maintained. However, if plants are wanted to flower earlier, they may be subjected to 50° or 55°. Eriostemons are sometimes attacked by brown and white scale. Fumigation with hydrocyanic gas is the best remedy. (George F. Stewart.)

A. *Foliage linear or narrowly lanceolate.*

B. *Lvs. linear.*

**scâber**, Paxt. A shrub with minutely pubescent or glabrous branches: lvs. covered with minute roughnesses, sessile, acute and mucronulate: petals white, tipped pink. P.M. 13:127.

BB. *Lvs. narrowly lanceolate.*

**linifolius**, Seghers. Lvs. broadest at middle, tapering both ways. R.B. 20:97.—Probably an old garden form of some well-known species.

**affinis**, Sprague. Shrub, 1–2 ft., the branches glabrous and shining: lvs. sessile, linear-lanceolate, 1–2 in. long, glabrous: fls. in axillary slender clusters, quite like the next, but smaller.

AA. *Foliage conspicuously wider.*

B. *Lvs. 10–12 times as long as broad.*

c. *Apex abruptly pointed.*

**myoporoides**, DC. Lvs. widest at the middle, tapering evenly both ways, 1–3, rarely 4 in. long: fls. umbellate; petals white or sometimes pink, glandular on the back. B.M. 3180.

cc. *Apex blunt.*

**salicifolius**, Smith. This willow-leaved species has perhaps the handsomest foliage. Lvs. widest above the middle, tapering more gradually to the base than to the apex: petals bright, soft pink. B.M. 2854.

BB. *Lvs. 3–4 times as long as broad.*

**intermedius**, Hook. Lvs. 9–18 lines long, elliptical, abruptly pointed: petals lanceolate, white, but tipped with pink outside in the bud like the rest; ovary placed on a flat disk and not ringed at the base. Probably of garden origin. Intermediate between *E. myoporoides* and *E. buxifolius*. B.M. 4439.

**buxifolius**, Smith. Lvs. as in *E. intermedius*, though perhaps smaller: petals obovate, white, tipped pink; ovary sunk into a double disk of 2 rings. B.M. 4101. G. 26:19.—*E. densiflorus*, Seghers, R.B. 20:97, looks like a prolific horticultural variety of this species.

WILHELM MILLER.

N. TAYLOR.†

**ERITRICHUM**: For *E. barbigerum*, see *Krynitzkia*. For *E. nothofulvum*, see *Plagiobothrys*.

**ERLANGEA** (bears the name of the University of Erlangen). *Compositæ*. One species of this genus, blooming in midwinter and spring, is offered in England.

The genus was long considered to be monotypic, but Moore has recently (Jour. Bot. 46. 1908) incorporated *Bothriocline* with it, and the new species have expanded the genus to 32 species, all Trop. African excepting 1 in New Guinea; it differs from *Vernonia* "only in the curious reduced achenes and the pappus of few, short, very caducous setæ." *E. tomentosa*, Moore (*Bothriocline Schimperii* var. *tomentosa*, Oliv. & Hiern). Shrub, to 5 ft.: st. and under sides of lvs. tomentose: erect herb: lvs. opposite or at top of st. rarely alternate, oblong to ovate-lanceolate, 2–5 in. long, nearly or quite obtuse, rounded at base, serrate, villous: fls. all tubular, about 40 in the head, the heads about ½ in. diam., short-peduncled and collected in

corymbose panicles; involucre-scales ovate, acute, scarious-margined. Trop. Afr. B.M. 8269. Foliage scented: fls. mauve or lilac, lasting 2 or 3 months in winter; habit of a eupatorium, and requires the treatment given the greenhouse members of that genus.

L. H. B.

**ERODIUM** (Greek, *a heron*; alluding to the beaked fruit). *Geraniaceæ*. **HERON'S-BILL** or **STORK'S-BILL**. Annual and perennial, some of the perennials grown in flower-gardens and with alpenes for their finely cut foliage and mostly purplish or white flowers.

The plants suggest the wild and hardy geraniums, from which they differ in having only 5 instead of 10 anther-bearing stamens, the other 5 being reduced to scales; also the tails of the carpels hairy inside and twisting spirally. Herbs, rarely somewhat woody or tufted: lvs. opposite or alternate, one often smaller than its mate, stipuled, toothed, lobed, or dissected: fls. regular or nearly so, mostly in umbels, of various shades, from crimson-pink to purple, with darker blotches on the 2 upper petals and the venation outlined in darker shades; sepals 5, imbricate; ovary 5-lobed, when ripe splitting into separate caps-lobes, each lobe 1-seeded: plants usually heavy-scented.—The latest monograph (Knuth, in Engler's *Pflanzenreich*, lft. 53, 1912) describes 60 species, widely dispersed in temperate and warm regions. The self-planting of the seeds or carpels of some species is very interesting.

These plants are chiefly for the front row of the hardy borders and the rock-garden, where they thrive in a gritty loam. They like dry, sunny spots, and may be trusted with a conspicuous position, being chiefly valued for their steady succession of bloom from June to August. Divided plants are chiefly sold here, but the species are easily propagated by seeds. Some erodiums can be grown in chinks of walls. Some of the annual kinds are widely spread in California and other parts of the West, and *E. cicutarium* and two or three others are grown for forage. The garden species have not attained much prominence in this country.

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#### A. Plant annual (or biennial).

1. **cicutarium**, L'Her. **ALFILARIA**. **ALFILERILLA**. **PIN-CLOVER**. Tufted, low and spreading, more or less glandular, often with coarse, soft, short hairs: lvs. oblong, 1–2-pinnate; lfts. small, nearly sessile, the uppermost confluent, lower ones sharply and deeply cut and with narrower lobes: stipules small, acute: sepals with 1 or 2 terminal bristles; filaments not toothed; fls. rose-purple. Abundantly run wild from the Rocky Mts. to the Pacific, on dry or barren lands, and also grown for hay and utilized as wild pasture. Feb.–Apr. Old World; immensely variable.

2. **moschatum**, L'Her. **FILAREE**. **MUSK-CLOVER**. Also **ALFILERILLA**. Glandular and musk-scented, at first stemless and with a rosette on the ground but later sending up stout fleshy sts. to 1 ft.: lfts. large, short-stalked, ovate to elliptical, serrate, broad-lobed: stipules large, rather obtuse: sepals not terminated by bristles; filaments 2-toothed; fls. rose-purple. Medit., Orient. Run wild in Calif. in the rich valley lands.

3. **Bötrys**, Bertol. Branching from the base and usually prostrate, white-pubescent: lf.-blades 1–2 in. long on petioles of similar or twice the length, oblong-ovate, pinnatifid, the lobes acute and serrate: sepals with 1 or 2 short bristles; fls. deep violet; filaments



widened upward and toothed. *Medit. region, now widely spread in Calif. and also grown for forage.*

AA. *Plant perennial.*

B. *Fls. yellow.*

4. *chrysanthum*, L'Her. Woody, 1-5 in. tall, silvery, the rhizome vertical: lvs. densely crowded at base, petiole and blade of equal length, broadly ovate, obtuse or nearly so, pinnate, the pinnæ cut; st.-lvs. few or none, subsessile: peduncles sometimes basal; fls. yellow, the petals exceeding sepals, broadly cuneate and retuse. *Greece. Gt. 1, p. 260.*

BB. *Fls. white, sometimes veined or spotted.*

5. *guttatum*, Willd. Woody, 3-6 in., the caudex vertical: lvs. many at base of st., long-petioled, ovate-cordate or long-cordate, obscurely lobed, crenulate: peduncle 2-5 in. high; fls. clear white with a dark spot at base of upper petals; sepals lance-spatulate or obovate-spatulate; petals broadly obovate, rounded. *S. W. Medit. region; a good little rock plant. Gt. 3, p. 244.*

6. *pelargoniflorum*, Boiss. & Heldr. Woody, to 1 ft. or more, the caudex vertical: basal lvs. rather numerous, long-petioled, hairy above, ovate-cordate, somewhat lobed, obtusely crenate-dentate: peduncles 1-5 in. high; fls. white, the 2 upper petals spotted with pink at base; sepals ovate; petals broadly obovate, rounded or retuse. *Asia Minor. B.M. 5206. Gt. 1:194. Gn. 59, p. 448; 63, p. 107.*

7. *supracanum*, L'Her. Stemless, 1-4 in. tall, the rhizome vertical: lvs. numerous, to about 2 in. long, densely silky-canescens above, green beneath, ovate or oblong, bipinnatisect, the pinnules entire or dentate or incised: fls. white, spotless, red-veined, the petals obovate and rounded, and sepals broadly ovate and 5-nerved. *Pyrenees.*

8. *chamædryoides*, L'Her. (*E. Reichardii*, DC.). Stemless, 2-3 in. tall: lvs. numerous, long-stalked, sparsely hairy, round-ovate, slightly cordate, crenate, apex rounded: peduncles about 1-fld., about 2 in. tall; fls. white, rose-veined; sepals ovate-spatulate or lance-spatulate, minutely mucronate; petals obovate, retuse. *Balearic Isls., Corsica.—An attractive alpine.*

BBB. *Fls. rose, red or purple (sometimes white in No. 14).*

C. *Lvs. undivided or obscurely lobed.*

9. *corsicum*, Lem. St. 2-6 in. high, the root vertical or oblique: basal lvs. many, long-petioled, grayish tomentose or becoming glabrous, ovate or broader, more or less obsoletely lobed, coarsely crenate-dentate: peduncle 1-2 in. high, about 2-fld.; fls.  $\frac{3}{4}$  in. across, in shades of rosy pink veined deeper color; sepals oblong-spatulate or ovate, not mucronate; petals broadly obovate or cuneate. *Corsica and Sardinia. G.C. III. 48:210.*

CC. *Lvs. all pinnatisect.*

D. *St. wanting.*

10. *macradenum*, L'Her. (*E. graveolens*, Lapeyr. *E. glandulosum*, Willd.). Remarkable for the great length of the roots when twisting among rocks, and strong odor of the foliage: 2-6 in.: lvs. hairy, glandular,  $1\frac{1}{2}$ -2 in. long, oblong, pinnate; segms. pinnatifid, rachis with a toothed wing: fls. light purple, the 2 upper petals a shade darker, and the spots nearly black. *Pyrenees. B.M. 5665.*

11. *daucoides*, Boiss. Plant 2-4 in., the rhizome vertical: lvs. many, tomentose, petiole exceeding blade, lanceolate or triangular in outline, the pinnæ pinnatisect and the lobes linear-lanceolate: peduncles standing above the foliage, about 4-fld.; fls. rose-color; sepals more or less ovate, 5-nerved; petals obovate, somewhat rounded. *Spain.*

12. *Manescavi*, Coss. Height 10-18 in., the rhizome vertical or oblique: lvs. attaining 6 and more in. long,

$2\frac{1}{2}$  in. wide, lanceolate or ovate-lanceolate; segms. alternate ovate, short-stalked, dentate, with sometimes a deeper cut: fls. at best 2 in. across, strong rosy purple, the spots of the upper petals only a shade or two darker. *Pyrenees. Gn. 55:292.—Colors stronger and more uniform than No. 10.*

DD. *St. evident.*

13. *Guicciardii*, Heldr. Woody, to 8 in. tall, from a more or less vertical rhizome: basal lvs. many, densely clustered, petiole equaling the blade (upper st.-lvs. sessile), silvery, broadly ovate or oblong-ovate, pinnate; pinnæ cut into linear or oblong-linear lobes: peduncle 1-3 in. tall, 4-7-fld.; fls. rose-colored; sepals ovate, obtuse and mucronate; petals obovate, rounded. *N. Greece.*

14. *absinthioides*, Willd. (*E. petræum*, Sibth. & Smith. *E. olympicum*, Clem. *E. Sibthorpiænum*, Kotschy). Two to 8 in. tall: rhizome vertical: lvs. many, crowded at base of st., the petioles very short (st.-lvs. few and sessile), soft-hairy, oblong or triangular-ovate, obtuse or acutish, bipinnatisect; lobes linear-lanceolate, entire or dentate: peduncle 1-4 in., 2-8-fld.; fls. violet or rose (rarely white), the sepals ovate, obtuse and mucronate, the petals cuneate-obovate. *Asia Minor.*

*E. gruinum*, L'Her. Annual or biennial,  $1\frac{1}{2}$  ft. high, the sts. 1 or few, white-hairy: lvs. cordate-ovate, undivided or obscurely lobed, dentate: fls. violet-blue, large, the petals broadly obovate and clawed, rounded at apex. *Sicily to Persia, N. Afr.—E. Stephaniænum*, Willd. Annual or biennial, villous, branched: lvs. nearly glabrous, bipinnatifid, the lobes linear; peduncles 2-3 in. high, 2-5-fld.; fls. dark purple; petals scarcely surpassing sepals, very broad-ovate. *Temp. Asia.*

L. H. B.†

ERPETION: *Viola.*

ERÛCA (origin of name in doubt; probably from the Latin *to burn*, in allusion to the hot seeds). *Cruciferae*. Perhaps ten or a dozen herbs of Eu. and W. Asia, annual or biennial. Allied to Brassica: differs in the shorter, more turgid silique, with keeled valves; style elongated; seeds in 2 rows in each cell. The lvs. are pinnately lobed or dentate, and the fls. rather large, yellow to purplish. *E. sativa*, Mill., ROQUETTE, TIRA or ROCKET-SALAD, is the only species cult. in this country. It is a weedy annual, resembling a mustard, 1-2 ft. high, with lyrate-pinnatifid lvs. and creamy yellow or whitish fls. in a raceme (which elongates in fr.). It is sparingly run wild in Canada, U. S., and Mex. See *Roquette*.

L. H. B.

ERYNGIUM (a Greek name for some sort of thistle). *Umbelliferae*. ERYNGO. SEA-HOLLY. Annual and perennial herbs, chiefly valued for the steel-blue or purplish cast of their rigid stems, prickly foliage and teasel-like heads.

Rarely shrubby: lvs. stiff or coriaceous, undivided, lobed or pinnatisect, the margin nearly always spiny: fls. small, white, greenish or blue, sessile or subsessile, bracteolate, in involucrate heads or spikes; calyx-teeth prominent, mostly rigid, sometimes ending in a spine-point; petals erect; disk expanded; styles slender: fr. ovoid or obovoid or more or less globose, scaly or tuberculate, without ribs, the carpels nearly terete and with usually 5 oil-tubes.—Wolff estimates (in Engler's *Pflanzenreich*, hft. 61, 1913) 220 species, widely dispersed in warm and temperate regions with the greatest extension in the *Medit. region*.

There are two very distinct groups of eryngoes, one with much-cut foliage, as shown in Fig. 1417, the other the "pandanus group" (of the New World), with long undivided leaves. The species are little grown in this country, but they are more used abroad. They produce striking semi-formal and often somewhat bizarre effects. They are used in subtropical bedding, particularly the large pandanus-leaved kinds. They are excellent for borders and rock-gardens, being prized particularly for their colored stems and often brilliant in-

volucere. The stiff leaves of the pandanus group are little damaged by weather. The dried stems retain their color, and are sometimes hung in living-rooms. The plants mostly grow from 2 to 3 feet high and head out in July to September. A light rich soil and sunny situation are advised. Poor drainage is to be avoided. *E. amethystinum* is probably the most popular species in this country. *E. planum* is said to be much visited by bees. They are slow to recover from the shock of division. This makes it difficult to work up a stock at home sufficient to make an effective group. The only safe way to increase them is by seed. The seed may be sown as soon as gathered. They will germinate in the spring, and should be ready to plant out the following year. Some of the species self-sow. The species described below are perennial.

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## A. The pandanus-leaved group.

## B. Bracts of involucre long and prominent.

1. *agavifolium*, Griseb. Becoming 6 ft. high in its native country: st. simple below and somewhat branched above, 3-forked at top: basal lvs. rosulate, ensiform, to 5 ft. long, coarsely spinose-serrate: head cylindrical, about 2 in. long and half as thick; the involucre bracts 10-16, ovate at base and gradually narrowed, entire or sparsely spinulose; sepals round-ovate or nearly orbicular; petals obovate or elliptic-oblong. Argentina, blooming Jan.-March. G.W. 15, p. 477.

2. *bromeliæfolium*, Delar. Becoming 9 or 10 ft. tall, the st. about 4-forked at top: basal lvs. numerous, 1½ ft. and more long, narrow and very acute, the margins subulate-dentate, spine-pointed: head ovoid or ovoid-cylindrical, about 1 in. long; involucre bracts many, rigid, unequal, linear-subulate, pungent-pointed; sepals ovate-lanceolate, short-acuminate and mucronate. Highlands, Mex.; Dec.

3. *protæflorum*, Delar. Plant very stout, 3 ft. and more, the st. fistulose and sulcate: st.-lvs. very stiff, the upper ones 8 in. or more long, linear-lanceolate, long-acuminate and pungent-pointed, the margin subulate-spinose: head ovoid-cylindrical, 2½ in. long; bracts of involucre very many and very rigid, in several series, lanceolate and sharp-pointed; fls. very many; sepals broad-ovate, obtuse, short-mucronate; petals white, obovate-spatulate. Mex. Sept. G.C. III. 41:248, 249. Gn. 75, p. 380.

## BB. Bracts of involucre scarcely prominent, not very stiff.

## c. Nerves of lf. diverging.

4. *aquaticum*, Linn. (*E. yuccæfolium*, Michx.). BURTON SNAKE-ROOT. RATTLESNAKE MASTER. Height

2-6 ft.: st. striate, unbranched or branched above: lvs. undivided, long and linear, rigid, mostly clasping, finely parallel-veined, lower sometimes 3 ft. long, 1½ in. wide, all bristly margined: heads globose-ovoid. Wet soil, E. U. S.

## cc. Nerves of lf. parallel, prominent.

5. *Lassauxii*, Decne. Height 3-6 ft., the st. fistulose, 3-forked at top: basal lvs. often slightly twisted, canaliculate, to 2 in. wide, long-acuminate, the margin spiny: heads in a broad corymb, each one small, about ½ in. through, whitish green; involucre-bracts ovate-lanceolate, spinulose-ciliate; sepals nearly orbicular or 4-angled-orbicular, truncate and erose; petals rectangular-ovate. S. Brazil, Paraguay, Uruguay. G.W. 3, p. 549.

6. *pandanifolium*, Cham. & Schlecht. St. to 8 ft. high, leafy, 3-4-forked above: basal lvs. 4-5 ft. long, spine margined above; st.-lvs. many, to 1½ ft. long, spiny: heads colored, globose-ovoid, less than ½ in. long, in large panicles; involucre bracts broad-ovate, very acute, rough on the back; sepals nearly orbicular or oval, short-mucronate; petals dark purple, ovate or orbicular-oblong. S. Brazil, Argentina. Gn. 61, p. 37. G.W. 4, p. 197.

7. *eburneum*, Decne. (*E. bracteodsum*, Griseb.). Height 8 ft., from a thick rhizome, the st. ivory-white: basal lvs. crowded, canaliculate, 3 ft. and more long, acuminate, very spiny, the spines being slender: heads not colored, ovoid or globose-ovoid, ¾ in. long; involucre bracts triangular or lanceolate or linear; sepals ovate or oval, obtuse or short-acuminate; petals somewhat rectangular-oblong, fimbriate at apex. S. Brazil, Uruguay, Argentina.

## AA. The cut-lvd. group (or lvs., at least on st., broader, more or less toothed, and not pandanus-like).

## B. Lvs. fleshy.

8. *maritimum*, Linn. Glauco-blue, stiff, much-branched, about 1 ft. high: lvs. very stiff, broad, sinuate, more or less 3-lobed, handsomely veined, with coarse prickly teeth, those on the st. clasping, the radical ones petioled: heads nearly globular, pale blue; involucre bracts 5-8, much smaller and narrower than the st.-lvs.; sepals ovate-lanceolate; petals oblong. Seacoasts of Eu. Gn. W. 15:489.

## BB. Lvs. not fleshy.

## c. Basal lvs. usually not lobed (or not prominently so).

9. *alpinum*, Linn. Height 12 ft., bluish above, from a thick root: radical lvs. deeply cordate-triangular, acuminate, coarsely double-crenate; st.-lvs. round-cordate, often 3-lobed at the apex or palmatifid: head globose-cylindrical, about 1 in. long; involucre bracts 12-18, lance-oblong, rigid, multifid; fls. many; sepals ovate-lanceolate; petals somewhat rectangular. Eu. B.M. 922. G.C. III. 53:139. G.M. 46:136. Gn.W. 21:278. G.W. 3:576; 15, p. 478. R.H. 1876, p. 113. Gn. 46:523.—There is a white variety. Prized for the attractive blue color of the heads and upper part of the plant.

10. *Oliverianum*, Delar. (*E. alpinum* var. *Oliverianum*, Spreng.). Hybrid, perhaps of *E. planum* and *E. giganteum*, or perhaps with *E. alpinum*: plant strong



1417. *Eryngium amethystinum*. (×½)



3 ft.: lower lvs. long-petioled, broadly cordate-ovate, indistinctly 3-lobed at the apex, unequally spinulose-serrate; younger and the lower cauline lvs. 3-lobed or -parted and the lobes again more or less lobed or angled and the margins spinose-serrate; head blue, cylindrical-ovoid, or ovate, many-fl'd.; involucrel bracts 10-15, subulate or linear, somewhat spinulose. Gn. 45, p. 223; 60, p. 425. Gn. W. 20:791. G.W. 15, p. 497.

11. *tripartitum*, Desf. Probably a hybrid: radical lvs. unequally spinulose-serrate with a large obtuse middle lobe; st.-lvs. deeply 3-parted, the lobes lanceolate and rigid, spiny-toothed: head globular, small; involucrel bracts 6-9, narrow-lanceolate, spiny margined.

12. *gigantæum*, Bieb. (*E. asperifolium*, Delar. *E. glaucum*, Hoffm.). Stout, 6 ft., the root thick and turnip-shaped, the st. simple below and 4-5-forked above: lvs. coriaceous, the basal ones broadly cordate or cordate-triangular, toothed; st.-lvs. more or less 3-lobed, spinulose-dentate: heads cylindrical or ovoid-cylindrical, 3-4 in. long, in an ample infl., blue or pale green; involucrel bracts lanceolate to obovate, very rigid, much cut; fls. very many; sepals ovate or ovate-lanceolate; petals obovate-lanceolate. Caucasus, Asia Minor. Gn. 46, p. 523; 70, p. 111. G. 34:95. R.H. 1906, p. 379. G.W. 15, p. 479.

13. *plânium*, Linn. (*E. planifolium*, Pall. *E. latifolium*, Gilib. *E. intermedium*, Weinm.). Root thick turnip-shaped, very long: st. 3 ft., mostly single, 3-5-forked at top: basal lvs. cordate, oblong or oval or broadly obovate, obtuse, spinulose, usually palmately 7-9-nerved; lower st.-lvs. short-petioled, shaped like the basal lvs. or 3-lobed, the lobes deeply serrate or cut, the upper ones sessile and 3-5-parted: heads blue, ovoid or nearly globular, about  $\frac{1}{2}$  in. long; involucrel bracts mostly linear, rigid, somewhat spinulose-serrate; sepals lanceolate; petals ovate-oblong. Eu., Asia. G.L. 18:136.—A var. *roseum* is offered.

14. *dichotomum*, Desf. (*E. tricuspidatum*, Tenore). Two ft. or less, glaucous-blue, the st. strong, few-lvd., branchy, 3-5-forked at top: lower lvs. long-petioled, cordate-oblong or obovate, very obtuse, serrate or crenate, reticulated; upper lvs. rigid, 5-parted: head nearly globose or ovoid-globose, about  $\frac{1}{2}$  in. long; involucrel bracts 6-7, rigid, narrow-linear or subulate, somewhat spinulose, pungent-pointed; sepals ovate or ovate-lanceolate, spine-tipped; petals ovate-oblong. Medit. region.

15. *cœruleum*, Bieb. About 3 ft., blue, the root thick and long turnip-shaped, the st. usually solitary, 4-5-forked above, the branches long: basal lvs. all long-petioled, cordate, cordate-ovate or cordate-oblong, crenate-serrate, outer ones undivided, inner ones 3-lobed: heads small; involucrel bracts 4-6, rigid and wide-spreading, linear-lanceolate, spinulose; sepals narrow-lanceolate; petals oblong. Caucasus and E.

16. *Leavenworthii*, Torr. & Gray. Purple-violet above, 3 ft., the st. strict and full-lvd., at the top 3-forked: basal lvs. oblanceolate and mostly obtuse, spinose-dentate, the others deeply palmate-parted, the divisions cut-pinnatifid and the segms. spreading and pungent-pointed: heads ovoid-cylindrical, 2 in. or less long; involucrel bracts 7-9, linear-lanceolate, spinose-pinnatifid; sepals pinnatifid. Dry soil, Kans. to Texas.

cc. Basal lvs. on the flowering plant all lobed or divided.

17. *sérbicum*, Panc. Height 1-1 $\frac{1}{2}$  ft., blue above: root elongated, thick, somewhat woody: st. slender, sparsely lvd., short-branching and 3-4-forked above: basal lvs. long-petioled, fresh green, divided into 5-7 grass-like segms.; st.-lvs. more or less clasping or short-petioled, the segms. very narrow and remotely spinu-

lose-cut: heads small, globose-ovoid; involucrel bracts 5-7, rigid, narrow-linear, sharp-pointed; sepals broad-ovate, obtuse; petals broadly oblong-ovate. Servia.

18. *Spinálba*, Vill. Plant rigid, whitish green, more or less blue above: st. stout, at the top 3-4-forked: lvs. coriaceous, rigid, broadly cordate-ovate, palmately 4-5-parted, the margins undulate and spiny-toothed: head blue, ovoid-cylindrical; involucrel bracts about 10 and very rigid, deeply pinnatifid, spine-pointed; sepals lanceolate or more or less ovate; petals oblong-linear. Eu., in the Alps.

19. *Bourgatii*, Gouan (*E. Tournefortii*, Bub.). Low, usually about 1 $\frac{1}{2}$  ft.: root thick, somewhat turnip-form: st. mostly solitary, simple below, sparingly branched above, apex 3-forked: lvs. somewhat coriaceous, pale green, rigid, nearly orbicular or somewhat reniform, palmately 3-5-parted and again lobed, spiny-toothed; st.-lvs. palmate, somewhat clasping: heads blue or rarely green, nearly globose or ovoid-globose; involucrel bracts 9-15, spiny or not; sepals lanceolate, acute; petals spatulate. Medit. region.

20. *Zabélîi*, Hort. (*E. alpinum*  $\times$  *E. Bourgatii*). Plant rather robust, 1 $\frac{1}{2}$  ft.: basal lvs. suborbicular, 3-parted; the segms. cuneate at base and deeply 3-lobed and again 3-lobed, margins strongly spinulose-serrate: head globose-cylindrical, 1 in. or more long; involucrel bracts, 12-14, rigid, lanceolate, spinulose-dentate, blue or amethystine. G.W. 15, p. 496.

21. *améthystinum*, Linn. (*E. pallescens*, Mill.). Fig. 1417. Stout, 1 $\frac{1}{2}$  ft. and more, blue or amethystine above or sometimes whitish: root thick, long-cylindrical: st. remotely leafy, branched, 4-5-forked at top: lvs. rigid, obovate or oblong-ovate, bipinnatifid, spinose-dentate; upper st.-lvs. clasping, pinnately parted, spinulose-dentate: heads ovoid-globose,  $\frac{1}{2}$  in. or more long, the peduncle thick and sulcate; involucrel bracts 6-9, unequal, linear-subulate or lanceolate, sharp-pointed; sepals ovate-lanceolate; petals ovate-oblong or nearly rectangular. Eu. Gn. 46, p. 522; 55, p. 454. G.L. 23:199. Variable. Var. *multifidum*, Wolff (*E. multifidum*, Smith) has much-cut lvs.

Any number of eryngiums may be expected to appear in the list, as they are likely to strike the attention of collectors. They appear to hybridize rather freely. *E. hybridum* is a trade name for garden forms, but it has no botanical standing.—*E. Röthenbergii* is a garden hybrid of *E. alpinum* and *E. gigantæum*.—*E. azureum* and *E. caelestinum* are garden names without botanical standing; the latter is said to be *E. amethystinum*.—*E. Eburneum*=*E. eburneum* (?).—*E. Wrightii* is said to be a free form of *E. planum*, blooming for a long period.

L. H. B.

**ERYSIMUM** (probably means *blister-drawing*). *Cruciferae*. Of this genus two brilliant yellow and orange, spring- and summer-blooming hardy "annuals," are cultivated, scarcely, if at all, inferior to the true wallflowers (*Cheiranthus*) for general purposes, and a few rock-garden and wild-garden plants.

Biennial, annual and perennial herbs, with long soft appressed 2-parted hairs: lvs. narrow, linear or oblong, entire or variously toothed: fls. orange or yellow, rarely purple, often fragrant; petals 4, usually large, clawed; stamens 6, free and without appendages; style persistent: pod broad-linear, strongly compressed or sometimes 4-angled; seeds many, various.—Species 80-90 in the north temperate zone, being most numerous in Eu. and Cent. Asia. Some of the species are said to hybridize with *Cheiranthus*. Numbers of species are likely to be mentioned as good subjects for alpine-gardening.

Although some of the popular kinds are biennials, the gardeners think of them as annuals. Their seeds can be sown in the fall and produce bloom earlier than if sown in spring. The rock-garden kinds do well also in the front row of the border and on dry banks. They like full exposure to sunlight, and in the spring months are completely covered with bright flowers. Divided plants, as well as seeds, are offered by American dealers.

In general, no special difficulty is experienced with *erysimums*. In Gn. 24, p. 462, it is said that *E. ochroleucum* on level ground is likely to lose its lower lvs. and to perish on heavy soils in hard winters. It thrives best when frequently divided, and may be propagated by cuttings. *E. Barbarea*, Linn., with forms having double fls. and variegated lvs., is *Barbarea vulgaris*.



1418. *Erysimum asperum*. ( $\times \frac{3}{4}$ )

*num*, Nutt.). Lvs. thin, repand-dentate, lanceolate.

*capitatum*, Greene (*E. grandiflorum*, Nutt. *Cheiranthus capitatus*, Douglas). COAST WALLFLOWER. Biennial or perennial, probably usually perennial, erect and leafy and finely pubescent, 1 ft. or less to 2 ft. high, nearly simple or said often to make a much-branched woody plant, with lvs. oblong, oblanceolate or linear and either entire or repand-dentate: fls. light yellow or cream-colored, the petals about 1 in. long with a rounded blade: caps. to 4 in. Seacoast, Calif. to Ore.

*Perofskianum*, Fisch. & Mey. Fig. 1419. Excellent hardy annual, 1-2 ft., erect: lvs. oblong, acute or nearly so, strongly toothed: fls. large, bright orange or reddish orange: pods standing out nearly at right angles, constricted below the narrower style. Caucasus, Afghanistan. B.M. 3757. P.M. 6:245.—There are compact and dwarf strains suitable for edgings (*E. Perofskianum nanum*. *E. nanum compactum aureum*, Gt. 46, p. 194. *E. compactum aureum*, Hort.). Seeds may be sown at different times for succession.

*pulchellum*, Boiss. (*E. laciniatum*, Boiss.). Perennial, green, often caespitose, the st. ascending 2-6 in. or more (even to 2 ft.): lower lvs. oblong-spatulate, dentate or lyrate; upper lvs. sessile, oblong or lanceolate, dentate; lvs. on the suckers lanceolate and often entire: fls. medium, deep orange: caps. erect-spreading, slender. Greece, Asia Minor.—Used as rock-garden plant. There are dwarf forms in the wild.

*ochroleucum*, DC. (*E. rheticum*, DC. *E. helveticum*, DC.). Perennial, 4-12 in.: sts. yellowish, creeping: lvs. oblong-lanceolate, dentate, usually more or less hairy: fls. fragrant, pale yellow, the petals obovate. Eu. Gt. 2, p. 162.—Variable. Forms a turf on rocks and mountains.

*E. Marshallianum*, Andr. Biennial, perennial, 6-8 in. high: lvs. lance-linear: fls. large, bright orange-yellow: used as an alpine. Siberia.—*E. murale*, Desf. Spring-flowering biennial or perennial, 6-8 in., forming a tuft: lvs. deep green, narrow: fls. golden yellow. Eu.

WILHELM MÜLER  
L. H. B.†

*asperum*, DC.

Fig. 1418. Biennial or perennial, height 1-3 ft. in the wild, 12-18 in. in gardens, the sts. erect: lvs. lanceolate to linear, either canescent or thin and green, dentate or entire, upper ones mostly entire, the lowest sometimes pinnatifid: fls.  $\frac{1}{2}$  in. or more across, orange or yellow, seldom purple: pods rough,  $1\frac{1}{2}$ -5 in. long, 4-sided, nearly erect. Que. to Texas and Calif. Var. *arkansanum*, Gray (*E. arkansanum*, Nutt.).

**ERYTHÆA** (one of the Hesperides, Daughter of Evening). *Palmææ*, tribe *Corypheæ*. Palms with solitary, often robust, spineless caudices, ringed at the base, clothed above with dead leaf-sheaths.

Leaves terminal, the younger ones tomentose in some species, glabrous in others, orbicular, flabellately many-parted, the lobes lacerated at the apex, intermingled with fibers, infolded; rachis short; ligule long; petiole stout, slender and arching in some species, smooth or spiny along the margins: spadices usually paniculate, long, white tomentose; branches stout; spathes many, sheathing the peduncle, thick-coriaceous, densely tomentose; bracts and bractlets distinct; fls. pale: fr. globose or ovoid.—Species 5, Mex.

This small group of American palms includes *E. armata*, which is known locally as the "blue palm," and *E. edulis*, the latter commonly known as the "Guadalupe palm," from the fact that it has been found in a wild state only on the island of Guadalupe, off the coast of Lower California. *Erythæas* bear much resemblance to *Brahea*, the segments of the leaves bearing whitish filaments. In the gardens of Santa Barbara, the *erythæas* in a few years form very handsome trees, but in less-favored latitudes they may be cultivated in the same manner as *kentias* or *latanias*, flourishing in a night temperature of 50° to 55° when grown in a rich and open soil and abundantly supplied with water.

A. Fr. more or less globose.

B. Lvs. distinctly glaucous.

*armata*, Wats. (*Brahea armata*, Wats. *B. glauca*, Hort. *B. Roëzlii*, Lindl.). BLUE PALM. Tall and slender, 40 ft. high: lvs. very glaucous; petiole narrow, deeply channeled, margined with numerous stout, more or less hooked, slightly spreading spines; segms. 30-40, sub-lacerate at the apex, slightly filiferous: spadix 18 ft. long or somewhat less, sparingly branched: frs. reddish brown at maturity. Low. Calif. G.C. III. 20:425.

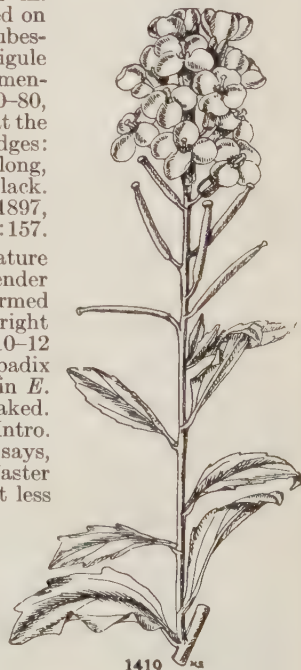
BB. Lvs. green, not glaucous.

*edulis*, S. Wats. (*Brahea edulis*, Wendl.). St. 40-50 ft. high, 15 in. thick, with thick, corky bark: sheaths fibrous; petioles stout, 1 in. wide, plano-convex, unarmed on the acute margins, fibrous-pubescent or glabrate above; ligule 2-3 in. long, densely silky-tomentose; blade 3 ft.; segms. 70-80, at first tomentose, lacerate at the apex and fibrous on the edges: spadices numerous, 5-6 ft. long, branched: fr. shining black. Calif. R.H. 1893, p. 297; 1897, p. 77. G.C. III. 13:507; 22:157.

*Brândeggei*, Purpus. In nature 125 ft. high and having slender trunk: petioles slender, armed with recurved spines; lvs. bright shining green, composed of 10-12 fronded, flabellate lfts.: spadix slightly branched: frs. as in *E. armata*, but somewhat streaked. Low. Calif. Gt. 52, p. 12.—Intro. by Franceschi in 1912, who says, "Appears to grow much faster than other kinds and is not less hardy."

AA. Fr. shaped like inverted pear.

*élégans*, Franceschi. Dwarfier and slower-growing than any other kind: trunk very short: petioles slender, glaucescent, edged



1419 *Erysimum Perofskianum*. ( $\times \frac{3}{4}$ )



with small spines; lvs. somewhat glaucescent on both sides: fl.-spadix 3-4 ft., branched: frs. about  $\frac{3}{4}$  in. diam., yellowish, at first waxy.—According to Franceschi it was first intro. and distributed by the late John Rock of San José, about 1880, and never found again in the wild state, while only one of the plants raised is known to have ripened.

N. TAYLOR.†

**ERYTHRÆA** (Greek, *red*; alluding to the fls. of some species). *Gentianaceæ*. Two outdoor species are in cultivation, with bright deep rose flowers, one of which is a rockery plant from the Azores, the other a Californian annual. Centaurium is name now used.

Small or low herbs, annuals, biennials and perennials with simple and entire sessile opposite lvs., and small or medium-sized 5- or 4-merous, mostly red or pink fls.: calyx-lobes narrow and keeled; corolla salver-shaped; filaments 4 or 5, slender, the anthers becoming twisted; style filiform: caps. oblong or elongated.—About 30 species in the Old and New Worlds; interesting, but little known in cult. Three or 4 small species have been naturalized from Eu.

A light sandy loam, in a protected nook of the rockery, with partial shade, is required for *E. Massonii* (or *E. diffusa*), which is a charming little alpine plant. It must be planted in a well-sheltered position, and requires protection from sun and severe frost in winter, but the little plant is well worth all the extra care one may have to expend on it in winter. Propagated by cuttings, seeds or division. (J. B. Keller.)

**Mássonii**, Sweet (*E. diffusa*, Woods). Height 4 in.: sts. ascending, tufted, not branched above, 1-3-fl.: lvs. fleshy, usually concave, shining: fls. lateral. Azores.—Annuals in Azores, biennial in W. Eu. The plant cult. under this name is considered perennial by our nurserymen.

**venusta**, Gray. Height 6-10 in.: sts. erect, 4-angled, cymosely branched: lvs.  $\frac{1}{2}$ -1 in. long, oblong or ovate-oblong, very blunt: corolla-lobes oval or obovate or oblong,  $\frac{1}{2}$  in. or less long, deep pink; corolla-tube yellowish, about the length of the calyx. Dry hills. Calif. B.M. 6396.

L. H. B.†

**ERYTHRINA** (from Greek for *red*). *Leguminosæ*. CORAL-TREE. Herbs, shrubs or trees, with large and showy papilionaceous flowers, for planting out and for greenhouse bloom; and open-ground subjects in Florida and California.

Erect, or the herbs more or less reclining, usually spiny: lvs. alternate, pinnately 3-foliate, with small glanduliform stipules: fls. mostly red and in dense racemes; calyx 2-lipped or oblique; standard free or very nearly so, erect or spreading; tenth stamen free, or united only half its length: fr. a slender, more or less twisted pod; seeds mostly ovoid.—Known species about 50, in tropical and warm temperate regions around the world.

Erythrinæ are much prized garden plants. Some of them, particularly the herbaceous kinds, are frequently planted out in the summer. In the house they demand an intermediate temperature. Give rich soil and frequent waterings. In the woody species, aim to have well-ripened wood for flowering, for the bloom is produced on wood of the preceding year. The herbaceous species are propagated by division of the rootstock; also by cuttings from shoots springing from the old roots. Woody species are propagated by cuttings of growing wood. All species are propagated by seeds, whenever these are obtainable. Many species have been more or less grown or tried within the limits of the United States; some of them fail to bloom in southern California, probably because of insufficient summer heat. The forms more or less in cultivation are likely to be imperfectly or doubtfully determined botanically. Some of the erythrinæ are used as shade for coffee and cacao plantations.

**A. Herbaceous species (or treated as such).** These die down at the end of the season, and the roots may be stored after the manner of dahlias. It is best to start the roots before planting them out, particularly in the N. In their native countries, these species are more or less woody.

**Crista-gállii**, Linn. (*E. laurifolia*, Jacq.). COMMON CORAL-TREE. Bushy and woody, sometimes developing a very short trunk, but the flowering branches dying back after blooming, the stronger branches coming annually or periodically from near the root: st. and petioles somewhat spiny: lfts. ovate-oblong or lance-oblong, acuminate, entire: fls. large, brilliant crimson, the keel nearly as long as the down-folding standard, the wings rudimentary. Brazil. B.M. 2161. B.R. 313. L.B.C. 3:296. G. 4:451. G.W. 3, p. 437; 6, p. 281. F.E. 16:637 (var. *compacta*).—Runs into many forms, varying in the shade of red, some of them with variegated lvs. South of Washington, it stands out-of-doors if protected. In the N. the fleshy roots are taken up and stored. Valuable for summer bloom. Fls. in large, terminal racemes. Madame Belanger is a popular garden form. **E. compácta**, Bull. of very compact habit and fls. rich crimson is probably a form of this species.

**speciosa**, Andr. Bush-like, reaching 8-12 ft., but usually cut back as *E. Crista-gállii* is: sts. and lvs. prickly: lfts. broad and more or less 3-lobed, pointed, veiny: fls. in pubescent racemes, rich crimson. W. Indies. B.R. 750.—St. green, very prickly.

**herbacea**, Linn. Perennial: sts. several and herbaceous, from a very thick root, 2-4 ft. high, the flowering ones nearly leafless: lfts. 3, ovate to hastate; petioles long, more or less prickly: fls. 2 in. long and very slender, deep scarlet, in loose racemes 1-2 ft. long: seeds scarlet. N. C. to Texas and W. Indies. Common on Gulf coast of Ala. and Miss. B.M. 877. **E. Bidwillii**, Lindl., is a beautiful hybrid of this species and *E. Crista-gállii* (the latter the pollen parent), with herbaceous shoots and an ascending vexillum. B.R. 33:9. H.F. 2:48.

**AA. Woody or tree-like species.** Greenhouse plants, or planted in the open in S. Calif. and S. Fla.

**Humeana**, Spreng. (*E. cæffa*, Ker-Gawl, not Thunb.). Often tree-like and 30 ft. or more, the st. and petioles very spiny: petioles long; lfts. rhomboid-ovate, acuminate: peduncles axillary and strictly erect, longer than the lvs., white-warty; fls. verticillate-spiked on the ends of the peduncles, long and slender, deflexed, brilliant scarlet fading to purple. S. Afr. B.M. 2431. B.R. 736.

**Coralodéndron**, Linn. CORAL-TREE. Tree, prickly: petioles not armed; lfts. ovate-rhomboid: calyx campanulate, the teeth obsolete; standard erect, linear-oblong, scarlet: seeds scarlet, usually with a black spot. W. Indies. L.D. 3:170.—The handsome deep scarlet large fls. are borne in long racemes after the lvs. fall.

**velútina**, Willd. Prickly tree: lfts. scurfy-tomentose beneath, broadly ovate, obtuse, the terminal deltoid-ovate: calyx split nearly to base, the 5 teeth minute; standard orbicular, reflexed (1-1½ in. long), the wings nearly as long as calyx, the keel-petals distinct and small: pod velvety, few-seeded. Jamaica to Brazil. B.M. 3227.

**índica**, Lam. (*E. cárnea*, Blanco). Tall tree with very small usually black prickles and thin gray bark: lfts. rhomb-ovate, membranous and glabrous: fls. showy scarlet, in dense short racemes; calyx split nearly to base; standard ovate-oblong and blunt or nearly so, slightly recurved, 2-2½ in. long, and about half as broad, much exceeding the wings and keel; wings and keel nearly equal, not more than half so long as the calyx: pod 6-12 in. long, torulose. India, Polynesia, W. Indies. Variable. Var. **pícta**, Hort (*E. picta*, Linn.), has variegated lvs. Var **Parcéllii**, Hort (*E. Parcéllii*, Bull), has lfts. with variable yellow varie-

gation: fls. bright cinnamon-red. G.C. II. 1874 (2): 393. G.Z. 18:64; 21, p. 2. By some, *E. picta* is accorded specific rank and *E. Parcellii* is united with it. Var. *marmorata*, Hort. (*E. marmorata*, Veitch), has large lvs. attractively spotted with white. G.Z. 24, p. 73.

*fusca*, Lour. Tree-like, 8 ft., the bark fuscous (brownish), bearing short prickles, the branching diffuse: lvs. unarmed; flts. lanceolate, entire, glabrous: fls. brown-red, in terminal racemes; calyx somewhat bilabiate, the lips entire and erect; standard very long, obtuse, convolute in a tube; stamens long, connate at base: pod long, terete, articulate, pilose; seeds oblong. Cochin-China.

*Poeppigiana*, Cook (*Micropteryx Poeppigiana*, Walp. *E. Micropteryx*, Poepp.). BUCARE. Used for shading coffee and cacao in the W. Indies: tree 40-60 ft., the prickles short: lvs. large, apparently not prickly; flts. broad, entire, with nectaries at base of the 2 lower petiolules: fls. cinnamon-red; calyx truncate; standard plane, elliptic or narrow-oval, to  $1\frac{1}{8}$  in. long; wings small, about twice exceeding the calyx, obovate or oval-elliptic; keel scarcely shorter than standard, arcuate. Probably Peruvian.—Offered in S. Fla. The *E. umbrosa* of the W. Indies is probably this species.



1420. *Erythronium americanum*.  
( $\times \frac{1}{2}$ )

*flabelliformis*, Kearney. Shrub or small tree, to 10 ft.: sts. velvety white when young, bearing stout curved prickles below the lf.-axils: lvs. canescent when young, usually prickly; flts. firm, fan-shaped or deltoid-ovate, usually broader than long, rounded at apex: fls. bright scarlet, crowded in short terminal racemes, numerous, pedicels velvety-canescant; calyx campanulate, truncate, usually somewhat oblique, white-tomentose; standard exceeding the calyx, about  $1\frac{1}{2}$  in. long, linear-oblong, narrowed at both ends; wings and keel short: pod linear, torose; seeds oval, bright scarlet with whitish hilum. S. E. Ariz.—Offered in S. Calif.

*E. arborea*, Small (*E. herbacea* var. *arborea*, Chapm.). Shrub or small tree, to 20 ft., armed: lvs. with wire-like petiole and rachis; flts. deltoid or hastately 3-lobed: fls. scarlet in racemes 4-8 in. long: pod 3-5 in. long, constricted between the seeds. Fla. Likely to be planted.—*E. bogotensis* appears in a European trade list of greenhouse plants.—*E. constantiana*, Mich. Tree, soft, the trunk thick and spiny: fls. large, scarlet, in racemes. Eu.—*E. insignis*, Tod. Tree, sparingly prickly: flts. ovate, tomentose when young: fls. scarlet, in short and dense racemes. Origin unknown. Gt. 28: 988.—*E. vespertilio*, Benth. Shrub, for a warm greenhouse: glabrous, branches prickly: lvs. not prickly; flts. broad-cuneate at base, 3 or 4 in. broad, usually 3-lobed, and the middle lobe of various shape and sometimes absent: fls. showy (red?) and many in racemes; standard ovate, recurved at top, nearly  $1\frac{1}{2}$  in. long; wings small, oblong:

pod long, torulose; seeds few, large and red. Austral. G.Z., 30, p. 1.—*E. viarum*, Tod. Tree, prickly: flts. rhombic-ovate, tomentose when young, terminal one long-stalked; fls. scarlet, in many-fld. short racemes, the standard obovate. Origin unknown.

L. H. B.

ERYTHROCHÆTE, or ERYTHROCHÆTON: *Ligularia japonica*.

ERYTHRONIUM (from the Greek word for red, applied to the purple-rose European species). *Liliacæ*. DOG'S-TOOTH VIOLET (although in no sense a violet). ADDER'S-TONGUE. Small spring-flowering hardy scapose bulbous plants.

Erythroniums have bulbs standing erect and from oblong to linear in form, 2 radical lvs., which in most species are handsomely mottled: scape slender and leafless, producing from 1 to many nodding very attractive fls.; perianth of 6 similar divisions, usually recurved; stamens 6 and a single 3-lobed style: fr. an oblong or obovoid more or less 3-angled loculicidal caps.—Handsome plants of the north temperate zone. One belongs to the Old World, 4 to E. N. Amer., 2 are found in the Rocky Mts., while in the cool woods and high mountains from N. Calif. to the British possessions the genus is represented by about 9 species and a number of well-marked varieties. The species are confused or variable. The first and perhaps second year from seed, the plants bear a single lf. and do not bloom. Some of the species spread in large patches, by means of underground stolons. The bulb is scaly outside but with a solid interior, being really a corm.

The erythroniums are most interesting spring flowers. They succeed in any light soil, particularly in partial shade. In common with all herbaceous perennials, especially those that produce bulbs or corms, they profit by a winter mulch of leaves or litter.—The western erythroniums are all plants of the cool woodlands, except a few that grow at such altitudes as to reach like conditions. They thrive best in shade, a thoroughly drained soil, moist and rich in mold, a surface covering of half rotten leaves tending to equalize conditions. Any good fibrous material, as fibrous peat, coconut fiber or spent tanbark, or even well-rotted sod, will answer the purpose to lighten the soil and give that abundance of mold they delight in. Pockets in shaded rockwork give ideal situations. They will thrive naturalized on cool wooded slopes; and where the drainage is good they will thrive in grass. The leaves ripen before the grass is cut and the effect is very good. Simply planted in boxes in a loose soil, rich in mold, and left year after year in a shaded spot, they sometimes give splendid bloom. *E. Hartwegii* flowers very early, and stands more heat and dryness than any other variety. *E. purpurascens* and *E. montanum*, from high altitudes, tend to throw up their growth very late, and are on that account rather difficult to cult. All of the western species are very satisfactory garden plants.—The propagation of *E. Dens-Canis* and varieties, the eastern American species and *E. Hartwegii*, is by offsets. All of the other western species can be increased only by seeds. The eastern species should be planted at least 5 inches deep. When planting erythronium bulbs, cover with 2 inches of earth; as the bulbs themselves may be 2 inches long, this means that the holes should be 4 inches deep.

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**A. OLD-WORLD ERYTHRONIUMS.** *Fls. always solitary, and without a crest near base of inner petals: lvs. handsomely mottled: offsets few.*

1. **Déns-Canis**, Linn. St. 4-6 in. high: lvs. oval-acuminate, rounded at the base, blotched or patched with reddish brown: fls. drooping, rose-colored, rose-purple or lilac; segms. strongly reflexed, narrow, long-pointed. Cent. Eu., Japan, in several forms. Gn. 76, p. 649.—Variations are white, rose-colored or flesh-colored. Var. *longifolium*, Hort., varies in its narrower lvs. and larger fls; var. *majus*, Hort., is apparently a form of this. Var. *sibiricum*, Hort., from the Altai Mts., is taller. The species thrives in a moist open garden soil, and exposed to the sun. Often used in rock-gardens. Little known in American gardens.

**AA. EAST-AMERICAN ERYTHRONIUMS.**—*Fl. solitary, without a crest on inner petals: mostly producing offsets.*

2. **americānum**, Ker. COMMON ADDER'S-TONGUE. Fig. 1420. Scape 6-10 in., from an ovoid bulb that produces offshoots: lvs. elliptic- or oblong-lanceolate, mottled with purple-brown and whitish: fls. yellow, the segms. recurved, the 3 inner ones auricled at base; stigmas united. E. Canada, to Fla. and Ark., in rich low grounds, particularly in or near woods. Runs into many forms. The following names belong with it: *E. lanceolatum*, Pursh; *E. angustatum*, Raf.; *E. bracteatum*, Boott.

3. **albidum**, Nutt. WHITE ADDER'S-TONGUE. Producing offshoots: lvs. not mottled, narrow: fls. pinkish white, yellow at base; segms. recurved, not auricled; stigmas spreading. Ont. and N. Y. to Minn. and Texas.

4. **mesachœreum**, Knerr. Without basal offshoots: lvs. not mottled, narrowly oblong to linear-lanceolate: fls. lavender, the segms. not recurved; stigmas spreading; earlier than the last. Iowa to Kans. and Mo.

5. **propüllans**, Gray. Bulb ovoid: offshoots arising from near middle of the st.: lvs. small, green or slightly mottled: fls. rose-colored, with yellow base; style slender and stigmas united. S. Ont. and Minn.

**AAA. WEST-AMERICAN ERYTHRONIUMS.**—*Fls. 2-4, sometimes more (rarely only 1-fl.).*—The lvs. are richly mottled, except in *E. grandiflorum*. The corms do not produce offsets, except in *E. Hartwegii*. Inner petals with auricles, except in *E. Howellii*. All except *E. purpurascens* have large and showy fls.

*B. Style 3-cleft.*

6. **grandiflorum**, Pursh (*E. giganteum*, Lindl.). Scape 1-2 ft. high: lvs. broadly lanceolate, to 6 in. long, acute and short-cuspidate, unmottled: scape slender, 3-5-fl.; fls. very bright yellow; petals recurved; anthers yellow. E. Ore. to Brit. Col. Var. *album*, Hort. (*E. montanum*, Hort.). Like the type, except the fls. are white, yellowish at center, and with a slight greenish cast. Var. *minus*, Morr., is smaller.—*E. grandiflorum* grows from very high mountains to (at one point) little above the sea-level. In cult. the high mountain form starts very late and is difficult to grow, while the sea-level form (var. *robustum*, Purdy) is an easy subject. In some localities the anthers are red, as in var. *Nuttallianum*, Purdy (*E. Nuttallianum*, Schult.), in others both red and yellow, but as a rule yellow. The so-called var. *minor* is small merely from less favorable situation. By some, the *E. giganteum*, Lindl., is kept distinct. G.C. III. 43:212. J.H. III. 58:397. G.M. 53:359.

7. **parviflorum**, Goodd. The Cent. Rocky Mt. form of *E. grandiflorum*: scape 4-12: lvs. oblong, tapering both ways: fls. usually solitary, bright yellow, greenish in the bottom; segms. lanceolate-acuminate, about 1 in. long, strongly recurved; anthers pale yellow.—A sub-alpine species.

8. **californicum**, Purdy. Lvs. richly mottled: fls. few to as many as 16; petals revolute and broader, creamy to light yellow, deeper at the center and often marked maroon at base. In the Coast Ranges of Calif., San Francisco Bay to Humboldt Co.—In cult. the most satisfactory East. The description of *E. revolutum* var. *Watsonii* in Cyclo. Amer. Hort., also covers *E. californicum*. G. 32:424.

9. **Hartwegii**, Wats. Bulb-bearing offsets freely on filiform stolons from the base: lvs. mottled: fls. 1-6, mostly in a sessile umbel, large, light yellow-orange at center and white or cream-color above. Foothills of the Sierra Nevada Mts. in Calif. G.C. III. 20:361; 43:215.—The plant appears to have several scapes because the umbel is sessile but each fl. is on a pedicel.

10. **revolutum**, Smith. Lvs. 1-4, mottled in white and light brown: fls. nearly always 1 or 2; petals narrow and curved; style large and stout; filaments from subulate (awl-shaped) to deltoid, opening from white flushed with pink to pinkish purple, becoming purple. J.H.

III. 35:523; 43:268. Var. *Bolanderii* is not separable from the type. *Pink Beauty* is a soft pink form found in Humboldt County, Calif. Var. *albiflorum*, Hort. (var. *Watsonii*, Purdy. *E. giganteum* var. *albiflorum*, Hort. *E. grandiflorum* var. *albiflorum*, Hook.). Fls. pure white with a greenish cast, often banded maroon at base; petals slender; a very beautiful plant. B.M. 5714. F.S. 20:2117. G.C. III. 3:556; 15:621. Var. *Johnsonii*, Purdy (*E. Johnsonii*, Bolander). Very similar to the type, but lvs. mottled in dark brown and looking as if coated in varnish, and fls. dark rose with orange center. Gn. 51:136. G.C. III. 19:549; 25:253. Var. *præcox*, Purdy. Lvs. mottled in mahogany, the most beautifully of any erythronium: the fls., usually 2-4, are creamy white with orange center.

11. **montanum**, Wats. Scape slender, to 18 in., 1-3-fl.: lvs. not mottled, broad-lanceolate to nearly ovate, contracted into a winged petiole; perianth pure white, orange at base. On high mountains of Ore. and Wash.—Very difficult to cult. as the bulbs start very late; one of the most beautiful.

*BB. Style not divided.*

12. **citrinum**, Wats. Rather stout, to 10 in., 1-9-fl., the fls. close together and opening at about the same time: lvs. mottled, very broad-lanceolate, obtuse and short-apiculate, attenuate to a very short petiole: petals broad, strongly recurved, light yellow, orange at center, the tips becoming pink. S. Ore. Gn.M. 6:65.

13. **Hendersonii**, Wats. Fig. 1421. Slender, to 12 in., 1-3-fl.: lvs. mottled in dark brown, lanceolate to oblong, obtuse and short-apiculate, narrowed to a short petiole: petals strongly recurved, pale purple, with a very dark purple, almost black, center. S. Ore. G.F.



1421. *Erythronium Hendersonii*. ( $\times \frac{1}{2}$ )

1:317 (adapted in Fig. 1421). G.C. III. 3:653; 15:623; 43:213. Gn. M. 6:65. Gn.W. 22:375. B.M. 7017.

14. *purpurascens*, Wats. Lvs. undulate, not mottled but shaded in dark metallic tints: fls. small, spreading, crowded in a raceme, light yellow (almost white), center orange, becoming purplish. Sierras.—A very small-fl. erythronium, with 1-8 fls. crowded together. This species grows at 5,000-7,000 ft. altitude in the Sierras. While under some conditions it is low-growing, under other conditions it equals in size and height the most robust species. At the lower altitudes of its habitat snow covers the ground until early May and this plant flowers shortly afterward; it remains very dry in summer and fall.

15. *Howellii*, Wats. Rather slender, to 18 in., 1-3 fld.: lvs. mottled, lanceolate to oblong-lanceolate, usually acute and short-apiculate: fls. pale yellow with orange base, becoming pinkish. S. Ore.—Of the Pacific coast erythroniums, this alone is destitute of the ear-shaped appendages at inner base of petal.

CARL PURDY and L. H. B.

**ERYTHRÓXYLON** (Greek, *red wood*; true of some species). Written also *Erythroxyllum*. *Erythroxyllaceæ*. COCA. A genus famous for the coca plant, the leaves of which are of vast importance in medicine, yielding cocaine, grown slightly in the extreme south of Florida and California, and rarely cultivated under glass in the North for its economic interest.

Erythroxyton comprises about 90 species of shrubs or small trees widely distributed in tropical and subtropical countries but most abundant in Trop. Amer.: lvs. alternate, entire, often coriaceous: fls. small, whitish, on bracteolate pedicels, solitary or fascicled; sepals 5 (or 6); petals of same number, deciduous, appendaged on the inner face; stamens twice the number of petals, connate at base: fr. a 1-seeded drupe.

**Côca**, Lam. Shrub, 5-6 ft. high, with rusty brown, slender branches, on the extreme tips of which the lvs. are borne: below the lvs., on the wood of the preceding year, which is reddish, clusters of 3-5 yellow 5-lobed fls.  $\frac{1}{4}$  in. across spring from the protection of the small scales that line the branchlets, and which are colored like the bark: lvs. oval, obovate or elliptical, differing in different cult. strains or varieties, about  $1\frac{1}{2}$ - $2\frac{1}{2}$  in. long and marked on the under side with 2 lines extending on either side of the midrib from base to apex. Native country uncertain; the earliest described form, which happens to be Peruvian, was named by Lamarck *Erythroxyllum Coca*, and figured in B.M. 7334. The lvs. of this form are about  $2\frac{1}{2}$  in. long, oblong-obovate, tapering to a short stalk, rounded at the apex, the midrib extending beyond into a short, sharp point. Coca is grown commercially on a large scale throughout S. Amer., and also in Java and Ceylon. There are 2 leading commercial varieties, according to Kraemer,—the Bolivian or Huanco, and the Peruvian or Truxillo. The lvs. are picked when fully grown, and quickly dried in the sun. The shrub is said to require for its best development a very humid atmosphere and comparatively high elevation. Coca should not be confused with cocoa and cacao, which are discussed under Theobroma.

L. H. B.†

**ESCALLONIA** (named for Escallon, a Spanish traveler in South America). *Saxifragaceæ*. Mainly evergreen shrubs or small trees, widely dispersed in South America, especially in the mountains.

Leaves alternate, glandular-serrate (rarely entire): fls. strongly odorous, white or of a pink or red color, in terminal racemes or panicles, or axillary; calyx-lobes 5; petals 5; stamens 5; style simple, the stigma obscurely 4-5-lobed and peltate, or 2-lobed and reniform or peltate. Noteworthy in the genus are the glands, stalked or not, which may occur almost anywhere on the plant. Lvs. often with resinous dots on

one or both surfaces.—About 45 or 50 species, a number of which have been intro. in the S., and in Calif. They are of easy culture; rapid growers; and often artificially trained as vines. Several will probably prove half-hardy as far north as N. Y.



1422. *Escallonia langleyensis*.

**A. Lvs. large, hairy, especially below, or in one variety glabrous but very shiny.**

**pulverulenta**, Pers. Shrub: lvs. very thick, oval or elliptic, obtuse, serrate, rough-hairy below, with scattered hairs above: fls. white, in long densely fld. terminal racemes; stigma distinctly 2-lobed, reniform: fr. a glandular-warty caps.: branches hairy. Var. **glabra**,

Engler. Differs from the species in being almost or quite glabrous. Handsomer than the type. Not in cult. in this country.

**AA. Lvs. glabrous or nearly so.**

**B. Fls. red or pink.**

**rùbra**, Pers. var. **glabriuscula**, Hook. & Arn. (*E. rùbra* of many authors). Dainty fld. shrub, with numerous stalked glands: lvs. ovate, often deltoid-ovate, acute, finely and irregularly doubly-serrate, glabrous, with brown resinous dots below, rather small: fls. red, tubular, borne in 2's or 3's (or rarely singly) on lateral pedicels, grouped near the ends of the branches; calyx densely glandular; petals long-clawed; stigma obscurely 5-lobed: fr. a top-shaped caps. B.M. 2890.

**macrantha**, Hook. & Arn. Shrub: lvs. thickish, broadly ovate, acutish or obtuse, bluntly serrate, essentially glabrous: fls. red, long-tubular, in a stocky, often branching, terminal raceme; calyx-lobes with marginal glands; stigma peltate, obscurely 5-lobed: fr. a glabrescent caps. F.S. 6:632.—Excellent. Var. **sanguinea** is a horticultural variety with fls. more crimson.

**organensis**, Gardn. Half-hardy S., 2-5 ft., glabrous throughout: lvs. thick, oblong, acutish, serrulate, with tiny resinous dots: fls. pink, in close, terminal clusters. B.M. 4274.—Excellent. Organ Mts., Brazil.

**BB. Fls. white, or, in *E. langleyensis*, rose-tinted.**

**C. Width of lvs. more than  $\frac{1}{2}$  in.**

**chlorophylla**, Cham. & Schlecht. (*E. càndida*, Lem.). Shrub, to 3 ft.: lvs. oblong-ovate or obovate, obtuse, apiculate, or more rarely acute, with a few blunt teeth on upper part, or wholly entire: fls. white, in a terminal, many-fld. panicle. J.F. 403.

**montevidensis**, DC. (*E. floribunda*, Reichb. *E. floribunda*, HBK. var. *montevidensis*, Cham. & Schlecht.). Shrub, to 9 ft.: lvs. thick, elliptic, obtuse, finely serrate, glabrous, shiny above: fls. white, in a terminal, many-fld. panicle; petals clawed; stigma obscurely 4-5-lobed: fr. a top-shaped caps., crowned by the obviously longer style. G. 25:576; 27:465.

**floribunda**, HBK. Shrub: lvs. oblong-ovate, obtuse, very minutely crenulate-serrate or entire, glabrous or nearly so: fls. white, in many-fld., compound, axillary or terminal panicles; petals clawed; stigma peltate, 2-lobed: fr. a caps., crowned by the equal or barely longer style. G.C. III. 47:53.



cc. Width of lvs. not over  $\frac{1}{2}$  in.

*leucantha*, Remy. Densely lvd. shrub: lvs. obovate, obtuse or nearly so, finely serrate, at least on upper part, glabrous, small: fls. white, in very dense racemes; petals spatulate, clawed: fr. an obovate caps.

*virgata*, Pers. (*E. Philippiana*, Mast. *E. virgata* var. *Philippiana*, Engler. *E. stricta*, Gay). Densely lvd. shrub, half-hardy south of Washington: lvs. stiff, lanceolate or obovate, obtuse to acute, tapering at base, with minute rather distant teeth on upper part, glabrous or nearly so, small: fls. white, axillary, scattered, or sometimes massed near the tips of the branchlets; petals spreading, scarcely if at all clawed: fr. a globose caps. G. 27, p. 464. Gn. 66, p. 64.

*langleyensis*, Vilm. & Bois. Fig. 1422. A graceful shrub (artificial hybrid of *E. macrantha* and *E. virgata*): lvs. linear-ovate, obtuse or acutish, minutely serrulate, small, in short racemes at the ends of the branchlets.

*E. alba*, a name found in some of the catalogues, is not determinable.—*E. pendula*, Pers. Shrub with red fls., in narrow racemes to more than 1 ft. long, and lvs. resembling those of tobacco. Desirable.—*E. rosea*. An unidentified catalogue name which in at least one instance, certainly does not refer to *E. rosea*, Griseb., a very little known species.

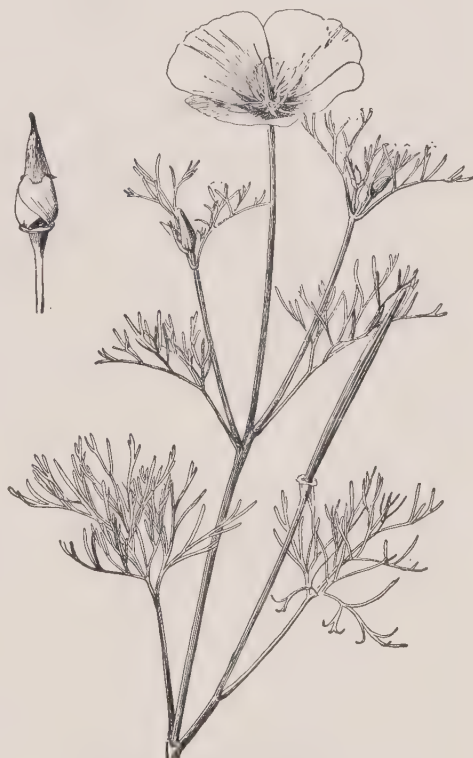
ALBERT HANFORD MOORE.

**ESCHSCHÖLTZIA** (J. F. Eschscholtz, of Kotzebue's scientific expedition). *Papaveraceæ*. Brilliant and popular garden flowers.

Low, pale or glaucous herbs, annual or perennial, with ternately dissected alternate lvs., and large, showy yellow or whitish long-peduncled fls.: sepals 2; petals 4; stamens numerous; stigmas 4-6: caps. long and slender like a silique, 1-loculed, elastically dehiscent at the instant it separates from the receptacle. The calyx forms a hood which is pushed off over the bud as the petals expand (see detail at the left in Fig. 1423). The torus or receptacle (from which the caps. arises) is prominently hollowed and surrounds the base of the pistil.—Few genera have been more diversely interpreted as to the limits of species. Gray accepted about a dozen species, and something like this view of the genus is commonly held. Greene, however, in Pittonia, V (1905) recognized 112 species and separated one of the described species under the new genus *Petromecon*. Fedde in Engler's Pflanzenreich, hft. 40 (1909), separates 123 species. These many species are segregated largely from the multifarious group to which the name *E. californica* has been applied. On this treatment Jepson writes: "This species is highly variable, especially so in trivial details of leaf-segmentation and of shape of calyptra and in habit. It is also variable in the size and color of petals and so runs into an extensive concourse of forms, many of which seem obviously seasonal or due to soil or moisture conditions. Some of these highly marked plants in the Sacramento Valley have two seasonally dimorphic forms, an erect vernal flowering form with very large golden corolla and huge torus rim, and an autumnal flowering form with small straw-yellow corolla and reduced or no torus rim. It has been found impossible thus far, after several trials, to reproduce this sequence in cultivation on the coast. The flower is not like either the vernal or autumnal form but approximates the coast form. A large number of the wild forms have been collected but probably only a small proportion of those in existence. Yet the number of specimens distributed to herbaria has been sufficient to form the basis for nearly 100 new species. It does not seem hopeful that the solving of the problem of *Eschscholtzia californica* in just this way will lead either to permanent results or afford a satisfactory basis for the kind of work most needed, namely the prosecution of combined field and cultural studies." Studies of growing plants under conditions of observation and control, both of wild and horticultural material, are awaited. Where the abundant garden material falls, in the segregations, is yet unknown. The cult. forms are derived from the old

*E. californica*, and *E. tenuifolia* appears also to be in the trade. *Eschscholtzia* is a genus of W. N. Amer., ranging both on the coast and in the interior valleys, and in the Sierras. It occurs from Low. Calif. to the valley of the Columbia River, in New Mex., Ariz., Nev., Utah. It has run wild in parts of Cent. Eu.

*californica*, Cham. CALIFORNIA POPPY. Fig. 1423. Perennial, but cult. as an annual, 10-24 in. high, forming mats: lvs. long-petioled and divided into linear parts, those on the sts. smaller and shorter-petioled: fl. saucer-shaped, opening in sunshine, 2-3 in. across, yellow or orange or cream-colored: pod 3-4 in. long, strong-ribbed: torus large and funnel-shaped. Calif. and Ore., mostly along the coast.—One of the most popular garden fls. It is treated as a hardy annual, the seeds being sown where the plants are to stand, and they should be sown very early. It stands considerable cold, and blooms after the first frosts. If well protected, plants of one season's growth will pass the winter and give some bloom the following spring. It sometimes self-sows. Very attractive as an edging, because of its interesting bluish foliage. There are double-fl. forms. Very variable, and cult. under a variety of names, as *C. maritima*, Hort. (nct Greene), *C. varia*, Hort. (trade name for mixed varieties), *C. aurantiaca*, Hort., *C. alba*, Hort., *C. Thórburnii*, Hort. In color forms are offered yellow, golden yellow, white, rose-white, carmine, rose. Var. *crœcea*, Hort. (*E. crœcea*, Benth.). Fls. deep orange: torus very widely expanded: calyx-bud long-attenuate. B.R. 1677. B.M. 3495. Var.



1423. *Eschscholtzia californica*. ( $\times \frac{1}{2}$ )

*Douglasii*, Gray (*E. Douglasii*, Benth.). Rather more slender, and blooms earlier: fls. pure yellow: torus rim narrow.

*tenuifolia*, Hook. Lower, with narrow lvs. in a radial tuft, the long divisions being almost capillary: fls. small (1 in. across), light yellow, overtopping the lvs.: torus less prominent: seeds muricate. Foothills of the Sierra Nevada. B.M. 4812.

L. H. B.

**ESCÓNTRIA** (named for Señor Don Blas Escontria, of Mexico). *Cactaceæ*. Large, much-branched cacti. Ribs few: areoles narrow, bearing pectinate clusters of spines: fls. small, yellow, diurnal: fr. and ovary covered with chartaceous, translucent, persistent scales, without hairs or spines; fr. fleshy, edible; seeds black. For cult., see *Succulents*.

**chiotilla**, Rose (*Cereus chiotilla*, Web.). Sixteen ft. or more high: ribs mostly 7: radial spines 10-15; central 1-2, the upper one 2 in. long, curved downward: fr. 1 in. diam. Mex.—Rare in cult. J. N. ROSE.

**ESPALIER**, a trellis or open support on which a tree or woody plant is trained in formal shape and to a given number of branches, usually in a vertical plane; and also the plant so trained. Apple trees and others are often trained as espaliers in Europe; the tree may be transplanted and subsequently attached against a wall or building, or it may be kept permanently on the trellis or open support. Sometimes espalier-training is employed only when the tree or bush is young, for the purpose of bringing it into shape and to prepare it for a wall or other support. Trees are trained on espaliers also to give them full exposure to the sun on all sides, to regulate the fruit-bearing and to provide easy means of controlling insects and diseases. Espalier-training is most frequent in cool and cloudy regions, in those in which space must be utilized to the utmost, and where hand-skill is obtainable or is relatively cheap.

There are many forms of training. The plant may be trained to a single shoot, or to two shoots lying in opposite directions, mostly horizontal, in which case it is called a cordon; or the top may be spread fan-shaped on the trellis, or in other forms, and it may then be called an espalier. The training is begun when the plant is very young—perhaps only a year or two from the graft or bud—and before it has produced a stiff trunk and unmanageable head. Usually the branching is started within a foot or so of the ground by heading back the main stem; and as many shoots as may be desired on the trellis are allowed to grow. These shoots are tied to the trellis or posts as they grow, and the side shoots are pinched out except such as are desired for further arms in the framework or for fruit-spurs. The trellises themselves may be of wire strung on posts, or the tree may be tied from post to post or stake to stake set close together. Espaliers are little used in this country, and then only in small gardens, and mostly when a trained gardener is employed.

L. H. B.

**ÉSULA**: *Euphorbia*. The *E. cristata* of the trade is probably the cristate form of *Euphorbia lactea* or similar species.

**ETHERIZATION OF PLANTS**. Etherization, as applied to plants, means strictly the forcing of a dormant plant into growth by subjecting the plant to ether vapors at certain concentrations in a closed chamber for a definite period of time, usually twenty-four to seventy-two hours. The plant after such treatment is placed under environmental conditions favorable for growth. Since in practice the use of chloroform is similar in its application and effects, it will be discussed here. The general nature of etherization was first noted by Johannsen in 1890, and following his investigation a wide stimulus was given to the commercial forcing of flowering shrubs. For other methods of forcing a dormant plant, see *Rest-period*.

Before discussing the method of etherization, its effects and application, it is necessary first to have some idea of what is meant by the term rest-period or the condition of dormancy.

#### *Rest-period.*

Perennial plants, especially those in the temperate regions, in general have a season of growth and active metabolism followed by a period of quiescence as

regards any outward manifestations of metabolism. During this period, not all of the vital processes are at a standstill and changes in the reserve food may be in progress, but the plant appears to be at rest and is dormant. The rest-period begins with the advent of the unfavorable growth conditions of the autumn, and normally continues until the favorable conditions of the spring.

One might reasonably assume that growing perennial plants removed from out-of-doors at the approach of autumn conditions to a greenhouse, would continue growth and not pass into the rest condition. One might assume, also, that if a plant in a dormant condition be brought into favorable conditions it would resume growth immediately. But experience and investigations show that many plants will not immediately continue growth, and, provided they do continue growth, it is at a slower rate. Dormant plants, that is those in the rest-period, may require considerable time before resuming growth. There are some plants that during dormancy respond quickly when brought into the greenhouse; there are others that remain dormant despite the most favorable environmental conditions. The rest-period in various species of *Acer* (maple), of *Quercus* (oak), of *Fraxinus* (ash), and of *Fagus sylvatica*, as well as other plants, is so well fixed as to make it almost impossible to force the dormant plants into growth by warmth and moisture alone. Special treatment is necessary, such as etherization. There are other plants in which the rest-period is not well established. These quickly respond to favorable growth conditions normally prevailing in a greenhouse. In many plants this rest-period has attained an almost habit-like character. The following table with data taken from results secured by Howard with branches brought into the greenhouse at Halle, Germany, is instructive:

GROWTH RESPONSE OF BRANCHES WHEN BROUGHT INTO GREENHOUSE.

Species	Collected Oct. 20–Nov. 4, 1905. No. of days for beginning of growth	Collected Jan. 8–10, 1906. No. of days for beginning of growth
<i>Acer negundo</i> var. <i>versicolor</i> .....	63	20
<i>Acer pseudoplatanus</i> ....	0*	0
<i>Azalea mollis</i> .....	26	0
<i>Æsculus Hippocastanum</i> ..	0	20
<i>Betula nigra</i> .....	62	12
<i>Berberis vulgaris</i> .....	10	3
<i>Celastrus scandens</i> .....	0	17
<i>Cercis canadensis</i> .....	0	10
<i>Cydonia japonica</i> .....	6	7
<i>Deutzia gracilis</i> .....	10	3
<i>Fagus sylvatica</i> .....	0	38
<i>Lonicera tatarica</i> .....	7	3
<i>Magnolia acuminata</i> .....	29	25
<i>Populus canadensis</i> .....	61	20
<i>Quercus macrocarpa</i> .....	59	0
<i>Spirea sorbifolia</i> .....	1	

\*0=No growth

In the investigation made by Howard, 234 species were collected from October 20 to November 4, and of these only 125 grew; and of the 125, only 18 per cent began growth within a period of nine days. Between January 8 to 10, another collection was made including practically all the species of the first lot and others in addition, so that the number totaled 283 species. Of this number 244 grew, of which 50 per cent began growth within the first nine days. The species that did not grow when brought into the greenhouse January 8 to 10 made growth when brought into the greenhouse on February 26. From these and the results of other experiments the conclusion is drawn that plants in general tend to pass out of the rest condition as the



season advances toward the spring. Dormancy is less stable in January than in November. This condition holds true not only for woody plants but also for bulbs and other herbaceous plants.

#### Method of breaking the rest-period.

The one method which has been largely employed for forcing dormant plants into growth is the etherization method. An air-tight chamber is provided, the size depending on the quantity or size of the material to be treated. The plants being placed in the chamber, it is tightly sealed except for a small opening through which ether may be introduced. Usually just below this opening is placed a sponge on which the ether is poured and then the opening is again sealed. If one desires to etherize a few bulbs, a wide-mouth bottle of two quarts capacity may be employed and the ether added in a small vial and the bottle then tightly stoppered. Special etherizing chambers are described for commercial work. The main desideratum is to have a chamber that will not permit of leakage of the ether vapor. The stopper must be securely fastened or weighted down.

**Quantity of ether.**—The quantity of ether best employed in forcing plants may vary with the nature of the plant, the season of the year, and the temperature of the etherization chamber. In general, the quantity to be added varies from 5 to 15 cubic centimeters per cubic foot of space (10 cubic centimeters equal about one-third fluid ounce). Early in the rest-period at 60° F., one should use about 15 cubic centimeters per cubic foot of space. In the middle of the rest-period, one should employ less and the amount should be further decreased toward the end of the rest-period. If the relative humidity of the chamber is high, a slight increase in the quantity of ether may be made. If chloroform is used, the quantity should be one-fourth to one-third of the quantity of ether recommended. The following figures are from Stuart:

#### TREATMENT RECOMMENDED FOR PLANTS AT DIFFERENT SEASONS

Cubic centimeters per cubic foot

	Ether		Chloroform	
	Cc. used	Exposure hours.	Cc. used	Exposure hours.
Lilac—				
October .....	15	48-24-24	4	48-24-24
November .....	12	48-24-24	3 ½	48-24-24
December .....	10	48-24-24	3	48-24-24
January .....	..	..	..	..
Astilbe—				
October .....	15	48-24-48	4	48-24-48
November .....	15	48-24-24		48-24-24
December .....	12	48-24-24		48-24-24
January .....	10	48	3	48

**Time of exposure.**—The time of exposure is also variable, being of greater duration in the early part and shorter in the latter part of the rest-period. In the early rest-period, a long exposure is given, varying from forty-eight to seventy-two hours to even as much as ninety-six hours. In case of long exposure, the practice is usually followed of making a forty-eight-hour exposure, after which the plant is removed from the etherization chamber for a day and then re-etherized for another twenty-four-hour period. Toward the middle and late rest-period, the time of exposure may be shortened as well as the quantity of ether.

#### The results.

The effect of etherization is to shorten the rest-period of the plant. Etherized plants come into bloom earlier and may be forced at lower temperature than unetherized plants. Howard found that seventy species

of woody plants collected December 17 to 24 and etherized for forty-eight hours, opened their buds fully in an average of 20.3 days, while the untreated plants required an average of 28.1 days for the same development. Many experiments have been made with lilacs. Jannvek states that lilacs etherized August 24 were in bloom September 18.

The following table compiled from results secured by Stuart show conclusively the value of etherization with lilacs:

#### INFLUENCE OF ETHER AND CHLOROFORM ON LILACS

Date of treatment	Substance employed	Dosage cc. per cubic foot	Expos. hours	Full bloom in days	
				Charles X	Marie Legraye
Nov. 18-22....	None	..	..	51	30.5
Nov. 18-22....	Ether	12	48	31	29.5
Nov. 18-22....	Chloroform	3.6	48	31	28.5
Dec. 17-21....	None	..	..	31	29.5
Dec. 17-21....	Ether	15	48	31	29.5

In the foregoing table it is noted that treatment in the middle of December resulted in no beneficial effect. The plants at the time were in the middle rest-period, when growth-response requires no strong stimulation outside of normal growth conditions.

In general it may be stated that lilacs if etherized before December 1 will respond markedly to the influence of etherization. General results show that etherized lilacs blossom in seventeen to twenty-five days. The saving in time may be eight to twenty days.

Favorable results have been secured with flowering shrubs. Positive results have been reported frequently for *Azalea mollis*, for *Viburnum* and *Astilbe*. Negative or slight results have been reported for *Deutzia gracilis*, *Prunus triloba*, roses, and *Spiraea prunifolia*. Similar results have been reported for lily-of-the-valley.

The method of action of the ether is not understood and any discussion of the subject is yet hypothetical.

#### Etherization of bulbs.

On the forcing of bulbs the evidence is unsatisfactory. At the Cornell Station, positive results were reported (see Bailey, "Cyclopedia of Agriculture," Vol. II: 29), but more recently Stuart has reinvestigated the forcing of bulbs and finds conflicting results. He states that the etherization of bulbs is not commercially practicable. Some unpublished data on the etherization of bulbs at the Cornell Station sustain this conclusion. Theoretically, those results are to be expected because the bulbs in practice are gathered in the late spring or early summer and then stored for months. After planting, the bulb is allowed to remain in a cold-frame for several months so that when brought into forcing conditions it is well over the rest-period and, indeed, has probably passed through its period by the time it is first planted.

**Effect on rhubarb.**—Some positive results have been secured at the Vermont Agricultural Experiment Station with etherization of rhubarb. Different lots of rhubarb were etherized on December 9, January 9 and February 24. The first gave an increase over the control of 34.4 per cent, the second 89.7 per cent and the third 5.7 per cent.

**General conclusions.**—Certain general rules may be applied to the practice of etherization:

1. Etherization shortens the rest-period.
2. The more resistant a dormant plant is in growth-response to favorable environmental conditions, the greater will be the advantage of etherization.
3. Etherization becomes of less value as the end of the rest-period is approached.

4. It is wasted effort to etherize a plant that readily responds in growth to the normally favorable growth condition.

**Bibliography.**—Howard, W. L., "Winter Rest-Period in Plants." Missouri Experiment Station, Research Bulletin No. 1 (1910). Johannsen, W., "Das Aetherverfahren beim Fröhrtreiben mit besonderer Berücksichtigung der Flidertreiberei." Jena, 1900. Zweite wesentlich erweiterte Auflage. Jena, 1906. Stuart, W., "The Rôle of Anesthetics and Other Agents in Plant-Forcing," Vermont Experiment Station, Bulletin No. 150 (1910).

LEWIS KNUDSON.

**ETROG.** This name is applied by the Jews to a citron (*Citrus Medica*, Linn.), which is imported and used by them for religious ceremonies connected with the Feast of the Tabernacles. The etrog and the lulab (palm leaf with myrtle and willow branches) are carried and waved during the services, especially those of thanksgiving. Since the time of the anti-Jewish demonstrations in Corfu in 1891, the etrog is imported more largely from Palestine than from that island. In addition to the use of the etrog by orthodox Jews for religious ceremonies, the natives of Palestine make salads of the fruit. See *Citron*.

WALTER T. SWINGLE.

**EUCALÝPTUS** (Greek, *eu*, well; *kalypto*, to cover as with a lid: the petals and usually also the calyx-limb fused and covering the flower before anthesis, then falling off in the form of a lid, or cover). *Myrtaceæ*. GUM-TREE. Plate XXXIX. Mostly trees, frequently of immense size, a few of the alpine and sub-alpine species shrubby, much grown in California and the Southwest for their ornamental value, as windbreaks and avenue trees, for fuel, and especially for their timber.

Leaves simple, entire; in the seedlings and on young shoots of many species horizontal, opposite, sessile, and cordate; in the adult mostly vertical, alternate, petiolate (rarely opposite and sessile), and varying from roundish to lanceolate-acuminate and falcate; always rigid, penniveined, glabrous except rarely on the young shoots, sometimes covered with a glaucous wax: fls. white, rarely yellowish or some shade of red, in umbels of 3 to many, rarely solitary, the umbels solitary and axillary or paniculate or corymbose; calyx-tube obconical, campanulate, ovoid, or oblong, adnate to the ovary at the base; petals and calyx-lobes connate, forming a lid, or cap, which separates from the calyx-tube by a circumscissile dehiscence; lid sometimes plainly double, the outer cap then derived from the calyx-limb, the inner cap from the petals; stamens numerous; anthers small; style undivided: fr. a caps. partially or wholly inclosed in the adherent calyx-tube, opening at the top by 3-6 valves; seeds numerous, small, mostly angular.—About 300 species, all native of Austral. and the Malayan region. Related to *Angophora* and to *Syncarpia*, but distinguished by the absence of distinct petals.

The genus *Eucalyptus* was monographed in part by Baron von Mueller in his *Eucalyptographia* (cited here as F. v. M. Eucal.), in which 100 species are illustrated (1879-84). The genus is now receiving exhaustive treatment by J. H. Maiden in his "Critical Revision of the Genus *Eucalyptus*," appearing in parts, with numerous plates. This author also furnishes the best information regarding the uses and timber of the various species, in his "Native Useful Plants of Australia." Bentham described 135 species in his "Flora Australiensis," vol. 3 (1866). The Australasian Association for the Advancement of Science published a very useful key by J. G. Luehmann in 1898. The most exhaustive American work on the genus is United States Forestry Bulletin No. 35, "Eucalypts Cultivated in the United States," by A. J. McClatchie. University of California Agricultural Experiment

Station Bulletin No. 196, by Norman D. Ingham, is a practical guide for planters, with descriptions of the more important species. The United States Forest Service, the California Station, and the California State Board of Forestry have all issued smaller bulletins on this subject. Inflated claims have been made for eucalyptus culture, and authentic publications should be secured if one contemplates planting them extensively.

*Eucalyptus* is a group adapted to semi-tropical and warm temperate regions. But few species are really hardy. *E. globulus* has been very widely distributed over the globe through the persevering efforts of the late Baron von Mueller; it is frequently planted in the malarial regions of warm climates, as at the Campagna at Rome, with very beneficial effect. (Sanitarians will be interested in "Eucalyptus in Algeria and Tunisia, from an Hygienic and Climatological Point of View," by Edward Pepper, Proc. Amer. Phil. Soc. 35:39-56.) In England, the same species is grown extensively for subtropical gardening, on account of its distinctive glaucous hue and symmetrical growth, but in that climate it needs the protection of glass in winter.

This is by far the most important genus of timber trees introduced into California. The ordinary blue-gum, *E. globulus*, has been grown in large numbers and is still the favorite for general planting. Its hard and durable wood is replacing oak and hickory to some extent for insulator pins, wheel-wrights' work, flooring, tool-handles, and furniture. Although pale in color, it takes a good polish, possesses a beautiful grain, and is readily stained. Furniture made from blue-gum wood and properly stained has every appearance of mahogany. The chief drawback to the use of eucalyptus for lumber is the tendency of its logs to end-check while curing, thus involving considerable waste. As a windbreak and fuel tree it is unsurpassed, since it is of rapid, erect growth and the timber is easily split. Its foliage has been distilled in large quantities for the oil it contains, practically all of the eucalyptus oil now sold in the United States coming from home-grown trees.

In addition to the blue-gum, *E. rostrata* and especially *E. tereticornis* are grown for railroad ties, piling, interior finish and furniture. *E. resinifera* is a hardy eucalypt yielding a good timber not so liable to check as that of some others; it has been but little grown in America thus far. *E. corynocalyx* is a good drought-resistant species for districts with mild winters, and its wood is of the best. *E. crebra* will grow under a greater range of conditions than perhaps any other and is especially suited to the hot and dry interior valleys. Other drought-resistant eucalypts are *E. microtheca* and *E. polyanthemos*, while the most resistant to frost are *E. crebra*, *E. rostrata*, *E. tereticornis*, *E. globulus*, *E. viminalis*, *E. rudis*, *E. robusta*, and *E. resinifera*. The species most cultivated as ornamentals are *E. ficifolia*, *E. leucoxylon*, *E. sideroxylon* var. *rosea*, *E. Risdonii*, *E. erythronema* and *E. polyanthemos*. Persistently repeated accounts of heights ranging from 325 to 500 feet for certain eucalypts are erroneous, as indicated under *E. amygdalina* var. *regnans*.

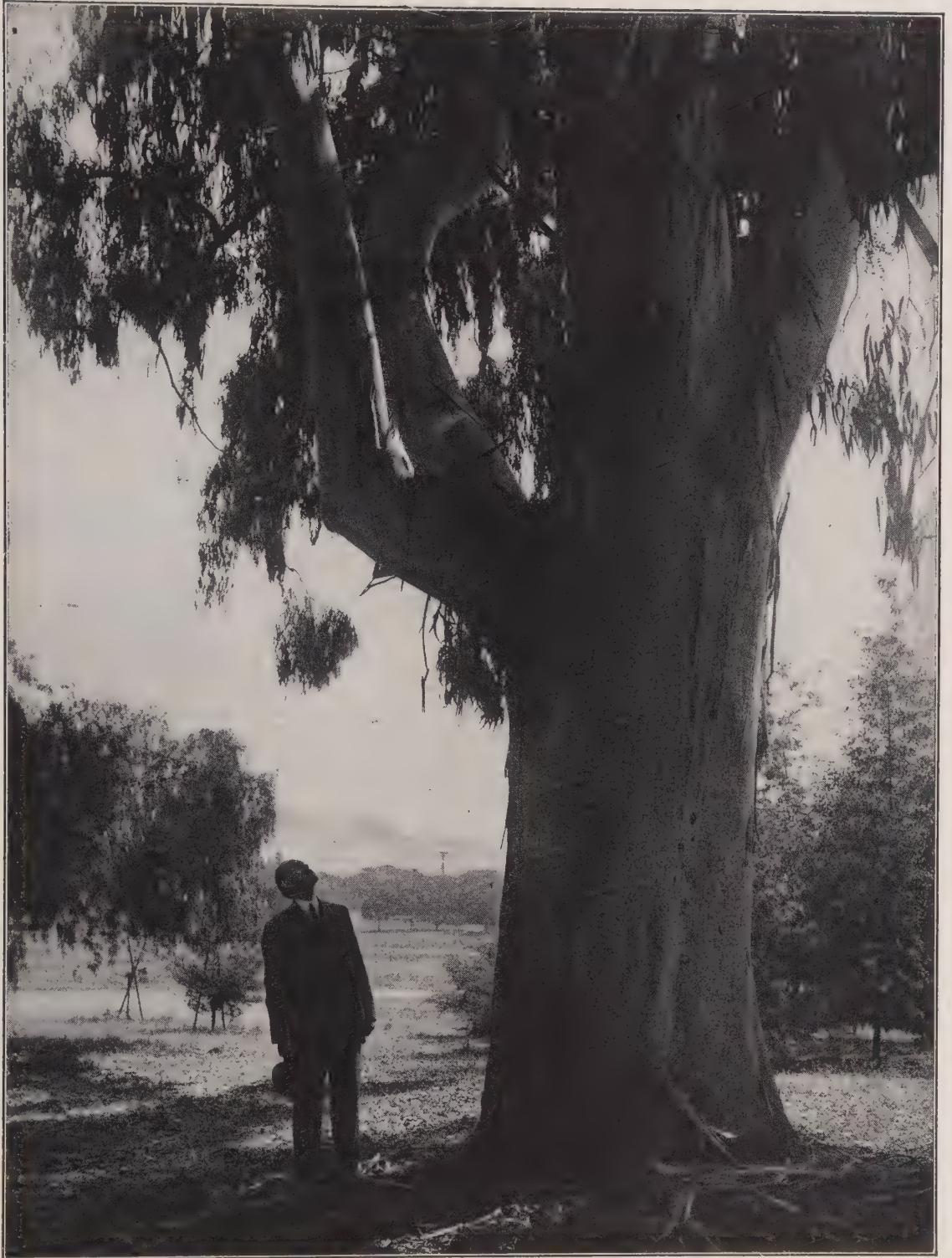
Although the eucalypts are not exclusively, and some species not even prominently horticultural, yet because of the great general interest attached to them and because of their varied uses, it is thought best to discuss them rather fully in this Cyclopaedia.

#### Culture of eucalyptus in California.

The following directions for the propagation of *Eucalyptus* are adapted very largely from Bulletin No. 196 of the California Experiment Station, entitled "Eucalyptus in California," by Norman D. Ingham (1908).

The necessary conveniences for the propagation of





XXXIX. *Eucalyptus viminalis* in California.





the seedlings are: seed-boxes or flats, a good soil, seed true to name, plenty of convenient water, and in most localities shade for the young plants. The seeds of most species may be gathered at all times of the year, although the greater amount mature during the summer and fall. The seed-cases should be gathered from the trees when the valves begin to open and placed on sheets of canvas in the direct rays of the sun, which will open the valves, allowing the seed and chaff to fall out. The number of fertile seed to the pound is very high; the average number of transplanted plants raised to the pound is 12,000. Eucalyptus seed will germinate and grow in nearly any soil but the best results are secured when the seeds are sown in a light loam, while a medium loam mixed with about one-quarter well-rotted horse-manure should be used in the transplanting flats.

The time to sow the seed varies somewhat with the locality, but as a general rule the seed should be sown in May or June and the seedlings from these sowings will be large enough to be set out in the field the following spring, if they receive proper care while young. The seed is usually sown broadcast in the seed-flats



1424. *Eucalyptus ficifolia* ( $\times \frac{1}{4}$ ). No. 2.

and the young plants transplanted once before being set in the field. Some persons take the trouble to sow one seed in a place and space them in the flats; by this method transplanting is unnecessary. Others sow the seeds in hills and practise thinning, instead of transplanting before setting out in the field. This last method is used in the warmer districts with good success, because of the great trouble experienced in transplanting during the hot summer months. Whichever method is used, fill the flats to a depth of 3 or 4 inches with the prepared soil, pressing it down firmly in the boxes, then sow the seeds and cover them to a depth of about  $\frac{1}{8}$  inch with the same soil, sand, or sawdust, pressing this covering firmly over them. The seed-flats should be kept damp through the heat of the day, until the young plants break the ground, then care must be taken not to use too much water and that there is a good circulation of air over the flats, or damping-off is liable to occur. This disease can be prevented by using practically no water on cloudy days and only in the mornings on clear days. If the seeds are sown broadcast in the flats, when the young plants have reached a height of 2 to 3 inches, they can be transplanted to other flats of prepared soil and spaced from  $1\frac{1}{4}$  to 2 inches apart. The best results in transplanting are secured if the plants are hardened-off for a few days beforehand by checking the water supply, allowing them to become quite dry. The soil into which the young plants are transplanted should be kept damp, and the plants should be protected from the direct rays of the sun for a few days. The lath-house or the screens are necessary to supply shade for the young

plants and will also protect the seeds in flats from the ravages of birds and the young plants from the frosts during winter months, before the time for setting in the field.

The time to set the plants in the field varies with the climatic conditions or localities and whether the plants are to receive irrigation or not. In localities in which frosts are common through the winter months, it is advisable to set the trees out as early in the spring as possible without endangering them to a late frost and still have them receive the benefit of the late rains, so that they will have a full season's growth to withstand the frosts of the following winter. If the trees are to be irrigated, they may be set out later in the season without danger of loss from want of moisture. To insure a good stand, the plants should not be under 6 or over 20 inches in height when set in the field; to a certain extent, the smaller the plants when set out, the better the results afterward, although the size varies somewhat with the species and the locality. In many species the roots are as long if not longer than the plant's own height above ground. This is a family of plants that will not stand a large amount of mutilation to the root-system; consequently better results are secured from setting out small plants.

If the soil is heavy rich loam, the trees may be planted as close as 6 by 6 feet apart unless irrigation is to be practised. In the latter case, 4 by 8 feet would be the right distance, thus leaving an 8-foot space for plowing out the irrigating-ditches each year. If it is a lighter soil on which the planting is to be made, 8 by 8 feet is the proper distance, or 6 by 10 feet, if irrigation is to be practised. The close planting has a tendency to sacrifice the diameter growth in favor of the height, also making more erect trees and forming a perfect canopy with their crowns that will shade the soil, nearly preventing evaporation, as well as any vegetable growth on the forest floor. Close planting matures a greater number of perfect trees, and is especially recommended when straight poles are desired. The plants should be blocked out in the flats before being brought into the field, by drawing a sharp knife between the rows. If care is taken to set out the young plants with this small amount of soil around the rootlets, the shock caused in transplanting is reduced to a minimum. Each planter should carry a trowel, to make the holes that are to receive the young plants at the intersection of the marked lines. These holes should be of such a depth that the plants can be set from  $\frac{1}{2}$  to 1 inch lower in the soil than they originally were in the flats. Each plant should have the soil pressed firmly about it and receive a small amount of water, unless the soil is moist from recent rains.

In order to provide a mulch, thus checking evaporation and also to kill the weeds, cultivation should be conducted in the new plantation as long as possible without danger of injuring the young trees by driving a horse between them. The plantings generally may be cultivated for the first season and part of the second before the limbs of the trees spread out and interlap so that it is impossible to drive between the rows. It is an acknowledged fact that the only way to secure a good stand, and give the trees a start, is to cultivate and take care of the plantings from the time of setting out. However, a number of groves have been set out on land that is too hilly or rocky to cultivate and the trees have made fair growths.

Thinning of the young trees is an important practice, as it is not good management to set out just the number of trees that one expects to mature. A planting upon any good soil may with advantage be set out 6 by 6 feet apart (1,210 trees to the acre), and at the end of the first year a rigid thinning should be started, removing with a grub-hoe all weak, inferior, or injured trees. This thinning should be conducted until only the strong and healthy trees, or a certain number,

remain to the acre. By this method some trees will stand at the original distance that they were planted, while others will stand at multiples of that distance. The extra cost of close planting will never be noticed when the largest possible stand of healthy trees is guaranteed, which is practically the case under this method. If thinning is carried out by a set plan, removing every other one or two trees, many strong and healthy trees will be sacrificed. All limbs that have a tendency to deform the trees should be removed each year. After the third or fourth year, the trees will have grown to such a height that to remove the limbs may prove impractical in most cases. At this period (the fourth or fifth year) there enters a new problem: the removal of the poorer trees for wood and stakes to allow the remainder a larger area of soil to draw upon and a greater space above ground to extend their branches. At this time the trees on an acre can be reduced to a certain number, leaving these to grow for telephone poles, ties, and lumber, or the entire grove may be cut for stakes and wood.

*Second-growth eucalyptus.*—In three to six weeks after the trees have been felled, the sprouts will start out from the stumps. These sprouts are produced in abundance and if properly thinned will soon replace the cut forest, thus providing a second growth of fuel or timber in much less time than was required with the original grove. These remarks apply probably to all species of eucalyptus, certainly to all sorts experimented with in California up to the present time.

#### Taxonomy of the cultivated eucalypti.

All of the keys used for the identification of species are more or less artificial. No satisfactory natural classification has yet been devised. While the following key is designed to aid in the making of determinations rather than to express relationships, species known to be closely related are placed near each other in the text so far as this can be conveniently done. For the ready determination of species in this critical genus, it is necessary to have adult leaves, buds, flowers, and mature fruit; immature fruits are often very misleading. Allowance should always be made for extreme forms, since only normal specimens are here described. This applies particularly to size of leaves. Unless otherwise stated, the leaf description is drawn from foliage on mature stems. The juvenile foliage, i.e., on young seedlings and on suckers, is usually very different, the leaves often broader, blunt, sessile, and of a different color.

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#### KEY TO THE SPECIES.

- A. Fls. mostly in panicles or corymbs, not simple umbels (occasionally the infl. appears to be paniculate in section AAA also, owing to dropping of lvs., so that it is well to look for lf-scars in doubtful cases).
- B. Fr.  $1\frac{1}{2}$ –2 in. long; valves inclosed: fls. large.
- C. Seeds black, not winged: fls. white or pink..... 1. calophylla
- CC. Seeds brown or red, winged: fls. red (pink to crimson or scarlet)..... 2. ficifolia
- BB. Fr.  $\frac{1}{2}$ –1 in. long ( $\frac{1}{4}$ – $\frac{1}{2}$  in. in E. maculata); valves inclosed: fls. medium.
- C. Lvs. paler beneath: fls. in terminal corymbs..... 3. corymbosa
- CC. Lvs. of nearly equal color on both sides: fls. in lateral and terminal panicles.
- D. Caps. slightly ribbed: fls. nearly or quite sessile in the clusters... 4. eximia
- DD. Caps. smooth: fls. distinctly stalked..... 5. maculata
- BBB. Fr.  $\frac{1}{4}$  in. or less long (nearly  $\frac{1}{2}$  in. in var. of No. 16); valves various: fls. small.
- C. Shape of lvs. orbicular to ovate, often nearly as broad as long.
- D. Petioles slender; lvs. alternate.
- E. Fls. stalked: lvs. dull grayish green..... 6. polyanthemos
- EE. Fls. nearly sessile: lvs. lustrous and dark green..... 7. populifolia
- DD. Petioles none; lvs. opposite.... 8. melanophloia
- CC. Shape of lvs. lanceolate or oblong, elongated.
- D. Lvs. distinctly paler beneath than above.
- E. Fr.-valves included in the calyx-tube..... 10. paniculata
- EE. Fr.-valves exerted..... 11. Ravertiana
- DD. Lvs. of equal color on both sides.
- E. Lid  $\frac{1}{4}$  in. or more long, beak-like..... 9. siderophloia
- EE. Lid shorter, not beak-like.
- F. Fr.-valves much exerted, spreading..... 12. microtheca
- FF. Fr.-valves about reaching the rim: lf.-veins very diverging..... 13. crebra
- FFF. Fr.-valves wholly included in calyx-tube: lf.-veins very oblique.
- G. Lid hemispheric..... 15. bicolor
- GG. Lid conic..... 16. hemiphloia
- AAA. Fls. solitary in the lf.-axils, or in strictly sessile umbels, large.
- B. Lvs. all opposite, cordate at base: shrub..... 17. macrocarpa
- BB. Lvs. mostly alternate, not cordate.
- C. Peduncles ascending, or fls. entirely sessile; lid warty.
- D. Plant a tree: lvs. acute..... 18. globulus
- DD. Plant a shrub: lvs. obtuse, very oblique at base..... 19. alpina
- CC. Peduncles recurved, flat; lid smooth: shrub..... 20. tetraptera
- AAA. Fls. in stalked umbels.
- B. Fl.-stalks (either pedicels or peduncles) flattened.
- C. Fr.-valves with teeth projecting well beyond calyx-rim.
- D. Teeth connivent into a cone: lid  $1\frac{1}{2}$  in. long.
- E. Fr. not embedded in receptacle. 24. cornuta
- EE. Fr. partly embedded in receptacle..... 25. Lehmannii



- DD. Teeth distinct: lid  $\frac{3}{4}$  in. or less long.
- E. Fr.  $\frac{1}{2}$ – $\frac{3}{4}$  in. long: lid about  $\frac{1}{2}$  in. long.
- F. The fls. sessile in the umbels: lvs. obtuse.....26. *platypus*
- FF. The fls. pedicellate: lvs. acute.....27. *occidentalis*
- EE. Fr. smaller: lid shorter.
- F. The fls. more than 3 in each umbel.
- G. Lid much longer than calyx-tube.....43. *resinifera*
- GG. Lid about as long as calyx-tube.....41. *punctata*  
42. *saligna*
- GGG. Lid much shorter than calyx-tube: fls. sessile.....33. *Cambagei*
- FF. The fls. usually 3 in each umbel.....52. *viminalis*
- CC. Fr.-valves included or scarcely exerted beyond the calyx-rim (exserted but closely incurved in *E. megacarpa* and *E. gomphocephala*).
- D. Breadth of fr. less than  $\frac{1}{2}$  in.
- E. Lid less than half as long as calyx-tube, depressed-hemispheric, blunt.
- F. Lvs. mostly 2–4 in. long: lid very short.
- G. Fr. 3–6 lines diam.: lid granular.....28. *coccifera*  
29. *virgata*
- GG. Fr. about 2 lines diam....40. *microcorys*
- FF. Lvs. mostly 4–8 in. long.
- G. Veins very oblique; lvs. mostly under 1 in. wide.
- H. Calyx not angular; outer stamens sterile.30. *hæmastoma*  
31. *Sieberiana*
- HH. Calyx very angular in bud; stamens all perfect.....32. *goniocalyx*
- GG. Veins at nearly a right-angle to midrib; lvs. thick, more than 1 in. wide.....34. *botryoides*
- EE. Lid at least half as long as calyx-tube, mostly conic and acute.
- F. Lvs. ovate-lanceolate,  $1\frac{1}{2}$ –3 in. wide; lateral veins widely spreading.....35. *robusta*
- FF. Lvs. lanceolate,  $\frac{1}{2}$ – $1\frac{1}{2}$  in. wide; lateral veins oblique.
- G. The fls. short-stalked.
- H. Arrangement of lvs. opposite: umbels bent downward.....70. *doratoxylon*
- HH. Arrangement of lvs. alternate.
- I. The lid narrowly conic, twice as long as calyx.....36. *redunca*
- II. The lid broader, not so long.....37. *pilularis*  
38. *Muelleriana*  
39. *acmeniodes*  
41. *punctata*
- GG. The fls. sessile in the umbel: lvs. paler beneath.42. *saligna*
- DD. Breadth of fr. over  $\frac{1}{2}$  in.
- E. Lid not or scarcely broader than calyx-tube.
- F. Lvs. roundish, obtuse.....26. *platypus*
- FF. Lvs. lanceolate, acute.
- G. Calyx-tube and lid very warty.....18. *globulus*
- GG. Calyx-tube and lid ridged or nearly smooth.
- H. Caps. sunk in the calyx-tube.....46. *incrassata*  
47. *Planchoniana*  
21. *cosmophylla*
- HH. Caps. protruding from calyx-tube.....48. *megacarpa*
- EE. Lid much broader than calyx-tube.....49. *gomphocephala*
- BB. Fl.-stalks cylindric or angular but not flattened.
- C. Caps. sessile or nearly so in the umbels.
- D. Fr.-valves with conspicuous projecting teeth.
- E. Lid 1– $1\frac{1}{2}$  in. long, cylindric....24. *cornuta*
- EE. Lid mostly  $\frac{1}{4}$ – $\frac{1}{2}$  in., conic.
- F. The fr.-valves merely acute....50. *rudis*
- FF. The fr.-valves ending in needle-like points.....51. *decipiens*
- EEE. Lid short, rarely  $\frac{1}{4}$  in. long.
- F. Buds ovoid, smooth.
- G. Fr. mostly 4-celled: fls. usually 3.....52. *viminalis*
- GG. Fr. mostly 3-celled: fls. usually more than 3....53. *Stuartiana*  
54. *Macarthuri*
- FF. Buds club-shaped, slender, often rough.....55. *amygdalina*
- DD. Fr.-valves included, or barely exceeding the rim.
- D. The fls. 4 or more.
- F. Lvs. of equal color on both sides.
- G. Venation of lvs. feathered.
- H. Fr.  $\frac{3}{4}$ –1 in. wide: shrub.61. *buprestium*
- HH. Fr.  $\frac{3}{4}$ – $\frac{1}{2}$  in. wide: trees.
- I. Buds club-shaped (i.e. widest above the middle), obtuse.....55. *amygdalina*  
56. *Risdonii*  
57. *obliqua*
- II. Buds ovoid, acute: fr. contracted at orifice.44. *piperita*  
45. *eugenioides*
- GG. Venation of lvs. longitudinal and almost parallel.....58. *stellulata*  
59. *coriacea*
- FF. Lvs. paler beneath.
- G. Lid broader than calyx: fr. streaked lengthwise...60. *corynocalyx*
- GG. Lid not broader than calyx: fr. not streaked...62. *diversicolor*
- EE. The fls. 1–3 in each umbel.
- F. Lvs. opposite, heart-shaped at base.
- G. Calyx obtuse at base: lvs. crenate.....22. *cordata*
- GG. Calyx tapering at base: lvs. entire.....23. *pulverulenta*
- FF. Lvs. scattered, narrowed at base.
- G. Fr. scarcely contracted at orifice.....21. *cosmophylla*
- GG. Fr. much contracted at orifice.....61. *buprestium*
- CC. Caps. plainly stalked in the umbels.
- D. Umbels with more than 3 fls.
- E. Fr.-valves plainly exerted.
- F. Fr. flat-topped; valves awl-shaped.....63. *salmonophloia*
- FF. Fr. rounded to the valves; valves triangular, acute.
- G. Diam. of fr. 2–3 lines...64. *rostrata*  
65. *tereticornis*
- GG. Diam. of fr. 4–6 lines.
- H. Anthers reniform.....66. *macrorhynchus*
- HH. Anthers oblong.....50. *rudis* [cha]
- EE. Fr.-valves included.
- F. Fr. scarcely or not at all contracted at orifice.
- G. Lvs. thick, odorless: fr.  $\frac{1}{4}$  in. across.....67. *Gunnii*
- GG. Lvs. thin: fr. slightly smaller.....68. *melliodora*  
69. *odorata*
- FF. Fr. contracted at orifice.
- G. Lvs. opposite.....70. *doratoxylon*
- GG. Lvs. mostly alternate.
- H. Breadth of fr. about  $\frac{1}{4}$  in.





ridges broader than in other ironbarks: lvs. 4-7 in. long; lid beak-like, very acute,  $\frac{1}{4}$ - $\frac{1}{2}$  in. long; stamens about 3 lines long; anthers minute, globular, opening by oblong slits: fr. obovoid, truncate, about  $\frac{1}{4}$  in. across, the valves slightly protruding. Oct., Nov. F.v.M. Eucal. 4:8. Maiden, Crit. Rev. Eucal. 47 (figs. 19-33).—Wood heavy, strong, and durable, useful for wagon work, tool-handles, building, posts, poles, and the like. Fls. provide honey for bees. Tree of rapid growth and resistant to extremes of temperature: grown in the San Joaquin Val'ey.

10. *paniculata*, Smith. WHITE IRONBARK. RED IRONBARK. Tall or medium-sized tree: bark hard, persistent, deeply furrowed, of a grayish brown color: lvs. lanceolate, acuminate, 3-5 in. long: fls. in panicles or sometimes in axillary umbels; lid variable; stamens 2-4 lines long, the outer ones sterile; stigma dilated: fr. truncate-ovate, pedicelled, 2-4 lines wide, with thin rim. Summer. F.v.M. Eucal. 5:8. Maiden, Crit. Rev. Eucal. 57 (figs. 8-21).—Wood usually very pale, but variable; the hardest of ironbarks; "cuts almost like horn:" valuable for railroad-ties, fencing, and building purposes. Does not endure heat and drought: much prized in Austral., but trees in Calif. are not promising.

11. *Raveretiàna*, F. v. M. Tall tree with thin angular branchlets: bark deciduous, leaving the branches smooth and gray, but often persistent on the trunk: lvs. lanceolate, opaque, 3-5 in. long: fls. exceedingly small, white, short-stalked; lid slenderly conic, under 2 lines long; stamens not 2 lines long; anthers reniform, opening by longitudinal slits: fr. little over 1 line wide, low-cup-shaped, the protruding valves forming a hemispheric summit. F.v.M. Eucal. 1:8. Maiden, Crit. Rev. Eucal. 53 (figs. 1-3).

12. *microtheca*, F. v. M. Tree, becoming 80 ft. high: bark rough, gray, persistent, or the outer layers deciduous, leaving the trunk smooth: lvs. narrowly lanceolate, 4-6 in. long: lid broad-conic; stamens very short; anthers minute, roundish, opening by longitudinal slits: fr. scarcely  $\frac{1}{2}$  in. wide; valves fully half-protruding. F.v.M. Eucal. 10:6. Maiden, Crit. Rev. Eucal. 52 (figs. 16-22).—Not yet fully tested in Amer.: endures frost and heat: recommended as a forest cover for the hot dry region of the S. W.: the roots yield water to natives and travelers on the Australian deserts. Wood beautifully colored but perhaps too hard for cabinet work.

13. *crebra*, F. v. M. NARROW-LEAVED IRONBARK. Small to large tree, with slender drooping branchlets: bark persistent throughout, hard, dark, ridged and deeply furrowed: lvs. pale, narrow, linear-lanceolate; lateral veins fine, nearly parallel, widely diverging from the midrib: lid conical or nearly hemispheric, not over 2 lines long; stamens 1 or 2 lines long, inflexed in bud; anthers globular, opening by longitudinal slits: fr. obovoid-truncate, not over 2 lines wide, the tips of the valves not or scarcely exerted. F.v.M. Eucal. 5:3. Maiden, Crit. Rev. Eucal. 53 (figs. 4-9).—A rapidly growing frost-resistant tree of picturesque habit: endures minimum temperatures of 18-20° and maximum temperatures of 110-118° (McClatchie), not very resistant to alkali (Loughridge). Grown in Calif. for its hard durable wood, of a reddish color. Bark sometimes described as grayish and deciduous.

14. *leptophleba*, F. v. M. Characters as in *E. crebra*, but fls. somewhat larger and fr. 3 or 4 lines wide: lvs. of a silky sheen.—This has been classed as a var. of *E. drepanophylla*, F.v.M., but the two are now known to be identical and *E. leptophleba* is the older name.

15. *bicolor*, A. Cunn. (*E. largiflora*, F. v. M.). BLACK BOX. Shrub or small tree, with drooping branches: bark persistent, rough and hard: lvs. lanceolate, 5 in. or less long; lateral veins at an acute angle

to midrib: lid double, the inner one hemispheric; stamens 1 or 2 lines long; anthers opening by lateral pores: fr. truncate-ovate, about 2 lines wide, the valves inclosed but not distant from the thin rim. F.v.M. Eucal. 5:7. Maiden, Crit. Rev. Eucal. 49 (figs. 5-13), 51 (figs. 9-19).—Timber hard, tough, and durable, rather



1426. *Eucalyptus globulus*. Shoots on a young plant. ( $\times \frac{1}{4}$ ) No. 18.

easily worked: suitable for ties, piles, shafts, poles, cogs, and the like.

16. *hemiphloia*, F. v. M. AUSTRALIAN GRAY BOX. Tree, 90 ft. or less high: bark of trunk persistent, solid, grayish and somewhat wrinkled; of branches deciduous in flakes or long strips: lvs. lanceolate-falcate to ovate-lanceolate, 3-5 in. long, thick and rigid, often ashy gray; lateral veins distant, diverging at a very acute angle: lid conical; stamens pale, about 2 lines long; anthers globular, opening by lateral pores: fr. ovoid-oblong, truncate and slightly contracted at orifice, about 3 lines wide. F.v.M. Eucal. 5:5. Maiden, Crit. Rev. Eucal. 50 (figs. 1-6).—Useful as a shade tree because of its dense foliage; also for fuel and as pasturage for bees. Wood hard, tough, and durable.

Var. *albans*, F. v. M. (*E. albans*, Miq.). WHITE BOX. Bark dull green, persistent: lvs. glaucous or white-mealy: buds chalk-white: fr. larger.

17. *macrocarpa*, Hook. Stout shrub, 6-15 ft., usually white-mealy: lvs. all opposite, sessile, cordate-ovate: fls. orange-colored to crimson, very large, solitary; calyx-tube smooth or obscurely ridged; lid conical, longer than the tube; stamens about 1 in. long: fr. depressed-hemispherical,  $1\frac{1}{4}$ -3 in. across, with raised rim and broad protruding valves. Hook. Icon. 405-407. B.M. 4333. F.v.M. Eucal. 8:4. Maiden, Crit. Rev. Eucal. 77 (figs. 1-3).—Desirable ornamental because of its glaucous foliage and brilliant bloom: grown sparingly in S. Calif.

18. *glóbulus*, Labill. BLUE GUM. Figs. 1425-1427. Tree, 300 ft. or less high: bark deciduous in long thin strips or sheets, leaving the trunk smooth and grayish or bluish white except at base: lvs. lanceolate, thick, often  $\frac{1}{2}$ -1 ft. long; those on young shoots and seedlings opposite, sessile, broad, and white-mealy: fls. solitary or 2 or 3 together, closely sessile or on a short peduncle; calyx-tube and lid warty, covered with bluish white wax; stamens above  $\frac{1}{2}$  in. long: fr. angular,  $\frac{3}{4}$ -1 in. across, the flat valves not pro-

truding. Dec.-May. F.v.M. Eucal. 6:2. G.C. II. 15:621; III. 2:777, 784; 10:737. Gn. 71, p. 18; 75, p. 606. Maiden, Crit. Rev. Eucal. 79 (figs. 1-12).—The best species for general planting; extensively used in Calif. Its combination of rapidity of growth, straightness of trunk, great strength of wood, and its known ability to flourish under a wide range of conditions in Calif., give it a great advantage over any other species (Ingham). Wood stronger than that of *E. rostrata* and *E. tereticornis*, yellowish white, easily stained, not durable in the soil in Calif.: used there for insulator pins, spokes, tellos, whiffle-trees, handles, flooring and interior finish; a good species for fuel: logs check badly in curing, this much less in the so-called "San José blue-gum" or "re-enforced gum" which, however, is thought by some to be only a selection of the best trees of ordinary blue-gum. Lvs. distilled for oil: fls. yield much honey to bees, but because of its pronounced flavor there is little or no demand for it in retail trade (Richter). Endures minimum temperatures of 25° and high temperatures of the San Joaquin and Sacramento Valleys but not of the desert districts: resists considerable drought when once established but best development is attained only on good and fairly deep soil. Fig. 427 shows the stamens and the structure of the bud. Nos. 1-4 are half natural size; 5 is on a larger scale. No. 4 is a section of a bud.

Var. *compácta*, Hort. DWARF BLUE GUM. Densely branched from the ground, forming a symmetrical rounded compact tree: lower foliage as in young growth of *E. globulus* but smaller with the longer narrower lvs. only near the top.—Said to have originated near Niles, Calif., from seed of the ordinary blue-gum (Calif. Nursery Co.).

The specific name *globulus* is sometimes written with a capital G, because it is a noun rather than an adjective; but the initial letter is here written in lower case in accordance with a recommendation of the International Botanical Congress.

19. *alpina*, Lindl. Shrub, 12 ft. high: lvs. inequilaterally semi-ovate, blunt, acute on young shoots, 2-4 in. long, thick and leathery: fls. sessile in the lf.-axils, solitary or few: fr. hemispherical,  $\frac{3}{4}$ -1 in. wide, not angular; rim broad; valves protruding. Sept.-Nov. F.v.M. Eucal. 2:1.

20. *tetráptera*, Turcz. Shrub or small tree: branches often sharply angled: lvs. very thick, oblong-lanceolate: fls. solitary, on flat recurved peduncles; lid 4-angled, much shorter than calyx; stamens not over  $\frac{1}{2}$  in. long: fr. prominently 4-angled, 2-3 in. long,  $\frac{3}{4}$ -1 in. wide, the valves well inclosed. F.v.M. Eucal. 2:10.—Highly ornamental; once grown at Santa Monica, according to Kinney who says that the calyx-tube and stalk just before the lid falls become a brilliant crimson and are by far the most striking part of the fl.

21. *cosmophýlla*, F.v.M. Tall shrub or small tree: bark smooth, ash-colored: lvs. broad-lanceolate, 3-5 in. long, very thick and rigid: peduncles almost 0; lid hard, low-hemispheric, blunt or short-pointed; stamens 4-6 lines long; anthers ovate, opening by distinct parallel slits: fr. globose-truncate, not contracted at orifice, smooth, 7-8 lines across; rim thick. F.v.M. Eucal. 7:2.

22. *cordata*, Labill. Small tree, to 50 ft.: lvs. opposite, sessile, orbicular to ovate, somewhat crenate, rarely over 3 in. long, usually white-mealy, as also the infl.: calyx broadly campanulate, obtuse at base,

smooth; lid low-hemispherical, obtuse or with sharp tip, shorter than tube; stamens 3-4 lines long; anthers opening by parallel slits: fr. globular-truncate, hard, 4-6 lines thick; valves rarely protruding. F.v.M. Eucal. 8:1. B.M. 7835. G.C. III. 3:803; 30:456; 47:168.—Useful mainly as an ornamental.

23. *pulverulénta*, Sims. Lvs. always entire: calyx-tube turbinate, tapering to the base; lid variable, mostly conical; otherwise about as in *E. cordata*. F.v.M. Eucal. 8:7. B.M. 2087. Gn. 75, p. 140.—The very blue foliage supplies a pleasing contrast for ornamental planting.

24. *cornúta*, Labill. YATE TREE. Moderate-sized or large tree, usually low-branched and spreading: bark either deciduous in irregular sheets or persistent and rough: lvs. oblong or broad-lanceolate, often obtuse, 2-5 in. long: fls. greenish yellow, numerous, in dense heads; lid cylindric, horn-like, 1-1½ in. long; stamens 1½-2 in. long: fr. short-cylindric, 4-5 lines wide, valves much exerted and connivent into a beak-like projection. June-Oct. F.v.M. Eucal. 9:1. B.M. 6140 (lid too highly colored).—Used successfully as a roadside tree in S. Calif.: especially good as a shade tree: adapted to the lemon belt, and tolerating alkaline and saline soils (Franceschi). Timber hard, heavy, tough, and elastic.

25. *Léhmännii*, Preiss (*E. cornúta* var. *symphiocárpa*, Auct. *E. macrocéra*, Turcz.). Perhaps only a form of *E. cornúta*: lvs. more often short and obtuse: fr. half immersed in the receptacle, forming a solid woody mass. June-Oct.

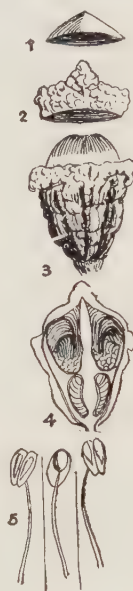
26. *plátypus*, Hook. (*E. obcordata*, Turcz.). Tall shrub or small tree: bark smooth, grayish: lvs. petioled, oval to obcordate, very obtuse, 1-2½ in. long, leathery and shining: peduncles winged, recurved; fls. dull red or yellowish white, not conspicuous; lid conic-cylindric, much narrower than the prominently angled calyx-tube; stamens  $\frac{1}{2}$ -¾ in. long: fr. truncate-ovate, very angular, 4-7 lines thick. F.v.M. Eucal. 7:6. Hook. Icon. 849.

27. *occidentális*, Endl. FLAT-TOPPED YATE. Spreading shrub or medium-sized tree: bark deciduous, smooth, or somewhat persistent and rough: lvs. lanceolate, acuminate, 1½-5 in. long; lid cylindric-conic,  $\frac{1}{2}$ -¾ in. long; stamens yellowish or orange,  $\frac{1}{2}$ -¾ in. long: fr. bell-shaped, with spreading rim, 5 lines wide; valves exerted, sharp. Oct.-May. F.v.M. Eucal. 6:5.—Suited to the coast districts; subject to frost.

28. *coccífera*, Hook. Small glaucous tree with smooth white bark: lvs. lanceolate, thick and shining, often tipped by a slender curved mucro: fls. nearly sessile, in close terminal clusters; calyx prominently angled; lid very short and flat, rugose; stamens about 3 lines long, all perfect; anthers reniform, opening by divergent slits: fr. obovoid-truncate, 4-6 lines across. B.M. 4637. G.C. II. 12:113; 13:395; III. 2:787, 789; 3:799, 801; 9:169. Gn. 71 p. 591. Maiden, Crit. Rev. Eucal. 28 (figs. 3-5).—A high-mountain form compared by some to *E. amygdalina* but recognized by the depressed lid and longer calyx. Of value as an ornamental: a very hardy species suitable for the foothill districts.

29. *virgáta*, Sieb. Shrub or small tree with stringy bark: lvs. lanceolate, thick and shining: calyx not angled; lid conical, granular-roughened, as also the tube; stamens scarcely 2 lines long; anthers reniform, opening by pores which extend into oblong slits: fr. globose-truncate, smooth, 3-6 lines across. Maiden, Crit. Rev. Eucal. 43 (figs. 1, 2).

Var. *stricta*, Maiden (*E. stricta*, Sieb.). Lvs. linear or linear-lanceolate: lid often shortly pointed. Maiden, Crit. Rev. Eucal. 43 (figs. 12-17). F.v.M. Eucal. 10:9. B.M. 7074.



1427. *Eucalyptus globulus*. No. 18.



Var. *obtusiflora*, Maiden (*E. obtusiflora*, DC.). Lvs. rather broad; lid depressed-hemispheric, very obtuse. Maiden, Crit. Rev. Eucal. 43 (figs. 3-11).

30. *hæmastoma*, Smith. Large tree: bark smooth, mottled, with a few ribbony flakes near the butt: lvs. lanceolate, usually oblique at base, falcate, coriaceous: fls. pedicelled, clavate in bud; lid very short; stamens 2-3 lines long; anthers of the perfect ones reniform, opening by short divergent slits: fr. ovate-truncate, with reddish rim, 3-4 lines across; valves sometimes slightly protruding, but soon deciduous. F.v.M. Eucal. 2:3. Maiden, Crit. Rev. Eucal. 46 (figs. 10-17), 47 (figs. 1-18).—Said to thrive on poor, sandy soil: perhaps not suited to dry interior valleys. Timber of inferior quality.

31. *Sieberiana*, F. v. M. Scarcely distinguishable from *E. hæmastoma* save by the bark, which on the trunk is furrowed, becoming dark, rugged, and stringy: foliage emits a slight peppermint-like odor when crushed in the warm hand. F.v.M. Eucal. 2:9. Maiden, Crit. Rev. Eucal. 45 (figs. 10-15).—Bark yields a very soluble kino.

32. *goniocalyx*, F. v. M. MOUNTAIN GUM. BASTARD BOX TREE. Tall tree: bark rough, tardily deciduous: lvs. lanceolate, usually falcate, of pale color: pedicels very short and angular, or fls. usually sessile; lid conical or hemispherical; stamens about 3 lines long, inflexed in bud; anthers ovate, opening by parallel slits: fr. ovoid-truncate, 3-4 lines across; valves about on a level with the rim. July, Aug. F.v.M. Eucal. 1:3. Maiden, For. Fl. N.S.W. 19.—Timber especially esteemed for wheelwrights' work: also used for house-building, fence-rails, railroad-ties, and so on: excellent for fuel. Grows well in the coast districts of S. Calif. A promising species for the mountains of the S. W., at moderate altitudes.

33. *Cambagei*, Deane & Maiden. BUNDY. Small or medium-sized tree: bark fibrous and matted throughout: lvs. lanceolate, elongated: fls. sessile; calyx-tube with 2-4 prominent angles; lid shortly pointed or hemispherical; stamens about 3 lines long; fr. ovoid-truncate. —A recently intro. species related to *E. goniocalyx* but with plainly exserted valves and thicker, flatter peduncles. Aside from shape of buds and peduncles it resembles *E. Stuartiana*.

34. *botryoides*, Smith. Tall handsome tree: bark rough, furrowed, persistent on trunks: lvs. lanceolate, acuminate with very diverging parallel veins, paler beneath: fls. sessile or nearly so; lid variable; stamens about 3 lines long, inflexed in the bud; anthers ovoid-oblong, with parallel cells: fr. obovoid-oblong, slightly contracted at orifice, 4-5 lines long, 3-4 lines wide; valves wholly inclosed. Sept., Oct. F.v.M. Eucal. 4:2.—This tree has beautiful dark green horizontal foliage. Useful for windbreaks and as a shade tree. Suited to the coast districts only. Timber hard, tough, and durable; used in Austral. especially for felloes.

35. *robusta*, Smith. SWAMP MAHOGANY. Handsome symmetrically branched tree of moderate height: bark of trunk persistent, rough, dark brown; of the branches reddish: lvs. oval-lanceolate, long-pointed, 3-7 in. long, 1½-3 in. wide, dark green, coriaceous; veins spreading almost at right angles to midrib; lid acute, about as long as calyx-tube; stamens 4-6 lines long; anthers with parallel cells: fr. goblet-shaped, becoming nearly ½ in. across, the rim thin and caps. much sunk. Oct.-March. F.v.M. Eucal. 7:8.—Formerly much planted in Calif. as a street tree, but the tops break down in strong winds, due to the heavy foliage and brittle wood; now almost discarded for this purpose: a profuse bloomer, especially valuable for bees: wood brittle but durable. Best adapted to moist coast districts but also flourishes in the interior valleys when given sufficient water: suggested for the coast

of the Gulf of Mexico in districts free from heavy frosts.

36. *redunca*, Schau. Shrub or small tree, to 120 ft.: bark smooth, white: lvs. oblong-lanceolate, rather obtuse, 3 in. or less long, not paler beneath: lid conical, acuminate, about twice as long as calyx-tube; stamens 3-4 lines long; anthers opening by parallel slits: fr. obovoid, about 3 lines thick. F.v.M. Eucal. 10:7.—Grows on cold flats of comparatively poor soil in Austral. Timber tough, heavy, and durable; prized for wheelwrights' work.

37. *pilularis*, Smith. BLACKBUTT. Slender tree, averaging 100-150 ft.: bark of trunk persistent, or flaking off above, blackish gray outside, somewhat fibrous and brownish inside; of branches smooth, gray or whitish: lvs. mostly lanceolate, falcate, acuminate, 3-6 in. long, rather less shining below than above; lid broadly conical at base, attenuate; stamens 2-3 lines long; anthers reniform, opening by divergent slits: fr. subglobose, truncate, 4-5 lines thick; valves completely inclosed to slightly exserted. F.v.M. Eucal. 3:7. Maiden, Crit. Rev. Eucal. 1, 3, 4.—Timber strong and durable: useful for general building and especially for telegraph poles, posts, and the like: reported as a good honey-producer. Does not thrive in the hot dry interior valleys: subject to extremes of temperature.

38. *Muelleriana*, Howitt. YELLOW STRINGYBARK. Perhaps only a var. of *E. pilularis*: bark more fibrous or stringy, the inner bark yellow and imparting a yellow stain to the wood: juvenile lvs. often with tufts of hairs; adult lvs. glossy above: lid blunt or slightly pointed: fr. typically 6 lines thick. Maiden, Crit. Rev. Eucal. 2, 38 (in part).—Forms with scarcely flattened peduncles approach *E. eugenioides*.

39. *acmenioides*, Schau. (*E. triantha*, Linn. *E. pilularis* var. *acmenioides*, Benth.). WHITE MAHOGANY GUM. Tall tree: bark persistent and fibrous on trunk and branches: lvs. paler beneath, sinuate: peduncles not much compressed, slender; pedicels sometimes 2 or 3 lines long: fr. not exceeding 3 or 4 lines in diam.; rim thin: otherwise as in *E. pilularis*. F.v.M. Eucal. 10:1. Maiden, Crit. Rev. Eucal. 42.—Grows in poor, well-drained soil in Austral. Timber heavy, strong, and durable; good for palings, rails and floorboards.

40. *microcorys*, F. v. M. TALLOW-WOOD GUM. Tall tree: bark persistent, wrinkled: lvs. broadly lanceolate, acuminate, thin, copiously dotted with oil-glands, much paler and opaque beneath: fls. distinctly pedicelled, the buds club-shaped; lid depressed-hemispherical; stamens about 3 lines long, outer ones sterile; anthers minute, almost heart-shaped, opening by divergent slits: fr. scarcely 2 lines across. F.v.M. Eucal. 2:6. Maiden, Crit. Rev. Eucal. 41 (figs. 6-9).—Timber yellowish; one of the most valuable after ironbark: strong and durable, under or above ground; used by wheelwrights and for flooring, especially for ballrooms; suitable for this latter purpose because of its greasy nature.

41. *punctata*, DC. LEATHER-JACKET. HICKORY GUM. Beautiful spreading tree, 100 ft. or more high: bark smooth and dark, thick, the outer deciduous in flakes: lvs. thin, narrowly lanceolate, acuminate, lustrous above, slightly paler and marked with oil-dots beneath; lateral veins moderately spreading: peduncles broad, much compressed; pedicels evident, angular, thick; lid ovate-conical; stamens about 3 lines long; anthers opening by parallel slits: fr. 3 or 4 lines wide, not contracted at orifice; valves barely exserted. Aug.-Oct. F.v.M. Eucal. 6:7.—Timber remarkable for its extreme hardness and durability. Grown in S. Calif.; too tender for the San Joaquin Valley.

42. *saligna*, Smith. Tall tree: bark gray and smooth: lvs. lanceolate, with close parallel transverse veins

much paler beneath; pedicels very short or fls. usually sessile; lid hemispherical, short, pointed; stamens 2-3 lines long, all fertile; anthers ovate, opening by parallel slits; fr. subglobose-truncate, not contracted at orifice; rim narrow; valves more or less protruding, separated from the rim by a narrow groove. F.v.M. Eucal. 2:8. Maiden, For. Fl. N.S.W. 13.—Timber of the best, usually pale red, straight-grained, comparatively easy to work. Prefers rich alluvial soil; probably will not endure severe conditions.

43. *resinifera*, Smith. KINO EUCALYPT. RED MAHOGANY. Erect symmetrical tree; bark of trunk persistent, rough, and fibrous; of branches deciduous; lvs. lanceolate, thick, and almost leathery; oil-dots quite obscure; veins widely spreading from midrib; lid conical; stamens 4-6 lines long; anthers ovate, opening by parallel slits; fr. about 4 lines wide, not contracted at orifice; valves acute, well exerted. F.v.M. Eucal. 1:9.—Apparently endures both cold and drought better than *E. globulus*; requires a rather moist climate. Wood strong and durable, red, but bears no real resemblance to true mahogany; not liable to shrink; lasts well underground.

Var. *grandiflora*, Benth. Fls. larger, the ovoid buds about 4 lines diam.: fr. 4-6 lines wide, with a raised rim.



1428. *Eucalyptus corynocalyx*. ( $\times \frac{1}{2}$ ) No. 60.

44. *piperita*, Smith. PEPPERMINT STRINGYBARK. Tall tree; bark of the trunk persistent, gray, rough and fibrous; of the branches smooth: lvs. oblique, 2-6 in. long, thin; veins very oblique but obscure; oil-dots copious, transparent; lid broad-conical, acute, about as long as calyx-tube; stamens about 2 lines long; anthers kidney-shaped, opening by divergent slits; fr. globular, ovoid, or urceolate, contracted at orifice,  $\frac{1}{4}$  in. across; rim thin, depressed. F.v.M. Eucal. 3:8. Maiden, Crit. Rev. Eucal. 45 (figs. 1-9).—The young foliage emits a strong odor of peppermint when bruised.

45. *eugenioides*, Sieb. Closely related to *E. piperita* but seedlings rough-pubescent: lvs. thicker, with more divergent veins and not peppermint-scented; bark strongly fibrous even on the small branches; rim of fr. flat or raised. July, Aug. F.v.M. Eucal. 3:8. Maiden, Crit. Rev. Eucal. 39 (figs. 1, 2), 40 (figs. 2-22).

46. *incrassata*, Labill. Shrub or small tree, to 25 ft.: lvs. lanceolate or ovate-lanceolate, rather obtuse, mostly 2-4 in. long; veins inconspicuous; calyx-tube ribbed in the common forms; lid thick, hemispheric or short-conic, often abruptly beaked; stamens all in-

flected in the bud; anthers ovate-oblong, opening by parallel slits; fr. ovoid-cylindric, about  $\frac{3}{4}$  in. across; valves often slightly exerted. F.v.M. Eucal. 5:6. Maiden, Crit. Rev. Eucal. 13, 15.—Australian deserts; one of the "mallee."

Var. *angulosa*, Benth. (*E. angulosa*, Schau.). Calyx-tube and lid prominently angled or ribbed, but varying much in this respect as well as in size of fls. and frs. Maiden, Crit. Rev. Eucal. 14.

47. *Planchoniana*, F. v. M. Tree, to 100 ft., with angular branchlets: lvs. lanceolate, acuminate, elongated; lid conical, about as long as the tube, both longitudinally streaked; outer stamens flexuous in bud but only the inner ones incurved; anthers broadly ovate, opening by parallel slits; fr. ovoid-cylindric, truncate, about  $\frac{3}{4}$  in. across, the caps. sunk and valves well inclosed. F.v.M. Eucal. 4:6.—A profuse bloomer. Timber heavy, hard, and durable; well adapted for sawing but not easily split.

48. *megacarpa*, F. v. M. Tree, 100 ft. or less high: bark deciduous, smooth, grayish white: lvs. lanceolate, falcate, mostly 4-6 in. long; fls. only 1-3 and sessile in the umbels; lid shortly conical; stamens about  $\frac{1}{2}$  in. long; anthers ovate-oblong, opening by parallel slits; fr. depressed-globular, thick and hard,  $\frac{3}{4}$ -1 in. across; rim convex, continuous with the thick obtuse incurved valves. F.v.M. Eucal. 6:3. Maiden Crit. Rev. Eucal. 78 (figs. 4-8).

49. *gomphocéphala*, DC. TOOART TREE. Tree, 120 ft. or less high: bark persistent, rough but not stringy, becoming dark: lvs. thick, narrowly acuminate, pale green: fls. usually 3-5, sessile; lid globose, very hard and thick; stamens 3-4 lines long; anthers opening by parallel slits; fr. turbinate; rim broad and convex, rounded to the incurved valves. F.v.M. Eucal. 7:4.—Easily distinguishable by the broad lid. Wood of a pale yellowish color; remarkable for hardness and strength, heavy, the grain close and twisted; shrinks but little and does not check while seasoning; suitable for large scantlings and for use where exposed to great heat, as in engine-rooms: one of the strongest woods known. Grows both along the coast and in the dry interior valleys: one of the most alkali-resistant species.

50. *ridis*, Endl. DESERT GUM. Tree, 100 ft. or less: bark gray, persistent, rough, but not deeply furrowed: lvs. broadly to narrowly lanceolate, mostly  $\frac{3}{4}$ -2 $\frac{1}{2}$  in. wide; peduncles  $\frac{1}{3}$ -1 in. long; pedicels short; lid conical, not beaked, about as long as calyx-tube; stamens 3-4 lines long; anthers opening by parallel slits; fr. broadly turbinate, 4-5 lines across; rim only slightly ascending. F.v.M. Eucal. 10:8.—Stands drought and extremes of temperature better than most other species: endures minimum temperatures of 15-18°: suitable for most situations in the S. W.: successfully used as an avenue tree and for windbreaks at Fresno, Calif. Timber probably of value only for posts and for fuel.

51. *decipiens*, Endl. Straggly shrub, or tree to 70 ft.: bark rough, persistent, fragile: lvs. ovate to lanceolate, 2 $\frac{1}{4}$ -4 $\frac{1}{2}$  in. long, seldom over  $\frac{3}{4}$  in. wide; peduncles  $\frac{1}{4}$ - $\frac{1}{2}$  in. long; pedicels 0; lid conical, often twice as long as calyx-tube; anthers very small, globular, opening by pores which become longitudinal slits; fr. broadly turbinate or globose, 3-4 lines across; valves awl-shaped. F.v.M. Eucal. 10:3. Maiden, Crit. Rev. Eucal. 63 (figs. 1-12).

52. *viminalis*, Labill. MANNA GUM. Plate XXXIX. Graceful tree, to 300 ft., the branchlets pendulous: bark either persistent, roughish, and dark-colored (never fibrous), or deciduous, very smooth, and grayish white: seedling lvs. lanceolate; mature lvs. lanceolate, acuminate, somewhat falcate: fls. usually 3, rarely 6-8, sessile or on very short pedicels; lid semi-ovate, mostly short-pointed; stamens about 3 lines



long; anthers ovate, opening by parallel slits: fr. subglobose-truncate, 3-5 lines across; rim flat or rounded; valves triangular, acute. May-Aug. F.v.M. Eucal. 10:10. G.C. III. 4:597.—A hardy species, grown as far north as Chico, Calif.: ranks next to *E. globulus* in rapidity of growth. Timber not so strong as that of many other sorts but of average value for fuel, and can be grown under conditions in which more valuable species would not survive or would make only an inferior growth. A good bee tree.

53. *Stuartiana*, F. v. M. APPLE-SCENTED GUM. Tall branching tree, with dense drooping foliage: closely related to *E. viminalis*, and distinguishable from the latter, when this has more than 3 fls. in an umbel, by the fibrous bark, roundish seedling lvs. and somewhat smaller fls.: pedicels almost 0; buds angular; lid almost hemispherical, or shortly and bluntly conical. Feb.-May. F.v.M. Eucal. 4:9.

54. *Macarthurii*, Deane & Maiden. Bark rough, "very woolly:" seedling lvs. linear-lanceolate, slightly cordate, strictly opposite; mature lvs. narrow, lanceolate: fls. 4-8, distinctly pedicelled; buds ovoid, smooth, very small: fr. semi-ovate, scarcely 3 lines across.—Related to *E. viminalis* and to *E. Stuartiana*: distinguished from the latter by the smooth slender-pedicelled buds and from both by the smaller fls. and frs.

55. *amygdalina*, Labill. PEPPERMINT GUM. Tree, the tallest of the genus (var. *regnans*): bark persistent on trunk and lower branches, fibrous: lvs. lanceolate, not noticeably oblique at base, 2-4 in. long; veins oblique; oil-dots large, not very numerous: fls. many and crowded in the umbels; buds clavate, often rough; lid hemispherical, very obtuse, shorter than the calyx-tube; stamens under 2 lines long; anthers kidney-shaped, opening by divergent slits: fr. hemispheric or shortly ovate, truncate, about  $\frac{1}{4}$  in. across; rim flat or slightly concave; valves flat or slightly protruding. F.v.M. Eucal. 5:1. B.M. 3260. B.R. 947 (as *E. longifolia*). G.C. III. 6:16. R.H. 1902, p. 83.—Timber of inferior durability and strength. Foliage with odor of peppermint; far richer in oil than any other eucalypt.

Var. *numerosa*, Maiden (*E. Andreana*, Naudin). Fls. very numerous, often over 20 in the umbel.

Var. *regnans*, F. v. M. (*E. regnans*, F. v. M.). GIANT GUM. Very tall tree (325 ft. or less high): bark usually smooth, whitish, fibrous only near the base: lvs. large, broad-lanceolate, especially those on seedlings broader than in typical *E. amygdalina*; oil-dots very fine, numerous: fr. usually conoid. Maiden, Crit. Rev. Eucal. 33.—Earlier reports of 400-500 ft. for this tree were erroneous (see Melbourne Argus for March 23, 1904, Maiden, Crit. Rev. Eucal. p. 183, and G.C. III. 47, p. 69).

Var. *angustifolia*, F. v. M. (*E. linearis*, Dehnh.). Graceful, spreading tree: branchlets drooping: lvs. very narrow: fls. numerous in the umbel. Jan.-Apr., and more or less throughout the year. Maiden, Crit. Rev. Eucal. 30 (fig. 5).

56. *Risdonii*, Hook. f. A beautiful glaucous-foliaged tree 20-50 ft. high, the branches somewhat pendulous: bark flaking off, smooth, not fibrous: early lvs. cordate, connate in pairs; later lvs. either opposite and ovate or alternate and broadly lanceolate, not very oblique at base; veins oblique: buds, fls., and fr. as in *E. amygdalina* but slightly larger. Maiden, Crit. Rev. Eucal. 32 (fig. 1).—A valuable ornamental: all the lvs. commonly opposite and connate.

57. *obliqua*, L'Her. (*E. fissilis*, F. v. M.). Tall tree: bark persistent even on the branches, grayish, very stringy but rather soft and fragile: lvs. thick, very oblique at base, 4-6 in. long; veins very oblique: lid hemispherical, depressed or somewhat pointed, shorter than the tube; stamens fully 3 lines long, opening by

diverging slits: fr. somewhat pear-shaped, truncate, slightly contracted at orifice,  $\frac{1}{4}$ - $\frac{1}{2}$  in. across; rim broad and concave: caps. well sunk. March-Aug. F.v.M. Eucal. 3:5. Maiden, Crit. Rev. Eucal. 5-8.—Will grow on poor soil but does not endure severe drought. Much valued in Austral. for bees: wood used only for cheap, rough work.

58. *stellulata*, Sieb. Small tree: bark becoming black and furrowed, deciduous in layers, smooth above: lvs. elliptic or lanceolate, 2-4 in. long; principal veins almost parallel to the midrib: fls. very small, numerous; buds ovoid, in star-like nearly sessile umbels; lid conic, acute, about equaling the tube; stamens under 2 lines long; anthers reniform, opening by divergent slits: fr. nearly globose, about 2 lines thick. F. v.M. Eucal. 6:9. Maiden, Crit. Rev. Eucal. 25.—Timber of but little value; scarcely used except for fuel.

59. *coriacea*, A. Cunn. (*E. pauciflora*, Sieb.). Tree, often tall, with spreading branches and slender somewhat pendulous twigs: outer bark deciduous; inner bark smooth, pale gray: lvs. ovate-lanceolate or lanceolate, 4-8 in. long, thick, smooth; lateral veins almost parallel to the midrib: fls. 5-10; buds club-shaped; umbels distinctly peduncled; lid hemispheric, obtuse or with a short point, twice or thrice shorter than the tube; stamens 2-3 lines long; anthers reniform, opening by divergent slits: fr. pear-shaped, truncate, 3-4 lines thick. Nov.-Feb. F.v.M. Eucal. 3:6 (as *E. pauciflora*). Maiden, Crit. Rev. Eucal. 26, 27, 28 (figs. 1, 2).—A high-mountain tree and one of the hardiest species. Cattle browse on the foliage in seasons of drought: timber used for fuel and fences; warps badly. Trees sometimes badly affected with scale.

60. *corynocalyx*, F. v. M. SUGAR GUM. Fig. 1428. Tree, to 120 ft.: bark smooth: lvs. elongate-lanceolate; veins oblique: lid almost hemispheric, projecting beyond the calyx-tube; stamens 2-3 lines long; anthers short-oblong, opening by distinct parallel slits: fr. almost egg-shaped, nearly  $\frac{1}{2}$  in. long by 3-4 lines thick; rim thin; caps. deeply sunk. June-Nov. F.v.M. Eucal. 2:2. G.C. II. 12:593.—A valuable drought-resistant species but does not endure temperatures below 20-25°. Timber close-grained and hard, of a yellowish white color: very durable underground: grown in Calif. for railway ties. An ornamental tree used for roadside planting in S. Calif.: affords much bee pasturage.

61. *buprestium*, F. v. M. Shrub, to 20 ft.: lvs. narrow, acute, 2-3 in. long: lid hemispherical, obtuse, shorter than calyx-tube; stamens 2-3 lines long; anthers opening by short divergent slits: fr. nearly globular, the orifice much contracted,  $\frac{3}{4}$ -1 in. across; rim depressed. July-Oct. F.v.M. Eucal. 6:1.—Valuable for bees.

62. *diversicolor*, F. v. M. (*E. collösea*, F. v. M. *E. diversicolor* var. *collösea*, Hort.). KARRI. Fig. 1429. Very tall symmetric tree: bark smooth, white: lvs. dark green and shining above; veins very diverging: lid obtusely conical, not wider than calyx-tube; stamens 4 lines long; anthers ovate, opening by parallel slits: fr. ovoid-truncate, about  $\frac{1}{2}$  in. long by 4-5 lines thick;



rim rather thick; caps. deeply sunk. Feb.-May, and again in Nov. F.v.M. Eucal. 5:4.—Thrives near the coast but does not endure well the dry heat of the interior: too tender for the San Joaquin Valley. A rapid grower, profuse bloomer, and considered a good tree for bees. Timber very hard, durable, of a light red color, and takes a fine polish: suitable for furniture, wagon work, ties, and general construction.

63. *salmonophlōia*, F. v. M. Finally tall: lvs. narrowly lanceolate, 2-5 in. long, shining; oil-dots copious: lid broadly conical, slightly longer than the tube; anthers roundish, opening by parallel slits: fr. semi-ovate, narrowed at base, 2 lines thick; valves much exserted, long-pointed. F.v.M. Eucal. 9:6.

64. *rostrata*, Schlecht. RED GUM, Fig. 1430. Tree, to 200 ft.: bark of mature trunks dark gray, either smooth and deciduous or somewhat persistent near the base and then checking into thick scales or even furrowed; bark of seedlings and twigs reddish: lvs. narrowly lanceolate, acuminate, 4-6 in. or more long: calyx-tube hemispheric; lid usually hemispheric and provided with a narrowed point or beak, sometimes merely conical and not beaked, rarely over 3 lines long; stamens 2-4 lines long; anthers oblong, opening by parallel slits: fr. nearly globular, rarely above 3 lines thick; rim broad, prominent; valves entirely protruding, even before they open. April-July. F.v.M. Eucal. 4:7.—One of the most valuable species; next to the sugar gum and forest gray-gum perhaps the most drought-resistant; withstands frosts better than blue-gum; endures the intense heat of Imperial Valley, on the Colorado Desert; grows where the ground is inundated for a considerable time; makes a good growth in alkali soils, yet best results are secured only on good soil, especially if moist and with a clayey subsoil. A slow-growing species in regard to height, but one of the first in regard to diam.-growth (Ingham). Timber



1430. *Eucalyptus rostrata* ( $\times \frac{1}{2}$ ). No. 64.

very durable, both above and below ground: heavy, takes a good polish: light red to deep red in color: not so strong as sugar and blue-gums and trees more irregular in growth: suitable for railroad-ties, piles, fence-posts, and the like: difficult to work when dry, therefore scarcely suitable for furniture. Blossoms supply honey to bees.

65. *tereticornis*, Smith. FOREST GRAY GUM. FLOODED GUM. Bark and the general characters as in *E. rostrata*: lvs. rather broadly lanceolate: calyx-tube

turbinate; lid slenderly conical, acuminate, rarely abruptly beaked, 3-6 lines long, always much longer than the tube; stamens 3-6 lines long: fr. obovoid or nearly globular, 3-4 lines thick; rim very broad and prominent; valves protruding. April-July. F.v.M. Eucal. 9:8.—Closely related to *E. rostrata*; usually coarser, the lvs. broader, peduncles and pedicels stouter, and fr. larger; yet variable in all these characters. According to Ingham, this species has an erect habit of growth, while *E. rostrata* grows very crookedly. Withstands fully as wide a range in temperature, moisture, and soil conditions as does *E. rostrata*: timber similar but usually paler in color; more valuable because of its more regular growth. *E. amplifolia*, Naudin, known in Calif. as the "Cooper" or "round-leaf tereticornis," is a form with large roundish lvs. when young.

66. *macrorhyncha*, F. v. M. Tall tree: bark dark gray, furrowed and fibrous: lvs. lanceolate, acuminate, 3-5 in. long; lower ones broader, thick, and coriaceous; veins very oblique, prominent: calyx-tube turbinate, the edge forming a prominent ring with the conical lid; anthers reniform, opening by divergent slits: fr. depressed-globose, 4-6 lines thick; rim broad, convex. F.v.M. Eucal. 1:5. Maiden, Crit. Rev. Eucal. 39 (figs. 3-21).

67. *Gúnnii*, Hook. f. CIDER GUM. Small, often scrubby tree: lvs. thick, shining, less than 3 in. long: lid shining, hemispherical, short-pointed; stamens 2-3 lines long; anthers nearly oval, opening by parallel slits: fr. pear-shaped, truncate, 3-4 lines across; rim thin; valves sometimes slightly protruding. April-July. B.M. 7808. G.C. II. 19:437; III. 2:781; 11:787.—A very hardy species: cattle readily browse on the foliage, as it lacks the peculiarly pungent eucalyptus odor. Fls. only 3 in the typical form, but this apparently not cult. in Amer.

Var. *acervula*, Deane & Maiden. Buds and foliage often of a yellowish cast: fls. usually 4-8 in the umbel: fr.  $\frac{1}{4}$ - $\frac{1}{2}$  in. across. F.v.M. Eucal. 4:5 (main fig.).—The form commonly grown in Calif. Sapwood yellowish.

Var. *undulata*, Auct. (*E. undulata*, Luehm., not of F. v. M.). SWAMP GUM. Tall tree: lvs. longer (over 3 in.), often 2 in. broad, somewhat undulate or plane: fr. top-shaped.—Yields much nectar: flowers earlier than *E. viminalis*. Timber strong and useful.

Var. *montana*, Auct. A mountain form of *E. Gunnii*, the only species which withstands the climate of the east of England.

68. *melliodora*, Cunn. HONEY-SCENTED GUM. YELLOW BOX. Spreading tree with somewhat drooping habit, to 150 ft. high: bark somewhat persistent below, roughish, brownish gray without, yellowish within, flaking off above, leaving the branches smooth: lvs. narrow, acuminate, 3-5 in. long: fls. small, the calyx about 2 lines across; lid conic-hemispherical; stamens 2-3 lines long; outer ones sterile; anthers minute, truncate, opening by terminal pores or short slits: fr. distinctly stalked, truncate-globular, under 3 lines thick. Feb.-Aug. F.v.M. Eucal. 2:5. Maiden, Crit. Rev. Eucal. 61 (figs. 1-14).—Will grow on poor hillside soil but best growth is made in the valleys. Timber used in Austral. by wheelwrights and shipbuilders: makes excellent fuel: fls. particularly rich in nectar and much sought by bees.

69. *odorata*, Behr. (*E. cajuputea*, Miq.). Differs from *E. melliodora* chiefly in the more erect habit and fr. which is often nearly sessile, obconic, not or scarcely contracted at orifice. F.v.M. Eucal. 2:7. Maiden, Crit. Rev. Eucal. 51 (figs. 9-19).—Grown at Fresno, Calif.: may be of value for its oil.

70. *doratóxylon*, F. v. M. SPEAR-WOOD. Beautiful shrub or small tree: bark smooth, greenish white: lvs. all opposite or nearly so, narrowly lanceolate, acumi-



nate, mostly under 3 in. long; fls. 4-7 on each recurved nearly terete peduncle; lid terminating in a rather long beak; stamens 2-3 lines long; anthers ovate-oblong, opening by parallel slits; fr. ovoid, about 3 lines long, scarcely as wide. F.v.M. Eucal. 4:4. Maiden, Crit. Rev. Eucal. 70 (figs. 3-5).—Of ornamental value because of its slender, graceful habit.

71. *marginata*, Smith (*E. floribunda*, Hueg.). JARRAH. Tall tree under favorable conditions, often low; bark persistent and somewhat fibrous or flaking off in strips; lvs. lanceolate, 3-6 in. long; veins widely spreading; peduncles sometimes a little flattened; lid oblong-conical, longer than calyx-tube; stamens 3-4 lines long, all fertile, the outer not inflexed in bud; anthers cordate-reniform, opening by divergent slits; fr. subglobose, narrowed to the stalk;  $\frac{1}{2}$  in. or more thick, hard, and smooth. April, May. F.v.M. Eucal. 7:5.—Valuable hardwood tree requiring a warm climate: not yet a success in Amer. Timber easily worked, takes a fine polish, not attacked by teredo, almost incombustible; used in England for street-paving and in Austral. for piles, underground work, telegraph-poles, ties, flooring, shingles, and general construction.

72. *Baileyana*, F. v. M. Tall tree: bark persistent throughout, fibrous; foliage dense and shady; lid hemispheric; anthers cordate, opening by divergent slits; fr. globular-urnshaped, scarcely  $\frac{1}{2}$  in. thick, 3-celled. F.v.M. Eucal. 3:1.—A "stringybark:" will grow well on sandy soil. Timber very tough: suitable for tool-handles: little known.

73. *erythronema*, Turcz. (*E. conoidea*, Benth.). Small tree: bark rough, reddish: lvs. lanceolate, 1-3 in. long, thick and shining; veins very oblique, obscure; fls. 2-3, red, distinctly stalked in the usually recurved umbels; lid hemispheric, acute; stamens about  $\frac{1}{2}$  in. long, raised above the border of the calyx by the thick disk; anthers oblong, opening by longitudinal slits; fr. top-shaped, truncate, 4-6 lines across; rim raised above the calyx-border, showing externally as a smooth ring. Spring. F.v.M. Eucal. 8:2.—A highly ornamental species of recent intro.

74. *leucóxylon*, F. v. M. (*E. gracilipes*, Naudin). WHITE IRONBARK. Fig. 1431. Tall tree, usually branching below: bark mostly deciduous in irregular strips, smooth, pale; juvenile lvs. ovate-lanceolate, sessile; adult lvs. narrow-lanceolate, grayish or dull green: fls. 2-5, mostly 3, long-stalked, white or rarely pink; lid semi-ovate, pointed, about as long as calyx-tube; stamens very unequal, outer ones often  $\frac{1}{2}$  in. long and usually sterile; anthers truncate, opening by apical pores; stigma much dilated; fr. obovoid, truncate, scarcely contracted at orifice, 4-5 lines across; rim thick. Nov.-April. F.v.M. Eucal. 1:4. Maiden, Crit. Rev. Eucal. 56 (figs. 1-12). R.H. 1901, p. 500.—Grows best near the coast and where there is plenty of rain but will endure considerable drought and poor soil: withstands minimum temperatures of 15-20°. Valuable bee tree, yielding an excellent honey. Timber superior to that of almost any other eucalypt for certain purposes: hard and durable, pale brown or white: used in carpentry and wheelwrights' work; also for ax-handles, railroad-ties, and underground work. The form with pink fls. is highly ornamental. Var. *purpurea*, Hort., has bright purple fls.

75. *sideróxylon*, Cunn. (*E. leucóxylon* var. *sideróxylon*, Auct.). RED IRONBARK. Characters mostly as in *E. leucóxylon*: usually not branched below: bark persistent, rough, dark red or black: juvenile lvs. linear-lanceolate; adult lvs. green: fls. white or yellowish except in the vars. Maiden, Crit. Rev. Eucal. 55 (figs. 5-13).—Wood dark brown or reddish, otherwise similar to that of *E. leucóxylon* and climatic requirements the same.

Var. *rosea*, Hort. (*E. leucóxylon* var. *rosea*, Hort.). Lvs. green: fls. rose-colored. Dec.-June.—A handsome

form and profuse bloomer, distinguished from the pink form of *E. leucóxylon* by the rough dark-colored bark.

Var. *pállens*, Auct. (*E. leucóxylon* var. *pállens*, Benth. *E. leucóxylon* var. *pállida*, Hort.). Lvs. silvery gray, not very coriaceous: fls. red.—A profuse bloomer.

76. *longifolia*, Link & Otto. WOLLYBUTT. Medium-sized or

tall tree: bark of old trunks persistent, gray, rough or wrinkled, somewhat fibrous: lvs. elongated-lanceolate; fls. long-stalked; lid broadly conical, acute, pale; stamens fully  $\frac{1}{2}$  in. long, inflected in the bud, all perfect; anthers ovate-oblong, opening by parallel slits; stigma not dilated; fr. bell-shaped or turbinate, truncate, angular, about  $\frac{1}{2}$  in. thick; rim prominent, ascending. F.v.M. Eucal. 2:4.—Flowering almost continuously: valuable for bees.

*E. annulata*, Benth. Shrub or small tree with characters of *E. cornuta*, except as follows: lvs. narrow-lanceolate, acuminate; lid 6-8 lines long, usually incurved; fr. depressed-globose, 4-5 lines thick, the convex rim protruding as a thick rim.—*E. Bosistoëna*, F. v. M. Next to *E. pilularis* in the key but perhaps related to *E. melliodora*. Lvs. narrow-lanceolate, copiously dotted, of equal color on both sides; veins very divergent: fls. few and pedicelled in the umbels; peduncles somewhat compressed; lid fully as long as tube, narrow-hemispheric; fr. small, with narrow rim; valves inclosed. Maiden, Crit. Rev. Eucal. 49 (figs. 1-4).—*E. californica*, used by Abbot Kinney in his book entitled "Eucalyptus," has not been recognized by botanists: also listed as *E. occidentalis* var. *californica*, Kinney.—*E. cinerea*, F. v. M. Related to *E. viminalis*. Bark persistent, fibrous: lvs. oppsite, sessile, cordate, more or less white-mealy: fls. 3-7, pedicellate; fr. 3 lines thick, with protruding valves.—*E. dealbata*, A. Cunn. Small tree, near *E. viminalis*: lvs. glaucous, often broad and obtuse: fls. 3-6, small: fr. rim flat; valves protruding even before they open. Cult. in Cuba.—*E. Deanei*, Maiden. Very close to *E. saligna*; distinguished chiefly by its broad sucker lvs.—*E. Fald Bay* (?), Naudin, is a horticultural form either of *E. rostrata* or of *E. tereticornis*: branchlets pendulous.—*E. jugalis*, Naudin, is a cult. form not yet identified.—*E. Maidenii*, F.v.M. Appearance and bark of *E. goniocalyx* but peculiar warty buds and caps of *E. globulus*: branchlets quadrangular.—*E. McClachie*, Kinney, is a horticultural name for the large-fld. form of *E. Gunnii* var. *acervula*.—*E. miniata*, A. Cunn. Placed after *E. ficifolia* in the key: fls. sessile in simple umbels, brilliant orange-color: fr. truncate-ovate, nearly 2 in. long. F.v.M. Eucal. 6:4.—*E. Mortoniana*, Kinney, is a horticultural species probably referable to *E. Maidenii*. Maiden, Crit. Rev. Eucal. 79 (figs. 13-14); 80 (figs. 1-12).—*E. patens*, Benth. Next to *E. pilularis* in the key: peduncles only slightly flattened, bearing 3-7 fls.; lid hemispherical, short-pointed, about half as long as tube; fr. truncate-ovate, 5 lines wide; rim narrow; caps. sunk. F.v.M. Eucal. 9:5.—*E. phaeafolia*, listed by Richter in Calif. Exp. Sta. Bull. No. 217, p. 1011, is probably a misprint for *E. ficifolia*.—*E. pinnata*, a garden name. J. H. Maiden suggests that Californian specimens under this name may be *E. coccifera* (Crit. Rev. Eucal., p. 143).—*E. rubida*, Deane & Maiden. Characters of *E. viminalis*, but bark always smooth and white, often with reddish patches, and the sucker lvs. broad.—*E. uncinata*, Turcz. Near *E. decipiens* in the key and, like it, a shrub: bark deciduous, smooth: lvs. very light green, narrow, copiously dark-dotted; veins fine, widely divergent; filaments kinked; anthers opening by terminal pores: fr. 2-3 lines across; valves little if at all exerted. F.v.M. Eucal. 4:10. Maiden, Crit. Rev. Eucal. 62.—*E. urnigera*, Hook. f. Shapely tree with drooping branchlets and glaucous bluish foliage: bark smooth, pale brown: fls. 2-4 in. long, obtuse: fls. mostly 3 in each umbel; peduncles often recurved: fr. nearly globose but somewhat urn-shaped, 4-5 lines wide; caps. much sunk and valves inclosed. Maiden Crit. Rev. Eucal. 80 (figs. 13-15).

Other names offered in foreign catalogues are: *E. capitellata*, *E. considenana*, *E. delegatensis*, *E. divas*, *E. gonipho-cornuta*, *E. lozophleba*, *E. paludosa*, *E. Smithii*.

HARVEY MONROE HALL.



1431. *Eucalyptus leucóxylon* ( $\times \frac{1}{2}$ ). No. 74.

**EUCHARIDIUM** (from the Greek for *charming*). *Onagraceæ*. Pretty small annuals, one of which (*E. concinnum*) is well known in gardens.

Three Californian herbs allied to *Clarkia* (and often referred to it), but differing in the calyx-tube being much prolonged beyond the ovary, and the stamens 4 and opposite the sepals and not appendaged at the base; petals lobed. Cult. simple, as for *Clarkia*.

**concinnum**, Fisch. & Mey. (*Clarkia concinna*, Greene), is a graceful garden annual, growing 1-2 ft. high, simple or very nearly so, pubescent or glabrous: lvs. small, oblong, petioled, entire: fls. regular, rose-colored, nearly or quite an inch across; calyx-tube filiform, an inch or more long; filaments filiform; petals 3-lobed, the middle lobe not much exceeding the others. B.R. 1962. B.M. 3589.—Of easy cult. in any garden soil; a useful annual.

**grandiflorum**, Fisch. & Mey. (*Clarkia grandiflora*, Greene). Differs from above in being diffusely branched from the base, corolla larger, irregular, 3 upper petals approximate and the other separate and declined, all the middle lobes long-clawed. There is a var. *alba* advertised.

**Bréveri**, Gray (*Clarkia Bréveri*, Greene. *C. Szadna*, Greene). 1-2 ft. high: lvs. 1 in. or more long, lanceolate, entire, short-petioled: corolla irregular; petals broadly obovate with the middle lobe narrow-spatulate and much exceeding the other lobes; filaments club-shaped: has a honeysuckle fragrance. L. H. B.

**EÜCHARIS** (very graceful, from the Greek). *Amayllidaceæ*. AMAZON LILY. Hothouse bulbous plants of great beauty and delightful fragrance, blooming in late winter and spring and at other times if the requisite treatment is given.

Bulb tunicated, 1-2 in. diam.: lvs. broad-ovate, narrowed into distinct petioles, prominently parallel-ribbed, radical: fls. white, in umbels, very showy, standing on long stout scapes; perianth-tube straight or curved, the throat dilated; segms. broad and spreading; perianth-cup either entire or toothed between the filaments: ovules 2 to many in each of the 3 locules.—Six or 8 handsome species from Colombia. The species are confused.

*E. grandiflora* (known to gardeners as *E. amazonica*), *E. candida* and *E. subdentata* are the well-marked types. The fls. in Fig. 1432, adapted from authentic plates, will distinguish the types. Hybridizes with *Urceolina* (see *Urceocharis*).

The Amazon lilies, as *eucharis* are popularly called,

are among the most desirable of warmhouse bulbous plants, being not only very beautiful but also very free in the production of flowers. When grown in pots, they require a coarse fibrous soil, composed chiefly of rotted 3od, and enriched with about one-fourth of dry cow-manure and a sprinkling of bone-dust. The pots should be well drained, for much water is needed during the growing season, but frequent potting should be avoided as the roots are impatient of disturbance. Shading from full sunshine is required, except during the winter months, and a night temperature of 65° to 70° is best for these plants. By drying off the *eucharis* to some extent for a few weeks, a crop of flowers may be had at almost any season, providing the bulbs are strong and healthy, but they should never be dried to such a degree that all the foliage is lost, else the bulbs will be much weakened. Good results are also had from planting out the *eucharis* on a bench in a warmhouse, the soil and treatment being much the same as for pot-grown specimens. The only insects liable to give much trouble in connection with these plants are mealy-bugs and thrips, and these may be controlled by thorough syringing. (W. H. Taplin.)

**grandiflora**, Planch. (*E. amazonica*, Lind.). AMAZON LILY. STAR OF BETHLEHEM (a name also applied to *Ornithogalum*). Fig. 1432. Bulb globular, 2 in. diam.: lvs. 2-4 to each stem, the petiole about 12 in. long; lf.-blade 1 ft. or more long and 5-6 in. broad, oblong; scape 1-2½ ft., bearing an umbel of 3-3 large (4 in. across), very fragrant star-like fls. on pedicels nearly or quite 1 in. long; segms. spreading, oblong and obtuse; tube of perianth cylindrical and curved, 2 in. long; cup forming a distinct projecting tube. B.M. 4971. F.S. 9:957; 12:1216-17. Gn. 48, p. 217; 59, p. 25; 61, p. 125; 63, pp. 71, 131; 66, p. 412; 76, p. 67; 77, p. 418. G.C. III. 7:193; 16:665; 28:115; 35:117; 41:71; 51:141. R.H. 1912, p. 115. G. 3:407; 9:301 (*E. amazonica* var. *grandiflora*); 10:5. G.L. 21:476. G.M. 46:83. G.W. 2, p. 87. G.Z. 2:1. A.F. 5:363; 8:445. F.E. 8:1000. F.R. 1:11; 2:364. Var. **Moðrei**, Baker, has smaller, rounder and thicker lvs., and smaller fls. with the cup lined with yellow.—Of all warm greenhouse bulbous flowering plants, *E. grandiflora* (*E. amazonica* of the gardener) stands without a rival in the purity and beauty of its bloom.—Prop. by offsets, but one must always bear in mind that these plants do not like to be disturbed much at the roots, and it will be some time before they recover from the operation of being divided. The spring is the best time to separate the bulbs. Turn the plant out of its pot, and take a hose with a gentle pressure on it and wash all the loam carefully away from the roots, care being taken to break as few as possible.—It thrives well in a good turfy loam. Add about a third of dried cow-manure, with as much sand and charcoal to keep the whole porous. The pots should be well drained with crocks, as these plants will never do well if the soil gets into a "sour" condition. Three bulbs to a 6-inch pot are enough, but if large specimens are desired for exhibitions, increase the number and the size of pot, having in view what is desired. Do not give much water after plants are divided, until growth has begun. When they are growing vigorously, a copious supply of water is required. A temperature of 65° by night should be maintained, and during the day it may run to 80° or 85°. The air should never be allowed to become "stagnant." This applies, of course, to all kinds of plants grown in glass structures. It must be remembered that in their native place the plants grow outdoors, and in heating greenhouses allowance should be made for the free admission of fresh air at all times. *Eucharis* like a light shade over them during the brightest part of the day, but from about the end of Sept. until March they will stand all the sun possible. *E. grandiflora* can be flowered 2 or 3 times during the year.—When the lvs. are fully matured, cease watering until signs of flagging of the



1432. *Eucharis*. Leaf of *E. grandiflora*, and fls. of a, *E. subdentata*; b, *E. Sanderi*; c, *E. grandiflora*; d, *E. candida*.



foliage is noticed, then water again to freshen them up. Keep this treatment up for a month, that is alternately drying and watering. The temperature may be lowered 5° during this resting-period. Start the plants by giving them a thorough soaking of water, and raise the temperature again to not less than 65° by night. The fl.-sts. will soon appear, and they may be watered with manure water, as advised for *Dipladenia*, until they begin to open, when it should be withheld until they have finished flowering. When the fl.-sts. have all been removed, a new set of lvs. will be meanwhile pushing up, and they may be again fed as advised above, until they are fully developed; and again treat them in every way as before. All the insect pests are liable to thrive on *Eucharis*, and the plants may be fumigated as advised for other greenhouse plants. Red-spider may be kept down by the syringe. (George F. Stewart.)

**Mástersii**, Baker. Bulb globose, often smaller: fl.-blade 8–9 in. long and 4–5 in. broad, oblong, rounded at the base, exceeding the petiole: scape 1 ft. high, bearing 2 nearly sessile fls. (2½–3 in. across) in the umbel, the perianth-segms. ovate and spreading and shorter than in *E. grandiflora*; tube slightly curved, 2 in. long; cup forming a shallow frilled or notched collar. B.M. 6831. G.C. II. 24:721. G.Z. 31, p. 217.—Possibly a hybrid of *E. grandiflora* and *E. Sanderi*.

**cándida**, Planch. Fig. 1432 d. Bulb globose, bearing stolons 2 in. diam.: fl.-blade 9–15 in. long, 4–5 in. broad at the middle, oblong, gradually narrowed both ways, about as long as petiole: scape somewhat flattened, glaucous, 1–1½ ft. high, bearing 6–10 short-pedicelled fls. in an umbel; segms. oblong, acute, more or less reflexed; tube 1½–2 in. long, curved; winged yellow filaments projecting, united at the base only. F.S. 8:788. G. 6:5; 15:289. J.H. III. 61:443. G.Z. 21, p. 194.—Smaller-fl. than *E. grandiflora*.

**Sánderi**, Baker. Fig. 1432 b. Bulb ovoid, 1–2 in. diam.: fl.-blade 10–12 in. long and 5–6 in. broad, oblong, cordate at base, twice longer than petiole: scape terete, 1 ft., bearing 2–3 nearly sessile fls.; segms. ovate, 1 in. or more long; tube curved, 2 in. long; yellowish cup, very narrow, like a collar or rim, and bearing the short, curved filaments on its edge. B.M. 6676. G.C. II. 19:349. G. 6:277. J.H. III. 52:9. G.Z. 28, p. 145.—By some thought to be a hybrid of *E. grandiflora* and *E. cándida*. Var. **multiflora**, Baker. Fls. smaller, 4–6, striped green. B.M. 6831.

**subdentata**, Benth. (*Calliphruria subdentata*, Baker). Fig. 1432 a. Bulb ovoid, 1½ in. diam.: fl.-blade 6–8 in. long, 3–4 in. broad, oblong, triangular at base, about as long as the channeled petiole: scape slender, 1 ft.; fls. 6–8 on pedicels 1 in. or less long; tube 1 in. long, funnel-shaped above; segms. oblong, ascending, 1 in. long; cup wanting or represented only by obscure teeth on the filaments. B.M. 6289. I.H. 28:415.—A small-fl. species.

*E. Bakeriana*, N. E. Br. Has the perianth of *E. grandiflora* and stamens of *E. cándida*: fls. 4–6 in the umbel, 2½ in. across, pure white; tube not enlarging emphatically at the top; cup projecting from the bases of the segms., not toothed: lvs. 4 or 5, elliptic, 10–18 in. long, very dark green and closely striate: scape 12–18 in. B.M. 7144. G.C. II. 7:417; 12:209.—*E. burfordensis*, Hort. Supposed hybrid between *E. Mastersii* and *E. Stevensii*: fls. bell-shaped, over 3 in. across, about 2 in. long.—*E. Elmétana*, Sander. Hybrid of *E. Sanderi* and *E. grandiflora*. Easier to grow than *E. Sanderi*. G.C. III. 26:345.—*E. Lehmannii*, Regel. Fls. about 4 in an umbel, 1½ in. across, the spreading corona with 12 long, narrow teeth, the perianth-segms. spreading or reflexed: lvs. 2, elliptic-oblong. Gt. 38:1300.—*E. Löwii*, Baker. Robust: fls. 4 in. across, the spreading outer segms. 1 in. wide and the 3 inner ones incurved: lvs. larger than those of *E. cándida*, long-stalked. Perhaps a natural hybrid of *E. grandiflora* and *E. Sanderi*. G.C. III. 13:539. J.H. III. 28:111; 43:276. Gn.W. 10:7.—*E. Stevensii*, N. E. Br. Free-flowering: fls. 3–3½ in. across about 7 in the umbel, pure white with yellow on the outside of the cup or corona: lvs. 12–14 in. long; very like *E. Sanderi*, and a garden hybrid of that species and *E. cándida*. J.H. III. 30:253. Gn. 46:128. G.C. III. 17:365.

L. H. B.

**EUCHLÆNA** (Greek *eu*, well, *chlaina*, covering). *Gramineæ*. Annual or perennial grasses, with stout stems, broad blades and monœcious inflorescence, occasionally grown in the South for forage and sometimes for ornament.

Staminate infl. in a tassel at the top, the pistillate in small ears in the axils of the lvs.; spikelets 1-fl.; pistillate spike slender, the several joints producing 1-seeded frs. trapezoidal in shape, the surface smooth and hard. The aspect is that of Indian corn (*Zea*) from which it differs in having free slender-jointed pistillate spikes that are not united into a cob.—Only one species is generally recognized, but there are probably others, all Mexican or Cent. American.

**mexicana**, Schrad. (*E. luxurians*, Dur. & Aschers. *Reana luxurians*, Dur.). **TEOSINTE**. Annual: sts. strongly cespitose, decumbent and spreading at base, erect above, 5–10 ft. or even more, leafy. Dept. Agric., Div. Agrost. 20:11.—Occasionally cult. for forage in the Gulf states. The seed rarely matures north of S. Fla. See Cyclo. Amer. Agric., Vol. II, pp. 638–9.

A. S. HITCHCOCK.

**EUCNIDE** (Greek-made word, referring to the sharp nettle-like hairs). *Loasacæ*. Several N. American annual or biennial herbs, by some authors referred to *Mentzelia*. Plants with stinging hairs: lvs. alternate or the lower ones opposite, cordate or ovate, more or less lobed: fls. yellow or white; calyx-tube oblong, the limb persistent, 5-lobed; petals 5, united at the base and inserted on the throat of the calyx; stamens numerous, the filaments filiform; ovary 1-loculed, bearing a 5-cleft style. **E. bartonioides**, Zucc. (*Mentzelia bartonioides*, Benth. and Hook.), is sometimes cult. It is a pretty summer-flowering annual, thriving in warm garden soil. Sts. about 1 ft., somewhat succulent, more or less decumbent, hispid-hairy: lvs. alternate, petioled, broad-ovate and toothed-lobed: fls. large, on long pedicels, opening in sunshine, the petals ovate-pointed, the numerous yellow hair-like stamens projecting and brush-like. Mex., New Mex., and Texas. B.M. 4491 (as *Microsperma bartonioides*). Gt. 5:320. L. H. B.

**EUCODONIA** is referred to *Achimenes*. *E. Ehrenbergii*, Hanst.—*A. lanata*, Hanst. (See p. 208, Vol. I). It is offered abroad. *E. nagelioides*, Hort.—*Eucodonopsis nagelioides*, Van Houtte, being a hybrid between *Eucodonia Ehrenbergii* and *Nagelia zebrina splendens*. Fls. single on the summits of the peduncles, declined, rose-purple. F.S. 16:1608. Var. *lilacinella*, Van Houtte, has large fls. white at the throat and striped and pointed with purple, and lilac-marbled on the limb. F.S. 18:1858–9.

**EUCOMIS** (Greek, *beautiful hair* or *topknot*). *Liliacæ*. Cape bulbs, half-hardy, producing radical rosettes of long leaves and a strong peduncle or scape bearing a raceme of greenish or whitish flowers more or less tinged with color, the cluster crowned or topped with a coma of leafy bracts (it is from this coma or crest that the generic name is taken).

Bulb tunicated: peduncle simple: lvs. lorate or oblong, often tinged or spotted with purple: fls. regular, 6-parted, rotate; stamens 6; ovary broad and short; style cylindrical and stigma capitate: caps. 3-valved.—Species about 12, African, nearly all from S. Afr. Prop. by offsets. The bulbs may remain in the open if in a warm place and well protected; some of them stand considerable frost, and bloom in spring. Of easy cult. Let the bulbs remain where planted. In the N. treated as glasshouse plants.

A. *Scape club-shaped*.

**règia**, Ait. Bulb globose, 2–3 in. diam.: lvs. 6–8, obtuse, not undulate toward the edge, to 1½ ft. long and 3–4 in. broad: scape 3–6 in. long, bearing a dense

oblong raceme 3-6 in. long; fls. green,  $\frac{1}{2}$  in. long, the segms. oblong, and stamens half as long as perianth: crown of 12-20 oblong, acute, crisped lvs. S. Afr.

**nana**, Ait. Bulb 2 in. diam.: lvs. about 8, obtuse, firm, purplish on back toward the base, to 2 ft. long, 3-4 in. broad above the middle; scape short, 1 in. thick at top, spotted purple; raceme with more or less purple, 3-4 in. long, dense, the fls. nearly sessile; perianth green,  $\frac{1}{2}$  in. long, the segms. oblong; crown of 12-20 oblong acute lvs. S. Afr.

**Jacquinii**, C. H. Wright. Differs from the above, with which it has been confused, in broader and shorter lvs. less tapering at base, and no purple in the infl. S. Afr.

AA. *Scape cylindrical.*

B. *Pedicels short.*

**undulata**, Ait. Bulb globose, 2-3 in. diam.: lvs. 6-9, strap-shaped, to  $1\frac{1}{2}$  ft. long, 2-3 in. broad, thin, not spotted on back, spreading or recurving, undulate; scape 1 ft. or less, bearing a dense raceme 3-6 in. long; perianth green,  $\frac{1}{2}$  in. long, the segms. oblong or oblanceolate; crown of 12-30 crisped lvs. S. Afr. B.M. 1083. G.W. 15, p. 305.

BB. *Pedicels long, erect-spreading.*

**punctata**, L'Her. PINEAPPLE FLOWER. Bulb globose, 2-3 in. diam.: lvs. 6-9, erect-spreading, long and narrow, to 2 ft. long and 2-3 in. broad, channeled, not undulate, brown-spotted beneath; scape 1 ft., spotted; raceme lax, cylindrical, to 1 ft. long; fls. green,  $\frac{1}{2}$  in. long, the ovary brown; crown of 12-20 oblong acute lvs. S. Afr. B.M. 913. F.S. 22:2307. G.W. 5, p. 121; 9, p. 5. J.H. III. 52:141. Gn. 70, p. 295. G. 19:291; 22:520; 27:409; 32:675. F.E. 31:1080.—A form with lvs. striped beneath with brown is var. *striata*, Sims. B.M. 1539.

**bicolor**, Baker. Bulb large and globose: lvs. 5-6, strap-shaped, thin, not spotted, undulate, to 2 ft. long by 3-4 in. broad; scape 1- $1\frac{1}{2}$  ft. long; raceme to 1 ft. long, dense at top; stamens and margins of perianth-segms. bright purple, otherwise close to *E. punctata*: crown of 12-20 oblong acute lvs. usually margined with red-purple. S. Afr. B.M. 6816. G.W. 14, p. 468. L. H. B.

**EUCOMMIA** (Greek, *eu*, well, and *kommí*, gum; alluding to the fact that the plant contains rubber). *Eucommia*ceæ. Deciduous tree grown for its handsome foliage and also for its possibility as a hardy rubber-producing tree.

Branches with laminate pith: winter-buds conspicuous, with imbricate scales: lvs. alternate, petioled, serrate, without stipules: fls. dioecious, without perianth, solitary in the axils of bracts at the base of the young shoots and precocious; staminate fls. pedicelled; stamens 6-10 with very short filaments and elongated linear anthers; pistillate fls. short-pedicelled with a 1-celled, 2-ovuled stipitate ovary, bifid at the apex, the lobes stigmatic on the inside: fr. a compressed winged nutlet.—One species in Cent. China, not closely related to any other genus; it was first placed with the Trochodendraceæ or Magnoliaceæ and afterward with the Hamamelidaceæ, but is now generally considered as representing a distinct family allied to the last named.

*Eucommia* is an upright-growing vigorous tree with rather large elliptic dark green foliage, inconspicuous precocious flowers and winged fruits; in habit and foliage it resembles somewhat an elm tree. In China the bark is a most valued medicine. The tree contains rubber in all its parts, particularly in the young growth and in the bark. Though the rubber has proved to be of good quality, it is apparently difficult of extraction and not present in sufficient quantity to make the commercial exploitation of the tree pay; therefore the hopes which have been set in this "hardy rubber tree"

will probably never realize. The tree has proved perfectly hardy as far north as Massachusetts and grows well in a loamy humid soil. Propagation is by seeds and by greenwood cuttings under glass.

**ulmoides**, Oliver. Tree, to 60 ft.: lvs. elliptic to elliptic-ovate, acuminate, broadly cuneate at the base, serrate, glabrous, glossy and dark green above, pubescent below when young, 3-7 in. long: samara oblong, bifid at the apex,  $1\frac{1}{4}$ - $1\frac{1}{2}$  in. long. April; fr. in Oct. Cent. China. H.I. 20:1950. R.H. 1909, p. 226. M.D.G. 1912:11, 613. ALFRED REHDER.

**EUCRYPHIA** (Greek for *well covered*). *Eucryphia*ceæ; formerly referred to *Rosaceæ*. A very few southern hemisphere resinous trees or shrubs, with opposite evergreen simple or pinnate lvs. and showy white fls.: sepals 4, free; petals 4, broad; stamens very many; ovary free, 5-18-celled: fr. a hard dehiscent caps. *E. pinnatifolia*, Gay, is a shrub or small tree, hardy in parts of England, with large white hypericum-like 4-petaled fls. and rose-like foliage, from Chile. B.M. 7067. G.C. II. 14:337; III. 9:613; 10:217; 15:109; 23:15 (fr.); 30:351. Gn. 63, p. 281; 77, p. 423. G. 29:96; 33:25. F.S.R. 1, p. 41. Gn.W. 9:821. G.M. 53:203. *E. cordifolia*, Cav., has simple serrate lvs. B.M. 8209. G. 33:607. G.C. III. 22:247; 42:259; 44:129. Gn. 70, p. 190; 73, p. 471.—Neither of these is in the American trade. Worthy of trial in the S. There are 2 species (*E. Billardieri*, Spach, and *E. Moorei*, Muell.) in Tasmania and New S. Wales.

Plants of *E. pinnatifolia* give much satisfaction in the open in England although not much known, the pure white fls. 3 in. diam., and borne more or less in pairs, being produced in great profusion in late summer; it grows 8-10 ft. high.

**EUGENIA** (named in honor of Prince Eugene of Savoy). *Myrtaceæ*. A large group of trees and shrubs, grown chiefly for their ornamental foliage and berries. Many tropical species yield edible fruits which are both eaten out of hand and made into jellies or confections. A number of these have been recently introduced into the warmer parts of the United States, where they give promise of attaining much importance. The clove of commerce belongs to this genus.

Evergreen trees and shrubs: lvs. opposite, mostly entire and finely penniveined: fls. white or creamy or the numerous stamens yellowish: fr. a drupe-like berry, usually globular or pear-shaped, 1-5-seeded. Habit and infl. of *Myrtus*, which see for cult. and prop.

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A. *Fls. solitary on axillary peduncles; petals not united.* (*Eugenia proper*.)

1. **brasilensis**, Lam. (*E. Dombeyi*, Skeels). GRUMIX-AMEIRA of Brazil. Tree, to 50 ft., glabrous or the infl. obscurely puberulent: lvs. oval or obovate-oblong, tapering at base, obtuse,  $2\frac{1}{2}$ -5 in. long, 1- $2\frac{1}{2}$  in. broad: peduncles 1-2 in. long, much exceeding the scales which subtend them: fr. edible, scarlet, black at maturity, the size of a cherry. Brazil. B.M. 4526. R.H. 1845:425.—Cult. in S. Calif. The frs. are candied and eaten in the tropics.

2. **uniflora**, Linn., not Berg. (*E. Micheli*, Lam.). PITANGA. SURINAM CHERRY. Shrub, 5-20 ft., glabrous: lvs. ovate-lanceolate, obtuse at base, glossy, 1-2 in. long, exceeding the peduncles: berry  $\frac{1}{2}$ -1 in. diam., ribbed, resembling a miniature tomato, edible, with a spicy acid flavor. Trop. Brazil. R.H. 1889, p. 532.—Hardy in S. Fla. and in S. Calif. Much esteemed for



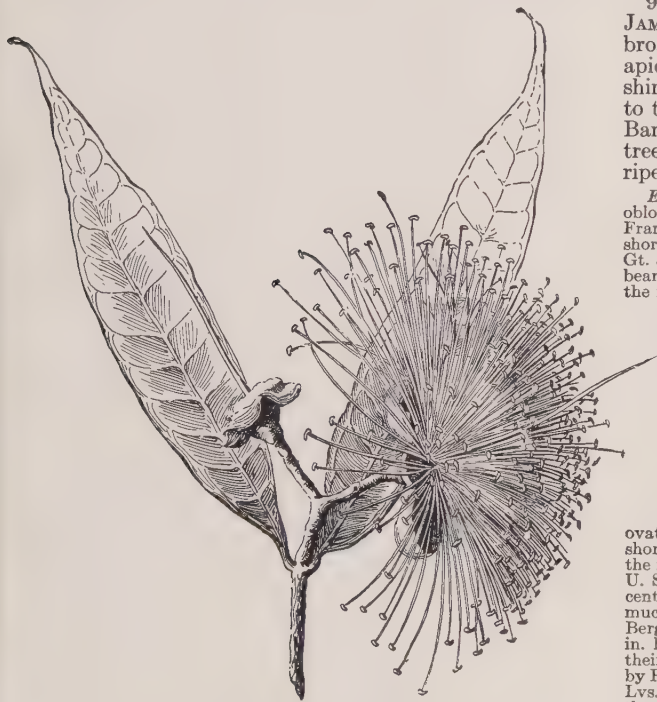
jellies. Useful also as a pot-plant, producing an abundance of showy red frs.

3. *Pitánga*, Kiaersk. PITANGA. Low shrub, young foliage and branchlets reddish pubescent: lvs. elliptic-oblong, acute at base,  $1\frac{1}{2}$ –3 in. long: berry red, subglobose, obscurely 8-nerved, about  $\frac{1}{2}$  in. diam. S. Brazil and adjacent Argentine.—Intro. into S. Calif. by Franceschi.

4. *microphylla*, A. Rich., not Bedd. nor Rich. ex Berger (*E. asperifolia*, Berg). Branchlets and infl. pilose: lvs. small, oval, acute, glabrous, longer than the peduncles: fr. unknown. Cuba.—Species other than the true *E. microphylla* apparently have been intro. under this name.

AA. Fls. in cymes or panicles; petals spreading, not united. (*Jambosa*, *Caryophyllus*.)

5. *myrtifolia*, Sims (*E. australis*, Wendl. *Jambosa myrtifolia*, Ndz.). AUSTRALIAN BRUSH CHERRY. Tree, attaining 80 ft., glabrous: lvs. oval or oblong-lanceo-



1433. Flower of rose-apple, *Eugenia Jambos*. (Natural size.)

late, mostly acute,  $1\frac{1}{2}$ –3 in. long: fls. white: fr. red, ovoid, nearly 1 in. long, with an acid taste. Austral. B.M. 2230. Univ. Calif. Pub. Bot. 4:8.—Hardy in the S. Much used in Calif. as an ornamental tree and for clipped hedges. The foliage is dense and glossy, green when mature, tinged with wine-red on the gracefully spreading young shoots. Frs. sometimes used in jelly-making.

6. *Jámbos*, Linn. (*Jambosa vulgaris*, DC. *Jambosa Jámbos*, Millsp.). ROSE-APPLE. JAMROSADE. JAMBOS. Fig. 1433. Tree, 20–30 ft., glabrous: lvs. lanceolate, very acuminate, 5–8 in. long, 1–2 in. broad, thick and shining: fls. greenish white: fr. pyriform,  $1\frac{1}{2}$ –2 in. thick, white or yellowish, tinged with rose-color, edible but rather insipid, fragrant. E. Indies. B.M. 1696. Gn. 75, p. 616.—Hardy in Calif. as far north as San Francisco. Grown for its rich foliage and showy fls. Frs. much used in the tropics for jelly-making and in confectionery.

7. *malaccensis*, Linn. (*E. macrophylla*, Lam., not Berg. *Jambosa malaccensis*, DC.). LARGE-FRUITED ROSE APPLE. JAMBOS. Glabrous tree: lvs. oblong to elliptic, acute, 5–10 in. long, 2–4 in. wide: fls. purple: fr. fragrant, red, obovoid, about 2 in. diam., with apple-like flavor. Polynesia.—More tender than *E. Jambos*, but the foliage more luxuriant and the frs. larger.

8. *aromática*, Baill., not Berg (*Caryophyllus aromáticus*, Linn. *E. caryophyllata*, Thunb. *Jambosa Caryophyllus*, Ndz.). CLOVE TREE. Lvs. ovate-oblong, acute, strongly tapering to the conspicuous petiole, 2–5 in. long, coriaceous, dotted; lateral veins numerous, parallel, the cross-veinlets obscure: fls. in terminal trichotomous cymes, pale purple, only  $\frac{1}{4}$  in. across. Moluccas.—Widely cult. in the tropics. Apparently not suited to even the warmer parts of U. S. The fls. are the cloves of commerce. See *Cloves*.

AAA. Fls. in cymes or panicles; petals united into a calyptra. (*Syzygium*.)

9. *jambolana*, Lam. (*Syzygium jambolana*, DC.). JAMBOLAN, or JAMBOLAN PLUM. Tall shrub or tree: lvs. broadly oblong, very broad at summit but often shortly apiculate,  $2\frac{1}{2}$ –5 in. long,  $1\frac{3}{4}$ –4 in. wide, thick and shining: berry edible, varying from the size of a cherry to that of a pigeon's egg. E. Indies.—Grown at Santa Barbara, Calif., where, according to Franceschi, the trees become large and flower profusely but never ripen fr.

*E. alba*, Roxbg., Malaya, may be known by its sessile ovate-oblong lvs. and branched peduncles. Intro. into S. Calif. by Franceschi.—*E. apiculata*, DC., Chile, has oval apiculate lvs. shorter than the mostly 1-fld. peduncles, and a pubescent infl. Gt. 890. Perhaps not now grown in N. Amer.—*E. cauliflora*, DC., bears fls. and frs. in sessile clusters along the woody branches and the main trunk down nearly to the ground: fr. about  $\frac{3}{4}$  in. diam., purple. Brazil. Intro. by Franceschi, and by U. S. Dept. Agric. (as *Myrciaria cauliflora*, Berg).—*E. costaricensis*, Berg., lvs. oblong, 2–3 in. long: fls. in sessile axillary umbels; pedicels  $\frac{1}{4}$  in. long: fr. obovoid, glabrous, small. Cent. Amer.—*E. edulis*, Vell. Branchlets, petioles, and young foliage ferrugineous-pubescent: lvs. willow-like, slenderly acuminate: fr. orange-color or yellow, downy, the size of an apple. Brazil. Intro. by Franceschi, and by the U. S. Dept. Agric. (as *Myrciaria edulis*, Skeels). Stands drought well.—*E. littoralis*, Panch. Lvs. spatulate, obtuse, subcordate at base: fls. sessile, fasciculate-congested; infl. pubescent: fr. puberulent, subglobose, about  $\frac{1}{2}$  in. diam., fragrant, sweet to the taste. New Caledonia. Intro. into Calif. by Franceschi.—*E. Luma*, Berg.—*E. apiculata*.—*E. Mato*, Griseb. Lvs. ovate, obtuse, about  $1\frac{1}{2}$  in. long: fls. solitary on peduncles much shorter than lvs. Argentine. Intro. by Franceschi, who describes the fr. as orange-colored, ribbed, and about 1 in. diam., and by the U. S. Dept. Agric.—*E. myriophylla*, Casar. Growing parts pubescent: lvs. mostly ternate, very narrowly linear,  $\frac{3}{4}$ – $1\frac{1}{2}$  in. long, much exceeding the solitary peduncles. Brazil.—*E. pinguens*, Berger. Young parts pilose: lvs. elliptic-oblong, spine-tipped, 2–3 in. long,  $\frac{3}{4}$ –1 in. broad, much exceeding the simple peduncles in their axils: fr. depressed-globose, puberulent, small. Brazil. Intro. by Franceschi, and by the U. S. Dept. Agric.—*E. pyriiformis*, Camb. Lvs. myrtle-like but white tomentose beneath, about equaled by the branched peduncles: fr. pear-shaped, yellow, puberulent, edible. Brazil. Intro. in Calif. by Franceschi.—*E. Ugni*, Hook & Arn.—*Myrtus Ugni*.—*E. Uvalha*, Camb., not Miq. Growing parts and infl. pubescent: lvs. oblong, narrowed at base, obtuse, 1–2 in. long, much exceeding the simple peduncles: fr. yellow, size and shape of a small pear, edible. Brazil. Intro. by Franceschi.

HARVEY MONROE HALL.

EULÁLIA: *Miscanthus*.

EULÔPHIA (Greek, *handsome crest*). *Orchidaceæ*. Terrestrial orchids, requiring warmhouse conditions.

Rather small plants with membranaceous lvs. and conspicuous pseudobulbs: scape basal, several-fld.; sepals and petals spreading, similar, ascending; labellum 3-lobed; pollinia 2.—About 50–60 species, in the tropics of both hemispheres. The cult. of *Calanthe* will apply to this genus.

*maculata*, Reichb. f. Pseudobulbs ovate, compressed: lvs. ovate, spotted or blotched: fls. small; upper sepal hood-shaped, lateral ones acuminate, reddish brown; petals broader, white or pale rose; labellum cordate, with 2 crimson spots, triangular in outline, near the base, otherwise white. Brazil. B.R. 618 (as *Angræcum*).

*scripta*, Lindl. Lvs. linear, subdistichous: fls. purple and yellow; sepals and petals linear-oblong; labellum 3-lobed, lateral lobes rotund at the apices. Madagascar.

*E. Côlee*, Rolfe. A slender-growing species with aloe-like lvs.—*E. Lubbersiana*, Laurent & Th. Dur. Allied to *E. maculata*: lvs. dark green, marbled with white. Afr.—*E. nuda*, Lindl. Scape about 2 ft. tall, many-fld.; fls. ranging from rose-purple to pink, or yellowish green; lip nearly entire, recurved. India and China. B.M. 8057.—*E. paniculata*, Rolfe. Pseudobulbs tufted, bearing 2 strap-shaped lvs.: fls. numerous; petals and lip yellowish green dotted with purple. Madagascar.—*E. undulata*, Rolfe. Scape about 1 ft. high, of slender growth; petals and lip pale green, the latter with 3 prominent keels on the disk. Rhodesia.—*E. Woodfordii*, Rolfe. With tall many-fld. infl.; fls. green with dull claret-purple lip. Old Calabar.

GEORGE V. NASH.†

**EULOPHIÉLLA** (a diminutive of *Eulophia*). *Orchidaceæ*. Orchids in habit resembling a small cyrtopodium.

Flowers in many-fld. racemes; sepals and petals similar, concave; lip 3-lobed, spurless; column with a curved foot; pollinia 2.—Species 2. They require the conditions and treatment given Cyrtopodium.

*Elisabethæ*, Hook. Lvs. nearly 2 ft. long, plicate: scape stout; raceme many-fld.; fls. about 1½ in. across; sepals and petals white, the former marked with rose on the outside; lip white with a golden disk. Madagascar. B.M. 7387. G.C. III. 45:407. C.O. 1. O.R. 6:177; 20:137.

*Peetersiana*, Kränzl. Bulbs 1 ft. long; raceme dense; fls. nearly 3 in. across, rose-purple; lip with a golden blotch. Madagascar. G.M. 51:267. C.O. 2. O.R. 6: frontispiece; 20:138.

*E. Hämelinii*, Rolfe. Resembling *E. Peetersiana* in habit but lvs. narrower and fls. smaller. Madagascar.

GEORGE V. NASH.

**EUÓNYMUS**: *Eonymus*.

**EUPATÓRIUM** (named for an ancient king of Pontus said by Pliny to have employed one of this group of plants in medicine). *Compósitæ*. JOE-PYE WEED. THOROUGHWORT. BONESET. HEMP AGRIMONY. MIST-FLOWER. Chiefly perennial herbs, a few species annual, many of the tropical ones shrubby or even arborescent; some of them hardy border plants, others grown in coolhouses as florists' plants, and others in warmhouses for the attractive foliage.

Heads rayless, mostly in dense flat-topped or rounded clusters, less frequently in open panicles, the florets (rarely 1-4) mostly 5 or more in each head, perfect, the 2 style-branches long, threadlike or club-shaped, protruding far out of the tube of the floret; involucre cylindrical to hemispherical, its scales in 2 to many overlapping ranks: achenes 5-angled, crowned with a well-developed pappus of hair-like mostly white bristles: lvs. mostly opposite: fls. purple, rose-colored or white, more rarely lilac or bluish violet, never yellow.—At least 600 species, chiefly of Mex., the W. Indies, and Trop. S. Amer. Certain species, now botanically placed in *Eupatorium*, still appear in trade catalogues and seed-lists under the names *Hebeclinium* and *Conoclinium*. Others have been confused with *Ageratum*.

Of this large and varied genus relatively few species have been brought into cultivation. Of these, there are two classes, namely certain warm-country species adapted only to glasshouse culture, and on the other hand a few native North American species (as well as the hemp agrimony of Europe), more or less tractable in cultivation, especially as components in making up mixed hardy borders. The glasshouse species are seen only in the larger or amateur collections, as a rule, although a few have been long in European cultivation. Of the hardy species, some, reputed medicinal, are found in old gardens. The glasshouse species demand the general treatment of *Piqueria* (*Stevia* of florists)—a cool or intermediate temperature and pot culture. They are easy to grow, and propagate readily by cuttings. They are useful for winter bloom, the heads, though individually small, being aggregated in showy masses.

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## KEY TO THE SPECIES.

- A. Glasshouse or warm-country species.
  - B. Florets pink, purple, lilac, or violet.
    - C. Involucral scales not ending in hairy tails.
      - D. Shape of lvs. ovate; lf.-stalks long.
        - E. Lvs. heart-shaped.
          - F. Sts. covered with dense reddish wool..... 1. *atrorubens*
          - FF. Sts. green.
            - G. Panicle dense, terminal: lvs. mucronate-toothed... 2. *megalophyllum*
            - GG. Infl. lax, partly axillary: lvs. crenate-toothed.... 3. *Purpusii*
            - EE. Lvs. pointed or blunt at base... 4. *ianthinum*
            - DD. Shape of lvs. lanceolate or oblong; lf.-stalks short.
              - E. Lvs. alternate; heads many-fld.. 5. *Lasseauxii*
              - EE. Lvs. opposite; heads 5-12-fld... 6. *serrulatum*
          - CC. Involucral scales ending in hairy, colored tails..... 7. *hecatanthum*
        - BB. Florets white or nearly so (the pappus sometimes colored).
          - C. Lvs. leathery, lance-oblong, glabrous, entire..... 8. *araliæfolium*
          - CC. Lvs. not leathery, usually somewhat toothed and hairy.
            - D. Lf.-blade elliptic-lanceolate, decurrent and crisped on short stalk..... 9. *micranthum*
            - DD. Lf.-blade round-ovate, toothed even to the decurrent base.... 10. *conspicuum*
            - DDD. Lf.-blade not decurrent on petiole.
              - E. Plant glandular-sticky.
                - F. Heads about ¼ in. diam.... 11. *glandulosum*
                - FF. Heads about ½ in. diam.... 12. *probum*
                - EE. Plant not glandular-sticky.
                  - F. Lvs. velvety beneath: infl. broad rounded corymb.... 13. *vernale*
                  - FF. Lvs. sparingly hairy or soon glabrate.
                    - G. Shape of lvs. round- or triangular-ovate; margins toothed.
                      - H. Lf.-blade small, ½-1½ in. long..... 14. *glechonophyllum*
                      - HH. Lf.-blade larger, 2-4 in. long..... 15. *pazcuarense*
                    - GG. Shape of lvs. elliptic-ovate; margins nearly or quite entire..... 16. *glabratum*
                    - GGG. Shape of lvs. narrowly lanceolate..... 17. *riparium*
          - AA. Hardy or border plants.
            - B. Florets flesh-colored, reddish or bluish-purple.
              - C. Lvs. lance-oblong, merely toothed, mostly whorled..... 18. *purpureum*
              - CC. Lvs. deeply 3-parted, opposite.... 19. *cannabinum*
              - CCC. Lvs. broadly ovate, opposite, merely toothed..... 20. *cælestinum*
            - BB. Florets white or nearly so.
              - C. Lvs. perfoliate (united around the st.)..... 21. *perfoliatum*
              - CC. Lvs. not perfoliate.
                - D. Lf.-blade lanceolate, the base narrowed and scarcely stalked.



- . Scales of involucre blunt,  
 gray-velvety.....22. *altissimum*  
 EE. Scales sharp, smoothish, with  
 thin white edge.....23. *album*  
 DD. Lf.-blade ovate-lanceolate, sessile  
 by a rounded base.....24. *sessilifolium*  
 DDD. Lf.-blade broadly ovate, usually  
 well stalked.  
 E. The lvs. taper-pointed, sharply  
 toothed.....25. *urticæfolium*  
 EE. The lvs. mostly blunt and  
 bluntly toothed.....26. *aromaticum*

1. *atrórubens*, Nichols. (*Hebeclinium atrórubens*, Lem.). Lvs. large, ovate, short-stalked, heart-shaped at base, opposite, toothed, covered on the edge and veins with long reddish or claret-colored hair; heads red or purple, in a very large red-rayed truss. S. Mex. I.H. 9:310.—A stately species with fine foliage and richly colored fls., but said to be difficult to grow. Rare in cult. Closely related, if not identical, is *E. grandiflorum*, André, though figured with smaller heads of redder color. R.H. 1882:384.

2. *megalophyllum*, Klatt (*Hebeclinium megalophyllum*, Lem., not DC. *H. megalophyllum*, Lem.). Half-shrub, robust: lvs. opposite, round, more or less heart-shaped, very large, the lower sometimes more than a foot in diam., veiny; heads in large clusters (1-1½ ft. broad); florets rose, the long hairlike styles conspicuous, bluish. S. Mex. R.H. 1866, p. 351. Gt. 16:548.—Fine showy species with rich foliage, but apparently rare and not recently in trade. Needs richly manured soil, much light, and frequent replanting.

3. *Purpúsi*, Brandegee (*E. petiolare*, Hort., not Moc. & Sessé). Smoothish or (var. *monticolum*, Brandegee) sticky-hairy, loosely branched: lvs. round-ovate, commonly heart-shaped, shortly taper-pointed, bluntly and rather coarsely toothed; heads slender-stalked, ½ in. diam.; florets at first white, changing rapidly to pinkish lilac. Low. Calif. G.C. III. 35:163.—Attractive, rapid-growing, herbaceous, tender. Weak and needing support.

4. *ianthinum*, Hemsl. (*Conoclinium ianthinum*, Morr. *Hebeclinium ianthinum*, Hook.). Somewhat shrubby, the thickish round sts. at first covered with a rusty purplish pubescence: lvs. large, ovate, long-stalked, opposite, pointed or blunt (but not heart-shaped) at base, somewhat hairy on both surfaces, serrate: fls. light violet, in a large compound terminal corymb. S. Mex. B.M. 4574.—A luxuriant species with heavy foliage, of easy pot cult. in a warmhouse.

5. *Lasseauxii*, Carr. (*Ageratum Lasseauxii*, Carr. *Conoclinium Lasseauxii*, Dur.). Habit of *Ageratum*, densely covered with short glandular hairs: lvs. alternate, oblong-lanceolate, narrowed at each end, bluntly toothed: heads in small compact unequally stalked clusters; florets very numerous, at first white, at maturity a vivid rose-color. Temp. S. Amer. R.H. 1870:90.—Intro. to European hort. in 1870. Attractive bedding plant, but apparently rare. Probably not fully hardy though less tender than most of the glasshouse species. Prop. easily and flowers continuously; 1-2 ft. high.

6. *serrulatum*, Hort. Shrub with lance-shaped, pointed, sharply and unevenly toothed, short-stalked lvs., very unequal involucre scales, and showy reddish lilac heads in large dense flat-topped clusters; florets 5 in each head. In European hort., and said to come from S. Brazil. R.H. 1894:304. Gt. 44, p. 570. G.C. III. 18:265.—Three to 6 ft. tall. Choice, but certainly not the true *E. serrulatum*, DC., which has much narrower finely and evenly serrulate lvs. and 11-12-fld. heads.

7. *hecatanthum*, Baker (*Hebeclinium Urolepis*, DC.). Robust annual, like a large *ageratum*: lvs. opposite, stalked, round-heart-shaped: heads showy, bluish purple; florets numerous (about 75); involucre scales

ending in similarly colored hairy appendages. Temp. S. Amer.—Promising species, worthy of trial as a bedding plant.

8. *araliæfolium*, Less. (*E. omphaliæfolium*, Kunth & Bouché). Soft-wooded shrub with thick and shining oblong-lanceolate lvs. 3-8 in. long; heads loosely panicle; involucre scales conspicuously unequal, the outer short and calyx-like, the inner 3-4 times as long; florets white. S. Mex. and Guatemala. Gt. 2, p. 4, t. 39.—From low and moist tropical habitat and presumably very tender. Rare in cult. and not noticed recently in trade. Needs rich leaf-mold, moist air, and high temperature. Prop. by cuttings. Flowers in March.



1434. Leaves of glasshouse Eupatoriums. a, *E. riparium*; b, *E. vernale*; c, *E. glandulosum*; d, *E. glabratum*. (× ¼)

9. *micranthum*, Less. (*E. ligustrinum*, DC. *E. Mörtsii*, Hort. *E. Weinmannianum*, Regel & Koern. Many other hort. names, for which see Gt. 22, p. 36). Lvs. opposite, elliptic-lanceolate, pinnately veined, the blade somewhat toothed and slightly decurrent in narrow crisped wings upon the short lf.-stalk: heads small and few-fld. but very numerous in large round-topped terminal corymb; florets white, but pappus pink-tinged to deep rose. Mex. Gt. 16, p. 260, t. 555, figs. 1-3. Gn. 47, p. 444. G.C. II. 5, p. 53.—Upright shrub rather widely cult. since about 1830 under a great variety of names, but chiefly as *E. Weinmannianum*.

10. *conspicuum*, Kunth & Bouché (*E. grandifolium*, Regel). Shrubby: lvs. opposite, large, thin, triangular-ovate, finely and sharply toothed to the very base, which is somewhat decurrent upon the long lf.-stalk: fls. white, in ample lax panicles, almond-scented. Guatemala. Gt. 1, p. 102, t. 12.—Planted out in summer forms a luxuriant shrub, attractive on account of its excellent foliage. Best prop. by cuttings placed in warm bed about the end of August. Winter-bloomer in glasshouse.

11. *glandulosum*, HBK. (*E. adenophorum*, Spreng. *E. adenanthum*, Hort., not DC. *E. trapezoidum*, Kunth.

*E. americanum*, Hort.). Fig. 1434. Diffuse and often decumbent herb, the slender round branches, petioles, and pedicels finely glandular-puberulent: lvs. triangular-ovate or rhombic-ovate, thinish, slender-stalked, taper-pointed, coarsely and sometimes unevenly crenate-dentate, sparingly puberulent beneath: heads pure white, ageratum-like, in close clusters. Mex. B.R. 1723.—Easy in pot cult. and not very tender, flowering in late autumn or early winter. Cuttings strike root readily. Var. *foliis variegatis*, Hort. Lvs. variegated.

12. *pròbum*, N. E. Br. Very viscid like the preceding, probably more tender: lvs. similar: heads decidedly larger,  $\frac{1}{2}$  in. diam. Peru. G.C. III. 7:321.—Recommended as promising and cult. in a few English conservatories. Apparently not yet in the trade.

13. *vernale*, Vatke & Kurtz. (*E. triste*, Hort., not DC. *E. triste*, Hort.). Fig. 1434. Strong herb (slightly woody in the wild), with hairy sts.: lvs. oblong-ovate, long-stalked, taper-pointed, serrate, finely hairy above,



1435. *Eupatorium perfoliatum*. ( $\times \frac{1}{5}$ )

paler and grayish velvety beneath, veiny, 3–5 in. long: fls. bright white, the heads in an ample terminal corymb; involucre scales long, narrow, green. Mex. Gt. 22:750.—Easy in pot cult. becoming popular for cut-fls.

14. *glechonophyllum*, Less. (*Ageratum conspicuum*, Hort.). Low, branching half-shrub, very leafy: lvs. small,  $\frac{1}{2}$ –1 (rarely 2) in. long, triangular-ovate, sharp-pointed, bluntly few-toothed, thin and nearly glabrous, on slender stalks: heads borne on threadlike pedicels in small or medium-sized flattish clusters. Chile.—Tender greenhouse perennial, but flowering in the open the first year if seeds are sown early. Closely related, if not actually identical was the *E. Haageanum*, Regel & Koern. intro. into European hort. in the middle of the 19th century (see Gt. 16, p. 260, t. 555, figs. 4–6).

15. *pazcuarense*, HBK. Puberulent but not glandular: lvs. opposite, stalked, round-ovate, light green, 2–4 in.

long, taper-pointed, sharply or bluntly toothed: heads very numerous in a wide (3–10 in.) flattish corymb. Uplands of Mex.—Essentially herbaceous, 1–3 ft. high. Recently intro. in cult. in S. Calif. Promising for cut-fls. and as a window plant.

16. *glabràtum*, HBK. (*E. elegans*, Hort. *E. latifolium*, Hort.). Fig. 1434. Shrubby, erect, with slender hard glabrous brown sts.: lvs. of firm texture though scarcely leathery, small, lance-oblong or ovate-oblong, tapering into a strong rather short petiole, blunt or pointed, wavy-margined or small-toothed: fls. (sometimes blush) in ascending cymose clusters, together forming a long terminal leafy panicle. Uplands of Mex.

17. *ripàrium*, Regel. Fig. 1434. Diffuse, becoming woody at base, 2 ft., the sts. slender, puberulent and usually reddish: lvs. opposite, long-lance-shaped, taper-pointed and at base narrowed to a long petiole, prominently 3-ribbed, toothed: heads in rather compact long-stalked clusters. Mex. Gt. 15:525. Gn. 40, p. 134.—Good winter bloomer. Best for florists. Readily cult. in coldhouse.

18. *purpùreum*, Linn. JOE-PYE WEED. Lvs. whorled, commonly in 5's and 6's, oblong or lanceolate, taper-pointed, coarsely serrate: heads in large compound clusters, pale purple or flesh-colored, rarely almost white. N. Amer.—Common and variable. Tall, rank plant of low grounds (reaching 8–9 ft.), good for bold effects in border or against shrubbery. Var. *maculàtum*, Darl. Of lower growth: lvs. commonly in 4's, ovate-oblong, roughish-pubescent: heads in smaller clusters, more deeply colored. Var. *foliòsum*, Fern. Similar but with the infl. surpassed by the long upper lvs. Var. *amènum*, Gray. Still lower (2 ft. high), smoothish: lvs. sometimes merely opposite.

19. *cannabinum*, Linn. HEMP AGRIMONY. Resembling Joe-Pye weed in general habit and with similar pale purple heads in terminal clusters: lvs. opposite, but deeply 3-parted in a manner to suggest verticillate lvs. Eu.—Common. May be used like the preceding species but less desirable. Thrives best in limy alluvial soil. Eng. Bot. 6:428.—The Asiatic *E. Kirilowi*, Turcz., is a very nearly related plant of lower growth (1–3 ft.), with narrower (linear-oblong) coarsely toothed lf-segms., the lateral often much reduced. Strict herb with dense terminal corymb of dull greenish purple heads. Gt. 24:850.

20. *cœlestinum*, Linn. (*Conoclinium cœlestinum*, DC.). MIST-FLOWER. Somewhat pubescent: lvs. opposite, stalked, triangular-ovate, somewhat cordate, thin, coarsely toothed: heads as in *Ageratum* in compact clusters, many-fl'd., light blue to violet. N. J. to Mich., Kans., and southward.—Perennial herb, late-blooming, heliotrope-fl'd. Appropriate to low borders.

21. *perfoliàtum*, Linn. BONESET. THOROUGHWORT. Fig. 1435. Hairy: lvs. lance-oblong, the pairs united at base about the st., wrinkled, remotely toothed or entire, taper-pointed: heads in dense terminal compound cymes. N. Amer., common in low rich soil.—Stout, slightly rank-smelling plant, 2–3 ft. high, long used in domestic medicine and found in old gardens. Excellent for striking effects, especially in low grounds. Fls. grayish white or in a comparatively rare variety (forma *purpùreum*, Brit.) bluish purple. In var. *truncàtum*, Gray, the lvs. (at least the upper ones) are rounded or truncate at the sessile base, not united about the st. A peculiar form apt to be encountered occasionally in large cultures.

22. *altissimum*, Linn. Grayish green, downy, much branched: lvs. opposite, narrowly lance-shaped, tapering to both ends, short-stalked, remotely toothed or entire: heads only 5-fl'd. Pa. to Minn., Neb., and southward.—Tall, vigorous herb, 4–8 ft. high, in open places and dry soil. Not very ornamental. See page 3568



23. *album*, Linn. Rough-hairy: lvs. opposite, lance-oblong, coarsely serrate, essentially sessile, veiny: involucrel scales scarious-margined: florets white. L. I., southward near the coast.—Somewhat attractive for border planting and specially suited to poor sandy soil.

24. *sessilifolium*, Linn. UPLAND BONESET. Lvs. oblong-lanceolate, gradually tapering almost from the rounded sessile base to the apex: heads 5-fld., white. Vt. to Mo. and southward.—A trim, smooth highly attractive hardy species. Thrives best in limy alluvial soil.



1436. *Eupatorium urticaefolium* ( $\times \frac{1}{2}$ )

25. *urticaefolium*, Reichard (*E. ageratoides*, Linn. f.). WHITE SNAKE ROOT. Fig. 1436. Lvs. opposite, thin, long-stalked, ovate with broad base, acuminate, coarsely and sharply serrate, green on both sides: heads small in loose but ample clusters; florets bright white. E. N. Amer. Mixed woods, common.—Neat, smoothish, branching herb, 2–4 ft. high. One of the best of the perfectly hardy summer-blooming species.

26. *aromaticum*, Linn. Much like the preceding but usually hairy: lvs. thickish and blunt or scarcely pointed, blunt-toothed: later-flowering, not aromatic. Mass. and southward near the coast.—Suited to very sandy soil. Var. *melissoides*, Gray (*E. Fraseri* and *E. cordifolium*, Hort.). Slender, roughish, strict: heads 5–12-fld.: lvs. subcordate, ovate or oblong, obtuse, the petioles often very short. S. E. U. S.—Also suited to poor and sandy soil, but more tender than the typical form.

The following species are said to have been recently intro. into European horticulture and to promise well: *E. deltoideum*, Jacq. A soft-wooded half-shrub with opposite triangular-hastate crenately toothed lvs. 3–5 in. long and somewhat pale and slightly velvety beneath, the basal lobes widely spreading acute: lf.-stalks 1–3 in. long: heads of rosy purple fls. in thyrsoid panicles; involucrel scales linear, very sharp, scarcely imbricated. S. Mex. A glasshouse species with striking foliage.—*E. herbaceum*, Greene (*E. arizonicum*, Hort.). An erect smooth or merely pulverulent perennial 1–3 ft. high, with opposite triangular-ovate pale green lvs. 1–3 in. long with rounded basal lobes, toothed sides, and rather short but slender stalks: fls. white; heads in broad rounded terminal clusters. S. W. U. S. Half-hardy and suited to dry places. *E. japonicum*, Thunb. Erect perennial resembling *E. cannabinum*, with dull purplish to greenish white fls. in flat clusters: lower lvs. deeply 3-parted, the upper simple: not very attractive.

B. L. ROBINSON.

**EUPHORBIA** (classical name; said by Pliny to be in honor of King Juba's physician; possibly from the Greek for fat). *Euphorbiaceae*. MILKWEED (improperly) WOLFS-MILK. SPURGE. The last name, most often applied to the genus as a whole, belongs more properly to the common herbaceous species and especially to *E. Lathyris*. Of very diverse habit, from succulent cactus-like trees to low or prostrate herbaceous weeds; planted mostly in the open, but some kinds grown under glass as oddities and some as florist's plants.

The genus is characterized by the single pedicellate, pistillate fl. without floral envelopes, or with only a rudimentary calyx, surrounded by numerous staminate fls., each consisting of a single stamen separated from its pedicel only by a joint; the whole infl. surrounded by a more or less cup-shaped involucre with 5 lobes and 1–5 glands is called a cyathium. The involucre is regular or nearly so; the glands free from one another: the fr. an explosive caps., with 3 carunculate seeds; the staminate fls. are usually subtended by

minute bracts.—One of the largest plant genera, of not less than 700 and probably over 1,000 species, occurring in most temperate and tropical regions. Many are desert plants and the greater number grow in dry and sterile places. *Euphorbia* is distinguished from the nearest related genera, *Pedilanthus* and *Synadenium*, by its regular or nearly regular involucre, which in *Pedilanthus* is protuberant on one side of the base and contains the glands, and by the free involucrel glands which in *Synadenium* are united into a ring. Some of the fleshy species are very similar to succulent cacti and *Asclepiadaceae*. One long grown under the name of *E. pendula*, Boiss., is a *Sarcostemma* according to N. E. Brown. For *E. tithymaloides*, see *Pedilanthus*; for *E. Grantii*, Hort., and *E. arborea*, Hort., see *Synadenium*.

Monographed by Boissier in DeCandolle's *Prodromus*, 15, pt. 2 (1862). See local floras and Norton, Rept. Mo. Bot. Gard. 11, for native species. See also Fobe, in *Monatsschrift für Kakteenkunde*, 8:42 (1898) and Berger, *Sukkulente Euphorbien*, a manual of the cactus-like species in cultivation. The recent work of N. E. Brown of Kew in *Flora of Tropical Africa* and *Flora Capensis* describes and gives keys to practically all the African species, which include nearly all the succulent ones, both wild and cultivated. Although the vegetative form varies remarkably, so that the various sections of the genus are considered of generic rank by many authors, the floral characters are very similar and so inconspicuous as to be of little importance generally in a horticultural work.

Most of the species have abundant milky juice, and the cactiform kinds have been thus distinguished from cacti, but many cacti also have milky juice. The juice of many species is acrid-poisonous, especially if it comes in contact with mucous membranes or open sores. The juice from some of the species is used in medicine as a purgative.

Many of the fleshy species are cultivated by lovers of succulents for their curious shapes; and a few are valuable for their ornamental foliage. The flowers are usually too minute to be noticeable. Some, like *E. corollata* (Fig. 1437), *E. maculata*, *E. Cyparissias* and *E. marginata*, are weeds in America, but not troublesome. The great majority of the species are insignificant herbs. The species are remarkably free from injurious insects, and are rarely attacked by a few fungi.

The fleshy species are grown much the same as cacti, but the culture is less difficult, and they do well with warmer treatment. In winter they are kept in a dry and cool house, 50° to 55° F., with good light and little water. Drips must be carefully avoided. In summer the pots should be plunged outdoors in hot dry situations, with a moderate supply of water and especially good drainage. It is better to protect them from continued rain, but most species do well without this. The more fleshy species, like *E. Caput-Medusae*, *E. mammillaris*, and *E. meloformis*, require more heat and better care than the others. They have to be watered with great care in winter. The air of most greenhouses is too damp for them if the requisite low temperature is maintained. The winter conditions of air and temperature in ordinary living-rooms make them ideal for the succulent euphorbias. Species like *E. neriofolia* need water in the growing season and dry conditions after the



1437. *Cyathium* of *Euphorbia corollata* ( $\times 2$ ). The pistillate flower is at 8, surrounded by several staminate flowers arising above the involucrel glands with their five oblong spreading petaloid appendages. No. 3.



leaves fall. The shrubby species, like *E. atropurpurea* and *E. dendroides*, do well with the treatment of the more fleshy kinds. See D. A. W. and F. S. Curtis, in Sharon Cactus Guide, March and May, 1897.

The few hardy species of ornamental value make good border plants or are suitable for the rockery. *E. epithymoides* usually known in gardens as *E. polychroma*, is one of the best herbaceous perennials, forming a hemispherical clump with beautiful yellow foliage of different shades when in bloom. *E. palustris* and related species are similar but erect and not compact.

The succulent species can nearly all be propagated by cuttings. These are taken best in early summer, allowed to dry somewhat and then planted in sand, charcoal or a mixture of these. Coal-ashes are used effectively by some. When seeds can be procured, they may be used in propagation. Grafting, as is sometimes practised with cacti, is possible. Potting soil need not be rich. A coarse sandy loam, or, some say, any kind of soil will do.

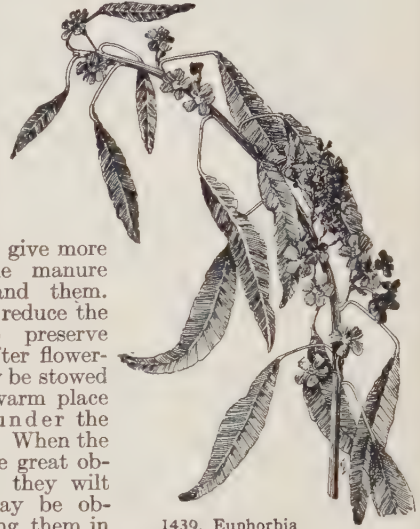
*E. pulcherrima* and *E. fulgens* are good winter-flowering greenhouse plants, and require special treatment. *E. fulgens* succeeds well in the warmest parts of the house, in pots, or best planted out like roses and trained upon the wall or strings. It is propagated from cuttings taken in June, when the old plants have started to grow, kept in a warm frame until rooted, and then kept growing with heat, any transfers being made with as little root disturbance as possible. If stocky show plants are wanted, several cuttings may be planted in one pot and checked two or three times during summer by repotting, and kept pinched back freely to secure branches. They are best kept cooler when in flower, but are very sensitive to cold or sudden changes in temperature. After flowering they are kept dry for a few months. For the cut sprays they are best grown from cuttings each year. They last very well when cut,

usually taken from the young wood. Successive sets of cuttings may be made at later periods if different-sized plants are wanted. When well started, the potted plants are plunged outdoors till September, with plenty of water, light and sunshine and good drainage. They do well in rich heavy loam in 5-7-inch pots. They are liable to drop their leaves if exposed to cold or other unfavorable conditions. In autumn they are transferred to the greenhouse, with moderate temperature.

When the bracts begin to appear, give more heat and some manure water to expand them. When in flower, reduce the temperature to preserve them longer. After flowering the pots may be stowed away in a dry warm place till spring,—under the benches will do. When the buds are cut the great objection is that they wilt easily. This may be obviated by keeping them in water for a few days before using. See Grieve, G.C. III. 9:106, and Hatfield in Garden and Forest 9:496. See article *Poinsettia* for further treatment.

*Euphorbia splendens* is another winter bloomer, and may be treated as the succulents, with more heat and water. It will do well in living-rooms, and bears some flowers all the year. It bears rough treatment well, and is propagated by cuttings from the young growth, which root with the greatest ease.

In tropical and subtropical regions many of the tree-like or succulent euphorbias make fine outdoor ornaments. The poinsettia is a magnificent landscape ornament in California, West Indies and so on. In Southern California the poinsettia is propagated by sticking canes 3 feet long in the ground from April on, these growing and blooming, often profusely, the first season. In the West Indies and Florida, some of the thorny tree-like forms, especially *E. lactea*, are grown as hedges, their thick, erect thorny branches making an almost impenetrable barrier. This and other species are grown also as specimen plants. See *Succulents*.



1439. *Euphorbia fulgens* ( $\times \frac{1}{2}$ ). No. 5.



1438. *Euphorbia marginata* ( $\times \frac{1}{2}$ ). No. 1

The culture of the poinsettia is very similar. To secure plants with large heads, the general plan is to grow from cuttings annually, but the old plants may be continued. Old plants that have been resting may be introduced to heat and moisture in late spring, and will soon give a liberal supply of cuttings, which are

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A. Glands of the involucre with petal-like appendages (almost none in 4): slender-branched herbs or rarely shrubs not spiny: lvs. entire. Section ADENOPETALUM. The Section ANISOPHYLLUM, genus *Chamæsyce* of some, differs in having small opposite lvs., unequal at base, stipules present, fls. small, glands 4. It contains most of the low herbaceous wild euphorbias of U. S., such as *E. maculata*, Linn., *E. Prestii*, Guss., *E. serpens*, and *E. capitata*; names from this group occur in American catalogues, but the species to which they properly belong are inconspicuous weeds. *E. lorifolia*, Hillebr., of Hawaii, has recently been investigated as a possible source of rubber. (Descriptions of these species will be found in the floras.)

## B. Stipules present.

1. *marginata*, Pursh (*E. variegata*, Sims). SNOW-ON-THE-MOUNTAIN. GHOST-WEED. Fig. 1438. Annual, about 2 ft. high, pubescent, dichotomously many-branched: lvs. numerous, light green, ovate-subcordate to oblong-lanceolate, 1-3 in. long, the upper white-margined, often entirely white: involucreal glands with large white appendages. July-Oct. Plains from Dak. to Texas and extending eastward. B.M. 1747. Gt. 30:218. V. 2, p. 281; 5, p. 64. G.W. 13, p. 305.—Hardy annual, used for its white foliage in bedding and mixed borders in sunny situations.

2. *sanguinea*, Hort. (*E. hæmatodes*, Boiss.?). A tall shrub: lvs. ovate, obtusely pointed, in whorls of 3, red when young to deep bronze or purplish red later.—This handsome plant of unknown nativity is cult. in S. U. S. While it is not possible to classify it exactly without fls. and fr., the foliage characters indicate its relationship to *E. cotinifolia*, Linn.



1440. *Euphorbia pulcherrima* ( $\times \frac{1}{2}$ ). No. 8.

## BB. Stipules absent or microscopic.

## c. Plant a perennial herb.

3. *corollata*, Linn. (*Tithymalopsis corollata*, Klotzsch & Garcke). FLOWERING SPURGE. Fig. 1437. Plant  $1\frac{1}{2}$ -3 ft. high, usually glabrous, slender and diffusely branched above: lvs. ovate-oblong to lanceolate, 1-2 in. long, those of the infl. much smaller and opposite: involucreal glands 5, with conspicuous white appendages. July-Oct. On rather dry soil E. U. S. B.M. 2992. L.B.C. 4:390. F.R. 1:969.—A hardy herbaceous perennial used like *gypsophila* for cutting, and as a bedder in

light soil. There are many variations in size, shape, color and pubescence of plant, lvs. and infl.

4. *Ipecacuânha*, Linn. (*Tithymalopsis Ipecacuânha*, Small). IPECAC SPURGE. Only the forking infl. (3-6 in.) above ground, with its red or green glabrous, opposite lvs. varying from oval to linear on different plants, the alternate lvs. of the short st. usually subterranean and scale-like: cyathia long peduncled; appendages of glands rudimentary. April. Sandy soil E. U. S. L.B.C. 12: 1145. B.M. 1494.—*E. geniculata*, Ort., is sometimes cult. under this name. It is a plant of Trop. Amer., related to *E. heterophylla*, but with broader lvs. the upper whitish at base.



1441. *Euphorbia heterophylla* ( $\times \frac{1}{4}$ ). No. 9.

## cc. Plant a shrub.

5. *fulgens*, Karw. (*E. jacquiniæflora*, Hook.). SCARLET PLUME. Fig. 1439. Small shrub with slender drooping branches: lvs. long-petioled, lanceolate, bright green: cyathia in small axillary cymes, with the conspicuous appendages to the 5 involucreal glands bright scarlet. Mex. B.M. 3673. R.B. 39:41. F.C. 2:55. R.H. 1905:440. Gn. 33:486; 39, p. 239; 67 p. 73. V. 2, p. 74. A.F. 16:1551. G.M. 53:89. G. 4:593. P.M. 4:31. Gng. 10:76.—A handsome winter-blooming plant, used for cut-fls. or for specimen plants.

6. *miseria*, Benth. Lvs. small, obovate, pubescent, clustered at the end of crooked branches: fls. inconspicuous. S. Calif. and Mex.—Recently catalogued in the Calif. trade.

7. *antisiphilitica*, Zucc. (*Trichostigma antisiphilitica*, Klotzsch & Garcke). CANDELILLO. Slender, erect, rod-like branches 1-3 ft. high, almost leafless Mex.—The plants yield a useful wax and are sometimes grown in collections of succulents.

## AA. Glands of involucre without petal-like appendages. (Nos. 8-65)

B. St. herbaceous or shrubby, not fleshy: lvs. well developed, the upper colored: stipules minute: infl. cymose. Section POINSETTIA.

8. *pulcherrima*, Willd. (*E. Poinsettiana*, Buist. *Poinsettia pulcherrima*, Graham). POINSETTIA. EASTER FLOWER. CHRISTMAS FLOWER. LOBSTER FLOWER. MEXICAN FLAME-LEAF. Fig. 1440. Shrub 2-10 ft. high, branched: lvs. ovate-elliptical to lanceolate, entire, sinuate toothed or lobed, or panduriform, 3-6 in. long, somewhat pubescent, the upper narrower, more entire to even linear-lanceolate and of the brightest vermilion-red: involucre 2-3 lines wide, greenish, with one large yellow gland. Nov.-March. Moist, shaded parts of Trop. Mex. and Cent. Amer. B.M. 3493. G.C. III. 21:125, 193. F.C. 1:33. Mn. 7, p. 67. Gn. M. 2:209.—Sometimes cut, usually used for specimen plants and in masses, often used in decorations. A gorgeous plant. Var. *plenissima*, Hort., has the fls., or most of them, transformed into red bracts, giving a fuller center. G.C. II. 5:17. Gt. 28:182. F.M.

1876:200. Var. *álba*, Hort., has the upper lvs. white. R.H. 1913:228.—It is not so vigorous, blooms later and requires more heat.

9. *heterophylla*, Linn. (*E. pandurata*, Hort.? *E. havanensis*, Willd. *E. cyathophora*, Muft.). MEXICAN FIRE PLANT. HYPOCRITE PLANT. PAINTED LEAF. FIRE-ON-THE-MOUNTAIN. ANNUAL POINSETTIA. Fig. 1441. Annual, nearly glabrous, 1-3 ft. high: lvs. ovate and sinuate-toothed, or panduriform, or some of them lanceolate or linear and entire, dark green, the upper bright red at least at the base: involucre small with 1 or 2 glands. July-Sept. E. and Cent. U. S. to Peru. Mn. 2, p. 53. Gt. 39, p. 105.—Easily grown from seeds in sunny gardens and also in pots indoors. White and yellow variegated forms are in cult.

BB. *Sts. more or less fleshy, often cactus-like and spiny: lvs. small, none or soon deciduous: infl. few-branched or cyathia single: stipules minute or none (except in E. Fournieri). Section EUPHORBIA. Nos. 10-51.*

C. *Branches cylindrical or angled, not thorny: lf.-bases not thickened and elevated as podaria: lvs. alternate or crowded on the angles.*

D. *Joints or branches cylindrical or flat. Subsection TIRUCALLI.*

10. *Tirucalli*, Linn. MILK-BUSH. INDIAN TREE SPURGE. A small tree, with a dense crown of slender, cylindrical whorled branches, curving outward then erect: joints about 4 in. long, twigs  $\frac{1}{4}$ - $\frac{1}{2}$  in. thick: lvs. narrow, about 1 in. long, soon falling. S. Asia.—A striking plant for the succulent collection. Easy of cult., often grown outdoors in warm regions.

11. *riphsaloides*, Lem., is a closely related African species probably not now in cult., but the name is in use in the trade.

12. *xylophyloides*, Brongn. Shrub or tree: trunk cylindrical, much branched; branches flat or 2-angled,  $\frac{1}{2}$  in. wide, slightly toothed along the edges: lvs. minute, soon deciduous. Madagascar.

DD. *Joints or branches 4-5-angled from the decurrent lf.-bases or comb-like rows of stipules. Subsection GONIOSTEMA (No. 13) and Subsection PTERONEURÆ (No. 14).*

13. *Fournieri*, André. St. 4-5-angled, the crowded persistent stipules forming comb-like rows on the angles: lvs. large at the apex of the short thick sts.; petioles and stipules red. Madagascar region. R.H. 1896, p. 226. L.B.C. 15:1477 (as *E. lophogona*).

14. *pteroneura*, Berger. A low shrub with erect, jointed branches,  $\frac{1}{2}$  in. thick, the 5-6 angles formed by sharp low ridges decurrent from the lf.-bases: lvs. reduced, soon deciduous. Mex. (?)—Erroneously grown under the name of *E. colletioides*, Benth.

CC. *Branches succulent with thickened elevated lf.-bases (podaria).*

D. *Spines 1-2 on each side the lf.-base. Subsection DIACANTHUM. Nos. 15-38.*

E. *Podaria (lf.-bases) not united into ribs; branches nearly cylindrical: lvs. well developed.*

F. *Bracts bright red. Class SPLENDENTES.*

15. *splendens*, Bojer. CROWN OF THORNS. Fig. 1442. Sts. 3-4 ft. long,  $\frac{1}{2}$ -1 in. thick, somewhat climbing, covered with stout

spines about an inch long: lvs. few, on the young growth, obovate to oblong-spatulate, thin, bright green, 1-2 in. long: cyathia in long-peduncled dichotomous cymes, near the ends of the branches, each closely subtended by 2 broadly ovate bright red bracts. Madagascar. Flowering all the year but mostly in winter. B.M. 2902. L.B.C. 18:1713. V.



1443. *Euphorbia nerifolia*.

2, p. 74; 14, p. 16. G.C. II. 19:816 (as *E. jacquiniæ-flora*).—Coolhouse plant. The red bracts in the green lvs. on the sinuous spiny sts. are very striking. It can be trained into ornamental forms. The seedlings have larger sts. and lvs. and double spines, a smaller one below each of the ordinary ones.

FF. *Bracts not conspicuously colored.*

Class GRANDIFOLIE.

16. *nerifolia*, Linn. Fig. 1443. Arborescent or shrubby: st. obtusely 5-angled; the small mammiform podaria in rows, with short, dark-colored, divergent spines: branches somewhat whorled, bearing obovate-oblong, obtuse, thick lvs., 3-5 in. long, at the summit: small sessile cymes of greenish cyathia in the upper axils. June, July. E. Indies. Gn.M. 6:196.—The large lvs. persistent from autumn to spring. Cristate forms are in cult. Fig. 1443 shows a hedge in W. Indies.

17. *drupifera*, Schum. & Thonn. (*E. grandifolia*, Haw.). Arborescent: st. terete: branches obsoletely 4-5-angled; spines small: lvs. terminal, obovate-cuneate, obtuse or retuse, 6-10 in. long: small cymes axillary, peduncled: caps. drupaceous. Guinea.

18. *mammillösa*, Lem. Low, caespitose: branches less than an inch diam.: podaria elongated, conical, in 5 spiral rows: lvs. and spines small, soon deciduous. Nativity unknown.—Rare in cult. and not well known. Probably the plants grown under this name are something else.

EE. *Podaria united into ribs: branches 2-13-angled: lvs. usually very small or rudimentary.*

F. *Angles of the branches, 2 (rarely 3), the branches flattened. Class COMPRESSÆ.*

19. *alcicornis*, Baker. St. obtusely 5-angled, 9 ft. high or less: branches flat, except the triangular base,  $\frac{1}{2}$  in. broad: spines short, slender, dark-colored. Madagascar.

FF. *Angles of the branches 3 (sometimes 4), but the main st. often 5-angled. Class TRIGONÆ.*

G. *Sides of branches solid green-colored.*

H. *Spine-shields separated by green tissue of ribs.*

20. *antiquorum*, Linn. Shrub, 8-10 ft. high: branches erect, jointed, 1-2 in. thick, the angles repand-dentate; spine pairs about 1 in. apart; spines 1-3 lines long: lvs. very small, roundish. India. See *E. lactea*, No. 23.

21. *grandidens*, Haw. Tree, to 30 ft. high, with trunk as much as 2 ft. diam.: branches slender,  $\frac{1}{2}$ - $\frac{3}{4}$



1442. *Euphorbia splendens*. ( $\times \frac{1}{3}$ )



in. wide, numerous, whorled, erect-spreading, making a dense rounded head in older plants; sides of branches almost plane; angles deeply sinuate dentate; spine pairs  $\frac{1}{2}$ – $\frac{3}{4}$  in. apart, spines 3–5 lines long, slender, light brown to gray: lvs. very small, triangular. S. Afr.

HH. *Spine-shields united, forming a continuous horny edge to the ribs.*

22. *grandicornis*, Goebel. Fig. 1444. Shrub or small tree: branches 3–5 in. wide, deeply jointed, the angles broadly winged, lobed and sinuate, the edge zigzag or wavy; spines large, 1–2 in. long, light colored: lvs. very small, triangular ovate. S. Afr.(?).—A fine plant, with the longest spines and widest wings of all. A rapid grower, the bright pale green contrasting beautifully with the rich light brown of the spines and horny margins on young plants.

GG. *Sides of branches marbled with white or yellow.*

23. *lacteæ*, Haw. (*E. havanensis*, Hort., at least in part). Fig. 1445. Similar to *E. antiquorum*, but with a white-marbled area running through the middle of each face of the branches. E. Indies.—One of the most common succulent euphorbias in cult., of fine candelabra form, and making rapid growth. The euphorbias grown for hedges in Fla., W. Indies, etc., are chiefly this species, though some may be *E. antiquorum*. It is often confused with *E. Hermentiana*. Cristate forms are in the trade as *E. lactea monstrosa* and *E. havanensis cristata*, though these should perhaps be referred to *E. antiquorum*.

24. *Hermentiana*, Lem. Shrub, with closely erect, scarcely jointed branches, about 2 in. thick; sides strongly concave, striped or marbled with white, especially when young, angles closely dentate; spines slender, brown, 2–3 lines long: lvs. lanceolate,  $\frac{1}{2}$ – $2\frac{1}{4}$  in. long. W. Afr. G.Z. 19:101.—One of the best. The true *E. candelabrum*, Trem., but probably not the one common in cult. under that name, is distinguished from *E. Hermentiana* by its rudimentary scale-like lvs.

FFF. *Angles of the branches 4–8 (rarely 3 on some branches). Class POLYGONÆ.*

G. *Spine-shields united, forming a continuous horny edge to the ribs.*

H. *Sides of mature branches plane or slightly convex, angles not winged, branches about 2 in. diam.*

25. *Pseudocactus*, Berger. St. 4–5-angled: branches 3–5-angled, joints tapering upward from a broad base, 4–6 in. long, 2 in. or less thick, the surface with yellow U-shaped marks from center to angles; spines stout,  $\frac{1}{2}$  in. long, brown to gray. Nativity(?). J.H. III. 60:99 (as *E. lactea*).—Frequent in cult., often under the name of *E. lactea*; also as *E. marmorata* and *E. tessellata*.

26. *cœrulæscens*, Haw. (*E. virôsa*, and var. *cœrulæscens* of Berger). Low, shrubby: st. 4–5-angled: branches 3-angled at base, 4–5-angled above, 2 in. thick; joints 2 in. or less long, the sides bluish glaucous; spines stout,  $\frac{1}{2}$  in. long: lvs. triangular, scale-like. S. Afr. G.Z. 19:102.—A handsomely colored compactly

branched succulent. According to N. E. Brown, *E. virôsa*, Willd., is quite a different plant. It is probably not in cult. in Amer.

27. *Echinus*, Hook. & Coss. Branching shrub, with 6-angled st., branches ascending, about 2 in. thick, 5- or more-angled: spine pairs less than  $\frac{1}{2}$  in. apart; spines  $\frac{1}{2}$  in. long, red to gray. Morocco. G.Z. 1904:122.

HH. *Sides of mature branches concave, angles more or less winged, branches often 3–4 in. thick.*

28. *triangularis*, Desf. Tree-like: st. at first 6-angled, later cylindrical: branches whorled, divergent, then ascending, 3–5-angled, 2–4 in. thick; joints 2–12 in. long; spine pairs 3–9 lines apart; spines less than 5 lines long; spine-shields united only on stronger shoots: lvs. small, roundish. S. Afr.(?).

29. *Cooperi*, N. E. Br. Tree-like: whorled ascending branches, 3–5 in. thick, the joints broad at base and tapering upward, 6-angled, spines 5 lines long, black to gray. Natal.—A fine species.

GG. *Spine-shields separate. See also No. 28.*

H. *Sides of mature branches plane or slightly convex, angles not winged, branches less than 2 in. thick.*

30. *resinifera*, Berg (*E. San Salvador*, Hort.). A much-branched shrub: branches 4-angled, spine-shields triangular-rounded, small, 3–5 lines apart. S.W. Morocco. G.Z. 19:102.—This species yields the euphorbium gum of the ancients.

31. *canariensis*, Linn. Shrub or tree, 12–20 ft. high, with many 4–6-angled, suberect, not conspicuously jointed branches, as much as 3 in. thick; angles sub-entire; spines 2 lines long, black: lvs. almost none. Canary Is. Gn. 53, p. 46.—This is one of the most common succulent euphorbias. It is easy to grow and prop. readily from cuttings, as well as from seeds which are frequently produced in cult. Several other species are in cult. under this name.



1445. *Euphorbia lactea*. No. 23.



1444. *Euphorbia grandicornis*. (X  $\frac{1}{2}$ )

HH. Sides of branches concave to deeply grooved between the ribs, which are more or less winged; branches 2-6 in. thick. (The species of this group and several others, e. g. *E. tenebrosa*, N. E. Br., *E. acurensis*, N. E. Br., *E. grandis*, Lem. (*E. neutra*, Berger), *E. controversa*, N. E. Br., *E. Erythraea* N. E. Br., are in cult., probably some in Amer., as *E. abyssinica* or some as *E. candelabrum*. The true *E. abyssinica*, Gmel., is not in cult.)

32. *neglecta*, N. E. Br. (*E. abyssinica*, Berger, not Gmel.). Tree: branches 5-8-angled, joints 4-12 in. long, 4-5 in. thick, the conspicuous wings marked by swollen veins; spine pairs 1 in. apart, sunken; spines stout, brown, 1-2 lines long; lvs. narrow, 1 in. or more long; flowering eye above the spine-shield. N. Afr. G.C. III. 20:497. Gn. 52, p. 106.



1446. *Euphorbia meloformis* ( $\times \frac{1}{2}$ ). No. 44.

shorter; spines darker; veins in wings not prominent. Natal(?).

34. *disclusa*, N. E. Br. (*E. candelabrum*, Berger, not Trem., see No. 24). Tree, with 4-5-angled st. and branches, slightly jointed; spine pairs 8-10 lines apart; spines 3-5 lines long, stout, dark brown to gray; flowering eye included in the spine-shield. Abyssinia.

FFFF. Angles of branches 9-13.

G. Spine-shields almost always united into a horny margin; grooves between ribs rather shallow; branches about 2 in. thick.

35. *Beaumierana*, Hook. & Coss. A shrub to 9 ft. high; branches erect, 9-10-angled; spines short, spreading, red when young. Morocco. J.H. III. 59:627.

36. *officinarium*, Linn. Shrub; branches 9-13-angled; spines but little spreading, yellowish to gray, 3-6 lines long; lvs. minute. N. Afr. R.H. 1875, pp. 336-7.

GG. Spine-shields often isolated; grooves between ribs very deep.

37. *fruticosa*, Forsk. Low shrub; branches erect, scarcely jointed, 6-9 lines thick, 10-13-ribbed; spines 6-9 lines long, spreading, brown when young. Arabia.

38. *Pfersdorffii*, Hort. Trunk round,  $1\frac{1}{2}$ -2 $\frac{1}{2}$  in. thick, 9-angled, much branched when old; spines large, 4-9 lines long.—A species not very well known.

DD. Spines, if any, not in stipular position. Subsection TREISIA.

E. Podaria in longitudinal rows or ribs.

F. Body cylindrical: sterile infl. transformed into thorns. CLASS ANTHACANTHA.

G. Ribs without prominent cross furrows between podaria.

39. *heptagona*, Linn. St. 3-4 ft. high, over 1 in. thick, candelabraform-branched, 5-8-ribbed; ribs broader than high; thorns not numerous, strong, yellow,  $\frac{3}{4}$  in. long; lvs. linear-lanceolate, acute. Cape of Good Hope.—According to N. E. Brown the plants of this section and their names are much confused in cult. and without careful study it would be difficult to say just what is being grown under the names of *E. heptagona*, *E. mammillaris*, *E. enopla*, etc.

40. *cereiformis*, Linn. (*E. enneagona*, Haw.). St. erect, 2-3 ft. high; branches with 9-13 straight ribs, the podaria forming declined teeth: lvs. small, triangular;

thorns numerous, 4-7 lines long. Cape region.—Cultings from the branches have a different form from seedlings.

41. *polygona*, Haw. St. up to 5 ft. high, 5 in. thick, 10-13-ribbed, the ribs high and narrow, often somewhat spiral; thorns 4-5 lines long; lvs. minute. Cape region.

GG. Ribs with the podaria separated by cross furrows.

42. *mammillaris*, Linn. Low: branches 7-12-ribbed, about 1 in. thick; ribs flat; podaria not prominent; zones of spines up to 1 in. long, alternate with areas free from them. Cape region. Var. *spinösior*, Berger, is more vigorous and spiny, with more prominent podaria.

43. *submammillaris*, Berger. St. irregularly branched, 1 in. thick; branches with about 5-8 straight ribs, 2 lines high; podaria forming pointed tubercles: lvs. linear; thorns numerous on strong branches, few on others. Cape region(?).—Grown as *E. mexicana*, *E. imbricata*, and *E. cereiformis*.

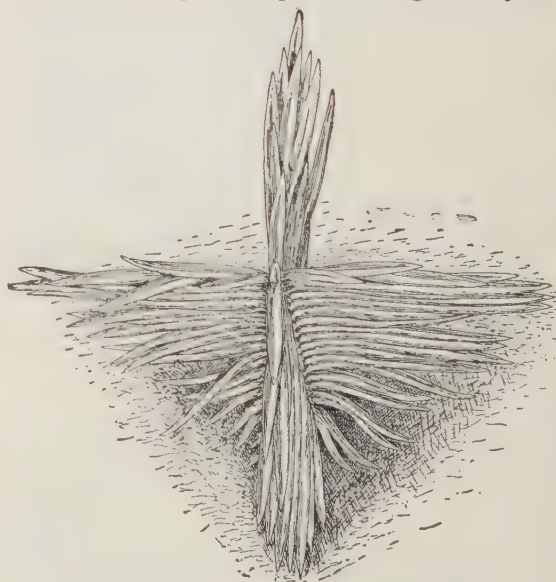
FF. Body spherical, not thorny.

44. *meloformis*, Ait. MELON SPURGE. Fig. 1446. Globose or pyriform, 3-5 in. thick, deeply 8-10-ribbed; ribs obscurely tuberculate on the almost acute angles; sides transversely dark and light green-striped, or wrinkled when old; lvs. few and small: fls. at the depressed apex; the old forked branches of the infl. sub-persistent but not spinose. A few small branches similar to the main st. present. S. Afr. L.B.C. 5:436. A.G. 11:463.—A curious and rare plant, often mistaken for a cactus and showing extreme reduction in xerophytic euphorbias as *Mammillaria* does for the cacti.

EE. Podaria in spirals checkering the axis.

F. Joints or branches globose to short-cylindrical: glands of the involucre with lobed or comb-like edges. See also No. 51. CLASS DACTYLANTHES.

45. *globosa*, Sims (*E. glomerata*, Hort.). Low, the spherical or short cylindrical to club-shaped joints crowded, forming a clump near the ground; joints



1447. *Euphorbia Lathyris*, young plant seen endwise. No. 52

$\frac{1}{2}$ -2 in. long; podaria very flat, pentagonal: lvs. very small, triangular: peduncle 2-4 in. long; glands of involucre with 3-4 lobes which are green with white pits; flowering all summer. Cape region. B.M. 2624.

46. *ornithopus*, Jacq. Much-branched half-shrub: joints 1 in. or less thick, short-cylindrical; podaria



elongated into conical projections: lvs. small ovate: peduncles short; fls. much as in *E. globosa*, involucre glands erect, the 3-4 teeth pitted and white-marked. Cape region. B.M. 2520. L.B.C. 3:220 (as *E. anacantha*).

47. *anacantha*, Ait. Cespitose sub-shrub, with some joints 4-8 in. long,  $\frac{3}{4}$  in. thick: podaria oblong, somewhat projecting: lvs. small, ovate-oblong; cyathia almost sessile at apex of branches; glands divergent, the 3-lobes white with greenish pits. Cape region.

FF. Joints of the branches obscure or none; branches cylindrical, many times as long as thick.

3. Sinuous or snake-like branches many, from a thick basal st.; thorns none: lvs. small; glands comb-like. Class MEDUSA.

48. *Câput-Medusæ*, Linn. (*E. Commelini*, DC.). MEDUSA'S HEAD. Branches 1-2 in. thick, numerous, declined about the short, obconical st., with ends erect, 6-12 in. long: lvs. linear-lanceolate, about 1 in. long: cyathia single, from short, thick peduncles; glands erect, white. Cape region.—A curious and interesting plant; often seen as single-stemmed plants grown from branch cuttings. *E. parvimamma*, Boiss., is also in cult. under this name. See Suppl. list.

49. *inermis*, Mill. (*E. viperina*, Berger, fide N. E. Br. *E. serpentaria*, Hort.?). Smaller: branches about  $\frac{1}{2}$  in. thick, 12 in. long; podaria narrow, in 6-8 somewhat spiral rows: lvs. very small, ovate; cyathia  $\frac{1}{2}$  in. wide, whitish, glands divergent. Cape region. B.M. 7971.

GG. Sinuous or snake-like branches none; glands simple, flat, without divided appendages: lvs. usually large; cyathia usually long peduncled, subtended by several broad bracts. Class TREISIA.

50. *loricata*, Lam. (*E. Hystrix*, Jacq., fide N. E. Br.). A shrub, 2-3 ft. high: branches divergent from the base,  $\frac{1}{2}$  in. thick: lvs. linear, 2-3 in. long: peduncles persistent as numerous brownish red thorns. Cape region.—Some species of the subsection Anthacantha are in cult. under the name of *E. Hystrix*. The names *E. clava*, Jacq., and *E. coronata*, Thunb., are used in the trade and belong to closely related if not identical species of S. Afr., probably not in cult. The sts. are smaller and the infl. less spinose than in *E. loricata*.

51. *bupleurifolia*, Jacq. St. ovate-spherical, elongated in age, 3 in. thick, 4-5 in. high: podaria scale-like, imbricated, quadrangular: lvs. at st. apex, 4-8 in. long,



1448. *Euphorbia epithymoides*. No. 57.

nearly sessile cyathia is listed, probably erroneously, in the trade.

BBB. Sts. herbaceous or woody, rarely somewhat fleshy, not spiny: infl. umbellate: stipules none. Section TITHYMALUS.

c. Lvs. below the umbel decussate: tall annual herb.

52. *Lathyris*, Linn. CAPER SPURGE. MOLE PLANT. Fig. 1447. Annual, 2-3 ft. tall: lvs. long, lance-linear, those of the infl. ovate-acuminate: glands short-

horned: caps. somewhat fleshy,  $\frac{1}{4}$ - $\frac{1}{2}$  in. diam. Eu., and naturalized in E. U. S. Rept. Mo. Bot. Gard. 11, pl. 11.—Cult. in old gardens. Caps. sometimes pickled, seeds used as a purgative. Said to drive away moles from its neighborhood (see Cornell Bull. 61:331); for a similar reason known as "gopher plant" in S. Calif.

cc. Lvs. usually clustered at ends of branches: shrubs. (*Euphorbia dendron*, Millsp.).

53. *atropurpurea*, Brouss. Branching shrub, 3-6 ft. high: lvs. pale, glaucous green, spreading or drooping, 2-3 in. long: umbel 5-10-rayed; cyathia surrounded by large, dark purple, broadly ovate, obtuse, connate bracts; glands ovate. March. Teneriffe. B.M. 3321.—Some other red-leaved species used for bedding in Amer. have been cult. under this name, i.e., a purplish variety of *E. pulcherrima*, and possibly *E. hama-todes*, Boiss.

54. *Régis-Jubæ*, Webb. Like the last but lvs. narrowly linear and bracts almost yellow: involucre glands with 2 short horns. Teneriffe.—Some plants under this name are *E. piscatoria*, Ait. See Suppl. list.

55. *dendroides*, Linn. A large branching shrub, more foliaceous than the two preceding: lvs. linear-lanceolate, obtuse or acute: bracts yellowish, rhomboid-orbicular mucronate; glands truncate or semi-lunate. Medit. region. Gn. 36, p. 203. R.H. 1887:160.

56. *fúlva*, Stapf (*E. elástica*, Altam. & Rose). PALO AMARILLO. Small tree: lvs. lanceolate, acute, pubescent: cyathia few, bracts small, glands ovate: caps. conical, 1 in. long. Mex.—Used for rubber.

ccc. Lvs. below the umbel alternate: leafy perennial herbs.

d. Glands of the involucre oval, entire.

57. *epithymoides*, Jacq. (*E. polychroma*, Kern.). Fig. 1448. Many sts. 1 ft. or more long, forming a hemispherical clump: rays of umbel 5: lvs. oblong, dark green, those of the infl. various shades of yellow at flowering time. May. Eu. B.M. 2258. Gn. 69, p. 295.—A beautiful plant for the formal or informal border.

58. *pilosa*, Linn. Sts. about 18 in. high from a thick rootstock, pilose: lvs. oblong, nearly entire: umbel 5-6-rayed, with similar branches below: caps. 2 lines broad, nearly smooth or hairy, with or without minute warts. Eu. and N. Asia. Var. *major* is a better form for gardens with beautiful golden yellow foliage.

59. *palustris*, Linn. Differs from *E. pilosa* chiefly in being glabrous or nearly so, more rays in the umbel, and caps. with small but distinct warts on the back. Eu. Gn. 76, p. 499.—The floral lvs. are a bright yellow.

DD. Glands of involucre truncate, retuse, 2-horned or crescent-shaped.

E. Seeds smooth.

60. *Cyparissias*, Linn. CYPRESS SPURGE and many local names. Fig. 1449. Many short plume-like branches from the crowns and adventitious root-buds, covered with spreading, narrowly linear, dark green lvs. 1 in. long. Eu. L.B.C. 2:118. G.C. II. 22:469. Rept. Mo. Bot. Gard. 11, pl. 50.—Cult. in old gardens and cemeteries for its moss-like growth. Naturalized and a weed in E. U. S., but rarely producing seed here.



1449. *Euphorbia cyparissias* ( $\times \frac{1}{4}$ ). No. 60.

61. *Wulfenii*, Hoppe. Sts. 3-4 ft. high, forming a clump, densely covered with lanceolate, linear, acute, bluish green pubescent lvs., those of the infl. yellow, or the base of the st. bare later, except for the conspicuous leaf-scars: umbel many-rayed; glands 2-horned. Eu. B. R. 24:6 (as *E. Veneta*). G. 31:103. G.C. III. 39:331. Gn. 57, pp. 440-1; 74, p. 40. G.W. 13, p. 305.

62. *biglandulosa*, Desf. Differs from *E. myrsinites*, chiefly in the erect sts., lanceolate, acute lvs. and smooth seeds. Sicily to Syria. B.R. 274 (as *E. rigida*).

EE. Seeds rugose or pitted.

63. *pinea*, Linn. St. glabrous: st.-lvs. linear; those of the infl. reniform-cordate: rays of umbel 5-7. Eu.

64. *robusta*, Small, and *Pálmeri*, Engelm., are many-stemmed desert plants from W. U. S., about 1 ft. high with small ovate lvs., irregularly crescent-shaped glands and roughened seeds. Rept. Mo. Bot. Garden. 11: pls. 40, 49.—They have been offered for sale, but have little cultural value.

65. *myrsinites*, Linn. The many declined sts. covered with large, fleshy, glaucous, obovate-oblong, concave, pointed lvs. in close spirals: umbel 7-12-rayed; glands and fls. yellow: seeds rugose. Eu.—A plant of old gardens; good for walls and rockeries.

The following have been reported in cult. in Eu. but are not in the American trade.

*E. aggregata*, Berger. A succulent grown like *E. cereiformis*.—*E. aleppica*, Linn. Annual of Tithymalus section.—*E. amygdaloides*, Linn. Perennial and almost woody. Common in England.—*E. angularis*, Klotzsch (E. fimbriata, Hort.). A 3-5-angled succulent.—*E. aphylla*, Brouss. Semi-succulent shrub, near *E. Tirucalli*. Gt. 37:277.—*E. arbuscula*, Balf. Semi-succulent shrub near *E. xylrophyloides*.—*E. balsamifera*, Ait. Tropical shrub; lvs. at end of branches. Allied to *E. dendroides*.—*E. Berthelotii*, C. Bolle. Subtropical shrub allied to *E. Regis-Jubæ*; name used incorrectly in 'he trade.—*E. Böjeri*, Hook. (E. Breonii). Semi-succulent, slender, spiny shrub near *E. splendens*, Hook. B.M. 3527.—*E. bubalina*, Boiss. (Section Treisia). Low, slender, spineless succulent, leafy at apex. R.B. 209 (as *E. oxystegia*).—*E. Cactus*, Ehrenh. Succulent, spiny 3-angled shrub, near *E. Hermentiana*.—*E. cattimandoo*, Ell. Small, succulent, spiny, 5-angled tree.—*E. cervicornis*, Boiss.—*E. hemata*.—*E. chamasce*, Linn. Low, opposite-lvd. herb with corolla-like cyathia in clusters.—*E. characias*, Linn. Umbellate perennial herb near *E. Wulfenii*. Gn. 59, p. 447. G.C. II. 13:657.—*E. collettoides*, Benth. Low Mexican shrub: lvs. opposite. Plants grown under this name may be *E. pteroneura*.—*E. Dinteri*, Berger. Spiny, 6-8-angled succulent shrub often grown under names of *E. virosa* and *E. tetragona*.—*E. Dregeana*, Mey. Spineless, almost leafless shrub, near *E. Tirucalli*.—*E. enopla*, Boiss. Spiny succulent near *E. heptagona*, and confused with it.—*E. erosa*, Willd. Spiny succulent, near *E. mammillaris*.—*E. falcata*, Linn. Annual herb, near *E. Aleppica*.—*E. fimbriata*, Hort.—*E. angularis*.—*E. hamata*, Sweet (E. cervicornis, Boiss.). Low succulent shrub, leafy at apex, near *E. clandestina*.—*E. helicothle*, Lem. Spiny, succulent tree, leafy at apex, near *E. nerifolia*. I.H. 4, p. 100, desc.—*E. helioscopia*, Linn. Umbellate annual (Section Tithymalus). Rept. Mo. Bot. Gard. 11: pl. 26.—*E. Intisy*, Drake. Semi-succulent tropical shrub, near *E. Tirucalli*.—*E. Lagasce*, Spreng. Annual, near *E. pilosa*.—*E. Laro*, Drake. Semi-succulent shrub near *E. Tirucalli*.—*E. lavrifolia*, Juss. Tropical shrub, leafy at ends of branches, near *E. atropurpurea*.—*E. Ledienii*, Berger. Spiny succulent, near *E. virosa*, grown under the names of *E. pentagona*, *E. cœrulea*, and *E. cœrulescens*. B.M. 8275.—*E. Lemaireana*, Boiss. Spiny succulent. Near *E. grandicornis*.—*E. lophogona*, Lam. Succulent with fringed angles, near *E. Fournieri*. B.M. 8076.—*E. macroglypha*, Lem. Spiny, 3-angled succulent.—*E. Marlothii*, Pax.—*E. Montieri*.—*E. mauritanica*, Linn. Semi-succulent shrub. Near *E. Tirucalli*.—*E. mellifera*, Ait. Tree, leafy at branch ends. Near *E. dendroides*. B.M. 1305.—*E. Montieri*, Hook. (E. Marlothii, Pax). Succulent shrub, leafy at the apex, of Section Pseud-euphorbium. B.M. 5534.—*E. Morinii*, Berger. Spiny succulent, near *E. cereiformis*.—*E. multiceps*, Berger. Succulent. Near *E. Caput-Medusæ*.—*E. nivida*, Ham. Spiny, succulent shrub, leafy at apex. Near *E. nerifolia*.—*E. Nykæ*, Pax. Succulent tree with 2-angled joints.—*E. obesa*, Hook. Succulent. Near *E. meloformis*. B.M. 7888.—*E. obtusifolia*, Poir. Semi-succulent shrub. Near *E. Tirucalli*.—*E. officinarum*, Linn. Succulent, spiny, 9-13-angled shrub. Near *E. Beaumieriana*.—*E. Paralias*, Linn. Perennial herb of Section Tithymalus.—*E. parvimamma*, Boiss. Low succulent, without spines. Near *E. Caput-Medusæ*.—*E. Phillipsia*, N. E. Br. Succulent, spiny, 9-angled shrub. Near *E. Beaumieriana*.—*E. pilulifera*, Linn. Low annual with opposite lvs. and inconspicuous cyathia in clusters: glands appendaged.—*E. piscatoria*, Ait. Tropical shrub: narrow lvs. at end of branches. Near *E. Regis-Jubæ*.—*E. plumerioides*, Teymann. Tropical shrub similar to the previous one.—*E. procumbens*, Mill. (E. pugniformis, Boiss.). Succulent, not spiny. Near *E. Caput-Medusæ*. B.M. 8082. R.B. 161.—*E. punicea*, Swartz. Tropical shrub. Near *E. atropurpurea*. B.R. 190. B.M. 1961. L.B.C. 20:1901. G.C. II. 15:529.—*E. pyrifolia*, Lam. Semi-succulent shrub, leafy at the apex.

Near *E. lophogona*.—*E. Sappinii*, De Wild. Slender, spiny succulent. Near *E. cereiformis*. G.C. III. 45:66.—*E. Schimperii*, Presl. Semi-succulent shrub. Near *E. Tirucalli*.—*E. Schimperiana*, Hochst. An African annual of Section Tithymalus. This name perhaps used erroneously for *E. Schimperii*.—*E. Scolopendria*, Don.—*E. stellata*.—*E. scopiformis*, Boiss.—*E. serpylliformis*.—*E. serpylliformis*, Boiss. Section Anthrothamnus. Slender-branched semi-succulent shrub with opposite, rudimentary lvs.—*E. Sib-sim-succulent* shrub with opposite, rudimentary lvs.—*E. Sib-sim-succulent* herb. Near *E. Wulfenii*.—*E. Sipoltsii*, thornii, Boiss. Perennial succulent shrub with decurrent lf.-bases. N. E. Br. Slender succulent shrub with decurrent lf.-bases. Near *E. pteroneura*.—*E. spinosa*, Linn. Umbellate sub-shrub or herb of S. Eu. Section Tithymalus.—*E. stapeliiformis*, Hort.—*E. stapelioides*, Boiss. (?) A plant near *E. bupleurifolia*.—*E. Stäpfi*, Berger. Spiny, succulent, 4-angled shrub.—*E. stel-læspina*, Haw. Spiny 10-13-ribbed succulent. Near *E. cereiformis*.—*E. stellata*, Willd. (E. uncinata, DC., referred here according to N. E. Br.). Spiny succulent with branches V-shaped in cross-section, and clustered on a short thick st.—*E. tetragona*, Haw. Spiny, succulent 4-angled tree. R.B. 39.—*E. trigona*, Haw. Spiny, succulent, 3-angled shrub, near *E. antiquorum*.—*E. tuberculata*, Jacq. Low succulent, near *E. Caput-Medusæ*.—*E. uncinata* —*E. stellata*.

Other names used but not classified: *E. Amélia*, Hort.—*E. articulata*, Hort.—*E. aurélia*, Hort. (E. Amélia?).—*E. Caput Comelini*, Hort. (E. Caput-Medusæ?).—*E. Caput-odorata*, Hort.—*E. Caput-Simie*, Hort.—*E. capensis*, Hort. (succulent).—*E. colubrina*, Hort.—*E. cylindrica*, Hort.—*E. dentata*, Hort.—*E. de Smetiana*, Hort.—*E. erecta*, Hort.—*E. funalis*, Hort.—*E. gardeniaefolia*, Hort.—*E. gracilis*, Hort.—*E. Houlettiana*, Hort.—*E. Houlettii*, Hort.—*E. longifolia*, Hort.—*E. mangador*, Hort. (E. mogador, Hort.?).—*E. Milleri*.—*E. obtusa*, Hort.—*E. pavoensis*, Hort.—*E. pulchra*, Hort.—*E. Pulletiana*, Hort.—*E. Rebütii*, Hort.—*E. sahariensis*, Hort.—*E. waltoniensis*, Hort.

J. B. S. NORTON.

**EUPHORIA** (name refers to the fact that the plant carries well its edible frs.). *Sapindaceæ*. A half-dozen trees in Trop. and Subtrop. Asia, allied to Litchi but differing in having petals and a deeply 5-parted imbricate calyx; both genera are sometimes combined in *Nephelium*. Lvs. pinnate: fls. regular; petals spatulate or lanceolate, hairy inside; stamens usually 8: fr. globular or ellipsoid, more or less tuberculate or warty, the size of a cherry or plum. The following species is widely cult. in the eastern tropics. *E. Longana*, Lam. (*Nephelium Longana*, Cambess.). Tree, 30-40 ft., with gray bark: lvs. scattered; lfts. opposite or alternate, elliptic to ovate to lanceolate, 2-5 pairs, rather obtuse at both ends, to 12 in. long, entire: fls. small ( $\frac{1}{4}$  in. or



1450. Leaves of *Euphorbia polyandra*. ( $\times \frac{1}{2}$ )



less across), yellowish white, in puberulent terminal and axillary panicles; calyx deeply 5-6-lobed; petals about equaling calyx, spatulate; fr. globose, reddish or purple,  $\frac{3}{4}$  in. or less diam., tuberculate or becoming warty or nearly smooth, with an edible aril. India. B.M. 4096. B.R. 1729.—A much-prized fr. in China, under the name of longyen, or linkeng, resembling litchi but smaller and smoother and yellow-brown.

L. H. B.

**EUPHRASIA** (Greek for *hilarity* or *delight*). *Scrophulariaceæ*. EYEBRIGHT. More than 100 low herbs, of no special horticultural value although some of them are mentioned in connection with alpine-gardening. They are more or less parasitic on roots of other plants: lvs. opposite, dentate or incised; fls. small, largely whitish or purplish, in terminal leafy spikes; calyx mostly 4-cleft; corolla 2-lipped; stamens 4, didynamous, ascending under the upper lip; caps. oblong, many-seeded, dehiscent. The species range in temperate and cold parts of the globe, several of them being N. American.

**EUPTELEA** (Greek *eu*, well, handsome, and *ptelea*, elm). *Trochodendraceæ*. Ornamental woody subjects grown for their handsome foliage; also the red anthers of the precocious flowers are conspicuous in early spring.

Deciduous shrubs or small trees: winter-buds conspicuous, with imbricate dark brown scales; lvs. alternate, slender-petioled, dentate; fls. before the lvs., in axillary clusters along last year's branches, perfect, without perianth; stamens many, with large oblong-linear, red anthers; carpels many, stipitate, oblique, with a decurrent stigma, developing after the stamens have dropped, growing into a small, slender-stalked obliquely winged 1-4-seeded nutlet.—Three species in Japan, Cent. and W. China, and E. Himalayas.

They are graceful bushy trees resembling the linden in habit and foliage; the bright green leaves are very slender-stalked, and the tree is conspicuous in early spring from the bright red anthers of its flowers. *E. polyandra* has proved hardy at the Arnold Arboretum and possibly *E. Franchetii* is of the same hardiness. They seem to grow well in a loamy well-drained soil and prefer somewhat moist situations. Propagation is by seeds or by grafting on their own roots.

*polyandra*, Sieb. & Zucc. Figs. 1450, 1451. Shrub or small tree, to 20 ft.: lvs. long-petioled, usually roundish ovate, cuspidate, coarsely and irregularly dentate, below pale green and slightly pubescent on the veins, 2-4 in. long; carpels usually 1-seeded,  $\frac{1}{2}$  in. long. April. Japan. S.Z. 72. S.I.F. 1:41. Gng. 16:162.

*Franchetii*, Van Tieghem (*E. Davidiana*, Hemsl., not Baill.). Tree, to 40 ft.: lvs. long-petioled, usually roundish-ovate, cuspidate, fairly regularly sinuate-dentate, light green below, 2-4 in. long; carpels usually 2-3-seeded. April. Cent. and W. China. H.I. 28:2787. V.F. 9.

*E. pleiosperma*, Hook. f. & Thoms. (*E. Davidiana*, Baill.). Closely related to *E. Franchetii*. Lvs. glaucous below; carpels somewhat larger. W. China, E. Himalayas.

ALFRED REHDER.

**EURYA** (Greek for *large*, but of no application). *Ternstroemiaceæ* (or *Theaceæ*). Shrubs of S. Asia and Malaya (30 or more species), with small diocious fls., berry-like frs., and simple, glabrous evergreen lvs.: fls. in axillary clusters, or rarely solitary; petals and sepals 5; stamens 15 or less (rarely only 5), joined to the base of the corolla; ovary usually 3-loculed. *Cleyera* is by some included in this genus. The euryas are allied to camellias, and require much the same treatment. They are grown for foliage rather than for fls. They require an intermediate temperature and a peaty soil. Prop. by cuttings taken from the tips of growing shoots. *E. japonica*, Thunb. (*E. Sieboldii*, Hort.), is the common species, and is very variable. The variegated form

of it (known in the trade as *E. latifolia variegata*) is one of the best glasshouse decorative pot shrubs: lvs. variable in shape, usually ovate-acuminate and irregularly toothed or notched, short-petioled, variously blotched with white; fls. greenish white, in small, axillary clusters. Japan. V. 23:5.

L. H. B.

**EURYALE** (mythological name). *Nymphæaceæ*. One species, the Indo-Chinese representative of *Victoria*



1451. Flowers of  
*Euptelea polyandra*.  
(Natural size.)

*regia*, from which it differs in having all the stamens fertile (in *Victoria* the inner ones are sterile) and in the very small fl. and in other technical characters. *E. ferox*, Salisb., is the species. The lvs. are 1-4 ft. across, circular, purple and spiny-ribbed beneath, dark green and uneven above; fls. about 2 in. broad, open by day, prickly outside; calyx reddish inside and the 20-30 purple petals shorter than the calyx-lobes; stamens numerous; fr. a small many-seeded, globular berry, bearing the remains of the calyx on its top; seeds edible. B.M. 1447.—Long cult. in China. Treated as an annual. Has attracted little attention since the intro. of *Victoria*. Prop. by seeds only, which are best stored in fresh cold water. Plant in rich earth as for nymphaeas, at 70-75° F. As far north as Philadelphia and St. Louis it is hardy, sowing itself every season. It is ferociously spiny.

*E. amazonica*, Poepp., still advertised in catalogues, is *Victoria regia*.

H. S. CONARD.  
WM. TRICKER.

**EURYANGIUM**: *Ferula*.

**EURYCLES** (Greek-made name, of no particular application). *Amoryllidaceæ*. Two south hemisphere tunicated-bulbous plants, allied to *Hymenocallis* and *Pancratium*. Fls. white or whitish, umbellate on peduncles 12-18 in. long; perianth-tube cylindrical, the segms. oblong-lanceolate, ascending and nearly equal; stamens inserted in the throat of the tube; lvs. broad and stalked, with prominent curving veins and interlocking veinlets. *E. sylvestris*, Salisb. (*E. amboinensis*, Loud.). BRISBANE LILY. Scapes 1-2 ft., bearing an umbel of 10-40 handsome, creamy white fls. (2 in. across); lvs. round-cordate, with a very short, blunt point; blooms in May and June in Eu., the lvs. appearing later. B.M. 1419 (as *Pancratium amboinense*). B.R. 715 (as *Pancratium australasicum*). R.H. 1879, p. 456 and p. 457 (as *E. australasica*); 1913, p. 111. G.W. 11, p. 583. G.Z. 24, p. 25. Malaya, Philippines, N. Austral.—Cult. apparently as for *pancratiums*.

L. H. B.

**EURYOPS** (*large eyes*, because of the prominent fls.). *Compositæ*. Small shrubs of 25-30 species of Afr. (mostly S. Afr.), Arabia and Socotra, very little known in horticulture. The fls. are yellow, the heads with female rays and tubular 5-toothed perfect disk-fls.; receptacle convex or conical; involucre of 1 series of scales: achene wingless and beakless, the pappus of several rows of caducous bristles. These little bushes or undershrubs grow from  $\frac{1}{2}$ -3 ft., or sometimes 5 ft.,

high. They are bloomed in the greenhouse or grown in the open in mild climates. None seems to be regularly in the trade.

**EÛSCAPHIS** (Greek, *eu*, handsome, and *scaphis*, vessel; alluding to the shape and the handsome color of the dehiscent capsule). *Staphyleaceæ*. Ornamental woody plant grown for its handsome foliage and the attractive fruits.

Deciduous upright shrub or small tree, glabrous: lvs. opposite, odd-pinnate, stipulate: fls. in terminal upright panicles, perfect; sepals, petals and stamens 5, all of nearly equal length; ovary 2-3-celled, surrounded at the base by an annular disk; styles 2-3, often connate: fr. consisting of 1-3 spreading, leathery dehiscent pods, each with 1-3 black seeds.—One species in Japan and Cent. China. A handsome plant with large pinnate lvs., small whitish fls. in upright panicles followed by attractive brownish red frs. disclosing shining black seeds when opening. It grows in any good garden soil, but is only half-hardy N. Prop. by seeds and green-wood cuttings under glass.

*japónica*, Dipp. (*E. staphyleoides*, Sieb. & Zucc. *Sambucus japónica*, Thunb.). Shrub, to 10 ft.: lfts. 7-11, ovate-lanceolate, glabrous, serrate,  $1\frac{1}{2}$ -3 in. long, each with 2 small stipules: fls. in broad many-fld. panicles to 6 in. long: fr. consisting of 1-3 pods,  $\frac{1}{2}$  in. long, apiculate, each with 1-3 steel-blue seeds. May, June; fr. Aug., Sept. Japan. S.Z. 67. S.I.F. 1:70.

ALFRED REHDER.

**EÛSTOMA** (good mouth, alluding to the corolla). *Gentianaceæ*. Two or 3 N. American large-fld. glaucous opposite-lyd. small herbs: fls. more or less paniculate, single on the peduncles, 5-merous or rarely 6-merous; calyx with narrow keeled lobes; corolla nearly campanulate, white, blue or purple, the lobes oblong or obovate, usually erose; stamens attached on the corolla-throat; ovary 1-celled; stigmas 2; caps. oval or oblong, many-seeded. *E. selenifolium*, Salisb. (*E. exaltatum*, Griseb.). Annual, but in S. Calif. said to be perennial, 9-15 in. erect: lvs. oblong, glaucous-green: fls. light blue or purple, the corolla-lobes about or nearly 1 in. long, twice exceeding the tube. Fla. to Calif. Offered in Calif.

**EÛSTREPHUS** (Greek, referring to the climbing habit). *Liliaceæ*. One or two Australian plants, botanically related to *Lapageria*, but much less showy; in habit suggestive of smilax (*Asparagus medeoloides*). Plants more or less woody at base, slender, branching, tall-climbing: lvs. alternate, sessile or short-petioled: fls. 2 to many, in axillary fascicles; perianth-segms. distinct and spreading; stamens 6. *E. latifolius*, R. Br., is a tall and much-branched half-twining herb, more or less woody at the base, bearing alternate, stiff, linear-lanceolate, short-stalked lvs. and small, axillary, drooping light blue fls. with spreading, ciliate perianth-segms.: fr. a dry berry: lvs. 2-4 in. long, sharp-pointed: fls. less than 1 in. across. B.M. 1245. Of easy cult., either in the glasshouse border or in pots. Very useful for table decoration and for design work.

L. H. B.

**EUTÁCTA:** *Araucaria*.

**EUTÁXIA** (from Greek words referring to the attractive appearance). *Leguminosæ*. Shrubs of Austral., with golden or yellow papilionaceous fls., one of which is offered for greenhouse cult.: lvs. small, opposite, simple and entire: fls. solitary or a few together, or sometimes crowded at ends of branches; standard orbicular, entire or nearly so, exceeding the other petals; stamens free; pod ovate, 2-valved. Said to require general treatment of *Chorizema*. *E. myrtifolia*, R. Br. Glabrous, 2-3 ft.: lvs. obovate-oblong to linear, mostly  $\frac{3}{4}$  in. or less long: fls. yellow with dark orange keel, solitary or 2-4 together. B.M. 1274 (as *Dillwynia*). R.B. 26:13. Var. *floribunda* is listed.

**EUTÉRPE** (mythological name). *Palmaceæ*, tribe *Arècæ*. Slender erect spineless palms, with solitary or fasciculate ringed caudices, and grown chiefly for their graceful habit and feathery pinnate foliage.

Leaves terminal, equally pinnatisect; segms. narrowly linear-lanceolate, long, and gradually acuminate or ensiform, membranaceous, plicate, the thickened margins recurved at the base; rachis and petiole 3-sided toward the base, convex on the back, concave above; petiole elongated; sheath very long, cylindrical, entire; spadix paniculately branched; rachis elongated: branches slender, gradually shortening above, usually scaly, thick at the base, erect-spreading in fl.: spathes 2, coriaceous or membranaceous, lanceolate, the lower one shorter, split at the apex, dorsally 2-keeled, the upper one symmetrical, split down the ventral side: bracts bordering the furrows; bractlets ovate-acute: fls. small, white, sessile in the furrows of the spadix: fr. like a pea, purple.—Species about 8. Trop. Amer. and W. Indies. G.C. II. 24:586.

Three species of *Euterpe* are commonly found in cultivation, namely: *E. edulis*, *E. montana* and *E. oleracea*. These are found under varying conditions in Central and South America and the West Indies, and all three species are valuable as food-producers to the natives of those countries. *E. edulis* grows in great quantities in the lowlands of Brazil, where it is known as the assai palm, owing to the fact that its seeds are macerated in water, and by this means is produced a beverage known as assai. *E. oleracea* is the well-known cabbage palm of the West Indies, growing in the lowlands near the coast, while *E. montana* is the mountain cabbage palm, and is frequently found at considerable altitudes in the same islands, and consequently does not attain the great dimensions of *E. oleracea*.—The euterpes do not present any special cultural difficulties, being free-rooting and rapid-growing palms; a night temperature of 65° F., and abundant moisture are among their chief requirements. A good turfy loam, with the addition of about one-fifth of stable manure while in the compost heap, provides a suitable soil. From their habit of forming a tall slender stem without suckering from the base, the euterpes are liable to become rather leggy specimens. When under cultivation, and for trade purposes, it is advisable to group three or four of the young plants together, thus producing a more bushy specimen. White scale is one of the worst pests to which these palms are subject, and soon ruins the foliage unless care is taken. Seeds germinate in a few weeks if sown in a warm greenhouse, and the young plants make better progress when moderately shaded. (W. H. Taplin.)

*edulis*, Mart. PARA PALM. ASSAI PALM. St. 60-90 ft. high, 8 in. thick, flexuous: lvs. 10-15, spreading; the lfts. often pendulous; sheaths 3-4½ ft.; petiole 1½ ft.; blade 6-9 ft.; segms. linear, spreading, deflexed, 60-80 on each side, densely crowded, 28-36 in. long,  $\frac{3}{4}$ -1 in. wide: spadix about 2-3 ft. long, bearing numerous rather inconspicuous fls. Brazil.

*oleracea*, Mart. CABBAGE PALM. St. 60-100 ft., scarcely 1 ft. diam. at base, attenuate above, flexuous: lvs. arcuate-spreading, 4-6 ft. long, the apex more or less deflexed; segms. pendent, linear-lanceolate, the upper 2 ft. long, 1 in. wide, many-nerved. Brazil. See *Oreodoxa*.

*montana*, R. Graham. St. 10 ft. high, swollen at the base, ringed: lvs. 9 ft. long, elliptical-obovate; segms. lanceolate, entire, glabrous, alternate; petiole 2 ft. long, scaly beneath, unarmed; rachis plano-convex below, subtriangular toward the apex: spadices several on the trunk at one time, axillary, much branched; fls. numerous, white. Grenada. B.M. 3874.—Intro. into Botanic Garden at Edinburgh in 1815.

JARED G. SMITH.  
N. TAYLOR.†



EUTOCA: *Phacelia*.

**EVAPORATING FRUIT.** The domestic operation of drying fruit has been practised ever since men looked beyond their immediate wants and stored food for time of greater need. Dried fruit has long been an article of commerce, yet until a few years ago only the most primitive methods were used in drying, and the industry, commercially, was confined to a few favored regions in Europe. The modern industry is not yet a half-century old. Its almost inconceivable growth in America in this brief time is one of the industrial phenomena of the times. Spurred into activity by the encroachment of American products in their markets, the European producers, by the adoption of better methods, and by governmental encouragement, have increased greatly their output of dried fruit. Thus, from an adjunct to fruit-growing for home use, drying fruit has become, within recent years, one of the main branches of horticulture.

An idea of the dried-fruit industry in the United States and of its great growth in recent years may be obtained from the following figures from the census of 1910 for the crop of 1909:

|                       |                           |             |
|-----------------------|---------------------------|-------------|
| Raisins.....          | 111,774,767 pounds, worth | \$4,837,933 |
| Prunes.....           | 138,498,490 pounds, worth | 5,130,412   |
| Peaches.....          | 46,843,391 pounds, worth  | 2,423,083   |
| Apples.....           | 44,568,244 pounds, worth  | 3,098,095   |
| Apricots.....         | 29,205,569 pounds, worth  | 2,277,177   |
| All other fruits..... | 29,438,306 pounds, worth  | 2,073,695   |

Adding the valuations given, results in a grand total of \$19,840,395 for dried fruits in the year 1909. Comparing this sum with the census of 1900, one finds that the crop in 1899 was valued at \$4,757,005 and that the industry, judged by the figures, has increased more than fourfold in ten years.

Fruit may be cured in the sun, or it may be cured in drying-machines, called evaporators. That cured in the sun is called by the producer "dried fruit," that in evaporators, "evaporated fruit." By far the larger part of the world's product is cured in the sun. Thus, at least three-fourths of the fruit dried in America is sun-dried in California.

*Sun-drying fruit.*—In countries having a sufficiently warm and dry climate, as Greece and Turkey, and parts of France, Spain and western America, fruit is dried almost wholly in the sun. The fact that in these favored localities the drying capacity is limited only by the acreage of sunshine, makes it certain that the proportion of sun-dried fruit will always be vastly greater than that of evaporated fruit. Drying fruit in the sun is a simple process, but one hedged in by many little arts and methods that facilitate the work and improve the product. In general, the process is as follows: The fruit is graded, bleached by sulfur, if a light-colored product is desired, in the case of prunes dipped or pricked, and is then spread on trays to be exposed to the sun. When the drying process is completed, the fruit is again graded, in most cases put through a sweat, and then "finished" in various ways, as by dipping or glossing.

*Evaporating fruit.*—There are many styles of evaporators, but all possess in common a chamber for the reception of the fruit, through which a current of warm air is forced, or the fruit is forced through the air, or both, the object being to remove the aqueous matter from the fruit as quickly as possible, and the principle being that warm air will absorb more moisture than cool air. The saturated air must not remain in contact with the fruit. Since different fruits exact different conditions, it is necessary to change the temperature and velocity of the air-current in the drying-chamber at will. To make the product homogeneous, current and temperature must be equal in all parts of the evaporator. It is obvious that simplicity in the machine and economy in heat and in room are cardinal virtues in a good evaporator. It is the rule to

start the evaporation of large fruits at a low temperature and finish at a high one, but with berries the reverse is true.

Recently two or three patented processes for curing fruit by "dehydration" have been introduced with much promise of betterment in the industry. While the machinery, the methods and the products are quite different in evaporating and dehydrating, the principle in the two operations is practically the same. In both processes the water is removed from the fruit by moving currents of warm air. In evaporation the air is warmed only. In dehydration the air is dried by cooling until the moisture is condensed out and is then warmed and passed over the fruit or vegetable to be cured. By the new process much time is saved and a greater variety of fruits and vegetables can be used.

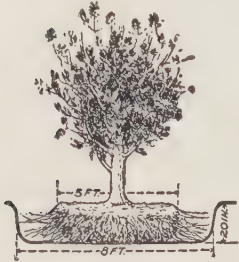
The following are definitions of the somewhat technical terms used in the industry: *Bleaching* is the process of changing the dark color of fruit to a lighter hue, or of preventing the discoloration; it is generally accomplished by sulfuring. *Bloaters* are prunes which in drying swell up to an abnormal size; they are usually produced by fermentation in over-ripe fruit. *Chops* are dried apples cured without paring or coring to be used in making cider or vinegar. *Dipping* is the process of cutting the skin of fresh prunes to facilitate curing. The operation is performed by submerging the fruit in boiling lye. Cured fruit is sometimes dipped in one of various solutions as a "finishing" process. *Drip* is the syrupy liquid which oozes from prunes in the process of evaporation; it generally characterizes a poor prune or a poor evaporator. *Frogs* are cured prunes having an abnormal shape, a condition caused by curing unripe fruit. *Pricking* is the process of puncturing the cuticle of fresh prunes. It is done by means of a machine, the essential part of which is a board covered with projecting needles, over which the prunes must pass. It accomplishes the same end as lye-dipping. *Sizes* is a term used to indicate the number of cured prunes it takes to make a pound. The "four sizes" known in the markets are 60's-70's, 70's-80's, 80's-90's, 90's-100's. *Sugaring* is the formation of globules of sugar on the cuticle of cured prunes or raisins. *Sulfuring* is a process to which fruit is subjected to give it a lighter color. The fruit is exposed to fumes of burning sulfur before being exposed to the sun or put in evaporators. *Sweating* is a process to which cured fruit is subjected before packing; it is put in a room at a high temperature and allowed to become moist. *Waste* is a dried product made from skins and cores of apples and pears and used for vinegar.

Apples and pears are peeled, cored, cut into rings and bleached by being exposed to the fumes of sulfur for about a half hour in preparation for drying or evaporating. Fruits so prepared are placed upon trays for sun-drying and must be cured in the sun for three to five days. In evaporating in the western states, the prepared fruits are placed on trays and passed in from six to twelve hours through the evaporator chamber, but in the East, where the product is chiefly made, the prepared fruit is piled from 4 to 6 inches deep on the floor of a kiln. Here it is left for fourteen to sixteen hours, being turned every two or three hours, until the fruit is no longer sticky, an indication that it has reached the proper stage of dryness. In New York, the law requires that evaporated apples contain not more than 27 per cent of moisture. One hundred pounds of apples will yield from twelve to fifteen pounds of evaporated apples.

Apricots, peaches and nectarines must be fully ripe before drying and without bruises. They are pitted, and may or may not be peeled. If peeled, the operation is done with a machine or with lye, though the use of the latter is considered bad practice. The fruit is placed on the trays cup side up. About three days are required for drying in the sun and about eight hours

for evaporating. The cured product should be of a translucent amber color.

Berries are seldom sun-dried for the markets. For evaporating they are placed on trays in quantities of sixteen to thirty quarts, given a temperature of about 175° at the start, and are finished in four to five hours, at a temperature of about 100°. After being taken from the evaporator, they are piled for sweating in a warm, ventilated room.



1452. Where to dig in removing an evergreen.

Figs for drying must be gathered when fully ripe. Some growers prefer drying in shade rather than in sun. Evaporators are seldom used. The fruit is not allowed to dry hard, and before packing must be well sweated. Usually, for "finishing," they are dipped in salt water or syrup. The drying process requires from five to eight days.

Prunes are allowed to ripen until they fall to the ground. Before being spread on the trays they are dipped or pricked in order to thin or crack the skin, that the moisture may easily escape, and dripping be prevented. Sun-drying requires from one to three weeks, while from twelve to thirty hours are required for evaporation. A thorough sweat prevents the sugaring so common to this fruit. Before packing they are graded in sizes. Dipping as a "finishing" process is practised by many producers. A good prune is soft, smooth and meaty, with loose pit, and of an amber, dark red or golden hue, depending upon the variety.

Grapes for raisins are sun-dried. They must be picked when fully ripe, the bunches, and the berries on the bunches, being sorted as the picking progresses. The operation of drying must be watched with care. The process requires from eight to fourteen days, during which time the bunches must be turned at least once. A sweat is given before packing. Raisins are graded into half a dozen or more brands for the market.

U. P. HEDRICK.

**EVERGREENS.** In horticulture, evergreens are plants that retain green foliage the year around; they do not shed all their foliage at any one time; in some cases, the individual leaves may remain attached and green for some years, as in many of the Coniferae, but in all evergreens the old leaves shed after a time when they become so overshadowed or crowded as to be no longer functional. The leaves of pines and spruces may persist three to fifteen years.

In the popular mind, "evergreen" and "conifer" are synonymous; but some conifers—as the taxodiums and larches—are deciduous. Moreover, in the tropics very many trees aside from conifers are evergreen, as notably the palms.

Evergreens may be classified as coniferous and broad-leaved, the latter including such plants as rhododendron, kalmia, mahonia, box and many others. The number of plants that are evergreen in the latitude of New York City is very large. Few persons recognize the wealth of good winter greenery that may be secured by exercising careful choice of material and providing proper conditions



1454. The roots bound up, and tree being loaded.

and protection for its growth. There are many very low evergreen plants that may contribute much to the winter interest of a yard or garden, in the way of edgings, masses, rosettes, and ground cover. The following lists indicate the materials that are now at the command of the planter.

Beyond the latitude of Lake Erie, the dependable evergreens are mostly conifers. At the Central Experimental Farm at Ottawa, those deciduous plants that hold their foliage fairly late in the autumn are mostly too tender for use. A few good plants, however, are, Oregon grape (*Mahonia*), bearberry (*Arctostaphylos Uva-ursi*), *Pachysandra terminalis*, shrub yellow-root (*Xanthorrhiza aptifolia*), and *Quercus imbricaria*. The Oregon grape is perhaps the most useful evergreen there for ground-covering. The hardier species of *Ligustrum* are also fairly satisfactory, but most of the species of this genus leave so much dead wood after winter that in very large masses they are liable to be unsightly. Many attractive conifers are reliable at Ottawa, in the genera *Abies*, *Chamaecyparis*, *Ginkgo*, *Juniperus*, *Picea*, *Pinus*, *Pseudotsuga*, *Taxus*, *Thuja*, *Tsuga*.

The uses of evergreens are discussed in other places in the Cyclopaedia, as under *Arbiculture*, *Herbary*, *Landscape-Gardening*, *Lawn-Planting*, *Perennials*, *Rock-Gardening*, *Screens*, *Shrubbery*, *Topiary Work*, *Wild-Garden*, *Windbreaks*, *Winter-Gardening*. For lists of evergreens for California, see pp. 379-381 (Vol. I).

L. H. B.



1455. The method of binding up the roots.



1453 Digging up an evergreen.

#### Moving large evergreens.

Figs. 1452-1457.

Large evergreens are moved with a ball of earth because they have no dormant period, but carry their foliage and need moisture at all times of the year. It is essential that the ball of earth contains a sufficient amount of small fibrous feeding roots to support the tree and that the tree be kept well watered for two or more seasons until the tree has spread its roots over sufficient area to gather enough rainfall to sustain the normal growth. The extent of fibers in the ball is increased by transplanting and root-pruning. Root-pruning is less essential with trees having an abundance of fibrous roots than with trees having only a few large coarse roots in the central portion. Some trees, as white pine, will survive with a comparatively small number of roots, their drought-resistant qualities enabling them to persist with a small supply of moisture. Other evergreens, as Nordmann's fir, have a long carrot-like taproot, and the tree is likely to die if this is cut and the tree given an inadequate quantity of water. Frequent nursery transplanting is, therefore, necessary with this species.

Trees are dug by starting a trench at a radius from the tree about 3 feet wider than the ball of earth to be taken. The roots are cut off on the outside of the trench and the soil dissected out from between the roots back to the size of the ball. These roots are bent around against the ball of earth if they are



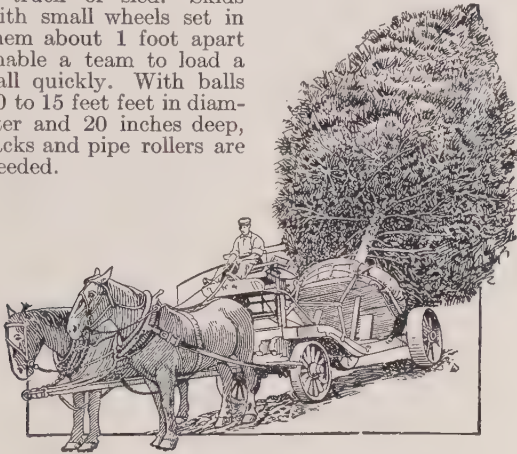
1456. Digging the hole in frozen ground to receive the tree.



flexible enough to bend. If not sufficiently flexible and tractable, they are cut off.

A canvas is made 15 to 24 inches deep, and is made smaller at the bottom by folding over a V and sewing it. This makes it fit a conical ball and, when it is pulled up 3 inches by the cross-lashing at the top, makes it tighter. The canvas has cross-ropes sewed on it with rings at the top and bottom, and on the deeper balls two rows of rings in the middle. The bottom rope is tightened by a wooden lever 20 inches long with four holes, the rope being looped through the holes and the lever thrown over to pull the rope tight. The top rope is then tied and tightened by cross-lashing.

To get the ball free from the subsoil, dig under all around and tip the tree slightly. Level off the bottom with a fork. If there are tap-roots, tunnel under and cut them with a saw. Put a platform as far under as possible and tip the tree back. To get the ball in the center of the platform, put a hammock around the ball and pull. Hold the platform in position by crowbars driven in front of it. Lash the ball to the platform, make an incline, drag the platform out of the hole onto a truck or sled. Skids with small wheels set in them about 1 foot apart enable a team to load a ball quickly. With balls 10 to 15 feet in diameter and 20 inches deep, jacks and pipe rollers are needed.



1457. Transporting a large evergreen tree.

Trees over 10 feet need to be tipped over to go under wires. If the canvas is put on tight and at the proper taper, and if the ball is cut flat to fit close to the platform and lashed tight to the platform, the tipping can be done without the ball shaking loose. Sometimes a canvas or burlap bottom can be put between the platform and the ball. In unloading, the tree is stood up, team hooked to the platform and the tree dragged off to the ground. The tree may drop 2 feet without injury. The platforms are dragged to the hole and balls less than 4 feet rolled into the hole. Larger balls have the platform dragged into the hole and the platform pulled out holding the tree in position by a hammock. To straighten the tree, tramp the earth solid under it until it stands erect. Take off the canvas, spread out the side roots, pack the earth and anchor as with deciduous trees. Keep the ball moist; examine it once a month or more often by digging or boring into the ball during the first two years. Evergreens moved with a too small ball or with not enough fibers in the ball or with the watering neglected, may grow 3 inches a year for the first two or three years. If properly moved, they will grow 6 inches or more a year—half their normal growth.

Deciduous trees may be moved with balls of earth by the above method, and it has proved an aid with difficult species, as beech, oak, liquidambar, tulip. Especially when previously transplanted or root-pruned, the above trees  $3\frac{1}{2}$  inches in diameter moved with a ball of earth 4 feet in diameter are very success-

ful, while without a ball many are lost or the growth is much slower. Investigation should be made to see whether this is because of less disturbance of the roots or because there is carried with the roots and soil a mycelium of a fungus which aids the roots to take up plant-food and moisture.

The time of year for moving trees is of minor importance. It is over-emphasized by purchaser, landscape architects and nurserymen, and results in heavy financial loss to nurserymen in congested sales and their own planting in the short spring season. It greatly lessens the total amount of planting needed for forest, shelter-belt, landscape, fruit, and other economic purposes. A nurseryman may plant all the year. Evergreens can be taken up with a ball of earth even in May and June. The new growth may curve down. After June 20, the spruces, and after July 10, the pines, are firm enough not to wilt. August-September sales with a ball of earth are just as successful as April. The ground is warm and the roots grow rapidly; the ground can be made moist. Weather in September is less dry than in May and June.

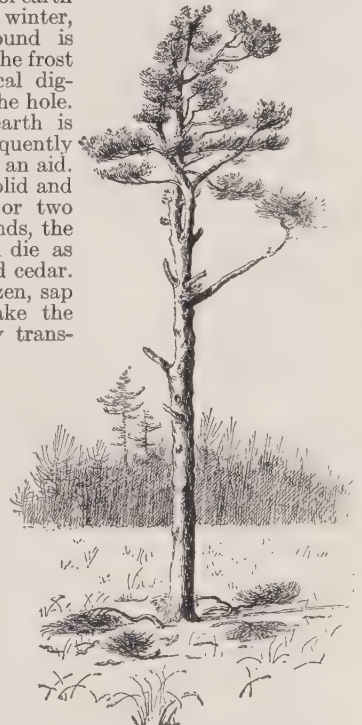
Small evergreens up to 2 feet high may be planted in August and September from one part of the nursery to another without balls of earth, if the roots are very carefully dissected out without breaking. There will be more failures if the week following planting is hot and dry.

Planting with balls of earth may continue all winter, especially if the ground is mulched to keep out the frost and permit economical digging of the tree and the hole. The frozen ball of earth is an old method, frequently referred to, but is not an aid. If the ball is frozen solid and remains so for one or two months with dry winds, the top may dry out and die as has occurred with red cedar. If the ball is not frozen, sap can come up to take the place of that lost by transpiration.

A ball of earth 3 feet in diameter is needed for an evergreen 8 to 10 feet high;  $4\frac{1}{2}$  feet in diameter for an evergreen 15 feet high, except red cedar which can have a ball 3 feet; a ball of earth 12 feet in diameter is needed for a pine 35 feet high. Root-pruning pines, spruce and hemlock, permits moving the following year with a smaller ball than otherwise. In root-pruning, the trench



1458. *Picea excelsa*, the Norway spruce. One of the most popular coniferous evergreens.



1459. Picturesque field pine, remnant of a forest

can go three-quarters of the way around or three or four of the larger roots can be left across the trench to keep the tree from blowing over. Root-pruning of red cedars is of less advantage and is rarely practised. In New England and northern New York, the pine, spruce and hemlock, have only a few coarse roots just under the surface and no roots extending 2 feet deep. When moved to better-drained soils on the coastal plain, they develop deeper roots and have ten times as many fibers in a ball 4 feet in diameter. The above evergreens with their shallow root-systems can be taken up with a disc of roots, peat and grass 8 inches deep and 3 to 4 feet wide. This can be set on a wagon and trees 10 to 15 feet high easily moved. Less roots



1460. The beauty of young evergreens lies in their symmetry and the preservation of the lower limbs.

will be broken or bare if the ball is tied in burlap. The usual cause of failure in this operation is neglect of watering. Hemlocks and probably other trees will be aided by shading for the first two months.

HENRY HICKS.

#### Woody evergreens for New England and New York.

B=Broad-leaved evergreens.

S=Semi-evergreen.

P=Protected at Arnold Arboretum, Boston.

T=Tender above New York City.

- SBT *Abelia chinensis*.
- SBP *Abelia grandiflora*.
- BT *Abelia uniflora*.
- T *Abies amabilis*.
- Abies appolinis*.
- Abies balsamea*.
- Abies cephalonica*.
- Abies cilicica*.
- Abies concolor*.
- Abies Fraseri*.
- T *Abies grandia*.
- Abies homolepis*=*A. brachyphylla*.
- Abies magnifica*.
- Abies nobilis*.
- Abies Nordmanniana*.
- Abies pectinata*=*A. Picea*.
- Abies Picea*.
- T *Abies Pinsapo*.
- T *Abies shastensis*.
- Abies sibirica*.
- Abies Veitchii*.
- BT *Acæna microphylla*.
- BT *Acæna ovalifolia*.
- BS *Akebia lobata*.
- BS *Akebia quinata*.
- B Alyssum saxatile*.
- B Andromeda floribunda*=*Pieris floribunda*.
- B Andromeda glaucophylla*.
- PP *Andromeda japonica*=*Pieris japonica*.
- HT *Andromeda nitida*=*Lyonia nitida*.
- B Andromeda polifolia*.
- BS *Andromeda speciosa*=*Zenobia speciosa*.
- BT *Arbutus Menziesi*.
- BT *Arbutus Unedo*.
- B Arctostaphylos Uva-ursi*.
- B Arundinaria chrysantha*.
- B Arundinaria Fortunei* var. *variegata*.
- B Arundinaria Hindsii*.
- B Arundinaria japonica*.
- BT *Aubrietia deltoidea*.
- BT *Aucuba japonica*.
- BS *Azalea amœna*=*Rhododendron amœnum*.
- BT *Azara microphylla*.
- BS *Baccharis halimifolia*.
- BT *Baccharis patagonica*.
- BS *Baccharis salicina*.
- B Bambusa nana*.
- BS *Berberis aristata*. See *Mahonia* for evergreen barberries with compound leaves.
- BP *Berberis buxifolia*.
- B Berberis Gagnepainii*.
- B Berberis ilicifolia*, Hort.=*Neubertii*.
- BS *Berberis Neubertii*=*B. vulgaris*×*M. aquifolium*. Foliage intermediate drying and turning brown in winter and both single and trifoliate leaves on same plant.
- Berberis Sargentiana* (one of the best).
- B Berberis stenophylla*.
- B Berberis verruculosa*.
- B Berberis Wallichiana*, Hort.=*B. Sargentiana*.
- BS *Berberis Wilsonæ* (leaves brown).
- BT *Bignonia capreolata*.
- Biota orientalis*=*Thuja orientalis*.
- Bruckenthalia spiculiflora* (light leaf-mulch).
- Bryanthus empetriformis*.
- Bryanthus erectus*.
- Bryanthus taxifolius*=*Phyllodoce cærulea*.
- SBP *Buddleia japonica*.
- SBP *Buddleia Davidii* (variabilis) var. *magnifica*.
- SBP *Buddleia Davidii* var. *superba*.
- SBP *Buddleia Davidii* var. *Wilsonii*.
- BS *Bumelia lanuginosa*.
- B Buxus japonica*.
- BP *Buxus sempervirens*.
- P Calluna vulgaris*, vars. *alba*, *elata*, *rubra*, *tomentosa* (light leaf-mulch).
- SBT *Carriera calycina*.
- Caryotaxus*=*Torreya*.
- Cassiope hypnoides*.
- Cassiope tetragona*.
- BT *Castanopsis chrysophylla*.
- BS *Ceanothus Fendleri*.
- T *Cedrus atlantica*.
- T *Cedrus Deodara*.
- P Cedrus Libani*.
- Cephalotaxus drupacea*.
- P Cephalotaxus Fortunei*.
- B Cercocarpus parvifolius*.
- BS *Chamæbatiara millefolium*.
- Chamæcistus*=*Loiseleuria*.
- T *Chamæcyparis Lawsoniana*.
- Chamæcyparis nutkaensis* (*C. nootkatensis*).
- Chamæcyparis obtusa*, especially var. *nana*.
- Chamæcyparis pisifera*.
- Chamæcyparis sphaeroidea*.
- BS *Chamædaphne calyculata* (leaves brown).
- B Chimaphila maculata*.
- B Chimaphila umbellata*.
- B Chiogenes hispidula*.
- T *Cistus laurifolius*.
- BS *Clematis paniculata*.
- T *Clematis Armandii*.
- BS *Cocculus Thunbergii*.
- Corema Conradii*.
- SBP *Cotoneaster adpressa*.
- BP *Cotoneaster buxifolia*.
- BP *Cotoneaster Dammeri*.
- SBP *Cotoneaster horizontalis*.
- BP *Cotoneaster microphylla*.
- ST *Cotoneaster salicifolia*.
- Cryptomeria japonica*.
- T *Cupressus Macnabiana*.
- BS *Cytisus capitatus*.
- BS *Cytisus nigricans*.
- BP *Cytisus purgans*.
- P Daboecia polifolia* (light leaf-mulch).
- B Daphne Blagayana*.
- B Daphne Cneorum*.
- SBP *Daphne Houtteana*.
- BT *Daphne Laureola*.
- BP *Daphne pontica*.
- Diapensia lapponica*.
- BT *Distylium racemosum*.
- B Dryas octopetala* (better with winter shade).
- BS *Elæagnus umbellata*.
- Empetrum nigrum*.
- Ephedra distachya*.
- Ephedra gerardiana*.
- B Epigæa repens*.
- P Erica carnea*.
- T *Erica stricta*.
- P Erica Tetralix*.
- P Erica vagans*.
- ST *Evonymus americana*.
- BS *Evonymus Bungeana* var. *semipersistens*.



- BT *Evonymus japonica*.  
 B *Evonymus nana* (leaves bronze).  
*Evonymus nana* var. *Koopmannii* (leaves bronze).  
 BT *Evonymus patens*.  
 B *Evonymus radicans*, in variety, especially *vegeta* and *Carierei*.  
 BT *Garrya elliptica*.  
 BT *Garrya Fremontii*.  
 BT *Garrya Veitchii* var. *flavescens*.  
 B *Gaultheria procumbens*.  
 B *Gaylussacia brachycera*.  
 BS *Genista elata*.  
 BS *Genista germanica*.  
 BPS *Genista pilosa*.  
 BPS *Genista procumbens*.  
 BS *Genista tinctoria*.  
 B *Hedera helix* (tender in exposed places: safer with winter shade).  
 BS *Helianthemum vulgare*.  
 BS *Hippophaë rhamnoides*.  
 B *Hyssopus officinalis*.  
 BS *Hypericum*.  
 B *Iberis sempervirens*.  
 B *Iberis tenoreana*.  
 PB *Ilex crenata*.  
 B *Ilex crenata microphylla*.  
 B *Ilex glabra*.  
 B *Ilex opaca*.  
 B *Ilex rugosa*.  
 BT *Ilex vomitoria*.  
 BT *Jasminum humile*=*J. revolutum*, Hort.  
*Juniperus chinensis* in variety, especially *procumbens*.  
*Juniperus communis* in variety, especially *fastigiata*, *hibernica* and *nana*.  
*Juniperus sabina* in variety, especially *humilis*, *prostrata* and *tamariscifolia*.  
*Juniperus virginiana* in variety, especially *globosa*, *procumbens* and *tripartita*.  
 B *Kalmia angustifolia*.  
 B *Kalmia glauca*.  
 B *Kalmia latifolia*.  
 B *Ledum groenlandicum*.  
 B *Ledum palustre*.  
 B *Leiophyllum buxifolium*.  
 B *Leucothoe axillaris*.  
 B *Leucothoe Catesbaei*.  
 BS *Leucothoe racemosa*.  
 T *Libocedrus decurrens*.  
 BS *Ligustrum Iboia* var. *myrtifolium*.  
 BS *Ligustrum strongylophyllum*.  
 BST *Ligustrum ovalifolium*.  
 B *Ligustrum Prattii*.  
 BS *Ligustrum vulgare*.  
 B *Linnaea borealis*.  
*Loiseleuria procumbens*.  
 BS *Lonicera fragrantissima*.  
 BS *Lonicera Henryi*.  
 BS *Lonicera japonica* (= *L. Halleana*) in variety.  
 BS *Lonicera similis* var. *Delavayi*.  
 BS *Lonicera Standishii*.  
 BS *Lonicera Standishii* var. *lanceifolia*.  
 BS *Lonicera xylosteum*.  
 BS *Lycium chinense*.  
 BS *Lycium halimifolium*=*L. vulgare*.  
*Lycopodium annotinum*.  
*Lycopodium clavatum*.  
*Lycopodium complanatum*.  
*Lycopodium lucidulum*.  
*Lycopodium obscurum*.  
 BT *Lyonia nitida*=*Andromeda nitida*.  
 BS *Magnolia glauca*.  
 B *Mahonia Aquifolium*.  
 B *Mahonia Fortunei*.  
 BF *Mahonia japonica*.  
 B *Mahonia nepalensis*.  
 B *Mahonia nervosa*.  
 B *Mahonia repens* (most hardy).  
 B *Mitchella repens*.  
 BT *Osmanthus Aquifolium*.  
 B *Pachysandra terminalis*.  
 B *Pachystima Canbyi*.  
 BF *Pachystima Myrsinites*.  
 BT *Pernettya angustifolia*.  
 BT *Pernettya mucronata*.  
 BT *Phillyrea decora*.  
*Phyllodoce cærulea*=*Bryanthus taxifolius*.  
 B *Phyllostachys flexuosa*.  
 B *Phyllostachys Marliacea*.  
 B *Phyllostachys violascens*.  
 B *Picea Abies*=*P. excelsa*.  
 B *Picea ajanensis*.  
 B *Picea Alcockiana*.  
 B *Picea alba*=*P. canadensis*.  
 B *Picea Engelmannii*.  
 B *Picea excelsa*=*P. Abies*.  
 B *Picea excelsa* var. *Barryi*.  
 B *Picea excelsa* var. *clanbrasiliana*.  
 B *Picea excelsa* var. *Ellwangeriana*.  
 B *Picea excelsa* var. *Gregoriana*.  
 B *Picea excelsa* var. *Maxwellii*.  
 B *Picea excelsa* var. *pendula*.

- Picea excelsa* var. *pumila*.  
*Picea excelsa* var. *pygmaea*.  
*Picea excelsa* var. *pyramidalis*.  
*Picea Mariana*=*P. nigra*.  
*Picea Menziesii*=*P. pungens*.  
*Picea nigra* and var. *Doumettii*.  
*Picea omorika*.  
*Picea orientalis*.  
*Picea polita*=*P. Torano*.  
*Picea pungens*.  
*Picea rubra*.  
 T *Picea sitchensis*.  
*Pieris*=*Andromeda*.  
*Pinus austriaca*.  
*Pinus Banksiana*=*P. divaricata*.  
*Pinus cembra*.  
*Pinus densiflora* and var. *pumila*.  
*Pinus divaricata*.  
*Pinus echinata*.  
*Pinus edulis*.  
 T *Pinus excelsa*.  
*Pinus flexilis*.  
 T *Pinus Jeffreyi*.  
*Pinus montana*.  
*Pinus monticola*.  
*Pinus palustris*.  
*Pinus parviflora*.  
*Pinus ponderosa*.  
*Pinus resinosa*.  
*Pinus rigida*.  
*Pinus Strobus*.  
*Pinus sylvestris*.  
*Pinus Tæda*.  
*Pinus Thunbergii*.  
*Pinus virginiana*.  
 B *Polygala chamæbuxus*.  
 B *Potentilla tridentata* (leaves brown-purple).  
 BP *Prunus Laurocerasus* var. *schipkaensis*.  
*Pseudotsuga taxifolia*=*P. mucronata* or *P. Douglasii*.  
 BT *Pyracantha coccinea* var. *Lalandii*.  
 BT *Pyracantha coccinea* var. *pauciflora*.  
*Pyxidanthera barbulata*.  
 BS *Quercus imbricaria*.  
 BT *Quercus macedonica*.  
 BTS *Quercus Libani*.  
 BS *Quercus Turneri*.  
*Retinospora decussata*=*Thuja orientalis* var. *decussata*.  
*Retinospora dubia*=*R. ericoides*, Hort.  
*Retinospora Ellwangeriana*.  
*Retinospora ericoides*, Zucc.=*Chamaecyparis sphaeroidea* var. *ericoides*.  
*Retinospora ericoides*, Hort.=*Thuja occidentalis ericoides*.  
*Retinospora filicoides*.  
*Retinospora filifera*.  
*Retinospora juniperoides*=*R. decussata*.  
*Retinospora leptoclada*, Hort.=*Chamaecyparis sphaeroidea* var. *andelyensis*.  
*Retinospora lycopodioides*.  
*Retinospora meldensis*.  
*Retinospora obtusa*.  
*Retinospora pisifera*.  
*Retinospora rigida*=*R. decussata*.  
*Retinospora Sieboldii*=*R. decussata*.  
*Retinospora squarrosa*, Sieb. & Zucc.=*Chamaecyparis pisifera* var. *squarrosa*.  
*Retinospora squarrosa*, Hort.=*R. decussata*.  
 BT *Rhamnus Alaternus*.  
 BTS *Rhamnus hybrida*.  
 B *Rhododendron arbutifolium*.  
 B *Rhododendron brachycarpum*.  
 B *Rhododendron californicum*.  
 B *Rhododendron carolinianum*=*R. punctatum*, in part.  
 B *Rhododendron catawbiense*.  
 B *Rhododendron caucasicum*.  
 B *Rhododendron ferrugineum*.  
 B *Rhododendron hirsutum*.  
 B *Rhododendron maximum*.  
 B *Rhododendron Metternichii*.  
 B *Rhododendron minus*=*R. punctatum*, in part.  
 B *Rhododendron myrtifolium*.  
 BT *Rhododendron ponticum*.  
 B *Rhododendron præcox* var. "Early Gem" (flowers often caught by early frost).  
 B *Rhododendron Wilsonii*, Hort.=*R. arbutifolium* (true *Rhododendron Wilsonii* is tender and not cultivated in the United States).  
 B *Rhododhamnus chamaecistus*=*Rhododendron chamaecistus*.  
 BS *Rosa wichuraiana*.  
 BS *Rubus laciniatus* (leaves bronze).  
 BS *Rubus spectabilis* var. *plena*=*R. fruticosus*.  
 BS *Ruta graveolens*.  
 B *Salvia officinalis*.  
*Sciadopitys verticillata*.  
 T *Sequoia sempervirens*.  
 T *Sequoia Washingtoniana*.  
 BT *Smilax laurifolia*.  
 BS *Spiræa cantoniensis*.  
*Taxus baccata* in variety, especially *repandens*, which is the most hardy English yew.  
*Taxus canadensis*.  
*Taxus cuspidata* (best and hardest of all yews).

- Taxus cuspidata* var. *brevifolia* or *nana*.  
*Teucrium chamædrys*.  
 T *Thuja gigantea*=*T. plicata*.  
*Thuja japonica*.  
*Thuja occidentalis* in variety, especially *plicata*.  
*Thuja orientalis* in variety, especially *decussata*.  
 T *Thujopsis dolabrata*.  
 BS *Thymus Serpyllum*.  
 BS *Thymus vulgaris*.  
*Torreya nucifera*.  
 T *Torreya taxifolia*.  
*Tsuga canadensis*.  
*Tsuga caroliniana*.  
*Tsuga diversifolia*.  
*Tsuga heterophylla*.  
 J *Tsuga mertensiana*.  
*Tumion*=*Torreya*.  
 T *Ulex europæus*.  
 B *Vaccinium macrocarpon*.  
 B *Vaccinium oxycoccus*.  
 B *Vaccinium Vitis-Idæa*.  
 B *Viburnum rhytidophyllum*.  
 B *Vinca minor*.  
 B *Yucca filamentosa*.  
 B *Yucca flaccida*.  
 B *Yucca glauca*=*Y. angustifolia*.  
 BS *Zenobia speciosa nitida*.  
 BS *Zenobia speciosa* var. *pulverulenta*.

RALPH W. CURTIS.

### Broad-leaved evergreens for Washington and the South.

Broad-leaved evergreens hardy at Washington, D.C. The evergreens and half evergreens of foregoing list are also good.

- Abelia floribunda*.  
*Aucuba himalaica*.  
*Aucuba japonica*.  
*Aucuba japonica* var. *concolor*.  
*Buxus balearica*.  
*Buxus sempervirens* var. *arborescens*.  
*Buxus sempervirens* var. *Handsworthii*.  
*Buxus sempervirens* var. *suffruticosa*.  
*Cotoneaster Simonsii* (nearly deciduous at Washington).  
*Cotoneaster thymifolia* (nearly deciduous at Washington).  
*Daphne Laureola*.  
*Elæagnus pungens* var. *reflexa*.  
*Eriobotrya japonica*.  
*Evonymus japonica* var. *macrophylla*.  
*Garrya elliptica*.  
*Ilex aquifolium*.  
*Ligustrum japonicum*.  
*Ligustrum lucidum*.  
*Ligustrum lucidum* var. *aureo-marginatum*.  
*Ligustrum Quihoui* (half evergreen).  
*Ligustrum sinense* (half evergreen).  
*Magnolia grandiflora*. [green].  
*Nandina domestica*.  
*Osmanthus Aquifolium*.  
*Phillyrea angustifolia*.  
*Photinia serrulata*.  
*Prunus Laurocerasus* var. *Bertini*.  
*Prunus Laurocerasus* var. *colchica*.  
*Prunus Laurocerasus* var. *schipkaensis*.  
*Prunus Laurocerasus* var. *rotundifolia*.  
*Pyracantha coccinea*.  
*Rhododendron amœnum*.  
*Rhododendron arbutifolium*.  
*Rhododendron carolinianum*.  
*Rhododendron Hinodegiri*.  
*Rhododendron minus*.



1461. *Picea pungens*. The two small tufts at the right are *P. excelsa* var. *Maxwellii*.

### Broad-leaved evergreens hardy at Norfolk and South

- Berberis congestiflora*.  
*Berberis Darwinii*.  
*Elæagnus pungens* var. *maculata*.  
*Elæagnus pungens* var. *Simonii*.  
*Gardenia jasminoides*.  
*Gardenia jasminoides* var. *Fortunei*.  
*Ilex cornuta*.  
*Laurus nobilis*.  
*Laurus regalis*.  
*Leucothoe acuminata*.  
*Magnolia fuscata*.  
*Magnolia Thompsoniana*.  
*Mahonia Fortunei*.  
*Mahonia nepalensis*.  
*Mahonia trifoliata*.  
*Photinia serrulata*.  
*Prunus caroliniana*.  
*Prunus lusitanica*.  
*Quercus acuta*.  
*Quercus Darlingtonii*.  
*Quercus sempervirens*.  
*Yucca aloifolia*.  
*Yucca Treleaseana*.

The following list of broad-leaved evergreens hardy at Arnold Arboretum may also be expected to thrive at Washington.

- Abelia grandiflora*.  
*Arctostaphylos Uva-ursi*.  
*Azara microphylla*.  
*Buddleia japonica*.  
*Bumelia lanuginosa*.  
*Bumelia lycioides*.  
*Buxus japonica*.  
*Buxus sempervirens*.  
*Cistus laurifolius*.  
*Cotoneaster buxifolia*.  
*Cotoneaster microphylla*.  
*Daphne Blagayana*.  
*Daphne Cneorum*.  
*Daphne pontica*.  
*Ilex crenata*.  
*Ilex glabra*.  
*Ilex opaca*.  
*Ilex vomitoria*.  
*Kalmia angustifolia*.  
*Kalmia latifolia*.  
*Leucothoe axillaris*.  
*Leucothoe Catesbæi*.  
*Mahonia japonica*.  
*Pachistima Canbyi*.  
*Pachistima Myrsinites*.  
*Pernettya angustifolia*.  
*Pernettya mucronata*.  
*Phillyrea decora*.  
*Pieris floribunda*.  
*Pieris japonica*.  
*Prunus Laurocerasus*.  
*Pyracantha coccinea* var. *Lalandii*.  
*Pyracantha coccinea* var. *pauciflora*.  
*Rhododendron amœnum*.  
*Rhododendron indicum*.  
*Yucca filamentosa* and varieties.  
*Yucca floccida* and varieties.  
*Yucca glauca*.  
*Zenobia speciosa* and varieties.



1462. Young trees of *Pinus ponderosa*, useful in the Rocky Mountain region.

A list of broad-leaved evergreens in addition to those recommended for Norfolk, Virginia, for the South Atlantic and Gulf Coast regions and as far inland as Augusta and Montgomery. Those marked "S" thrive only in the warmest sections.

- Arbutus Unedo*.  
*Ardisia crenulata*.  
*Berberis fascicularis*.  
*Bumelia angustifolia*.  
*Bumelia tenax*.  
*Camellia japonica* (S).  
*Cinnamomum Camphora* (S).  
*Cleyera japonica*.  
*Cytisus canariensis*.  
*Cytisus filipes*.  
*Cytisus monspessulanus*.  
*Gardenia florida*.  
*Gardenia Fortunei*.  
*Gardenia radicans*.  
*Helianthemum ocyroides*.  
*Illicium anisatum* (S).  
*Leucothoe acuminata*.  
*Prunus lusitanica*.  
*Prunus versallensis*.  
*Ligustrum nepalense*.  
*Metrosideros floribunda* (S).  
*Myrtus communis*.  
*Nerium odoratum*.  
*Nerium Oleander*.  
*Nerium fragrans*.  
*Olea integrans*.  
*Pittosporum Tobira*.  
*Quercus suber*.  
*Ruscus aculeatus*.  
*Thea Bohea*.  
*Trachycarpus Fortunei* (S).  
*Viburnum odoratissimum*.  
*Viburnum suspensum*.  
*Viburnum Tinus*.  
*Viburnum sandankwa*.

F. L. MILFORD.

### Plants that are evergreen on the middle Great Plains.

It must be remembered that on the Great Plains the conditions vary enormously, and that few plants naturally range over the whole area, or are capable of being successfully grown in artificial plantations throughout the whole area. Two special localities are frequently mentioned in the list. Arbor Lodge is the arboretum established by the late J. Sterling Morton at Nebraska City, within a few miles of the Missouri



River. The University Arboretum is at Lincoln, Nebraska, on the high prairies 60 miles west of the Missouri River.

*Trees.*

*Abies balsamea* (not common).  
*Abies cephalonica* (Arbor Lodge; University Arboretum).  
*Abies cilicica* (Arbor Lodge).  
*Abies concolor* (common).  
*Abies nobilis* (Arbor Lodge).  
*Abies Nordmanniana* (Arbor Lodge).  
*Abies Picea* (Arbor Lodge)=*A. pectinata*.  
*Abies Pinsapo* (Arbor Lodge).  
*Abies Veitchii* (Arbor Lodge; University Arboretum).  
*Chamaecyparis pisifera* (Arbor Lodge).  
*Juniperus scopulorum* (native in western portion).  
*Juniperus virginiana* (native in eastern portion).  
*Juniperus virginiana* var. *aurea variegata* (University Arboretum).  
*Juniperus virginiana* var. *elegantissima* (University Arboretum).  
*Juniperus virginiana* var. *glauca* (University Arboretum).  
*Picea Alcockiana* (Arbor Lodge; University Arboretum).  
*Picea canadensis* (common)=*P. alba*.  
*Picea Engelmanni* (rare).  
*Picea excelsa* (common)=*P. Abies*.  
*Picea excelsa* var. *inverta* (University Arboretum).  
*Picea excelsa* var. *pumila* (University Arboretum).  
*Picea excelsa* var. *pumila compacta* (University Arboretum).  
*Picea mariana* (Arbor Lodge)=*P. nigra*.  
*Picea orientalis* (Arbor Lodge).  
*Picea nigra* (University Arboretum)=*P. mariana*.  
*Picea nigra* var. *Doumetti* (University Arboretum).  
*Picea Parryana* (common)=*P. pungens*.  
*Picea polita* (Arbor Lodge; University Arboretum)=*P. Torano*.  
*Pinus austriaca* (very common; University Arboretum).  
*Pinus austriaca* var. *cebnensis* (monspeliensis) (University Arboretum).  
*Pinus cembra* (Arbor Lodge).  
*Pinus divaricata* (common)=*P. Banksiana*.  
*Pinus laricio* (Arbor Lodge).  
*Pinus massoniana* (Arbor Lodge).  
*Pinus montana* (Arbor Lodge; University Arboretum).  
*Pinus resinosa* (not common).  
*Pinus rigida* (Arbor Lodge).  
*Pinus scopulorum* (native in western portion).  
*Pinus Strobus* (common).  
*Pinus sylvestris* (very common).  
*Pseudotsuga taxifolia* (common)=*P. Douglasii*.  
*Taxodium distichum* (not common).  
*Taxus canadensis* (Arbor Lodge).  
*Thuja occidentalis* (common).  
*Thuja orientalis* (Arbor Lodge; University Arboretum).  
*Tsuga canadensis* (Arbor Lodge).

*Shrubs.*

*Arctostaphylos Uva-ursi* (native in western portion).  
*Berberis ilicifolia* (University Arboretum).  
*Buxus* (not common; tender at University Arboretum).  
*Evonymus japonica* (University Arboretum).  
*Evonymus nana?* (University Arboretum).  
*Evonymus radicans* (University Arboretum).  
*Hedera helix* (rarely hardy; tender).  
*Ilex opaca* (rarely planted; tender).  
*Juniperus chinensis* (University Arboretum).  
*Juniperus communis* var. *aurea* (University Arboretum; tender).  
*Juniperus communis* (native in western portion; University Arboretum).  
*Juniperus communis* var. *hibernica* (University Arboretum; tender).  
*Juniperus sabina* var. *prostrata* (University Arboretum).  
*Juniperus stricta* (University Arboretum).  
*Ligustrum Iota* (half evergreen; University Arboretum).  
*Ligustrum ovalifolium* (evergreen; half hardy; University Arboretum).  
*Ligustrum ovalifolium* var. *aurea* (half evergreen; hardy; University Arboretum).  
*Ligustrum vulgare* (half evergreen; University Arboretum).  
*Ligustrum vulgare* var. *buxifolium* (evergreen, hardy; University Arboretum).  
*Ligustrum vulgare* var. *fructealba* (half evergreen; University Arboretum).  
*Lonicera japonica* var. *Halliana*.  
*Mahonia Aquifolium* (native in western portion).  
*Rhododendron maximum* (rarely planted; tender).  
*Smilax hispida* (half evergreen; native).  
*Yucca filamentosa* (common).  
*Yucca glauca* (native in western portion).

*Herbs.*

*Equisetum hiemale* (native throughout).  
*Equisetum laevigatum* (native throughout).  
*Equisetum scirpoides* (native throughout).  
*Equisetum variegatum* (native throughout).  
*Iris germanica*.  
*Iris pumila*.  
*Mamillaria missouriensis* (native in western portion).  
*Mamillaria viviparus* (native in western portion).  
*Opuntia arborescens* (native in southwestern portion).  
*Opuntia camanchiana* (native in southwestern portion).  
*Opuntia fragilis* (native throughout).

*Opuntia humifusa* (native throughout).  
*Opuntia polyacantha* (native throughout).  
*Opuntia tortispina* (native in southern portion).  
*Pellaea atropurpurea* (native throughout).  
*Salvia officinalis* (common).  
*Selaginella rupestris* (native throughout).  
*Vinca minor* (common).

*Rosettes.*

Many herbaceous plants have rosettes of green leaves throughout the winter, the following being the more conspicuous on the Great Plains.

*Capsella Bursa-pastoris* (throughout the region; common cruciferous weed, introduced long ago and known as "shepherd's purse").  
*Dianthus* } (several species).  
*Plantago* }  
*Rumex* }  
*Fragaria virginiana* (throughout the region).  
*Geum canadense* (throughout the region).  
*Hieracium longipilum* (in eastern portion).  
*Oenothera biennis* (throughout the region).  
*Pentstemon grandiflorus* (throughout the region).  
*Pyrola chlorantha* (in the western portion).  
*Pyrola elliptica* (in the western portion).  
*Pyrola secunda* (in the western portion).  
*Taraxacum officinale* (throughout the region); not green in University Arboretum, Lincoln, except where covered by snow.  
*Taraxacum erythrospermum*.  
 CHARLES E. BESSEY.

**EVERLASTINGS.** A term applied to flowers or plants that retain their shape and other characteristics after being dried; equivalent to the French word "immortelle." With everlastings are also included various artificial or manufactured articles that imitate flowers or plants.

The most important commercially of the flowers that retain their form and color in a dried state have been the French immortelles, *Helichrysum arenarium*. These flowers are used very extensively in France in their natural yellow color, for the manufacture of memorial wreaths and crosses, which, being constructed very compactly, are exceedingly durable, even in the severest weather, and are exported in large numbers to all parts of the world. The flowers bleached white, or bleached and then dyed in various colors, are also shipped in enormous quantities, either direct to this country or by some of the large exporting houses of Germany. In the United States, however, the use of these immortelles has fallen off on account of the high duty.

Approaching the French immortelles in aggregate value have been the so-called "cape flowers," *Helichrysum grandiflorum*, which formerly reached an enormous sale in this country, and they largely supplanted the immortelles on account of their silvery texture and greater beauty every way. They are naturally white, but require bleaching in the sun to give them the desired luster. They came from the Cape of Good Hope, and reached this country mainly from Hamburg. Of recent years, these products have been less important in the American trade because of the uncertainty of the crop, poor quality, and the competition of artificial materials. There is now being made in Germany an artificial "cape flower;" this flower is made from paper and waxed, and is an excellent imitation African cape. Large quantities of these goods are being imported into this country, and they have given great satisfaction to all florists that have used them. Probably in time the German product will



1463. A mature field tree of *Pinus ponderosa*.

entirely supersede the natural African cape, more particularly as each flower has a wire stem which the florists attach to the toothpicks or sticks, and this saves considerable labor.

The common everlasting of American and English country gardens, *Helichrysum bracteatum*, is the only one of these flowers grown to any extent in North America, and more or less extensive cultivation of it, commercially, has been practised in this country but a large percentage is still imported. These plants come in white, straw and brown colors naturally, and take readily to a variety of artificial tints; together with *Ammobium alatum* and the well-known globe amaranth, *Gomphrena globosa*, they are grown and used to a considerable extent by the country folk in the construction of the many forms of wreaths, stars, and other Christmas forms, which they sell in the city markets in large quantities, but their sale by wholesalers and jobbers for general consumption is very limited. *Statice incana*, cultivated or wild from the swamps of southern Europe, and *Gypsophila* in several species are used to a considerable extent; and the sale of statice especially, which is popular in combination with cape flowers in memorial designs, is quite an item with the dealers in florists' supplies.

Of the dried grasses, the pampas plumes of California, *Cortaderia argentea*, native of South America, are the only American production attaining any great commercial importance. Their beautiful silky plumes, unapproached by any other horticultural product, are used in enormous quantities for decorative purposes, and are an important item of American export. They are used mainly in a sun-bleached state, but more or less dyeing, often parti-colored, is also done. *Bromus brizæformis* is the most extensively used of the smaller grasses. It is mostly imported from Europe. It can be imported, however, including duty, for about 25 per cent less than it is possible to grow it in this country. It is handled in the natural state. *Briza maxima*, another popular grass, is grown in Italy. *Briza media*, a medium-sized grass, and *Briza minima*, the flowers of which are as fine as sawdust, are also handled in the same way as *Briza maxima*, very little of the *B. minima* being used dyed, however. *Phleum pratense*, *Stipa pennata*, and various kinds of oats have more or less commercial value, being used considerably in the manufacture of imitation flowers and straw goods, but from a florist's standpoint they are not important. The most important commercially of the imported grasses is the Italian wheat, the quantities used in this country for the manufacture of sheaves for funeral purposes being enormous, and increasing yearly. It comes in many grades of fineness and length of stem. In this country all attempts to cultivate it in competition with the European product have failed. Of late years, a decorative natural grass called "Minerva" and treated artificially is being imported in large quantities, and is used by florists in combinations, making a very effective setting-off to flowers in basket decoration.

Much use is now made in this country of the dried twigs and foliage of ruscus. This is grown in Italy, and is shipped to Germany where it is prepared and dyed in many attractive colors. It holds its form well. It is made up into wreaths and other articles, and provides a good foliage effect.

Enormous use is now made of magnolia leaves prepared and colored in brown, red and green. In former years these goods were secured from Germany and Italy, but they are no longer imported for the reason that they are prepared in this country as good, if not better than they are on the other side, and much cheaper. They are gathered and prepared in Florida, and shipped to all parts of the United States, put in cartons containing about 1,000 leaves. They are used very extensively by all classes of florists on account of their lasting qualities and fine appearance. They have

almost entirely superseded the galax leaf, which has been in use for so many years in the making up of mortuary emblems.

A number of our native composites—of the genera *Gnaphalium*, *Antennaria* and *Anaphalis*—are called everlastings, and are often used in home decorations, particularly in the country; but they have no commercial rating.

There is an increasing demand for artificial decorative articles, to be used alone and in conjunction with fresh cut-flowers; they are now being used by the best florists and plantmen. The demand for decorative artificial flowers, plants and like materials, has grown to such an extent that there are now a large number of businesses devoted exclusively to the manufacture of them. This is well illustrated in the product called "Japanese wood frieze," in appearance resembling very much the well-known worsted and silk chenille. It is made from wood-fiber colored in shades to represent the colors of immortelles. This frieze or wood chenille, when worked up in various designs, so closely resembles immortelles that the difference between them can hardly be detected.

One of the interesting artificial greens is the "sea moss." It is an alga-like hydroid (one of the animal kingdom), known as *Sertularia argentea*, which is commonly distributed along our Atlantic coast northward from New Jersey to the Arctic. The long moss-like strands are dyed bright green, and the "plant" is used in making table decorations and jardinière pieces. It is sometimes called "air plant." The apparent lateral minute buds clothing all the branches are, of course, the shelter for the zooids of the colony during life. There is another one (*Aglaophenia struthionides*) found on the Pacific coast, which is even more beautiful, and which is put to the same decorative uses, and is known there as the ostrich plume, the branches having a beautiful pinnate arrangement along the two sides of a single axis. These sea-mosses are dried, the dirt picked out, and then dyed and fixed in a preparation to make them permanent. They are likely to have an unpleasant odor.

H. BAYERSDORFER.  
WM. N. REED.†

#### Everlastings for home use.

After much experience with the growing of everlastings for home winter decorations, the three following species have been found the best for plantings: *Helichrysum monstrosum*, the double form of *H. bracteatum*, known as "golden ball," *Acroclinium (Helipterum) roseum flore-pleno*, and the Chinese lantern plant, *Physalis Franchetii*. These are easily grown, are free bloomers and give better and brighter color in their dried state than other forms. They have a certain warmth in color that is appreciated in zero weather.

The helichrysum and acroclinium are started in the greenhouse or hotbed during the latter part of March, planting them out in full sun as soon as all danger of frost is past. Any good garden soil suits them.

It is most important that the flowers of the acroclinium be picked just as soon as the buds show color, even if they look almost too small, because if too far advanced the ray petals open up flat, exposing the center, which will soon turn brown when dried and spoil the effect. Those cut early will open up part way, presenting only their full color. In full blooming season they should be picked daily. With the helichrysum one can wait until the bud is of fairly good size but all the smaller ones will open up also when dried. Those fully open or showing the center at all will turn brown. With both plants pluck off all foliage, place in bundles and hang them, heads down, in some dry closet. They should be examined at times, as in the drying the stems shrink and the flower may fall down. They should remain in this dry shelter until the house is heated in the



fall, reducing the moisture in the air, otherwise the dry flower-stems would absorb the moisture and become limp.

A certain number of "droopers" is wanted when arranging a bouquet, in order to avoid stiffness. These are easily secured. Take a long sheet of a pliable cardboard about 8 inches wide, tack one edge lengthwise on the top of a shelf, at the front bringing it out and downward so as to form a half circle, and fasten it there. Then lay the freshly picked flower-stems on the shelf, heads hanging down. It is sometimes necessary to place a book or some weight on the stems to keep them in place. They will dry in this curved form. Brown split bamboo baskets make good vases, as they harmonize well with the deep orange of the golden ball and the pink of the acroclinium. A wire mesh in these baskets enables the flowers to be arranged more easily. As there is no green foliage used, it is well to use some short-stemmed flower in the center, midway between the basket and the tallest flowers. These "flecks" of color relieve the bareness of the stems.

The Chinese lantern plant (*Physalis Franchetii*) is an easily grown perennial, spreading at the roots. The seed-pods are very ornamental, retaining their brilliancy of color when dried, the colors ranging from a pale green to orange and red. They hang like inverted balloons, on slender peduncles and lose their graceful appearance unless the main stem that carries them can be curved outward when dry. They have to be treated differently from the others. Boards on a partition in a wood-shed may be used, driving tacks, one each side, close up to the side of the bottom of the main stem, the heads of the tacks overlapping the stick. Run the stem up straight for about 6 inches, then curve to right or left and fasten in same manner. Then, when dried, the lanterns will hang clear of the stem. The seed-pods of the balloon vine, *Cardiospermum Halicacabum*, work in well among the lanterns. Cut away part of the side of the lantern, and see the brilliant wick inside.

W. C. EGAN.

**EVODIA** (Greek, *pleasant odor*). *Rutaceæ*. Ornamental woody plants grown chiefly for their handsome foliage.

Deciduous or evergreen trees or shrubs: trunk with smooth bark: winter-buds naked: lvs. opposite, petioled, simple or pinnate with entire punctate lfts.: fls. in terminal or axillary panicles or corymbs, unisexual, usually 4-merous, less often 5-merous; sepals imbricate; petals valvate or slightly imbricate; stamens 4-5, at the base of a cupular disk: carpels 4-5, each with 2 ovules, nearly free or connate, with a cylindric style, at maturity dehiscent, 2-valved, 1-2-seeded.—About 50 species in E. Asia, from Korea and N. China to S. Asia., Austral. and Polynesia. Allied to *Zanthoxylum* which is easily distinguished by its alternate lvs.; very similar in habit and foliage to *Phellodendron* which besides in the berry-like frs. differs in the winter buds being inclosed in the base of the petiole, while in *Evodia* they are borne free in the axils.

The cultivated hardy species are strong-growing deciduous trees with rather large pinnate leaves of aromatic odor when bruised, and with whitish flowers in terminal broad panicles followed by small capsules exposing glossy black seeds when opening. *Evodia Daniellii* has proved hardy at the Arnold Arboretum. *E. glauca* and *E. Henryi*, are somewhat tenderer. There are also a few tropical species from New Guinea, rarely cultivated as warmhouse evergreens; they are little known and their correct names have not yet been determined. Propagation is by seeds and of the warmhouse species by cuttings of half-ripened wood; probably also by root-cuttings.

A. Frs. *obtuse or only mucronulate at the apex*.

*glauca*, Miq. (*E. Fargesii*, Dode). Tree, to 50 ft.: lfts. 5-11, usually 7, on slender slightly hairy stalks,

$\frac{1}{4}$ - $\frac{1}{2}$  in. long, elliptic-ovate to oblong-lanceolate, long-acuminate, broadly cuneate or rounded at the base, minutely crenulate, glaucous below and glabrous except hairs along the midrib near the base,  $2\frac{1}{2}$ -4 in. long: infl. corymbose, 6-8 in. broad, nearly glabrous; pistil of the staminate fls. glabrous: fr. about  $\frac{1}{4}$  in. long, finely pubescent. June; fr. Sept. Cent. China.

AA. Frs. *strongly beaked*.

**Hénryi**, Dode. Tree, to 35 ft.: lfts. 5-9, short-stalked, ovate-oblong to ovate-lanceolate, long-acuminate, rounded or narrowed at the base, finely crenulate, glaucescent or pale green below and glabrous,  $2\frac{1}{2}$ -4 in. long: infl. paniculate, 2- $2\frac{1}{2}$  in. across: fr. reddish brown, sparingly hairy,  $\frac{1}{4}$  in. long, with slender beaks about half as long. June; fr. Sept. Cent. China. See page 3568.

**Daniellii**, Hemsl. (*Zanthoxylum Daniellii*, Bennett). Small tree: lfts. 7-11, ovate to oblong-ovate, acuminate with an obtusish point, rounded at the base, sometimes subcordate or broadly cuneate, pale green below and glabrous except hairs along the midrib and sometimes on the veins, 2- $3\frac{1}{2}$  in. long: infl. corymbose, 4-6 in. across: fr. nearly  $\frac{1}{2}$  in. long, slightly hairy or nearly glabrous, with a rather short, usually hooked beak. June; fr. Sept. N. China, Korea.

*E. elegans*, Hort. Evergreen: lvs. 3-foliolate; lfts. linear-lanceolate, undulate and crenate; resembling *Aralia elegantissima*. New Guinea. F.E. 1899:291. Gng. 12:404. G. 21:273.—*E. formosa*, Hort. A similar species, intro. in 1900 by Sander & Co. This and the preceding are warmhouse evergreens and belong probably to species already described.—*E. officinalis*, Dode. Allied to *E. glauca*. Small tree: lfts. 5-11, ovate to elliptic-oblong, acuminate, pubescent and light green beneath: infl. pubescent: fr. glabrous, Cent. China.—*E. rutecarpa*, Hook. f. & Thoms. Allied to *E. glauca*. Small deciduous tree: lft. short-petioled, broader, pubescent on both sides: infl. smaller and denser, with stout pedicels, pubescent, Japan. Himalayas. S.Z. 1:21 (as *Boymia rutecarpa*).—*E. reticulata*, Rehd. & Wilson. Allied to *E. Henryi*, but lvs. and young branchlets densely short-pubescent: fruiting corymb 4-8 in. across. Cent. China.

ALFRED REHDER.

**EVÓLVULUS** (*to unroll*, because not twining as in *Convolvulus*). *Convolvulacæ*. Prostrate or erect annual or perennial herbs or sub-shrubs, rarely planted or grown in greenhouses. The genus differs from *Convolvulus* in having 2 styles 2-cleft, stigmas always narrow, corolla often open or rotate, and not twining: lvs. entire, small: fls. small, in summer and autumn; sepals 5, the calyx not bracted at base; corolla blue, rose or white, 5-angled or shortly 5-lobed. The species are about 80; in warm regions, several in the U. S. *E. purpureo-cæruleus*, Hook., of Jamaica, appears to be the only species prominently mentioned horticulturally, and this is seldom planted: 1-2 ft., woody at base: lvs. small, lanceolate-acute: fls. purplish, terminal, the corolla rotate, white-centered and purple-rayed. B.M. 4202.

**EVÓNYMUS** (ancient Greek name). Often spelled *Euonymus*. *Celastracæ*. SPINDLE-TREE. Woody plants, erect or climbing, grown chiefly for their handsome foliage and the attractive fruits.

Deciduous or evergreen shrubs or small trees with usually more or less 4-angled branches, mostly erect, rarely creeping or climbing by rootlets: winter-buds usually conspicuous with imbricate scales: lvs. opposite, petioled, usually serrate, and mostly glabrous: fls. small, in axillary cymes, 4-5-merous, generally perfect; style and stamens short, the latter inserted on a disk: fr. a 3-5-lobed, somewhat fleshy caps., each dehiscent valve containing 1 or 2 seeds inclosed in a generally orange-colored aril; the seed itself is white, red or black.—About 120 species in the northern hemisphere, most of them in Cent. and E. Asia, extending to S. Asia and Austral.

The spindle-trees are of upright or sometimes procumbent or creeping habit, with rather inconspicuous greenish, whitish or purplish flowers in axillary cymes; very attractive in fall, with their handsome scarlet,

pink or whitish, capsular fruits, showing the bright orange seeds when opening, and with the splendid fall coloring that most of the species assume, especially *E. alata*, *E. Maackii*, *E. sanguinea*, *E. verrucosa*, *E. europæa* and *E. atropurpurea*. The wood is tough, close-grained and light-colored, often almost white, and used, especially in Europe, for the manufacture of small articles. The bark of *E. atropurpurea* has medical



1464. *Evonymus obovata*. ( $\times \frac{3}{4}$ )

properties.—Most of the cultivated deciduous species, except those from Himalayas, are hardy North, while of the evergreen ones only *E. radicans* is fairly hardy, and, on account of its greater hardiness, is often used North as a substitute of the ivy for covering walls, rocks and trunks of trees, climbing if planted in good soil, to a height of 15 and sometimes 20 feet. *E. europæa*, and South, the evergreen *E. japonica* are sometimes used for hedges.

The spindle-trees are not particular as to the soil and are well adapted for shrubberies. Propagation is by seeds which are usually stratified and sown in spring, or by cuttings of ripened wood in fall. The evergreen species grow readily from cuttings of half-ripened wood under glass in fall or during the winter in the greenhouse. Varieties are sometimes grafted or budded on stock of their typical species.

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#### A. *Foliage deciduous*. Nos. 1-13.

##### B. *Caps. tuberculate, depressed-globose: fls. 5-merous*.

1. *americana*, Linn. STRAWBERRY BUSH. Upright shrub, to 8 ft.: lvs. ovate-lanceolate or oblong-lanceolate, usually acute at the base, acuminate, crenately serrate,  $1\frac{1}{2}$ -3 in. long; peduncle slender, few-fl.; fls. yellowish or reddish green: fr. pink. June; fr. Sept.-Oct. From S. N. Y. south, west to Texas. L.B.C. 14: 1322. B.B. (ed. 2) 2:491. Var. *angustifolia*, Wood (*E. angustifolia*, Pursh). Lvs. lanceolate or linear-lanceolate, half-evergreen S.

2. *obovata*, Nutt. (*E. americana* var. *obovata*, Torr. & Gray). Fig. 1464. Procumbent shrub, with rooting st. and erect branches, to 1 ft.: lvs. obovate or elliptic-obovate, crenately serrate, light green, 1-2 in. long; fls. purplish: caps. usually 3-celled. May; fr. Aug., Sept. From Canada to Ind. and Ky. G.F. 9:385 (adapted in Fig. 1464).—It may be used for covering the ground under large trees, or for borders of shrubberies. Var. *variegata*, Hort., has the lvs. marked pale yellow.

##### BB. *Caps. smooth: fls. generally 4-merous*.

##### C. *Fr. divided to the base into 4 or less nearly separate pods*.

3. *alata*, Maxim. (*E. Thunbergiana*, Blume. *E. striata*, Loes.). Spreading shrub, to 8 ft.: branches stiff, with 2-4 broad, corky wings: lvs. elliptic or obovate, acute at both ends, sharply serrate, 1-2 in. long; fls. 1-3, short-peduncled, yellowish: caps. purplish, small; seeds brown with orange aril. May, June; fr. Sept., Oct. China, Japan. S.I.F. 1:63. F.E. 32:54. Var. *subtriflora*, Franch. & Sav. Branches not winged: fls. 1-5. Var. *aperta*, Loes. Aril open at the apex, disclosing the black seed. Cent. China.—This species is one of the handsomest; the lvs. turn bright crimson in autumn, the small, but numerous frs. are brightly colored and in winter the shrub is conspicuous by its broadly winged branches.

##### CC. *Fr. more or less 3-5-lobed*.

##### D. *Branches densely warty*.

4. *verrucosa*, Scop. Erect shrub, to 6 ft.: lvs. ovate-lanceolate, crenately serrulate, acuminate, 1-2½ in. long; fls. slender-peduncled, 1-3, brownish: caps.



1465. *Evonymus europæa*. ( $\times \frac{1}{2}$ )

deeply 4-lobed, yellowish red; seed black, not wholly covered by the orange aril. May, June; fr. Aug. S. E. Eu., W. Asia. H.W. 3, p. 55.

##### DD. *Branches smooth*.

##### E. *Antlers yellow*.

##### F. *The caps. with obtuse lobes*.

5. *nana*, Bieb. Low shrub, to 2 ft., with slender, often arching or sometimes procumbent and rooting



branches: lvs. linear or linear-oblong, mucronulate, entire or remotely denticulate and revolute at the margins,  $\frac{1}{2}$ – $1\frac{1}{2}$  in. long: fls. slender-peduncled, purplish: caps. deeply 4-lobed, pink; seed brown, not wholly covered by the orange aril. May, June; fr. Aug. W. Asia to W. China.—Handsome shrub for rockeries and rocky slopes; forming a graceful, pendulous, standard tree if grafted high on *E. europæa*. Fr. ripens in Aug., earliest of all species. Var. *Koëpmannii*, Beissn. (*E. Koëpmannii*, Lauche). Lvs. larger and broader.

6. *europæa*, Linn. (*E. vulgaris*, Mill.). Fig. 1465. Erect shrub or sometimes small tree, to 20 ft.: lvs. ovate or oblong-lanceolate, acuminate, crenately serrate,  $1\frac{1}{2}$ – $2\frac{1}{2}$  in. long: fls. yellowish, in few-fl. cymes: caps. 4-lobed, usually pink. May. Eu. to E. Asia. B.B. (ed. 2) 2:492. H.W. 3, p. 53.—Varying with narrower and broader lvs. There are also several varieties with variegated lvs. and some with frs. of different colors, as var. *atrórubens*, Rehd. (*E. vulgaris* var. *atrórubens*, Schneid. *E. europæa* fr. *atropurpurea*, Hort.), with deep purple frs.; var. *leucocárpa*, DC. (*E. europæa* fr. *álbo*, Hort.), with whitish frs., and var. *atropurpurea*, Arb. Kew, with rather narrow purplish lvs. Var. *nana*, Lodd., is a dwarf, dense, and strictly upright form with elliptic to elliptic-lanceolate lvs.  $1\frac{1}{2}$  in., or on vigorous shoots, to  $2\frac{1}{2}$  in. long: it hardly ever flowers and is tenderer than the type.

FF. The caps. with winged lobes: lvs. broad.

7. *latifolia*, Scop. Shrub or small tree, to 20 ft.: winter-buds elongated, acute, about  $\frac{1}{2}$  in. long: lvs. obovate-oblong, acuminate, crenately serrate, 2–4 in. long: fls. yellowish, often 5-merous, in slender-peduncled, rather many-fl. cymes: caps. pink, large, with winged lobes. May, June; fr. Sept. S. Eu., W. Asia. B.M. 2384. Gn. 39, p. 213. Gt. 53, p. 30. G. 4:235. H.W. 3, p. 54. F.S.R. 3, p. 29.—A very decorative species, with handsome foliage and large pendulous frs.

8. *sanguinea*, Loes. Shrub or small tree, to 20 ft.: winter-buds elongated, acute: branchlets nearly terete: frs. broadly oval or ovate to elliptic-ovate, acute, broadly serrate or rounded at the base, densely fimbriate-serrulate, dull green above, paler below and slightly reticulate,  $1\frac{3}{4}$ –4 in. long: cymes lax, long-peduncled; fls. usually 4-merous. fr. purple, slightly lobed, 4-winged, the wings  $\frac{1}{4}$ – $\frac{1}{2}$  in. long; aril orange, entirely covering the black seed. June; fr. Sept. Cent. and W. China. Var. *brevipedunculata*, Loes. Peduncles about 1 in. long. W. China. Var. *camptoneura*, Loes. Lvs. oval or ovate to elliptic-ovate, veins curved (broader in the type and veins nearly straight). Cent. and W. China.



1466. *Evonymus radicans*.

EE. Anthers purple.

F. Fls. purple.

9. *atropurpurea*, Jacq. (*E. americana*, Hort.). BURNING BUSH. Shrub or small tree, to 20 ft.: lvs. elliptic, acuminate, obtusely serrate, pubescent beneath,  $1\frac{1}{2}$ –5 in. long: fls. purple, in slender-peduncled, many-fl. cymes: caps. deeply 3–4-lobed, scarlet. June; fr. Oct. E. N. Amer., west to Mont. B.B. (ed. 2) 2:491.

FF. Fls. yellowish or whitish.

G. Petioles one-fifth to one-sixth as long as the lf.; lvs. acute or gradually acuminate: fr. pink.

H. Lvs. oblong to ovate-oblong, broadest about or below the middle.

10. *Maackii*, Rupr. (*E. Hamiltoniana*, Dipp., not Wall.). Large shrub or small tree, glabrous: lvs. elliptic-oblong to oblong-lanceolate, acuminate, gradually narrowed toward the base, serrulate, 2–3 in. long and  $\frac{3}{4}$ – $1\frac{1}{4}$  in. broad: cymes small, about  $\frac{3}{4}$  in. across: fr. pink, 4-lobed, about  $\frac{1}{2}$  in. across; aril orange-red, usually closed, rarely slightly opened at the apex. June: fr. Sept. N. E. Asia.

11. *hians*, Koehne. Large shrub: lvs. ovate-oblong, short-acuminate, rounded or broadly cuneate at the base, serrulate,  $2\frac{1}{2}$ – $4\frac{1}{2}$  in. long and  $1\frac{1}{4}$ – $1\frac{3}{4}$  in. broad: cymes rather long-stalked, small; stamens with very short filaments: fr. pink, turbinate, deeply 4-lobed,  $\frac{1}{2}$  in. across; aril blood-red, open at the apex and disclosing the blood-red seed. June; fr. Sept. Japan. S.I.F. 2:39 (as *E. europæa*).

HH. Lvs. generally obovate or obovate-oblong, to  $2\frac{1}{2}$  in. broad.

12. *yedoensis*, Koehne (*E. Sieboldiana*, Rehd., not Blume). Large shrub: lvs. usually obovate, sometimes elliptic, broadly cuneate at the base, abruptly acuminate, serrulate, 2–5 in. long and  $1\frac{1}{2}$ – $2\frac{1}{2}$  in. broad: cymes long-stalked, rather dense and many-fl.: fr. pink, deeply 4-lobed,  $\frac{1}{2}$  in. across; aril orange, usually closed. June; fr. Sept. Japan. Gt. 53, p. 31. S.T.S. 1:62. F.E. 31:125. Var. *calocarpa*, Koehne. Fr. bright carmine. Var. *Koehneana*, Loes. Lvs. hairy on the veins below. Cent. China.

GG. Petioles usually a third to a fourth as long as the lf., lvs. abruptly long-acuminate: fr. pale yellowish or pinkish white.

13. *Bungeana*, Maxim. Shrub, to 15 ft., with slender branches: lvs. slender-petioled, ovate-elliptic or elliptic-lanceolate, long-acuminate, finely serrate, 2–4 in. long: fls. in rather few-fl. but numerous cymes: fr. deeply 4-lobed and 4-angled; seeds white or pinkish, with orange aril. June: fr. Sept., Oct. China, Man-



churia, M.D.G. 1899:569.—Very attractive with its rather large, profusely produced frs., remaining a long time on the branches. Var. *semipersistens*, Schneid. (*E. Hamiltoniana* var. *semipersistens*, Rehd. *E. Sieboldiana*, Hort., not Blume). Lvs. elliptic, long-acuminate, half-evergreen, keeping its bright green foliage S. until mid-winter: fr. bright pink, usually sparingly produced and ripening very late.

AA. *Foliage evergreen or half-evergreen (see also the preceding var.).*

B. *Lvs. rather thin, half-evergreen.*

14. *pätens*, Rehd. (*E. kiautschowica* var. *pätens*, Loes. *E. Sieboldiana*, Hort., not Blume). Spreading shrub, to 10 ft., the lower branches sometimes procumbent and rooting; branchlets obscurely 4-angled, minutely warty: lvs. elliptic to elliptic-oblong, rarely obovate-oblong, acute, cuneate at the base, crenately serrulate, bright green above: cymes 2-3 in. across, loose, slender-peduncled: fr. subglobose, pink; seed pinkish brown, covered entirely by the orange aril. Aug., Sept.; fr. Oct., Nov. Cent. China. S.T.S. 1:64.—Hardy as far north as N. Y., in sheltered positions to Mass. One of the best shrubs for winter-effect on account of its abundant late-ripening frs. and the handsome foliage remaining on the branches until spring except when destroyed by severe frost.

BB. *Lvs. thickish, evergreen.*

15. *japónica*, Linn. Upright shrub, to 8 ft., with smooth and slightly quadrangular or striped branches: lvs. obovate to narrow-elliptic, cuneate at

1467. *Evonymus radicans*.

the base, acute or obtuse, obtusely serrate, shining above,  $1\frac{1}{2}$ - $2\frac{1}{2}$  in. long: fls. greenish white, 4-merous, in slender-peduncled, 5- to many-fl. cymes: caps. depressed, globose, smooth, pink. June, July; fr. Oct. S. Japan. S.I.F. 2:39. B.R. 30:6.—A very variable species. Var. *macrophylla*, Sieb. (var. *robusta*, Hort.). Lvs. oval, large,  $2\frac{1}{2}$ -3 in. long. Var. *microphylla*, Sieb. (*E. pulchella*, Hort. *Eurya microphylla*, Hort.). Lvs. small, narrow-oblong or oblong-lanceolate. Var. *columnaris*, Carr. (var. *pyramidalis*, Hort.). Of upright, columnar habit: lvs. broadly oval. There are many varieties with variegated lvs.; some of the best are the following: Var. *argenteo-variegata*, Regel. Lvs. edged and marked white. Var. *aureo-variegata*, Regel. Lvs. blotched yellow. Lowe, 49. Var. *albo-marginata*, Hort. Lvs. with white, rather narrow margins. Var. *medio-picta*, Hort. Lvs. with a yellow blotch in the middle. Var. *pallens*, Carr. (var. *flavescens*, Hort.). Lvs. pale yellow when young; similar is var. *aurea*, Hort., but the yellow is brighter and changes more quickly to green. Var. *viridi-variegata*, Hort. (var. *Duc d'Anjou*, Hort.). Lvs. large, bright green, variegated with yellow and green in the middle. Var. *aureo-marginata*, Hort. Lvs. edged yellow. F.E. 16:436; 29:815.

16. *radicans*, Sieb. (*E. japonica* var. *radicans*, Regel. *E. repens*, Hort.). Figs. 1466, 1467. Low, procumbent shrub, with often trailing and rooting or climbing branches, climbing sometimes to 20 ft. high: branches terete, densely and minutely warty: lvs. roundish to elliptic-oval, rounded or narrowed at the base, crenately serrate, usually dull green above, with whitish

veins,  $\frac{1}{2}$ -2 in. long: fls. and fr. similar to the former, but fr. generally of paler color. June, July; fr. Oct. N. and Cent. Japan. R.H. 1885, p. 295. G.C. II. 20:793. M.D. 1906, p. 219.—Closely allied to the former, and considered by most botanists as a variety; also very variable. Var. *Carrièrei*, Nichols. (*E. Carrièrei*, Vauv.). Low shrub, with ascending and spreading branches: lvs. oblong-elliptic, about  $1\frac{1}{2}$  in. long, somewhat shining. G.W. 8, p. 16. Var. *argenteo-marginata*, Rehd. Lvs. bordered white. Var. *roseo-marginata*, Rehd. Lvs. bordered pinkish. Var. *reticulata*, Rehd. (var. *picta*, Hort., var. *argenteo-variegata*, Hort. *E. gracilis*, Sieb.). Lvs. marked white along the veins. R.H. 1876, p. 354; 1878, p. 135. G.W. 1, p. 475. A.G. 19:37. Var. *minima*, Simon-Louis (*E. kewensis*, Hort.). Lvs. marked like those of the preceding variety but smaller,  $\frac{1}{4}$ - $\frac{1}{2}$  in. long.

Var. *végeta*, Rehd. Low spreading shrub, to 5 ft., usually with a few prostrate rooting branches at the base, and climbing high, if planted against a wall: lvs. broadly oval or almost suborbicular, acutish or obtusish, crenately serrulate,  $1\frac{1}{4}$  in. long, those of the rooting branchlets smaller and thinner and generally ovate. Japan. S.T.S. 1:65. M.D.G. 1908:13.—Handsome and hardy shrub; the frs. appear in great profusion and remain on the branches a long time. Var. *acuta*, Rehd. (*E. japonica* var. *acuta*, Rehd.). Rooting and climbing: lvs. elliptic or ovate-elliptic, acute or short-acuminate, serrulate, with the veins below slightly elevated. Cent. China.

*E. Aquifolium*, Loes. & Rehd. Evergreen shrub, to 10 ft.: lvs. coriaceous, nearly sessile, ovate to ovate-oblong, spiny sinuate-dentate: fr. 4-lobed, usually solitary. W. China. One of the most striking species on account of its holly-like lvs.—*E. echinata*, Wall. Usually creeping or climbing, with rooting branches: lvs. ovate-lanceolate: fr. spiny. Himalayas. B.M. 2767.—*E. fimbriata*, Hort., not Wall.—*E. pendula*.—*E. grandiflora*, Wall. Shrub, to 12 ft.: lvs. obovate or obovate-oblong, finely and acutely serrate: fls. white  $\frac{1}{2}$  in. across: fr. globose, yellow; aril scarlet. Himalayas, W. China.—*E. Hamiltoniana*, Wall. Allied to *E. Maackii*. Small tree: lvs. oblong-lanceolate, acuminate, finely and irregularly serrulate,  $2\frac{1}{2}$ -4 in. long: anthers yellow: fr. pink, turbinate, 4-lobed. Himalayas. Probably not in cult.; the plant cult. under this name is *E. Maackii*.—*E. lanceifolia*, Loes. Allied to *E. hians*. Shrub or tree, to 30 ft.: lvs. firm at maturity, lanceolate to elliptic-oblong, crenately serrulate, 3-6 in. long: anthers purple: fr. 4-lobed, pale; aril orange, open at the apex; seed crimson. Cent. and W. China.—*E. macroptera*, Rupr. Allied to *E. latifolia*. Lvs. obovate or obovate-oblong, cuneate at the base: cymes many-fl. fr. with 4 narrow wings  $\frac{1}{2}$ - $\frac{3}{4}$  in. long. Japan. N. E. Asia. I.T. 6:121. Hardy.—*E. occidentalis*, Nutt. Shrub, to 15 ft.: winter-buds rather large: lvs. ovate or elliptic-lanceolate, irregularly serrulate: fls. 5-merous, purple: fr. slightly lobed. Ore., Calif.—*E. oxyphylla*, Miq. Shrub or small tree: lvs. ovate or obovate, acuminate, rather large, serrulate: fls. 5-merous, purple or whitish: fr. globose. Japan.—*E. pendula*, Wall. (*E. fimbriata*, Hort.). Evergreen, small tree, with pendulous branchlets: lvs. oblong-lanceolate, sharply serrate, shining, 3-6 in. long: fr. with 4 tapering wings. P.F.G. 2:55. F.S. 7, p. 71.—*E. planipes*, Koehne. Allied to *E. latifolia*. Lvs. cuneate at the base; petioles flat, not grooved: fr. acutely 5-angled, scarcely winged. Japan. M.D. 1906, p. 62. Gt. 53, p. 29.—*E. sacchalnensis*, Maxim. Allied to *E. latifolia*. Lvs. ovate-oblong, crenate-serrulate: cymes very long-peduncled; fls. purple: fr. distinctly winged, convex at the apex. N. E. Asia.—*E. Sargentiana*, Loes. & Rehd. Evergreen shrub: lvs. obovate to oblong-obovate, abruptly acuminate, remotely crenate-serrate,  $2\frac{1}{2}$ -3 in. long: fr. oblong-obovoid, 4-angled. W. China.—*E. Semenovi*, Regel & Herd. Allied to *E. europaea*. Small shrub: lvs. lanceolate, serrulate: cymes usually 3-fl. fr. 4-lobed with obtuse lobes. Turkestan.—*E. semiserrata*, Koehne. Allied to *E. Maackii*. Lvs. oblong or oblong-lanceolate, crenate-serrate, 2-5 in. long: fr. light pink; aril orange, open, with the blood-red seed almost half exposed. Japan.—*E. Sieboldiana*, Blume. Allied to *E. Maackii*. Lvs. slender-petioled, elliptic to oblong, acuminate, serrulate: fr. not lobed, strongly 4-ribbed. Japan. M.D. 1906, p. 62. Not in cult.; the plants cult. under this name belong to *E. yedoensis*, *E. patens* or *E. Bungeana* var. *semipersistens*.

ALFRED REHDER.

**EXACUM** (classical name, of no significance to these plants). *Gentianaceæ*. Herbs treated either as annuals or biennials or perennials, with flowers of white, lilac, blue or dark purplish blue, cultivated in a very few greenhouses.

Very rarely suffrutescent: dwarf or tall and paniculate-branching: lvs. sessile, clasping or short-stalked, ovate or lanceolate, mostly 3-5-nerved: fls. small or attaining 2 in. across, rotate, pedicelled or not, in forking cymes,



calyx 4-5-parted, the segms. keeled, winged or flat and 3-nerved; corolla-lobes 4 or 5, ovate or oblong, twisted; stamens 4 or 5, attached to the throat, with very short filaments, the anthers opening by apical pores that finally enlarge nearly to the base: fr. a globose 2-valved caps.—Species about 30, in Trop. and Subtrop. Asia, Malaysia, Trop. Afr., Socotra.

Plants of *E. affine* flower in summer. If specimens in 5-inch pots are desired, sow in March of the same year; for larger specimens, sow in August of the preceding year. The plants must be kept in a cool but not draughty greenhouse or frame in summer, and shaded from fierce sunlight. They usually are given warmhouse conditions.

A. *Lvs. with stalks often ½ in. long.*

**affine**, Balf. St. cylindrical, 1-2 ft. high, much branched from the base: lvs. 1-1½ in. long, elliptic-ovate, faintly 3-5-nerved: sepals with a broad wing on the back; corolla 6-9 lines wide; lobes almost rounded. Socotra. B.M. 6824. A.F. 13:1104. Gng. 6:229. R.H. 1883, p. 512. Gt. 32:1108. G.C. II. 21:605.

AA. *Lvs. nearly or quite stalkless.*

B. *Corolla-lobes rounded.*

**zeylânicum**, Roxbg. Annual: st. 4-sided, branched only above: lvs. becoming 3 in. long, strongly 3-nerved, elliptic-oblong, acuminate, narrower than in *E. affine*, and tapering: fls. blue, 1½ in. across, in terminal, leafy corymbs; sepals broadly winged; corolla-lobes obovate, obtuse. Ceylon. B.M. 4423 (sky-blue, with a dash of purple). R.H. 1859, p. 238. J.F. 1:43. H.F. II. 2:60.

BB. *Corolla-lobes usually tapering to a point.*

**macrânthum**, Arn. (*E. zeylânicum* var. *macrânthum*). Fig. 1468. St. cylindrical, slightly branched: lvs. as in *E. zeylânicum*, though perhaps more variable from base to summit: fls. purplish blue, 2 in. across. In both species there is a narrow ring of yellow at the mouth, to which the conspicuous clusters of stamens are attached. Ceylon. B.M. 4771 (deep purplish blue). G.C. III. 15:331. R.H. 1911, p. 31. J.H. III. 42:182; 51:259.—The best of the genus. The rich, dark blue is worth striving for.

**Förbesii**, Balf. Bushy and shrubby: lvs. triangular or ovate-lanceolate, 1½ in. across at base: fls. upwards of ½ in. across, purple or violet-purple, in terminal racemes, the anthers yellow and prominent. Socotra. G.C. III. 31:93. G. 23:679. G.W. 6, p. 290. G.M. 45:81.—A good plant for intermediate temperature, blooming well in a 6-in. pot.

WILHELM MILLER.  
L. H. B.†

**EXCÆCÀRIA** (from Latin *excæcæres*, referring to its effect on the eyes). *Euphorbiacæ*. Tropical trees or shrubs with poisonous milky juice rarely cultivated for ornament.

Glabrous: lvs. alternate or opposite, usually entire (or crenate to serrate): infl. usually in axillary spikes; fls. dioecious or monœcious; calyx imbricate; sepals 2-3, free or connate at base; petals none; stamens 2-3, erect in bud; filaments free; ovary 3-celled, 3-ovuled: seed not canaliculate.—About 25 species in the Old World tropics. Related to *Stillingia* and *Sapium*.

**bicolor**, Hassk. (*Crôton bicolor*, Hort.), with the opposite lvs. red beneath is sometimes cult. for ornament in European greenhouses or outdoors in the tropics. *E. Agallocha*, Linn., **AGALLOCHA**, **BLINDING TREE**, **RIVER POISON**, etc., with alternate lvs., is a well-known poisonous tree of the coasts of S. Asia. J. B. S. NORTON.

**EXHIBITIONS** of horticultural products have been both a concomitant and a stimulant of progress in American horticulture. The great international expositions ushered in by the Centennial Celebration of 1876 at Philadelphia, through the opportunities afforded

for the comparison of products, have been the means of unusual education in the identification of varieties. No amount of descriptive literature can compare with this method of acquiring accuracy in naming and describing fruits, flowers, and vegetables.

The interest in these great exhibitions by the growers of soil products indicates a peculiarity of this class of producers. They are the ones to reap the smallest direct result, and yet they have always been willing to give freely of their productions to swell the volume of these great fairs and emphasize the possibilities of the localities in which they lived. They would even pay their own expenses to attend these fairs and explain to the world how they succeeded in growing such attractive things. No producers of the useful things of life will compare with the horticulturist in willingness to impart to his fellow the secrets of his



1468. *Exacum macranthum* (× ½).

success. National, state, district and township exhibitions have thus become great methods of disseminating information of value to the horticulturist—educators of the people.

For many years the most prominent feature of fruit shows was the nomenclature of the exhibit. In vegetables it was the size of the specimen, in flowers the number of sorts and their tasteful arrangement. People flocked together to identify varieties, to see the big things and to satisfy esthetic longing. Later the art in exhibiting products was given more attention, and wonderful creations have resulted from combinations and artistic arrangement.

Exhibitions have been the favorite opportunities of bringing out new and valuable sorts and often the usefulness of a variety dates from some particular fair at which it was prominently displayed. Notable instances of this were the grapefruit, which was shown in quantity for the first time at the great New Orleans exhibition; the Kieffer pear, which was a distinguishing

feature of a meeting of the American Pomological Society in Philadelphia; the Niagara grape, which was featured at a winter meeting of New York fruit-growers. Striking examples of this are found in the annals of floral exhibits. The dissemination of the most delightful strains of carnations and chrysanthemums dates from some particular fair or "show."

In recent years, the experiment stations of the country have added greatly to their usefulness in preparing technical exhibits for winter exhibitions of horticultural societies, helping their progressive work, through graphic illustrations of the results which they have obtained in growing products under varying conditions, and having in mind the demonstration of problems of value to growers.

One of the most recent developments has been the opportunity given students of agricultural colleges of putting into practice the knowledge of varieties which they have acquired in the naming of various collections as a competitive drill.

The products of glass farming have been brought into prominence through national, state, and local horticultural societies in their annual exhibitions, and the great seedhouses of the country have used these exhibitions as avenues for the dissemination of new and valuable varieties. Nurserymen have successfully utilized exhibitions in publishing to the world not only their new creations but their methods of propagation.

During recent years the initiative of the American Pomological Society has been followed by many other organizations in perfecting a scale of points for judging exhibits of horticultural products. By this means, more accurate methods have come into use at our great fairs, and, in the hands of experts, the judgments rendered have been far more satisfactory and useful.

A most important result of exhibitions has been the acquirement of the knowledge that varieties vary a great deal as the result of climatic conditions and differences in soil, and it is found as an outcome of these comparisons that certain localities are especially adapted to certain varieties in which they reach their highest perfection. This is illustrated in the Rocky Ford cantaloupe, the Albemarle Pippin, certain strains of carnations, and head lettuce. The facts brought out through these comparative exhibits are leading to scientific investigations concerning the conditions which produce these variations which will be of great use to the producers, as well as deep interest to the scientist.

Commercial problems are finding their solution through exhibitions which illustrate styles of packing and kinds of packages and general attractiveness in presenting the products to the consumer. Already these exhibitions have brought to the attention of law-makers the importance of uniform legal requisitions concerning methods of marketing throughout the land.

The most recent development of values resulting from horticultural exhibits of great utility has been the carrying of the methods of comparison instituted there to the growing of products on the farm and in the garden, orchard and vineyard, thus awakening a deeper interest in the factors which affect the production of horticultural creations and a recognition of the uses of these creations in landscape art. Thus an abiding interest has been awakened in the development of the science as well as the art of horticulture through the adoption of new and improved methods of production and widening the usefulness of the products.

CHARLES W. GARFIELD.

### Exhibitions of plants and flowers.

Floral exhibitions undoubtedly had their origin, in part, in the desire to display publicly the products of one's skill and to attain renown and a position of pre-

eminence among one's fellows by successful rivalry and the demonstration of superior cultural abilities. But, in addition to this factor of self-interest and excusable pride, the laudable spirit that seeks to promote a taste for ornamental gardening and floriculture in general, and to acquire knowledge and diffuse information concerning it, has from the first been a powerful incentive; and it cannot be questioned that public floral exhibitions have contributed most substantially to the advancement of refinement and good taste and exercised a potent and salutary influence on the domestic life, health, morals and happiness of the respective communities in which they have been held.

Exhibitions of plants and flowers, as usually conducted, may be broadly divided into two classes: (1) Those whose particular purpose is to demonstrate advancement in cultural methods and exploit new and improved varieties and which are calculated to interest primarily the trade and professional gardeners. The unavoidably monotonous system of staging exhibits in such an affair is well-known. To the general public, its salient points are scarcely apparent, and the elements which often appeal most strongly to the professional are all but lost on the average visitor. It has been demonstrated over and over again, that as an attraction for the people who look for entertainment in a show and are willing to pay for the privilege of seeing it, this sort of an array is fundamentally deficient. (2) If public support is sought, the first requisite is that the public fancy be considered and catered to and the character and scope of the exhibition be such as the people care to take an interest in. A practical demonstration of the uses of flowers and plants and their appropriate arrangement for the various events of social or home life will invariably excite curiosity and interest when prim rows of dozens and fifties of competitive blooms will often fail to awaken appreciative response. It is to be regretted that the so-called retail florist trade has so long been neglectful of its duty and its opportunity as a supporter of and participator in the flower shows. Without the assistance and coöperation of the experienced decorator and artistic worker in flowers, these affairs must invariably fall short of their mission and their educational possibilities. How to overcome the indifference of this branch of commercial floriculture toward these enterprises which should bring immeasurable benefit to their industry is one of the serious problems for which those who believe in flower shows must find a solution before the ideal of what a horticultural exhibition should be can be realized.

The direct cost of installing a public flower show is no small matter and many a commendable enterprise has failed through lack of sufficient income properly to finance it. Rent of hall, music, advertising, premiums, tables, vases, management, labor and a host of incidentals must be taken carefully into consideration, and to launch any such project, under conditions now existing, without some form of endowment, subscription, guaranty or other definite and reliable resource, apart from the uncertain sale of admission tickets, is merely tempting fate and taking chances on misfortune.

The grouping of pot-plants for effect calls for talents of a high order. Arrangements of this kind, which are so indispensable in giving character to a flower show that will appeal to the artistic eye as effective studies in form and color, are indeed rarely seen. Two almost universal faults are excessive formality in contour of the group and overcrowding of material, and it not infrequently happens that when a studied effort has been made for irregularity of outline, the result is still unnatural and often almost grotesque. The promiscuous mixing together of incongruous subjects, as, for example, hardy conifers, tropical palms, geraniums and orchids in one group, is all too common. A taste-



ful grouping of plants of congenial character will always inspire enthusiastic admiration among cultured and discriminating visitors, and if the flower pots are hidden from sight by moss or other natural material, the pleasing effect will usually be further enhanced, particularly in the case of plants which might naturally grow together.

It is well known among flower-growers that the time of day, the condition of development, and other factors have a considerable influence on the keeping qualities of their product. A sojourn in a cool, dark room over night with stems deeply immersed in fresh water is really an essential with many flowers if they are to remain for any time in good condition in the atmosphere of an exhibition hall. Nothing is more disfiguring in a flower show than a lot of wilted blooms. Much depends upon the style of vases used. Vases spreading at the top and narrowing to a point at the bottom, while perhaps the most graceful in form, are very destructive to flowers, the small quantity of water available at the base of the stems soon becoming heated and impure. Constant changing of water, and keeping down the temperature of the hall will help to preserve the exhibits. Table baskets and dinner-table exhibits generally, as often arranged, scarcely last until the first visitors are admitted. Only those in which the flower-receptacles are such as contain water can give any satisfaction in a flower show.

The background against which flowers are shown, as the color and material of the walls, covering of tables, and so on, has much to do with the general impression, favorable or otherwise, on the visitor. Green—the natural foliage green—is unquestionably the “middle of the road” background hue for flowers. Back of and beyond green, the neutral grays and browns, and sometimes pure white, are pleasing and satisfactory. It is worth noting that, while terra-cotta or flower-pot tones are usually beyond reproach as a background for living green, yet a brick wall is a disheartening condition for this purpose, showing that it is not alone color which decides the appropriateness of exhibition hall walls or drapery.

The number of specimens usually shown in cut-flower classes depends upon the kind of flowers, the ingenuity of the schedule-makers, and the demands of the occasion. The more extensive and pretentious the exhibition, the larger should be the classes. Roses and carnations in half-dozens, for example, have little value in a large exhibition. Fifties and hundreds alone will impress the visitors. When individual blooms, or groups composed of individual varieties are displayed, much depends upon the taste shown in color-arrangement. This is especially important with such subjects as chrysanthemums, dahlias, gladioli and sweet peas, all of which afford wide scope for demonstration of taste in exquisite blending, contrasting and gradation of color-tones, qualities which should count for much in the final decisions of the judges. The question of the height of tables or platforms on which flowers are shown is one which should be carefully considered in planning an exhibition. There are flowers which should be looked down upon if their full beauty is to be seen. Others must arch overhead to display their graces, and there are many intermediate steps. As a rule, exhibition tables are set too high.

One main reason for the flower show being its educational value, the proper and legible labeling of species and varieties is essential. In no other respect are our exhibitions so deficient. A neat label, attached so it can be read without handling, and legible at a fair distance, is something rarely seen at a flower show, while obtrusive advertising cards or award cards frequently spoil the beauty of an otherwise creditable staging.

Competitive exhibitions properly conducted and entered into with the right spirit are, as before said,

calculated to accomplish much good for the art of horticulture. Emulation in a friendly contest for honors is a strong factor in the success of a show, but the kind of rivalry which stimulates jealousies, envenoms disappointment and incites to angry protests over judges' decisions, is one of the most mischievous elements that can intrude upon the scene. In order to discourage the protesting habit and minimize the demoralizing influence of questionable decisions, great care should be exercised always in the selection of competent, disinterested and impartial judges. Their names should be announced a sufficient time in advance so that every intending exhibitor may know who is to pass upon his exhibits.

It is now a generally established custom to inclose the name of an exhibitor in an envelope bearing only the class number, the identity of the exhibitor not to be disclosed until after the judging has been completed. Some very excellent systems of cards, record books, envelopes, and so on for this purpose have been devised and are in general use.

WM. J. STEWART.

#### Exhibition of fruits. Fig. 1469.

The educational value of carefully planned exhibitions of fruits can scarcely be overestimated. That this fact is appreciated in increasing measure each year is demonstrated by the growing number of such exhibitions that are being held throughout the country. Commercial fruit regions do much of their advertising by means of these annual affairs, and there are few towns or hamlets, however unpretentious, without their yearly fruit show promoted by the grange, the school, the church, or some other organization whose aim is progress in country affairs.

Foresight, with careful attention to details, is essential if the possibilities of an exhibition are to be developed to the utmost. The larger number of such events are held in the fall, since fall is Nature's harvest season for fruits. This means that preparation must begin in midsummer to insure the greatest measure of success. There are many things that the grower can do at this time to secure high-class fruit for exhibition purposes, and no other should be considered.

The best fruit is often found near the top of the tree, if thorough spraying has been done. It is the best because conditions there are most nearly ideal for its development. As the fruit increases in size and the weight upon the branches becomes greater, the side branches settle more closely together, while the top-most branches and those most nearly upright in habit of growth, always advantageously situated, have an increased opportunity to receive the abundance of air and sunlight so essential to normal and perfect fruit. Fruit on such branches invariably possesses the highest color of any on the tree, and color is of vital importance for the matter in hand. The color may be heightened and the size increased if the fruit is thinned until the specimens hang 6 inches or more apart. A branch may be headed back, and occasionally one may be removed entirely to the benefit of those remaining, if good judgment is used. This matter of thinning is of considerable importance in the securing of high-class exhibition fruit, whether the fruit be apple, orange, or grape.

The production of exhibition specimens by abnormal processes—as by ringing or girdling—is not allowable, unless for the express purpose of showing what can be accomplished by such practices: fruits produced by such means should not be shown in comparison or competition with specimens produced under recognized and standard methods.

The specimens should be allowed to remain attached to the parent plant as long as possible. The longer they remain thus, the more intense will be their color and the greater will be their size. Pears especially

increase very rapidly in size just before maturity. The picking should be done by hand and with the greatest care. Many an excellent specimen has been ruined by careless handling. The stems should remain intact. The picker should remove, not a sufficient number of specimens to meet the requirements under which the exhibit is held, but many times that number. A bushel, or even a barrel, of seemingly high-class fruit will often yield after the most rigid inspection but a single plate of perfect specimens.

The actual selection of the specimens to be exhibited is the most difficult and perplexing problem connected with this work. Fundamental to a successful solution of this problem is a thorough knowledge of the variety, an intimate acquaintance with the characters of a normal specimen, and a fine discrimination in the balancing of these characters and in the attaching of the proper values to each.

The external factors that must be considered are size, form, color, uniformity, and freedom from blemishes. The criteria to be used in the inspection of the



1469. Good exhibition plates of apples.

first three factors are the attributes of a typical normal specimen of the variety when grown under conditions favorable to its development. The largest apple is not necessarily the best; in fact, great size is usually obtained at the expense of some equally desirable factor. The extra-large specimen is always an abnormal specimen and, as such, is not to be sought. It is in regard to this factor, however, that many exhibitors make their first mistake. A safe rule to follow is to choose the specimen combining large size with the highest color. This rule will almost invariably eliminate the abnormally large specimen.

The form of the specimen should be true to the prevailing type of the section in which it grows. Occasionally different sections produce different types, as, for example, the New York and the Oregon-grown Esopus. One is as true to type as the other, but the two types should never be mixed on the same plate or in the same package.

Of all external factors, none exceeds in importance the quality of color. High color always sets up in the mind the presumption of excellence; the higher the color, the more pronounced seems to be the presumption, though it is not always justified. Color is also an indication of fitness, of approaching maturity, but a specimen maturing far in advance of its companions should be regarded with suspicion lest it harbor a worm that may emerge at a most inopportune moment if it escapes detection. Polishing a specimen to enhance its color should not be practised. The operation removes the bloom, which is more beautiful than the high polish because it is natural.

The factor of uniformity implies that one specimen should resemble every other specimen as nearly as

it is possible for the human eye and hand to make it. It is a literal application of the expression "as nearly alike as two peas." A single specimen of highest order should not be retained for a moment if its companions are on a more nearly equal though somewhat lower plane of excellence.

Freedom from blemishes implies that the specimen is perfectly sound. A blemish may be anything from a bruise, a broken stem, or a stem puncture to a scale-mark or scab-spot. In an age when knowledge of preventive measures is so widespread and so accessible, evidence of injury from insect or disease should completely exclude a specimen from consideration. Needless to say, the condition of the specimen should be as sound as the season permits, showing neither flabbiness nor physiological disintegration of the tissues.

The factor of quality is also worthy of consideration, though it is of more importance in case of collections in which one variety is exhibited against another than in case of different specimens of the same variety. Granted that size, form, and color are normal, the factor of quality will usually take care of itself.

There is need of a standardization of requirements under which fruit exhibits are held. These requirements should be based on trueness to type and all that the term implies, and the values attached to the different characters concerned should be fixed in proportion to their relative importance for the purpose in hand. Such a statement appears in the following score-card for apples, which is in somewhat common use in the eastern United States:

|                             |     |
|-----------------------------|-----|
| Size.....                   | 10  |
| Form.....                   | 10  |
| Color.....                  | 20  |
| Uniformity.....             | 15  |
| Quality.....                | 20  |
| Freedom from blemishes..... | 25  |
| Total.....                  | 100 |

This score-card may be no more nearly correct than many others, but it represents a concerted effort to fix a satisfactory standard. There should be more of this work for every fruit.

Score-cards for other fruits have been adopted by particular exhibitions and institutions as the following for grapes:

|                           |     |
|---------------------------|-----|
| Form of bunch.....        | 10  |
| Size of bunch.....        | 15  |
| Size of berry.....        | 10  |
| Color.....                | 10  |
| Bloom.....                | 5   |
| Freedom from blemish..... | 20  |
| Flavor.....               | 25  |
| Firmness.....             | 5   |
| Total.....                | 100 |

There is need also of a general agreement as to the number of specimens to be exhibited on a single plate. The rules now governing all large exhibitions in the East require that plates of apples, peaches, pears, and quinces shall contain five specimens; of the smaller fruits a sufficient number to fill a 6-inch plate; and of grapes three clusters.

Fruit to be sent away for exhibition should be carefully packed. A bushel box is a satisfactory package for this purpose, being better than a larger package in which the pressure on the fruit is greater. Each specimen should be wrapped, and the box should be well lined with excelsior or other material. Extra specimens should be included to replace those that are injured in any way.

In selecting the room in which the exhibition is to be held and in setting up the fruit, one prime factor should always be kept in mind—there should be nothing in the room to detract in any way attention from the fruit. To this end, the walls should be plain or



even bare. The decorations should be few, simple, and in harmony with the colors of the fruit, that is, substantial and perfectly plain. Red and white make a very effective combination for ceiling decorations, if decorations seem desirable. Plain white is best for draping the tables. If electric lights are present, the shades may be covered with red crepe paper. This will give a quiet and subdued effect to the room when the lights are on and will be in keeping with the other decorations. The tables should be covered with a material that will throw the fruit into sharp relief without attracting attention to the covering itself. Oatmeal paper, gray-green in color, answers these specifications very well. Six- or eight-inch papyrus plates are better than smooth-pressed paper plates or the wooden plates and need no covering.

The fruit should be set up in such a way that a mass effect is produced, which impresses the observer with the fruit and with nothing else. This means that all the fruit must be on the same level. Shelves or tiers one above the other are not desirable. In other words, every detail should be subordinated to bringing out as sharply as possible the fruit that is on exhibition. It is therefore highly undesirable to place labels on the top of a specimen, as is so often done. The observer notes first of all a vast and meaningless sea of tags and after that perhaps the fruit. The label may be pinned into the plate in such a way that it is unnoticeable except on close inspection, when it can be plainly seen. A satisfactory label is a plain white card with three lines on it, the first for the variety name, the second for the name of the exhibitor when permissible, and the third for the section from which the fruit comes. If the exhibit is to attain its highest educational value, the varieties must be correctly named and the names correctly spelled.

In general, it will be better to group varieties together in order that comparisons may be made between the different plates. By so doing an opportunity is afforded for a study of variations of fruits grown under different methods of management and in different sections in which climatic conditions are unlike. Occasionally grouping by sections may be desirable, especially if there are general and marked contrasts between the same varieties as grown in different sections.

The plates should not be crowded on the tables lest the eye become confused and the fruit appear to be a jumble of specimens lacking orderly arrangement. The background of paper covering the table should be visible between every plate, not in order that it may be seen, but because it will serve to set off each plate as a separate unit meriting for the moment undivided attention.

Finally, the specimens should be arranged in the same order on every plate and the plates should be in perfect alignment in every direction. Not only this, but when the angles formed by the specimens on a plate are right angles, as in case of apples with four specimens on the bottom and one on top at the center, the angles should assume the same direction as those of the table top.

The same rules hold for the selection of fruit for barrels, boxes, or other packages as for single plates. The arrangement should be such as to bring out the fruit and subordinate the package, exemplified in the bank of boxed fruit.

C. S. WILSON.

#### Exhibition of vegetables.

The exhibition of vegetables is usually an important feature at county, district and state fairs, and often at farmers' institutes, horticultural society meetings and conventions of vegetable-growers. Vegetables are also likely to occupy a prominent place in county or state exhibits at state, national or international shows or expositions. The exhibits may be

competitive or non-competitive. In the former case they are usually made by the individual producers; in the latter case, they are more often made by a company, development bureau, or an institution, primarily for advertising or educational purposes. In either case, they have some educational value, even the individual exhibitor learning by comparison of his exhibit with others.

Competitive exhibits are of two kinds: (1) those in which the exhibit consists of a specified quantity of a given kind of vegetable, e.g., one dozen table carrots, and (2) those which consist of a collection or display of vegetables alone, or combined with other products of the soil. Vegetables in exhibits that are designed primarily for advertising or educational purposes usually form only a part of some general exhibit.

In making exhibits in competition with the products of other exhibitors, the successful competitors are usually those who give most careful attention to the selection, preparation and installation of their exhibits.

In making single exhibits, care should be taken to show the exact quantity or number of specimens mentioned in the entry list. At county fairs, especially, exhibitors are prone to make their "pecks" or "half-pecks" exceedingly small if exhibition material is scarce or time limited. The present tendency is to specify in premium lists the number of specimens, whenever this is feasible, rather than a given bulk, and to disqualify exhibits which do not conform to the requirement in this respect.

In selecting specimens which are to form a single exhibit, very few inexperienced persons appreciate the importance of uniformity in size and type. Sometimes an exhibit will be very creditable with the exception of one or two specimens. These odd specimens may be very good as individuals, but differ much in size or type from the other specimens and detract seriously from the value of the exhibit.

Vegetables on exhibition should be clean. Root crops should usually be washed. Onions are best prepared by careful brushing. Cauliflower and cabbage should be carefully trimmed; tomatoes, eggplant and melons wiped with a moist cloth. Celery, lettuce and endive should be gathered with the roots on, carefully washed, and displayed with the roots immersed in water so that the plants will not wilt.

The arrangement of the specimens in a single exhibit is also important. When the judging is by comparison, only those exhibits which attract the immediate attention of the judge will be likely to receive careful consideration if the number of entries is at all large. Under such conditions it often happens that the arrangement of the specimens is fully as effective in securing careful examination of the exhibit as is the perfection of the specimens themselves. In the case of many kinds of vegetables, if the number of specimens is not over one dozen, the exhibit can often be displayed very advantageously on plates or trays. If one peck or one-half bushel is prescribed, splint baskets are desirable receptacles. In any case, the appearance of the exhibition room will be greatly enhanced if the receptacles used for all the single exhibits are as uniform as the nature of the products will permit. With this end in view, it is desirable that the management furnish the receptacles.

In the exhibitions held by thoroughly established organizations which give special attention to vegetables, there is likely to be a recognized appropriate method of disposing the specimens of each kind of vegetable in or upon a given type of receptacle. At county fairs, each exhibitor usually exercises his own ingenuity both as to type of receptacle and method of arrangement; and the result is at least lacking in monotony. To show at its best, every exhibit should be characterized by neatness and simplicity in arrangement.

The principles involved in making a general display

including a number of different kinds of vegetables are much the same as for making individual exhibits: the specimens must be selected with care, thoroughly cleaned, and attractively arranged. In addition, the character and arrangement of the exhibit as a whole must be given careful attention. Very often, general displays fail in effectiveness because the number of specimens of each kind is too limited or the different specimens of the same kind are too much scattered through the exhibit, instead of being massed so that they would make an impression upon the spectator. Exhibitors are likewise inclined to weaken the character of an exhibit by introducing a few specimens each of numerous species or varieties that are little known or of small commercial importance. These are often scattered promiscuously through the exhibit and detract the attention from the main features. The general effect of the exhibit as a whole is of prime importance.

Non-competitive exhibits of vegetables for advertising or educational purposes are usually confined to a comparatively few species or varieties in a given exhibit. In exhibits made for advertising some particular section or locality, the vegetables are likely to be merely a minor part of a general exhibit, and to consist of specimens likely to attract attention by reason of their unusual size rather than any other noteworthy feature.

Certain kinds of vegetables lend themselves readily to the making of purely educational exhibits to illustrate the influence of differences in soil treatment or cultural methods or the results of treatment for plant diseases. In such exhibits, it is unwise to attempt to illustrate the results of many different treatments in one exhibit. It is much better to concentrate the attention of the spectator upon one or two striking results than to try to demonstrate a number of minor variations. If the latter method is attempted, the effectiveness of the display will be destroyed; for the passing observer recognizes only striking contrasts. For example, if a number of different fertilizer treatments have been employed, and all give marked results as compared with the check (the unfertilized plat), it would be unwise in an educational exhibit to attempt to illustrate the proportionate yields from all the treatments. Only the yields of the check plat and one or two others should be given. The casual observer can see three things at a glance, but not a dozen.

In making an educational exhibit to represent differences in yields, the quantities shown should represent yields from definite areas of ground, such as one-hundredth or one-thousandth of an acre; and the specimens should be arranged in such a way that the differences will be most apparent.

In arranging an exhibit to illustrate the results of treatment for plant diseases, e.g., treatment of seed potatoes for the control of scab, it is better to sort the specimens from each plat into "diseased" and "sound," and to display them in two contiguous piles, than to mix the diseased and sound promiscuously in the same pile.

The educational value of all exhibits, whether competitive or non-competitive, is greatly enhanced if careful attention is given to the proper labeling of the various parts or features of each exhibit. Conspicuous legends of a concise nature are of some benefit to even the casual observer, and are greatly appreciated by the few who are specially interested in the particular exhibit or the matter it is designed to illustrate. JOHN W. LLOYD.

**EXÓCHORDA** (from *exo*, external, and *chorde*, a cord, referring to the chord belonging to the external part of the placenta on the ventral side of the carpels). *Rosaceæ*. PEARL-BUSH. Ornamental shrubs grown chiefly for the showy racemes of pure white flowers.

Deciduous: winter-buds conspicuous, with imbricate

scales: lvs. alternate, petioled, entire or serrate: fls. in terminal racemes, polygamo-dioecious; calyx-tube broadly turbinate; calyx-lobes and petals 5; stamens 15–25, at the margin of a large disk, short; carpels 5, connate; styles distinct: fr. a 5-angled, deeply furrowed caps., separating into 5 bony, 1–2-seeded carpels; seeds winged.—Three species in China and Turkestan.

The pearl-bushes are slender-branched shrubs with rather thin bright green foliage and very showy white flowers. *E. Korolkowii* is hardy North. *E. racemosa* and *E. Giraldii* are at least hardy as far north as Massachusetts. They grow best in a well-drained loamy soil and in a sunny position. Propagation is by seeds, or by softwood cuttings taken from forced plants; taken in summer from the open they root slowly and with difficulty; also by layering.

**racemosa**, Rehd. (*E. grandiflora*, Lindl. *Amelanchier racemosa*, Lindl.). Fig. 1470. Slender spreading shrub, to 10, rarely to 15 ft., glabrous: lvs. elliptic to elliptic-oblong or oblong-obovate, entire or on vigorous shoots serrate above the middle,  $1\frac{1}{2}$ – $2\frac{1}{2}$  in. long, whitish below; petioles about  $\frac{1}{2}$  in. long; racemes 6–10-fl.; fls. 2 in. across, pure white, short-stalked; petals roundish, clawed; stamens 15: fr. turbinate, about  $\frac{1}{2}$  in. long. April, May. China. B.M. 4795. F. S. 9:954. L.I. 11–12. Gt. 47: 1455. R.H. 1889, p. 128; 1896, p. 324, 325. J.H. III. 34:483; 53:285. G.C. II. 16:73; III. 7:613. Gn. 58, p. 315; 60, p. 232; 62, p. 161; 66, p. 141. A.F. 6:643. Gng. 5:97. F.E. 30:117; 31:971. G.M. 44:531. M.D.G. 1901:321; 1905: 254; 1906:561. G.W. 10, p. 430. H.F. 1867:250. Var. *prostrata*, Hort. A form with prostrate branches.—The species is among the showiest shrubs blooming in May.

**Giraldii**, Hesse (*E. racemosa* var. *Giraldii*, Rehd.). Similar to the preceding: lvs. oval or elliptic, entire, very rarely crenate-serrate; petiole about 1 in. long, usually red; fls. very short-stalked or nearly sessile; petals obovate, gradually narrowed into the claw, sometimes toothed; stamens 25–30. N.W. China. M.D.G. 1909:295. G.W. 16, p. 450. Var. **Wilsonii**, Rehd. (*E. racemosa* var. *Wilsonii*, Rehd.). Lvs. elliptic to oblong, occasionally serrate; petioles  $\frac{1}{2}$ – $\frac{3}{4}$  in. long, usually green: stamens 20–25. Cent. China.

**Korolkowii**, Lav. (*E. Albertii*, Regel. *E. grandiflora* var. *Albertii*, Aschers. & Graebn.). Upright, slender-branched shrub, to 12 ft., glabrous: lvs. oblong, to oblong-oblancoleate, obtuse or acute, gradually narrowed toward the base, entire, but the lvs. of the stronger shoots often serrate above the middle and at the base with 1 or few small narrow lobes,  $1\frac{1}{2}$ – $2\frac{1}{2}$  in. long; racemes 5–8-fl.; fls.  $1\frac{1}{2}$  in. across; petals narrowly obovate; stamens 25; caps.  $\frac{3}{4}$  in. long, ovoid, pointed. April, May. Turkestan. G.W. 16, p. 451. G. 31:505.—This is one of the earliest shrubs to burst into leaf in spring; it is of more upright habit and with



1470. *Exochorda racemosa* (×  $\frac{1}{3}$ )



darker and denser foliage than the preceding, but not so floriferous.

**macrántha**, Lemoine (*E. racemosa* × *E. Korolkóvii*). Similar to *E. racemosa*, but of more upright habit and more vigorous: lvs. generally obovate or oblong-obovate, bright green, entire on vigorous shoots crenate, 2-3 in. long: racemes 8-10-fld.; fls. 1¼-2 in. broad; petals obovate, narrowed into the claw; stamens about 20. April, May. Of garden origin. R.H. 1903, pp. 18, 64. M.D.G. 1902:484. G.W. 16:449.

**EXOGENIUM**: *Ipomæa*.

ALFRED REHDER.

**EXORRHIZA** (*exo*, out, outside, *rhiza*, root; alluding to the large aerial roots above the ground). *Palmæceæ*, tribe *Coccolineæ*. High-growing pinnate-leaved palm.

Stem or trunk straight, smooth, supported at the base by large aerial, spiny roots: lvs. large, pinnate. Allied to *Kentia*, but distinguished by the imbricate sepals of the staminate fls., the elongated subulate filaments of the stamens, by the roundish ovate sepals of the pistillate fls. and by the parietal ovule. In *Kentia* the ovule is basal and erect. Cult. as in *Kentia*. The following species flowered at Kew in 1901.

**Wendlandiána**, Becc. (*Kentia Exorrhiza*, Wendl.). Often more than 60 ft. high but in cult. reaching only 24 ft.: lvs. 10-12 ft. long; pinnæ alternately arranged, 1-2 in. from each other, becoming 4 ft. long and 2 in. broad, 8-10-nerved; spadix appearing below the lvs., enveloped in thick, coriaceous boat-shaped spathes; spadices 2, much longer than the spathes. Fiji Isls. B.M. 7797.

N. TAYLOR.†

**EXOSTÉMA** (name alludes to the exerted stamens). *Rubiaceæ*. Evergreen trees and shrubs of W. Indies and other parts of Trop. Amer., by some united with *Rustia*. There are upwards of 20 species. They are little known as warmhouse subjects, and the name does not appear in the trade. It is probable that the general treatment given *Cinchona* and similar things will apply to them. Lvs. opposite: fls. white, various in size and arrangement; corolla salver-form, the lobes 5 and spreading and narrow; stamens 5, inserted in the bottom of the corolla-tube, long-exserted; disk annular: fr. an oblong, cylindrical or club-shaped 2-valved caps. The fls. are commonly axillary or in terminal corymbs.

**EXPERIMENT STATIONS.** Every state of the Union, every island dependency of the United States, and every province of the Dominion of Canada has one experiment station for agriculture supported by public funds. A very few of the states have two stations, one being the regular federal agency in the state and the other being usually an institution established and maintained directly by the state and representing the movement that began before the passage of the federal experiment station act.

By the middle of the last century, the discussion for institutions or agencies to make experiments in agriculture was well under way. It was not till 1875, however, that any legislative body made an appropriation for the establishing of such an institution. This was in Connecticut. Other stations followed in several states, some of them under direct legislative enactment and others being organizations within colleges or college departments of agriculture. These movements were marked in North Carolina, New York, New Jersey, Ohio, Massachusetts, and other states. The movement in the United States for a national system of experiment stations took form in a bill for the purpose introduced into Congress in 1882 by Hon. C. C. Carpenter of Iowa. The bill finally to become a law was introduced in the House of Representatives by Hon. William H. Hatch of Missouri; this became law March 2, 1887, by the signature of President

Cleveland. It appropriates \$15,000 to each state for the purpose of establishing an agricultural experiment station, to be located at the land-grant college unless the state shall determine otherwise.

A second act, supplementing the Hatch Act, was approved March 16, 1906, by President Roosevelt, it having been introduced and carried to passage by Hon. Henry C. Adams, of Wisconsin. This appropriates \$15,000 to each state "for the more complete endowment and maintenance" of the stations, with the understanding and requirement that it shall support fundamental researches. About \$1,500,000 is therefore expended annually by the federal government for the maintenance of experiment stations in the forty-eight states, aside from similar grants for stations in Porto Rico and Hawaii, expenditures in the Philippines through the War Department, and in Alaska and Guam directly through the United States Department of Agriculture; and there is also a large and important expenditure in the Department of Agriculture itself, both for supervision and for investigation. The states also contribute heavily to the experiment station work. The total revenue in the United States for the year ended June 30, 1912 was \$4,068,240.09.

By law, reports are to be issued at least quarterly by the different experiment stations. These institutions are now issuing numerous bulletins, circulars and reports on an astonishing range of subjects and of the greatest importance to the people. The publications of the United States Department of Agriculture are very extensive and of the highest technical and general value.

In Canada, the experiment station movement was practically parallel with that in the United States. The Act for a dominion system was passed in 1886. One central station, or "central experimental farm," was established at Ottawa, and the stations in the provinces are branches of it and under the administration of its director. The grant of Parliament for the year 1913-1914 for the maintenance of the system of experimental farms was \$900,000.

In both the United States and Canada, horticulture is one of the important subjects of experiment and research. Usually this work is in charge of a separate officer, commonly known as a "horticulturist," and the number of associates and helpers may be several or many. The extent of horticultural research is now large and it is rapidly increasing. Persons desiring to be in touch with this work should apply to the experiment station in the state or province or to the national department; and a list of these institutions is given below. For further history and discussion of Experiment Stations in the two countries, see pp. 422-430, Vol. IV, Cyclo. Amer. Agric.

In the United States the address of the experiment station and of the college of agriculture is usually the same post-office. In New York, there is a state station at Geneva as well as the federal station and college at Ithaca; in Ohio, the experiment station is at Wooster, and the college is part of the State University at Columbus; in Georgia, the station is at Experiment and the college at Athens, in the University; in Connecticut, the federal station is at New Haven, and the college at Storrs; in other states the post-offices of the two are the same.

#### Canada.

The Dominion or headquarters institution is the Central Experimental Farm, Ottawa, Ontario.

#### Alberta.

Experimental Station, Lacombe.

Experimental Station, Lethbridge.

#### British Columbia.

Experimental Farm, Agassiz.

Experiment Stations, at Invermere, and at Sidney on Vancouver Island.

*Manitoba.*

Experimental Farm, Brandon.

*New Brunswick.*

Experimental Station, Fredericton.

*Nova Scotia.*

Experimental Farms, Nappan, Kentville.

*Ontario.*

Central Experimental Farm, Ottawa.

*Prince Edward Island.*

Experimental Station, Charlottetown.

*Quebec.*

Experimental Stations, Cap Rouge, Ste. Anne de la Pocatiere, Lennoxville.

*Saskatchewan.*

Experimental Farm, Indian Head.

Experimental Stations, Rosthern and Scott.

**United States.**

United States Department of Agriculture, Washington, D. C.

*Alabama.*

Agricultural Experiment Station of the Alabama Polytechnic Institute, Auburn.

Canebrake Agricultural Experiment Station, Uniontown.

Tuskegee Agricultural Experiment Station, Tuskegee Institute.

*Alaska.*

Alaska Agricultural Experiment Stations, Sitka, Kodiak, Rampart, and Fairbanks.

*Arizona.*

Agricultural Experiment Station of the University of Arizona, Tucson.

*Arkansas.*

Arkansas Agricultural Experiment Station, Fayetteville.

*California.*

Agricultural Experiment Station of the University of California, Berkeley.

*Colorado.*

Agricultural Experiment Station, Fort Collins.

*Connecticut.*

The Connecticut Agricultural Experiment Station, New Haven.

Storrs Agricultural Experiment Station, Storrs.

*Delaware.*

The Delaware College Agricultural Experiment Station, Newark.

*Florida.*

Agricultural Experiment Station of Florida, Gainesville.

*Georgia.*

Georgia Experiment Station, Experiment.

*Guam.*

Guam Agricultural Experiment Station, Island of Guam (address Island of Guam, via San Francisco).

*Hawaii.*

Hawaii Agricultural Experiment Station, Honolulu.  
Hawaii Sugar Planters' Experiment Station, Honolulu.

*Idaho.*

Agricultural Experiment Station of the University of Idaho, Moscow.

*Illinois.*

Agricultural Experiment Station of the University of Illinois, Urbana.

*Indiana.*

Agricultural Experiment Station of Indiana, La Fayette.

*Iowa.*

Iowa Agricultural Experiment Station, Ames.

*Kansas.*

Kansas Agricultural Experiment Station, Manhattan.

*Kentucky.*

Kentucky Agricultural Experiment Station, Lexington.

*Louisiana.*

State Experiment Station, Baton Rouge.

North Louisiana Experiment Station, Calhoun.

Rice Experiment Station, Crowley.

Sugar Experiment Station, Audubon Park, New Orleans.

*Maine.*

Maine Agricultural Experiment Station, Orono.

*Maryland.*

Maryland Agricultural Experiment Station, College Park.

*Massachusetts.*

Massachusetts Agricultural Experiment Station, Amherst.

*Michigan.*

Experiment Station of Michigan Agricultural College, East Lansing.

*Minnesota.*

Agricultural Experiment Station of the University of Minnesota, University Farm, St. Paul.

*Mississippi.*

Mississippi Agricultural Experiment Station, Agricultural College.

McNeill Branch Experiment Station, McNeill.

Delta Branch Experiment Station, Stoneville.

Holly Springs Branch Experiment Station, Holly Springs.

*Missouri.*

Missouri Agricultural College Experiment Station, Columbia.

Missouri State Fruit Experiment Station, Mountain Grove.

*Montana.*

Montana Agricultural Experiment Station, Bozeman.

*Nebraska.*

Agricultural Experiment Station of Nebraska, Lincoln.

*Nevada.*

Nevada Agricultural Experiment Station, Reno.

*New Hampshire.*

New Hampshire College Agricultural Experiment Station, Durham.

*New Jersey.*

New Jersey Agricultural College Experiment Station, New Brunswick.

New Jersey State Agricultural Experiment Station, New Brunswick.

*New Mexico.*

Agricultural Experiment Station of New Mexico, State College.

*New York.*

New York Agricultural Experiment Station, Geneva.  
Cornell University Agricultural Experiment Station, Ithaca.

*North Carolina.*

North Carolina Agricultural Experiment Station, West Raleigh.

Agricultural Experiment Station of the North Carolina State Department of Agriculture, Raleigh.

*North Dakota.*

North Dakota Agricultural Experiment Station, Agricultural College.



- Ohio.*  
Ohio Agricultural Experiment Station, Wooster.
- Oklahoma.*  
Oklahoma Agricultural Experiment Station, Stillwater.
- Oregon.*  
Oregon Experiment Station, Corvallis.
- Pennsylvania.*  
The Pennsylvania State College Agricultural Experiment Station, State College.
- Philippine Islands.*  
Lamiao Experiment Station, Lamiao, Bataan.
- Porto Rico.*  
Porto Rico Agricultural Experiment Station, Mayaguez.  
Porto Rico Sugar Producers' Experiment Station, Rio Piedras.
- Rhode Island.*  
Agricultural Experiment Station of the Rhode Island State College, Kingston.
- South Carolina.*  
South Carolina Agricultural Experiment Station, Clemson College.
- South Dakota.*  
South Dakota Agricultural Experiment Station, Brookings.
- Tennessee.*  
Tennessee Agricultural Experiment Station, Knoxville.
- Texas.*  
Texas Agricultural Experiment Station, College Station.
- Utah.*  
Agricultural Experiment Station, Logan.
- Vermont.*  
Vermont Agricultural Experiment Station, Burlington.
- Virginia.*  
Virginia Agricultural Experiment Station, Blacksburg.  
Virginia Truck Experiment Station, Norfolk.
- Washington.*  
Washington Agricultural Experiment Station, Pullman.
- West Virginia.*  
West Virginia Agricultural Experiment Station, Morgantown.
- Wisconsin.*  
Agricultural Experiment Station of the University of Wisconsin, Madison.
- Wyoming.*  
Wyoming Agricultural Experiment Station, Laramie.

#### Research in horticulture. (U. P. Hedrick.)

For the purposes of this discussion we need not concern ourselves with formal definitions of horticulture nor discuss its several divisions. (For definitions, see *Horticulture*.) It is more to the point to indicate the nature of the research problems to be solved in the several loosely correlated industries of which horticulture is composed. Experimenters in horticulture may investigate the phenomena of science, the mechanical methods of an art, and latterly they have come to have much to do with business affairs. What should be the relative status of science, art and business in research work in this branch of agriculture?

Horticulture is a "no man's land" in science. Botanists, chemists, entomologists, bacteriologists and geneticists, join in solving its problems. First one science and then another lets in its light and illuminates an obscure nook. Thus, systematic botany, in the classi-

fication of orchard and garden plants, began the construction of rational horticulture; then came chemistry to furnish knowledge of soils and fertilizers; botany and entomology brought aid in combating innumerable pests. When, however, a discovery is made in any science men are drawn to it as moths to a light, and botany and entomology, which have recently been most prominent, are now giving way in horticulture to genetics and the sciences having to do with the soil, discovery and activity being greatest in these fields. Thus, there is no science of horticulture, but there is science in horticulture. The science field, also, is as open to horticulturists as to experimenters in the sciences that form the foundation of horticulture.

The application of science is art. The botanist and entomologist discover the life-history of insects and fungi; the control of the pests, by means of spraying or otherwise, is an art. The discovery of the laws that govern soil-moisture and soil-heat is a field for the scientist; the art of tillage is or should be founded on the science of soil physics. A widely different phase of physics comes into action when the mechanical engineer is asked to help solve the problems of cooling, storing and transporting horticultural products. The manipulation of plants in propagating, grafting and training is an art based on plant physiology. Thus, research work in horticulture partakes of the "practical;" indeed, applicability usually must be a paramount consideration in investigations in this field. Much that is called "pure science" is helpful in horticulture, but the horticulturist is chiefly concerned with applied science.

So, also, there are inter-relations between business, science and art in horticulture. A prevalent phase of experimentation is the determination of the cost of the unit—the barrel of apples, for example—of agricultural products; other business experiments seek to determine the outgo and the income of the orchard and garden; still others consider the relative profits of two crops in certain soils or other environmental conditions. These problems are largely studies of business methods and are not true research subjects, but one can conceive of scientific investigations in the business affairs of horticulture and certainly science and business come into close touch in this industry.

The distinctions that have been made are not clearly defined in the activities of horticulturists. Too often men supposed to be engaged in research work in horticultural science are busy with the art—very often not in discovery or invention in art but simply with the details of well-established art. Much that is put out as the result of research work is a description or a discussion of the technic of horticulture. A study of business methods, pure and simple, is frequently offered as the results of research. These isolated observations on the art and business of horticulture, having no relation to either pure or applied science, ephemeral and of but limited application, bear but poorly the brand of investigation. Data in the art and business of horticulture, to be worth the while of the true research worker, must be a part of the coordinated and classified knowledge of horticulture, must be of more or less universal application, and must deal more or less directly with scientific principles. Investigating is not teaching, nor demonstrating, nor observing, nor describing, nor proving, unless primarily behind any of these is the design to discover laws.

On the other hand, much that passes as scientific investigation turns out to be theory made attractive by the rouge of speculation; or it is controversy for controversy's sake; not infrequently the offering of science is an old garment made over in a new style; or it is a small truth much adorned; sometimes the scientific offering but heralds a discovery which never appears. Pseudo-research is by no means confined to the practical phases of horticulture.

The writer does not overlook the body of good work being turned out by the American experimenters in horticultural lines, but this is not the subject of the present discussion.

#### *The training of research workers.*

The diverse character of experimentation in horticulture as set forth indicates somewhat the training that investigators in this field should have. It follows from the importance attached to science in horticulture, that thorough training in the sciences is imperative, but the distinctions here made indicate just as clearly that a person trained in the sciences and not in the art and business of horticulture is sadly handicapped. We may put down as the first essential in the mental equipment of the research worker, a broad and severe scientific training. The second essential is, perfect familiarity with garden, orchard and greenhouse plants and methods of handling their products. It is not sufficient that the horticultural experimenter know but the industry in which he may specialize. Knowledge of what is done in the greenhouse, for example, is indispensable to the experimenter with fruits, offering him suggestions at every turn. Whatever knowledge a man may possess of the needs and care of plants in any field of agriculture will be helpful in a specialized field. Perhaps the ability to correlate science and art should be put down as a third essential.

But at present chief emphasis must be laid on the scientific training. The art of horticulture is sufficiently well taught in agricultural colleges, and the money-earning value of an education is in most institutions over-emphasized. The atmosphere of practicums and money-making which prevails in most of our colleges is not one in which investigators are born and bred. Instead, for the proper training of a horticulturist there should be an atmosphere of investigation for investigation's sake, of sound learning, of appreciation of science not only in its applications but as pure science and for its disciplinary value. It is desirable, almost imperative, that one training to become a horticulturist should take a post-graduate course in which special attention may be devoted to the sciences and the problems of horticulture.

#### *Equipment for research.*

Less need be said about the material equipment for horticultural research than the mental make-up of the worker. The nation and the states have been free in the expenditure of money for experimental work. Not a few horticultural departments in the experiment stations of the country are over-equipped with land, buildings and laboratories—the things that money can buy. Certain it is that the output from the institutions conducting research is not in proportion to the money spent or to the number of men on the staff. The fact that equipment and materials do not create, needs emphasis everywhere in horticultural experimentation. The custom of obtaining money to build up a department without specific work to be done is a vicious one from which there must in time be a reaction. Opportunity, equipment and problem should go together, and all these are valueless without a man with initiative, ideas, and training to use them. There are probably more over-equipped departments in horticulture than under-equipped ones. Large experimenting is sometimes small experimenting and small experimenting large experimenting.

In one particular, however, the horticultural departments of the country are sadly under-equipped. There are no comprehensive plantations of economic plants in the experiment stations of the United States. The amelioration of plants is the chief work in horticulture and it would seem that the establishment of economic gardens is imperative, since material to be used advantageously must be near at hand. At least one station

in every distinct agricultural region in the country should have an economic garden where may be found the food plants of the world suitable for the region. This should be an agricultural garden, not a plant museum to show the curious and the ornamental; in it agriculture must be dominant, not recessive.

#### *Organization for research.*

Horticulture is composed of so many industries and involves so many sciences that its problems are too diverse and too complex to permit of many definite statements in regard to organization for research. But several generalities may be set down as essentials to a good organization: (1) There must be a man in command—a broadly trained man. (2) The position of the experimenter should be permanent, subject only to efficiency. (3) The time and thought of the investigator must not be taken up with other activities, as administration, teaching, extension work and the like. (4) The organization must be permanent, to give continuity, coherence and exhaustiveness to the work. (5) The organization should usually correspond with the subdivisions of horticulture rather than the sciences upon which it is founded. That is, there should be pomologists, gardeners and florists, rather than botanists, chemists and entomologists. (6) Money and effort should be concentrated upon a few comprehensive problems that can be exhaustively carried to sound conclusions. Too many experiments are but fragments of a larger problem; discovered to be such, they are often discarded after waste of time and money.

The third of the essentials just given needs amplification. The greatest deterrent to good work in experimentation is the association of research with teaching either in the classroom or from the institute platform. So much of the time and energy of men having these dual-purpose positions is taken by the more present, and therefore more pressing, work of teaching that they are often investigators only in name. In every institution where teaching and investigating are combined, the demand is naturally strongest from students, and investigation suffers. There are, it is true, advantages in the combined position of teacher and investigator, but few indeed are the cases in which the disadvantages do not outweigh them and always the research work suffers.

There should be coöperation between the horticultural experimenters in the several states and the United States Department of Agriculture. A most pathetic spectacle in our agricultural institutions is that of isolated men attacking one and the same problem, duplicating results, often duplicating errors and in either case wasting public funds. So far as possible there should not be overlapping of experimental work, unless duplication is desirable to make more certain the results. In the latter case the work should be jointly planned and from time to time compared and adjusted to secure efficiency and economy. The Society for Horticultural Science is an excellent clearing-house in which the official horticultural experimenters in North America may interchange ideas and adjust their work.

Theories in horticulture are so general, facts so numerous, evidence of one kind or another so easily adduced, that the temptation is strong to state a theory, supply facts from the many already known, adorn the work with a dash of personally collected evidence and call the result an experiment. Such work lacks coherence and is incomplete. Few, indeed, are the horticultural investigators who make their work invincible by exhaustiveness. Again, the urgent call for results has led to the study of problems admitting of hurried conclusions rather than those that are fundamental, and for this reason much work is unfinished and inconclusive. The superb exhaustiveness of Darwin's work, much of it horticultural experimentation, should furnish inspiration and method to investigators in this



field of agriculture in particular. All call to mind that the "Origin of Species" is but a short statement of the theory of evolution which is then shown to be an impregnable fact by a vast amount of evidence over which Darwin labored for twenty years, biding time until his views reached full maturity. There is every temptation to publish prematurely, but permanent work is that which is completely worked out. Besides, given time, investigation is easier, material coming of itself which, under speed, would have required travail of mind to bring forth.

#### *The immediate field.*

In conclusion it may be well to state, as a record of the times, and for possible suggestive value, some of the present problems of horticulture.

Experimentation is needed in the oldest of horticultural operations—pruning. It must be approached through physiological botany. We know next to nothing about the feeding of plants and the influences of the food elements on plant-products—current methods of fertilizing are largely arbitrary. Many questions having to do with sex are before us. There is need of more precise knowledge about bud-formation and the setting and dropping of fruits. There is yet much to be done in the classification and description of horticultural plants. More than elsewhere in agriculture, horticultural plants are inter-planted as in catch-crops, cover-crops and in crop-rotation; the inter-relationships of plants and the effects of crop residues, therefore, must be studied. Greater knowledge of the associations of plants would throw new light on the relations of climates and soils to plant-growing—plant ecology. We have not yet reached the limit of improvement in any cultivated species and plant-breeding must be given attention. The relationships of parasites and hosts involving the whole matter of predisposition, resistance and immunity offer a series of problems. The good and bad effects of sprays, quite aside from their insecticidal or fungicidal functions, are worthy of study. Much has been written but very little is really known about the reciprocal influences of stock and graft. The whole matter of stocks needs experimental attention, fruit-growers in particular having little to guide them in the choice of stocks for the several fruits. We know that cultivated plants vary greatly: are any of the variations heritable or do they appear and disappear with the individual? A study of the last problem would bring one to a much-needed investigation of mutations. Acclimatization deserves consideration. There yet remain many native plants worthy of domestication. Forcing of plants brings up many problems; as, the influence of heated soils and atmospheres, soil sterilization, artificial lights in place of sunlight, the use of electricity in forcing growth and the physiological disturbances of the plant brought about by the changed environment. Lastly, those who ship and store horticultural products are calling for experimental aid to solve their many problems.

#### EXTENSION TEACHING IN HORTICULTURE.

Extension work is the effort made by an institution of higher learning to carry outside its own walls and directly to the people, any form of helpful educational influence. A state university, or institution that derives financial support from the state, may legitimately be called upon to give instruction to the people who cannot attend its courses, if means are provided for the performance of this office. Such an institution no longer fulfils its complete function when it confines itself to teaching students who come to it and to the investigation of problems within its laboratories. A strong college of arts and science, necessarily the center of the great university of today, may extend its educational ideals and its higher educational functions to the people of the state as well as to the students who

reside within it. The professional schools of law, medicine, education, engineering, journalism, agriculture and others (articulated with the college of arts and science, to make up the university) are each investigating the problems of their respective fields and gathering information that may be carried to the people of the state, through organized extension work. More and more the people are coming to depend upon this information as a basis for better enactment, better municipal functions, better sanitation, better regulations as to health, better civic improvement of all phases, and last, but not least, better agriculture, better roads, and a higher plane of country life.

Extension work in horticulture is that phase of organized extension activity that has to do with better production, better handling and better marketing of horticultural products and the higher efforts of living to which this work contributes.

Horticultural extension is conducted by means of private letters, lectures, publications, correspondence courses, demonstration schools, demonstration experiments, and the like.

*Private correspondence.*—Every fruit-grower, gardener, florist or other horticultural worker may encounter special problems upon which he needs individual advice. The horticultural department in any of our leading colleges of agriculture is called upon to answer thousands of letters of inquiry every year. Each of these inquiries is referred to the member of the horticultural staff best qualified to handle it. Many of these inquiries entail special letters. Some of them may be more fully answered by sending circulars or bulletins.

*Publications.*—Departments of horticulture disseminate much information through bulletins, circulars of information and press notices. These bulletins are the published results of the investigation of special problems by the members of the horticultural staff. Circulars of information are more popular treatises of horticultural subjects of interest in the state, and pertaining to which the department has gathered information of interest. Press notices are usually timely topics or seasonal advice furnished the press of the state to publish at the opportune time for their readers. If an insect or disease appears suddenly and promises to become widespread, due to unusual conditions, it often may be checked by prompt action. Unusual weather conditions may sometimes call for unusual methods of management of plants or of crops.

The publication may take the form of an organized reading-course effort without assuming to construct and conduct correspondence courses.

*Extension lectures.*—Hundreds of lectures on horticultural topics are given by members of the horticultural staff, at schools, teachers' meetings, civic improvement societies, commercial club meetings, nurserymen's conventions, canners' associations, fruit-growers' organizations, florists' clubs, and other gatherings. In this way something of the work of the Department may be carried to every organized body in the state which is interested in a phase of horticulture.

*Surveys.*—That the department of horticulture may be of special service to a horticultural center, or special horticultural industry, a careful survey of the horticultural conditions as they exist may be desirable. Such a survey may determine what varieties are proving most profitable, which of the prevailing methods of management are yielding the most satisfactory results, what are the difficult problems that need investigation and what are the reasons for successes or failures. The average result may throw much light upon what is already proving best in the neighborhood. A question that is vexing the average grower may have been answered by the work of the best growers, whose results show the answer to the question. As an example of the plan and possibilities of such surveys may

be mentioned the orchard survey of some of the leading apple-growing counties of New York. A measure of the commercial value of spraying is secured by statistical results from sprayed and unsprayed orchards. The commercial value of orchard tillage as compared with orchards growing in sod is shown by the returns from each class of orchard. The best methods of greenhouse construction and management for particular crops may be determined and explained in the same way.

*Extension schools.*—In many states, extension schools of horticulture are held for the purpose of carrying special horticultural instruction to a neighborhood. Such schools often consist of lectures and demonstrations in a subject of immediate interest. For example, just previous to harvesting a fruit crop a school in fruit-packing may be held. The methods and advantages of proper packing are presented by means of lectures. This is followed by practical laboratory periods in which those in attendance learn to do the work of proper packing. In a similar way, pruning, spraying and other phases of fruit-production are being taught in brief periods of one or two days or a week, the time varying with the needs of the community and the character of the subject taught; or situations with vegetable-growers and florists may be met.

*Correspondence courses.*—Some schools teach courses in horticulture by correspondence. Certain subjects are capable of being taught in this way. Outlines for the lessons are mailed to the student. Prescribed reading is required and directions for observations and original work and study of plants are formulated. Examinations usually consist of written reports made by the student, embodying a statement of the results secured by him. These reports usually show whether or not the student has grasped the subject and wherein he may need further suggestions and study.

*Boys' and girls' clubs.*—A movement that is destined to have a very profound influence is the organization of boys' and girls' clubs for the study of subjects relating to horticulture. Often this club work takes the form of contests in gardening or in the production of some special garden crop, such as tomatoes. Organization is best effected through cooperation with the schools or somebody that can direct the work of each local club. Printed sheets are mailed the club members, from time to time, giving instruction in the details of the work and the conditions governing the contest. Prizes are usually awarded at the local contests and sometimes the prize-winners compete in a state contest.

*Coöperative demonstrations and experiments.*—A very efficient means of promoting the productive growth of any horticultural interest is by means of coöperative demonstrations conducted on the grounds of some energetic grower, whose conditions fairly represent the neighborhood. The ground may be leased by the institution or offered by the local grower. Experiments are carefully outlined to test some problem of interest, such as spraying, comparison of methods of pruning or of cultivation or planting, the use of fertilizers, determination of the merits of particular flowers or vegetables, or other question which the community needs to have worked out. A representative of the horticultural staff visits the grounds as often as is necessary to oversee proper conduct of the work and to record the results of the experiment. Whenever results are secured that are of benefit to the growers, a meeting is held for the purpose of explaining and observing these results and demonstrating the methods for the benefit of those who may profit by adopting them. This form of extension affords the means not only of presenting to the grower facts and methods already known, but it also works new problems out for the neighborhood by securing results that are adapted to their special local requirement. It makes the work convincing; the growers themselves have a hand in it and feel that it is their own; they grow into

an understanding of it as the work grows; it gives a new pride and a new power in working for superior methods. While this is perhaps the most productive form of extension work, its scope is, of course, necessarily limited by the fact that working force and funds are not available for handling more than a limited number of the pressing problems in a state at one time.

*General considerations.*—Incidentally there are other ways by which extension work may be accomplished. Enough already has been accomplished to show that organized extension work has a large and increasing influence upon the horticulture of a state.

Like any other great movement in behalf of human progress, the measure of success of extension work in horticulture depends largely on its proper organization. It offers a multitude of opportunities for work that the world needs to have done. As indicated above, the work is approached in numerous ways. Unless properly organized there is danger of scattered effort, duplication, and failure to follow up results so as to give stability and permanence. It should be a factor in the organized extension work of the entire institution of which it is a part. The question then arises as to whether the work should be undertaken by a separate corps of workers, especially trained for the purpose, and acting under the direction of an extension department head, or whether, since it relates to a special professional field, it should be carried by the officers of the department of horticulture in the college and experiment station. To the writer, the latter seems to be the more rational arrangement. It is no doubt true that if a corps of men do extension work exclusively, with no definitely organized relation to college teaching and experiment station investigation, there will be a tendency to lose touch with higher educational ideals and failure to take to the people the stimulus of productive investigation and the last word in scientific advancement. Undoubtedly there is a tendency, especially on the part of younger men who have the faculty of appealing to the popular audience, to become satisfied with the plaudits of the multitude, and to strive only to enthuse and amuse, unless they are closely connected with college and station work. While one function of extension work may be to inspire and exhort, the day has passed when that alone is sufficient. The commercial horticulturist has reached a plane of development when he needs definite helpful instruction. Attractive letters and lectures are no longer sufficient. He needs, in addition, so far as it is possible to supply it, definite demonstrations of how to do his work according to the most approved methods. The men most closely in touch with strong college teaching and station investigation should be the best fitted to supply this need.

Furthermore, the college teacher or investigator equally needs intimate contact with the commercial grower and his problems. His problems are the problems of the teacher and the investigator. The above conclusions do not dispute the fact that an individual may have especial talent and taste for extension work and lack the plodding patience to make a strong investigator. He may largely devote his time to extension if only the organization keeps him closely linked with college and station men. On the other hand, a productive investigator may not best succeed as a popular lecturer and may give most of his time to investigation. His help may be indispensable in solving some of the difficult problems that arise in the field of extension. The organization of the individuals doing college and station work, ought to afford that union of relationship that will enable the director of extension to call the department of horticulture to his aid. The organization within the department should be best able to supply this need by calling upon the individual best fitted to meet the specific demand.

J. C. WHITTEN.











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